IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications for resource consents and notices of requirement in relation to the Ōtaki to North of Levin Project
BY	**WAKA KOTAHI NZ TRANSPORT AGENCY**
	Applicant

ŌTAKI TO NORTH OF LEVIN HIGHWAY PROJECT

TECHNICAL ASSESSMENT I: CONTAMINATED LAND

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EXECUTIVE SUMMARY

1. The Ōtaki to north of Levin highway Project ("**Ō2NL Project**" or "**Project**") involves the construction, operation, use, maintenance and improvement of approximately 24 kilometres of new four-lane median divided state highway (two lanes in each direction) and a shared use path ("**SUP**") between Taylors Road, Ōtaki and the Peka Peka to Ōtaki expressway ("**PP2Ō**") and State Highway 1 ("**SH1**") north of Levin.

2. A Preliminary Site Investigation ("**PSI**") has been undertaken over the full extent of the Ō2NL Project, focussing on historic and current land uses on properties along the proposed designations and, in particular, the indicative footprint of the new road where disturbance of soil will occur.

3. As required under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations (the "**NESCS**"), the PSI identifies potential Hazardous Substances and Industries List[1] ("**HAIL**") sites where use or deposition of hazardous substances has or may have occurred historically. It then assesses the actual and potential impacts on human health and the environment from the Ō2NL Project due to soil disturbance that has the potential to cause migration of contaminants.

4. Resource consent for activities managed under the NESCS and any relevant Regional Plan rules is not being sought at this stage of the process. Instead, consents will be sought, as required, in accordance with the outcomes of the recommendations in this report.

5. Based on the current and inferred historic land use and activities within the 'Project corridor' (by which I mean the land area encompassed by the proposed designations for the Project), I consider that potential for contaminated land exists within the corridor.

6. The disturbance of contaminated land during the construction of this Project may, without effective management, result in the discharge of contaminants to air, groundwater, and surface water. Such discharges may have adverse effects on human health and the environment.

7. The Ō2NL Project passes through typically gently undulating pastoral farmland located along the Horowhenua plains, with the Tararua Range / foothills to the east, and the Tasman Sea sand-dune country to the west.

[1] the Hazardous Substances and Industries List is promulgated by the Ministry for the Environment.

The soils are free-draining and groundwater flow is generally in a westerly direction towards the coast or Punahau / Lake Horowhenua.

8. The current land use can be characterised as agricultural landscape, comprising dairy farming, extensive areas of market gardening, pockets of orchards, glasshouses, poultry farms, and a vineyard. The existing State Highway 1, and the North Island Main Trunk Railway, between Wellington and Palmerston North are generally located to the west of the Ō2NL Project. Some of these land uses are identified as HAIL activities.

9. The PSI identified 35 potential HAIL sites which might be affected by the Ō2NL Project (30 of which are located within the area subject to the proposed designations and the remaining 5 are within the vicinity). 26 of these HAIL sites are identified as market gardens and orchards. 'Market Gardens' and 'Orchards' are listed as HAIL (A10) activities as there may have been historically bulk storage and use of persistent pesticides and herbicides such as Dichlorodiphenyltrichloroethane ("**DDT**") (which was banned in New Zealand in 1989) and residual contaminants may remain in soils.

10. There are also several dwellings and associated outbuildings (including sheds) that will be removed as part of the proposed construction work and there is potential for lead and asbestos to have been used in these buildings, especially for asbestos if they were built or renovated between 1940 and 1990. Sheep dips and offal pits may possibly be present on some farm properties.

11. A historical landfill (G3) has also been identified within the general location of the south bank approach to the proposed Ohau River bridge that will be part of the Ō2NL Project works. An active quarry is also located next to this site.

12. An investigation of Manawatū-Whanganui Regional Council's ("**Horizons**") list of HAIL sites identified three sites adjacent to the proposed designations and a further two in close proximity to two of the material supply sites next to the Waikawa Stream. These sites are outside the proposed designations and hydraulically downgradient in terms of groundwater flow direction and therefore possible contamination migration from any of these sites is likely to be away from the proposed works. No HAIL sites were identified on the Greater Wellington Regional Council ("**GWRC**") Selected Land Use Register ("**SLUR**") list within or close to the proposed designations.

13. The inclusion of a property on the HAIL does not, of itself, demonstrate the presence of land contamination at that property. However, it does provide an alert that land in and around that property may be contaminated and, on that basis, and with the support of associated supplementary evidence (if available), allows a conclusion as to whether further site investigation of the levels of possible land contamination should be undertaken.

14. The 35 HAIL sites identified within, or adjacent to, the proposed designations or material supply sites were assessed in terms of potential risk to human and/or environmental health. An initial qualitative risk screening, based on the likelihood and the nature of contamination existing at the site from a particular activity and potential for exposure has been assigned to each HAIL site.

15. A high-risk rating indicates a high potential for contamination that would require additional management and validation testing as part of the proposed works. A low-risk rating indicates a low potential for contamination or exposure as the site will not be disturbed as part of the work. A medium-risk rating indicates an uncertainty in whether an activity will have resulted in site contamination and further investigation is required to quantify these risks and determine the potential for reuse within the construction footprint. Land that was observed to be used for market gardens and orchards prior to 1989, when DDT was in use in New Zealand are considered a higher risk than more recent horticultural land.

16. Eight properties were identified as medium risk, though some activities crossed multiple property boundaries. I recommend that a detailed site investigation ("**DSI**") be undertaken once access to the land designated for the Project becomes more readily available and once the construction methodology is finalised, to determine the likely concentrations of residual pesticides and metals within the soil that may be disturbed as part of the Ō2NL Project. The DSI will assess if the soil to be disturbed as part of the works are within background levels and can be reused within the Project, are within NESCS guideline values, and can be encapsulated as part of the road embankments within the HAIL site, or whether the material should be appropriately disposed of offsite. The DSI will, as and if required, inform the development of a contaminated soils management plan ("**CSMP**") prior to construction works.

17. One site (an historical landfill / waste disposal site) was identified as high-risk and needing further investigation and management as part of the proposed works. A review of previous site investigations was undertaken as part of the PSI. A contamination investigation undertaken by Stantec in 2021 involved systematic soil sampling and analysis within the southern Ohau River bridge approach.[2] Geophysical assessment of the site was also undertaken. These confirmed the presence of fill material at this location although the soil analysis showed concentrations only slightly above the background concentration range (soil type 1) for chromium, copper and zinc.

18. The geophysical assessment also noted the potential for leachate to be present. This is water that has percolated through the landfill material and leached out some of the contaminants. The quality of this water depends on the type of material it has moved through and how well those contaminants are bound to the soil. There is potential for this to migrate to the Ohau River or groundwater if not adequately contained and have a negative impact on the water quality.

19. The presence of historical landfill material within the road alignment has a potential to impact on the structure of the new bridge and roadway at Ohau River. Consideration should be given within the design to either:

    (a) leaving the material undisturbed in situ, ensuring it is adequately contained and capped, and constructing the road over the top.

    (b) removal and disposal of all unsuitable material offsite.

20. If the Ō2NL Project is able to avoid disturbing the material within the landfill site and ensure that it is adequately contained and protected from erosion from the Ohau river, this would be preferable to the Project. If it is not practicable to avoid disturbance, any unsuitable material should be disposed of at a facility authorised to take the material. In such a case, and depending on the extent of the disturbance, it may be that remediation works will be appropriate to remove all historical landfill material and dispose of it properly. Any leachate should be collected and treated appropriately. This will reduce the potential for future discharge of contaminants to the Ohau River from this site. Once a designation is place, I recommend a DSI be undertaken at this site and, if contaminants are found above background levels, a remedial action plan developed.

[2] Section 3.2, page 20, of the PSI (**Appendix I.1**).

21. The presence of asbestos – cement sheet roofing material has been identified at one site and the removal of this material will need to be managed by a licensed operator. I recommend that all buildings built prior to 1990 that are to be removed as part of the works be inspected for the presence of asbestos by a suitably qualified person prior to being demolished.

22. There is always the possibility that currently unknown / unrecorded areas of historical contamination might be encountered during the Ō2NL Project works or discovered by other disciplines carrying out investigative activities, most particularly the geotechnical experts or within historical building inspections.

23. If unexpected potentially contaminated material is disturbed during Ō2NL Project works, an unexpected discovery protocols should be implemented; the consequences of this may be that the nature and extent of suspected contamination needs to be promptly investigated, including by sampling and analysis of potentially contaminated material. This should be undertaken under the guidance of a Suitably Qualified and Experienced Practitioner ("**SQEP**") and based on the results, appropriated management measures put in place to manage the contaminants onsite or to remove and dispose of the contaminated material to an authorised facility.

INTRODUCTION

24. My name is Kathryn Anne Halder.

25. I am Principal Environmental Scientist, of Stantec New Zealand.

26. My specialist areas are the investigation and assessment of land contamination, solid waste management, landfill acceptance of special waste and waste assessments, monitoring environmental discharges from contaminated land, and the preparation of site management plans with respect to soil contamination.

27. This assessment is based on a PSI of the Ō2NL Project that I have undertaken in accordance with the NESCS and in general accordance with the Ministry for the Environment's ("**MfE**") Contaminated Land Management Guideline ("**CLMG**") No 1: Reporting on Contaminated Sites in New Zealand (2021). The PSI is attached as **Appendix I.1**.

28. The PSI relies on the records of known HAIL sites held by Horizons, Kāpiti Coast District Council ("**KCDC**") and Horowhenua District Council ("**HDC**")

and identified on the GWRC online maps, historical and current aerial photography publicly available through Retrolens, LINZ and google earth, drone footage, previous site investigations and geotechnical, hydrogeology and geophysical assessments undertaken by Stantec and Cook Costello and a site visit of the proposed Ō2NL Project corridor.

29. The PSI has been reviewed by Kevin Tearney, Technical Director – Land Quality & Remediation, SLR Consulting NZ Limited and a certified environmental practitioner site contamination specialist (CEnvP SC).

30. Resource consent for activities managed under the NESCS and any relevant Regional Plan rules is not being sought at this stage of the process, however, as above, a PSI has been undertaken, as well as a subsequent site visit and analyses as described in this report. This report provides an overview of the information gathered and assessments undertaken so far. It also includes recommendations on next steps, including a DSI at several sites.
I understand consents will be sought, as required, in accordance with the outcomes of the DSI and the other steps I have recommended in this report.

Qualifications and experience

31. I have the following qualifications relevant to this assessment:

    (a) Bachelor of Science Honours (in Environmental Science), Aberdeen University;

    (b) Masters of Science (in Environmental Engineering), Queens University Belfast;

    (c) Charter member of the Chartered Institution of Waste Management (CIWM) and Certified Environmental Practitioner while working in the UK;

    (d) Member, WasteMINZ; and

    (e) SQEP, as referenced in the NESCS and defined in the User's Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.

32. My experience in contaminated land spans some 20 years of consulting experience, with most of this having been carried out in New Zealand. I have also worked on contaminated sites in Northern Ireland, Scotland and Fiji.

33. Since being in New Zealand, I have undertaken over 100 projects with respect to risk assessment of contaminated soil, contaminated land investigations, and contaminated soil management. I have been involved as a contaminated land advisor as part of the State Highway 58 ("**SH58**") road improvements works since 2019. I have managed contaminated land at wastewater treatment plants, historical landfills, gas works, orchards and within a variety of utility pipework renewals and road upgrades throughout the country. I have also spent seven years assessing special and contaminated soil waste acceptance applications for the Tasman District landfill in terms of the environmental effect, safe handling, and disposal protocols, where appropriate.

34. As part of both my BSc and master's thesis I undertook research work on contaminated land risk assessments based on historical land uses, source, pathway, receptor modelling and in-field testing to support the models.

Code of conduct

35. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

36. Waka Kotahi has lodged Notices of Requirement ("**NoRs**") for designations to HDC and KCDC, and is applying for the necessary resource consents from Horizons and GWRC, for the Ō2NL Project. The Ō2NL Project is part of the New Zealand Upgrade Programme ("**NZUP**") and has the purpose to "*improve safety and access, support economic growth, provide greater route resilience, and better access to walking and cycling facilities*".

37. The new State Highway route was selected following a staged multi-criteria analysis ("**MCA**") of route, interchange and local road options. The process involved a consideration of the investment and project objectives, environmental, archaeological, built heritage and social impacts amongst other factors.

38. This report is one of a suite of technical reports prepared for the Ō2NL Project and identifies contaminated or potentially contaminated land that could be affected by the Ō2NL Project and the potential impacts on human health and the environment from soil disturbance. It has been prepared to inform the Assessment of Environmental Effects ("**AEE**") provided in Volume II and to support the NoRs and application for resource consents required for the Ō2NL Project.

39. The objective of this assessment has been, to identify any past or present HAIL activities, or other activities that may result in contaminants being present within or adjacent to the indicative alignment and to assess the potential risk to human health and the environment from contaminants within site soils that may be disturbed by the Ō2NL Project.

40. My assessment has been reviewed against the NESCS and regional plans to determine if resource consents is required and to provide recommendations for further investigations (if applicable) and for the appropriate management, reuse or disposal of contaminated soils encountered as part of the works.

Assumptions and exclusions in this assessment

41. The only assumption made in this report is that the historical records of land uses held by HDC, KCDC, Horizons and GWRC along the proposed designations are complete and accurate and that the locations of HAIL sites have been correctly recorded and provided to Stantec during requests associated with the preparation of the PSI. This is a standard assumption made in the course of preparing PSIs.

42. The detailed assessment of buildings that may be removed as part of the works is outside the scope of this contaminated land assessment. All buildings built prior to 1990 that are to be removed as part of the works should be inspected for the presence of asbestos by a suitably qualified person prior to being demolished.

PROJECT DESCRIPTION

43. Waka Kotahi is giving notices of requirement for designations to the HDC and the KCDC and is applying for the necessary resource consents from Horizons and GWRC for the Ō2NL Project.

44. The Ō2NL Project involves the construction, operation, use, maintenance, and improvement of approximately 24 kilometres of new four-lane median

divided state highway (two lanes in each direction) and a SUP between Taylors Road, Ōtaki (and PP2Ō) and SH1 north of Levin. The Ō2NL Project includes the following key features:

(a) a grade separated diamond interchange at Tararua Road, providing access into Levin;

(b) two dual lane roundabouts located where Ō2NL crosses SH57 and where it connects with the current SH1 at Heatherlea East Road, north of Levin;

(c) four lane bridges over the Waiauti, Waikawa and Kuku Streams, the Ohau River and the North Island Main Trunk ("**NIMT**") rail line north of Levin;

(d) a half interchange with southbound ramps near Taylors Road and the new Peka to Ōtaki expressway to provide access from the current SH1 for traffic heading south from Manakau or heading north from Wellington, as well as providing an alternate access to Ōtaki.

(e) local road underpasses at South Manakau Road and Sorensons Road to retain local connections;

(f) local road overpasses to provide continued local road connectivity at Honi Taipua Road, North Manakau Road, Kuku East Road, Muhunoa East Road, Tararua Road (as part of the interchange), and Queen Street East;

(g) new local roads at Kuku East Road and Manakau Heights Road to provide access to properties located to the east of the Ō2NL Project;

(h) local road reconnections connecting:

    (i) McLeavey Road to Arapaepae South Road on the west side of the Ō2NL Project;

    (ii) Arapaepae South Road, Kimberley Road and Tararua Road on the east side of the Ō2NL Project;

    (iii) Waihou Road to McDonald Road to Arapaepae Road / SH57;

    (iv) Koputaroa Road to Heatherlea East Road and providing access to the new northern roundabout;

(i) the relocation of, and improvement of, the Tararua Road and current SH1 intersection, including the introduction of traffic signals and a crossing of the NIMT;

(j) road lighting at conflict points, that is, where traffic can enter or exit the highway;

(k) median and edge barriers that are typically wire rope safety barriers with alternative barrier types used in some locations, such as bridges that require rigid barriers or for the reduction of road traffic noise;

(l) stormwater treatment wetlands and ponds, stormwater swales, drains and sediment traps;

(m) culverts to reconnect streams crossed by the Ō2NL Project and stream diversions to recreate and reconnect streams;

(n) a separated (typically) three metre wide SUP, for walking and cycling along the entire length of the new highway (but deviating away from being alongside the Ō2NL Project around Pukehou (near Ōtaki)) that will link into shared path facilities that are part of the PP2Ō expressway (and further afield to the Mackays to Peka expressway SUP);

(o) spoil sites at various locations along the length of the Project; and

(p) five sites for the supply of bulk fill /earth material located near Waikawa Stream, the Ohau River and south of Heatherlea East Road.

45. The Ō2NL Project provides the final northern link of the Wellington Northern Corridor that extends from Wellington International Airport to north of Levin.

46. The main feature of relevance to this contaminated land assessment is the bridge over the Ohau River, specifically the southern approach to this bridge where a possible historical landfill has been identified and road alignment that crosses historical market garden and orchard land.

47. Other features of relevance to this contaminated land assessment are the preferred material supply locations near the Waikawa Stream and the general alignment through historical market gardens and pastural land.

METHODOLOGY

Identification of Potential Source of Contaminated Land

48. An understanding of potential areas of contaminated soil that may be present along the proposed designations is an essential element of construction planning. It also influences consenting requirements, reuse or disposal location(s) selection for surplus soil, the health and safety risks that may be posed to project construction workers who carry out activities in any areas of contaminated soil along the alignment, and the risk to the Project and surrounding environment through contaminant migration caused by dewatering activities or exposed soil, erosion and stormwater runoff.

49. Sources of historical and current land use information were scrutinised and included:

    (a) A review of GWRC, KCDC, HDC and Horizons contaminated sites databases and historical records of known HAIL / SLUR sites.

    (b) A review of drone footage from March 2021 undertaken along the entire route of the Ō2NL Project to identify current land use. This was supported with imagery from Google Earth and streetview.

    (c) A review of aerial photography including scrutiny of historical images (Retrolens (https://retrolens.co.nz/) for the pre 1990 imagery and LINZ (https://data.linz.govt.nz) for 1991-current imagery, indicating historical land uses at properties within the proposed designation boundary.

    (d) Obtaining a general understanding of the surrounding environment, hydrology and hydrogeology and the nature of the geology to support contaminant migration, sourced from other technical studies being undertaken for the Project.

    (e) Identification of known and potential HAIL sites that will be disturbed by the work, or within the proposed designation boundary that are relevant to the project.

    (f) Identification of any potential contamination risks from the extraction of aggregate from ‘material supply sites’ situated along the Ō2NL project because of historical activities.

(g) A review of site investigation work previously undertaken on an area identified as historically being used as a landfill, to assess the potential level of risk to human health and the environment if disturbed.

(h) A site visit, undertaken on 16 September 2022 ("**September site visit**") to verify ground features or current site uses and note any variations from what is visible on the photographic evidence.

50. Based on the information collected, a conceptual site model was developed that considered the following:

(a) ***Source*** - a substance that is capable of causing an unacceptable risk to human and/or environmental health.

(b) ***Pathway*** - a mode or route by which the substance / source can migrate to a receptor.

(c) ***Receptor*** - someone and/or something that could be adversely affected by the substance / source.

51. Where one or more of these elements are absent, it is highly unlikely that there will be a risk to human and/or environmental health. Where all of these elements are present, a complete or potentially complete pathway for contamination exists and there is a potential risk to human and/or environmental health that requires further investigation and possible remediation and/or management. The magnitude of the risk is primarily a function of the concentration, mobility and physico-chemical properties of the source, the sensitivity of the receptor and the nature of the migration pathway.

52. A risk screening methodology was applied to all identified HAIL sites within the proposed designation of the Ō2NL Project to reflect the hazards that presents the greatest risk and assess the likelihood of exposure to contaminants as part of the Ō2NL project. This risk rating then informs the conceptual site model ("**CSM**") and the requirement for DSIs to be undertaken and resource consents.

ASSESSMENT CRITIERIA

National and Best Practice Criteria

53. The disturbance of contaminated land is governed by the NESCS, supported by several CLMG produced by the MfE.

54. The "*minimum requirements*"[3] for the conduct of a PSI, in order to ensure it aligns with NESCS, are set out in Appendix A of the CLMG. The steps required for a PSI include site identification and proposed site use, site description, historical site use, risk assessment, conclusions, recommendations, limitations and SQEP certification, among others.

55. For the Project's PSI, all required criteria were assessed and a checklist was provided within the PSI, in accordance with Appendix A of the CLMG.

Applicable National Standards

56. The NESCS has the objective of ensuring that land affected by contaminants in soil is appropriately identified and assessed when soil disturbance and/or land development activities will take place.

57. The NESCS enables the safe use of affected land by:

    (a) establishing regulations for five specific land use activities[4] that ensure district planning controls relevant to assessing and managing public health risks from contaminants in soil are appropriate and nationally consistent;

    (b) establishing soil contaminant standards protective of human health and requiring their use when decisions are made under the NESCS; and

    (c) ensuring best practice and consistent reporting on land affected or potentially affected by contaminants is applied and enables efficient information gathering and consistent decision-making.

58. As is standard procedure for such major infrastructure projects, and consistent with Regulation 6 of the NESCS, a site wide PSI has been undertaken, in addition to the interrogation of both Horizons' and GWRC's

[3] Appendix A of the CLMG, page 31.
[4] Rural residential / lifestyle block 25%production; Residential 10% production; High-density residential, Recreation; commercial / industrial outdoor worker (unpaved) as included in the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (MfE, 2011).

historical land use records, in order to identify possible HAIL sites along the Project's indicative designation corridor.

59. The Ō2NL Project includes land that hosts or has previously hosted activities or industries which are described in the HAIL and, therefore, meets the definition of "land covered" under Regulation 7 of the NESCS. Specifically, as noted below, the Project passes through activities A10 (Market Gardens), A10 (Glass houses), and G3/G5 (historic landfill). There is also potential for the storage of fuel (A17), fertilisers (A6) and agri chemicals (A2) to have occurred and outbuildings to have been constructed using products that contain lead or asbestos (E1).

60. As discussed below, it cannot yet be said with certainty that disturbing soils at these sites would pose no risk to human health or the environment. A DSI is required at a number of sites before it can be determined with certainty if, under Regulations 9, 10 and 11, resource consent is required to disturb soils at the HAIL sites.

EXISTING ENVIRONMENT

61. The following is summarised from Dr Jack McConchie's Technical Assessment G (Hydrogeology and Groundwater).

62. The existing environment is characterised by improved rural farmland in grass pasture or crops for animal feed, orchards, and market garden / horticultural land parcels with farm residences and associated out-buildings, including implement sheds and similar facilities. There are no industrial premises along the proposed designations or in close proximity (<100m from the proposed designation boundary).

63. The topography is typically gently rolling, with various streams running in a general east to west direction across the area of the proposed designations. The proposed designation crosses the Ohau River some 5km south of Levin and there are other minor streams which the proposed designation will cross in the stretch between the Ohau River and the northern outskirts of Ōtaki, where the Ō2NL Project works commence. These rivers and streams have meandered back and forth over time.

64. The geology along the Ō2NL indicative alignment is described as comprising glacial and interglacial sands and gravel deposits interspersed with riverine sediments. The soils are free-draining and, in certain circumstances, there is

potential in such soils for the migration of contaminants to impact soils some distance from any contamination source.

65. Groundwater flow is generally in a westerly direction towards the coast or Punahau / Lake Horowhenua. In general, the water table mimics the topographic surface and ranges. Springs and some wetlands occur where the water table intersects the ground surface, especially towards the northern and southern ends of the Ō2NL Project.

66. Consented takes in the area are mainly for agriculture irrigation / water supply, horticultural irrigation / water supply and recreational irrigation / industrial use. Other shallow groundwater bores, with abstraction, are used for domestic and stock water supply.

67. The Ō2NL Project is designed to not alter the existing water balance of the area, avoid any direct interaction with the groundwater system; and maintain the existing hydraulic connections between surface water and groundwater.

ACTIVITIES OF CONCERN

68. The nature of pastoral farming and the presence of several orchards and market gardens implies the use of fertilisers for soil improvements. This activity is likely to have been widespread within the proposed designations. Market gardens and orchards are listed as HAIL A10. There may have been bulk storage and use of persistent pesticides such as DDT and resulting residues that remain in soils of the area.

Figure I.1 Typical land use within the project designation

69. Fuel supplies in limited volumes (typically diesel) are present on most farms and there is the potential for lead and asbestos to have been used in some of the old farm buildings.

70. There is a poultry farm located at the northern end of the proposed designation. Poultry farms (especially older ones) have been historically constructed from asbestos containing material. Other contaminants such as pathogens, nutrients, emerging organic contaminants and viruses may also be present on surrounding land depending on historical use of poultry waste as fertiliser.

71. Sheep dips may possibly be present on some farm properties through which the Ō2NL Project passes, although there is no record of these in either Horizons or GWRC records.

72. A gravel quarry is located adjacent to the alignment next to the Ohau River. This site is not identified on the Horizons HAIL records. Fuel is often stored at such locations.

73. The eastern urban area of Levin is immediately adjacent to the proposed designation. This area of Levin is entirely residential in nature and there are no known facilities such as service stations present which border the alignment and which could have an impact on the soils within the Project area.

74. The existing State Highway and the NIMT Railway between Wellington and Palmerston North are generally located to the west of the Ō2NL Project. Works to the existing SH1 would be very limited and only occur at the tie-ins to the Ō2NL Project indicative alignment.

POTENTIAL CONTAMINATION SOURCES

75. Horizons provided details from their database of known or potentially contaminated sites (HAIL sites) within the proposed designation boundaries and surrounds. Three HAIL sites were identified along Arapaepae South Road adjacent to the proposed designated boundary.

76. HDC provided the following records (Table I.1) for each of the three HAIL sites identified on the Horizons database.

Table I.1 HAIL sites as identified next to the designation boundary by Horizons

Title	Site HAIL ID 33	Site HAIL ID 10	Site HAIL ID 11
Horizon File No	ERM 0501AC	ERM 0501AV	ERM 0501AU
Address	26 Arapaepae South Road Levin 5510	380-386 Arapaepae Road Levin Rural 5571	378 Arapaepae Road Levin Rural 5571
Property Title	Lot: 1 DP: 322349	Lot: 4 DP: 25093	Lot: 2 DP: 427531
Status	Current	Current	Current
Contaminants	Landfill sites - General waste	Fuel Storage Tanks - Hydrocarbon	Fuel Storage Tanks - Hydrocarbon
Horizons SAHS	700518	700653	700652
Activity - HAIL	G3	A17	A17
Description	Arapaepae Road small dump - Landfill site	Storage Tanks and drum storage - underground fuel tank in shed - back entrance to house	Storage tanks and drum storage - above ground fuel storage tanks
Current Status	Unverified history hazardous industry / act	Verified history hazardous industry / act	Verified history hazardous industry / act
Tank Removed?	No	No	No

77. The HAIL sites at 378 and 380-386 Arapaepae Road, Levin (Figure I.2) were noted as having fuel storage tanks present and therefore the potential losses of petroleum hydrocarbon-based fuels associated with refuelling of farm vehicles to be present within soils. These sites are outside the proposed designation and hydraulically downgradient in terms of groundwater flow direction. Therefore, possible contamination migration from any of these known sites is likely to be away from the proposed works and not influenced by any dewatering that could be required. The likelihood of encountering petroleum hydrocarbon contaminants from these HAIL sites as part of the works is therefore considered to be low.

Figure I.2 HAIL sites at 378 and 380-386 Arapaepae Road

78. During the September site visit the storage tanks were located at 378 Arapaepae Road. These were in the ground at the northern corner of the site behind the residential building and well away from the designation boundary.

79. The tanks at 380-386 Arapaepae Road were no longer present. The tenant was present at the site at the time of the inspection and confirmed that the fuel storage was associated with a machinery building that used to be located in the northwest corner of the property. The tenant located an old sump (Figure I.3) and soak away area which he believed drained the machinery area. This flowed in a northern direction and away from the Ō2NL Project designation area.

Figure I.3 Sump and soak away area at 380-386 Arapaepae Road (HAIL ID 10)

80. 26 Arapaepae South Road Levin (HAIL ID 33) was recorded to be the location of a historical landfill site. There are no HDC records of the age of the landfill, the quantity of material that may have been deposited here or its composition. There is an area of low ground observed in 1940 (Figure I.4) which is subsequently filled, and a dwelling located on the site. The HAIL site is outside the proposed designation boundary and hydraulically downgradient of the works and will not be disturbed as part of the works.

Figure I.4 HAIL Site 26 Arapaepae South Road (source Retrolens imagery 1940)

81. Horizons also provided details from their database of known or potentially contaminated sites near the material supply sites for the works. Two historical landfill sites were identified next to the Waikawa Stream near material supply sites (#15 and #19) HDC records note the following details

(Table I.2) for each site. No HAIL sites were identified next to material supply sites #34a and 36.

Table I.2 HAIL sites identified near material supply sites

Title	Site HAIL ID 35	Site HAIL ID 34
Address	887 State Highway 1 Levin Rural 5570	861 State Highway 1 Levin Rural 5570
Property Title	WN826/26	WN7D/255
Status	Current	Current
Contaminants	Landfill sites - General waste	Landfill sites - General waste
Horizons SAHS	700692	700060
Horizon File No	ERM 0501CL	ERM 0501P
Activity - HAIL	G3	G3
Description	The Properties of Ransfield - 891 State Highway 1 Levin South - Old refuse landfill site - Manakau - near Waikawa Stream	Waikawa Stream Manakau - Landfill site
Current Status	Verified history hazardous industry/act. The land has been subdivided and the landfill extents is now located within 13 North Manakau Road next to Waikawa Stream and within part of 883 Sate Highway 1	No identified Contamination The land has been subdivided and Council no longer consider this property to be a HAIL site
Near material supply site	#15	#19

82. Historical imagery publicly available from Retrolens imagery (Figure I.5) shows disturbed land at various locations along the eastern side of the Waikawa stream.

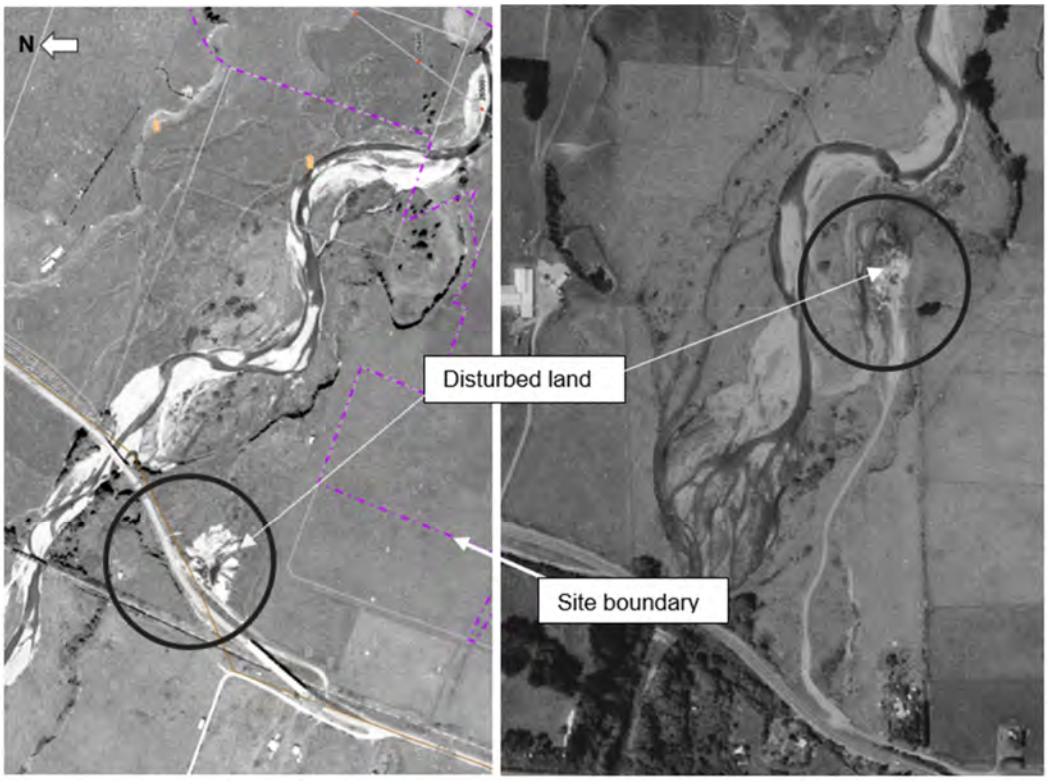

Figure I.5 Potential Landfills Waikawa Stream (source Retrolens imagery 1940 & 1983)

83. The full scale and location of landfill material is unclear from the imagery. Council records note that the site is located within the Waikawa flood plain, the materials dumped here have not been identified but some capping of the site has been undertaken.

84. During the September site visit and discussions with the landowner the extent of the landfill was located within 13 North Manakau Road next to Waikawa Stream and within part of 883 State Highway 1. The landfill is approximately 500m west of SH1.

Figure I.6 Approximate location of the historic next to Waikawa Stream

85. This HAIL site is located downgradient in terms of groundwater flow direction from the material supply site and no excavations are proposed within HAIL site #35.

86. Investigation of the HDC property file for HAIL site ID #34 noted that the HAIL classification was attached to the land and had remained on the property when it was subdivided. It refers to the Manakau Landfill which is located across the stream. HDC no longer consider this property to be a HAIL site.

87. GWRC's SLUR is freely available to use on the GWRC website and holds similar information about contaminated sites as the Horizons database. Accordingly, the GWRC SLUR was accessed and interrogated, given that the southern part of the proposed designations (the first 6km or so) lies within the GWRC boundary. The southern part of the Ō2NL Project lying within the GWRC's jurisdiction has no HAIL sites identified on the SLUR.

88. Land covered by the NESCS includes any piece of land where an activity or industry described in the HAIL is, or has been, undertaken, whether it is included in Council records or not.

89. A review of aerial photography including scrutiny of historical images (Retrolens (https://retrolens.co.nz/) for the pre-1990 imagery and LINZ (https://data.linz.govt.nz) for 1991-current imagery was undertaken for the entire Ō2NL route. This review looked for evidence of other historical HAIL

land uses at properties within the designation boundary not included on the Council's databases.

90. This review identified 30 potential HAIL sites within the indicative Project alignment where use or deposition of hazardous substances has or may have occurred historically.[5] 26 of these are identified as either 'Market Garden' or 'Orchard'. 'Market Gardens' and 'Orchards' are listed as HAIL (A10) activities as there may have been historically bulk storage and use of persistent pesticides such as DDT which was banned in New Zealand in 1989 but may remain as a residual contaminant in soils. A single market garden may expand over multiple properties.

91. Two of the 30 sites were identified to have poultry or other animal husbandry and the potential for outbuildings to contain asbestos.

92. One was identified as a quarry and one a potential landfill site. Discussions with the owner of the quarry site next to the Ohau River as part of geotechnical investigations noted that landfilling activities (HAIL ID 7) had historically occurred near the quarry. The site is located (Figure I.7) within the southern approach to the Ohau River bridge and will be disturbed as part of the Project construction works. This site is not on the Council HAIL records. The quarry is identified as a HAIL site due to the potential for fuel storage at the site.

Figure I.7 Location of historical landfill within the southern approach to the Ohau River bridge

[5] See Table 7, at page 18, of the PSI (**Appendix I.1**). As set out at Table 4 (page 12) of the PSI, three sites were identified as "Historical HAIL Activities" adjacent to the indicative alignment. These were Site ID 33 (26 Arapaepae Road), Site ID 10 (380-386 Arapaepae Road) and Site ID 11 (378 Arapaepae Road). These sites are identified as "Low Risk Sites" at Table 9 (page 23) of the PSI. Two other sites (Site ID 34 – 861 SH1 and Site ID 35 (13 North Manakau Road, within part of 883 SH1) were also identified as either 'No Risk' or 'Low Risk'.

93. There is no evidence within the historical photos available for HAIL ID 7 of ground disturbance at this location other than the riverbed that was located across part of the site in 1940.

94. A review of previous site investigation reports was carried out to assess the nature and extent of possible landfill material and the potential effects of the Ō2NL Project.

95. Preliminary sampling and further investigations carried out by Stantec in 2021 (in respect of HAIL ID 7) found:[6]

    (a) evidence of landfill material including fence posts, a metal pipe, potentially a mattress, plastic, and bits of wire;

    (b) all contaminants other than heavy metals were below detection limits and no asbestos was identified within the samples;

    (c) the presence of historic landfill in the site's general vicinity has not resulted in widespread contamination of the soil, and no contaminant concentrations exceeded the NESCS soil contaminant standards for commercial / industrial land use;

    (d) given the low levels of contaminants encountered, there was no evidence of widespread landfilling having occurred in the area;

    (e) further consideration should be given to whether a consent (supported by a CSMP) is required under the NESCS for disturbance of soil and the off-site disposal of any surplus soil;

    (f) landfill material had historically been disposed of at this site; and

    (g) there is the potential for leachate (water that has percolated through the landfill material and leached out some of the contaminates) to be present.

96. These findings are supported by a geotechnical assessment and ERT modelling (Figure I.8) of the site undertaken on 13 August 2012 which looked to define the extent of the potential landfill.

[6] Pages 20-21 of the PSI (**Appendix I.1**).

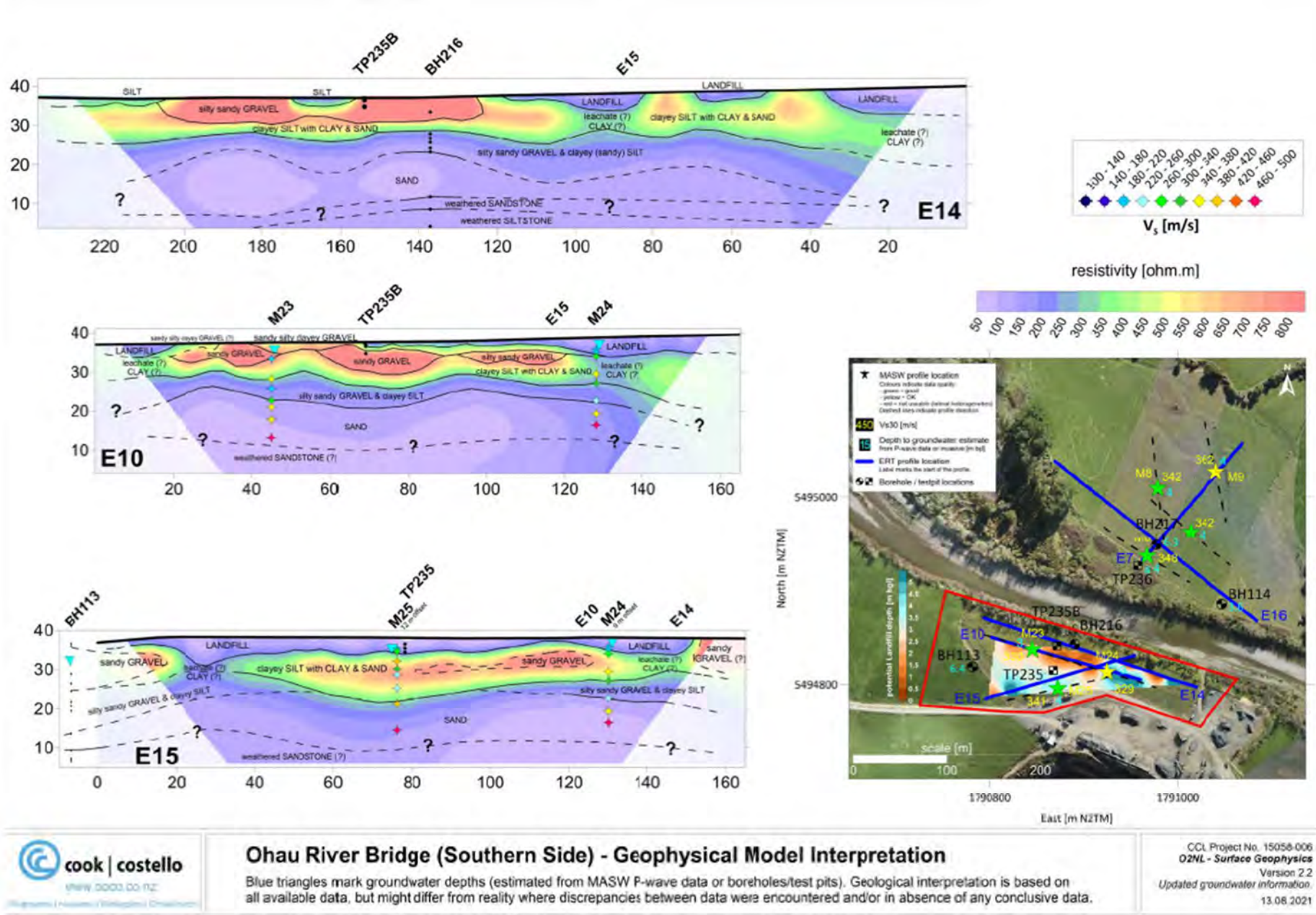

Figure I.8 Geophysical Assessment (Source: Cook and Costello)

ASSESSMENT OF EFFECTS

97. Possible construction effects of the Ō2NL Project on contaminated land include:[7]

    (a) disturbance of contaminants in soil and groundwater and consequential discharges of contaminants to air, land and water (surface and groundwater) where there may be an effect on the environment; and

    (b) discharge of such contaminants where there may be an effect on human health – including site workers and the public.

98. Sites 33 (Horizons File No ERM 0501AC), 10 (ERM 0501AV) and 11 (ERM 0501AU) are outside the proposed designation, as defined by F4 Design Package released 20 April 2022. No soil will be disturbed at any of these sites as part of the Project construction works and they are considered 'Low Risk Sites', including in terms of risk to human health.[8]

99. Sites 35 (ERM 0501CL) and 34 (ERM 0501P) are located along the Waikawa Stream and downgradient of potential material supply site #15 and #19. No soil shall be disturbed within these sites as part of the Ō2NL Project construction works and they are considered either 'No Risk' (HAIL site ID 34) or 'Low Risk' (35).

100. Orcharding practices prior to the 1970s entailed the use of various pesticides and agrichemicals that persist in the environment. Metals are often a co-contaminant for fertilisers and pesticides/herbicides. Residual concentrations of contaminants may remain within the soils and disturbed as part of the Ō2NL Project. The total concentrations of potential contaminants are currently unknown.

101. The findings of the PSI and review of previous investigation reports identified a historical landfill (HAIL ID 7) next to the Ohau River within the Ō2NL Project indicative alignment. Soil analysis as part of the site investigations has shown expected contaminants are present with the soils in concentrations that are slightly above background levels, as shown in Table I.3. The individual sample results showed chromium and nickel concentrations were above the background range across all samples, with copper slightly elevated in 50% of samples and zinc in 25% of samples.

[7] Page 29 of the PSI (**Appendix I.1**).
[8] Page 23 of the PSI (**Appendix I.1**).

Table I.3: Analytical results for soil samples at southern approach to Ohau River bridge

	Wellington background concentration (Soil type 1)[9]	Landfill acceptance criteria (Class B)	Average of Results for 12 Soil Samples
Total Recoverable Arsenic (mg/kg)	<2 - 7	**10**	6
Total Recoverable Cadmium (mg/kg)	<0.1 - 0.1	**2**	0.04
Total Recoverable Chromium* (mg/kg)	7 - 12	**10**	16
Total Recoverable Copper (mg/kg)	4 - 10	**10**	12
Total Recoverable Lead (mg/kg)	4.5 - 180	**10**	24
Total Recoverable Nickel (mg/kg)	4 - 9	**20**	14
Total Recoverable Zinc (mg/kg)	28 - 79	**20**	68
Benzo[a]pyrene (BAP) (mg/kg)	<0.002 - 0.08		0.005

102. None of the concentrations of analysed contaminants exceeded the NESCS criteria for a commercial / industrial land use and thus it is unlikely that there will be a risk to human health if proposed works are undertaken at the Ohau River historical landfill location.

103. Several heavy metal contaminant concentrations exceeded the MfE acceptance criteria for a Class B landfill, meaning that any soil to be disposed of off-site should be disposed of to a Class A landfill. MfE guidelines for landfill acceptance criteria provide only a guideline disposal at various landfill types, the results should be compared to the specific landfill's acceptance criteria.

104. The presence of fill material within the road alignment has a potential to impact on the structure of the new bridge at Ohau River and needs to be considered further as part of the final design.

Risk assessment

105. A preliminary CSM was used in the determination of the potential risk to human health and/or the environment as a result of soil being disturbed as part of the Ō2NL Project and/or groundwater conditions.

[9] Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (GWRC, August 2003).

106. The following locations were considered medium – high risk and likely to be disturbed as part of the proposed works.

Table I.4: Preliminary CSM Risk Assessment

HAIL ID	Site ID	Address	HAIL Activity	Contamination Status	Possible Contaminants	Risk
5	169	703 State Highway 1, Manakau	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - Market Garden present in the 1970s
6	173	695-703 State Highway 1	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - Market Garden present in the 1970s
7	209	559 State Highway 1, Manakau	G3 or G5	Verified field sampling has been undertaken	TPH, PAH, heavy metals and asbestos.	High Risk as waste material observed by geologist during site investigation. Soil contaminants tested low
9	298	416 Arapaepae South Road, Levin	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - no imagery available to determine if present in the 1970s
12	367	232 Kimberley Road, Levin	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - no imagery available to determine if present in the 1970s
20	499	34 Arapaepae Road, SH57 Levin	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s
21	506	50 Arapaepae Road, Levin	A10 Orchard	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s
22	511	1051 Queen Street East, Levin	A10 Market Garden	Unverified Land use noted on project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s
28	586	101 Waihou Road, Levin	A10 Glass houses	Unverified	Asbestos, Pesticides and Heavy Metals.[10]	Medium-High Risk – Site observations and testing indicate that asbestos cement

[10] Other contaminants Pathogens, nutrients, EOCs, viruses may be present depending on historical use of poultry waste on the site from neighbouring property.

HAIL ID	Site ID	Address	HAIL Activity	Contamination Status	Possible Contaminants	Risk
						corrugated roofing material is present on this site.

107. Land parcels where horticultural and/or orchard activities have historically been undertaken were considered of low risk of being affected by the Project if the activity was established later than 1980 and/or the activity was outside the footprint of the area of soil disturbance and/or downgradient of the works.

108. The main migration pathways (that is, a means by which a receptor can be exposed to or affected by a contaminant) identified for the Ō2NL Project are dermal contact and sediment runoff during construction works and migration of exposed soils or contaminated water. Soils which have residual pesticide concentration are likely to inhibit the success of any planting if used within the stormwater channel. Once the road is established the new road pavement will act as a barrier to the migration pathway.

109. The main receptors identified for the Project are the site contractors / workers involved in the construction works and surface water ecosystems if contaminated soil is discharged from the site through runoff or reused within planted recreational areas.

Measures to Remedy or Mitigate Actual or Potential Adverse Contamination Effects

110. This assessment has identified potential sources of contamination within the proposed designation area of the Ō2NL Project. In order to mitigate the potential adverse effects of disturbing contaminated soil as part of the construction of the Ō2NL Project a DSI needs to be undertaken on those sites identified as medium-high risk. Based on the results, the following mitigation measures should be considered within the CSMP (to be provided in support of NESCS consents, if these are determined to be required):

    (a) Leaving the material undisturbed in situ and design the road over it allowing for any settlement;

    (b) Encapsulating any disturbed soils that are within the NESCS guidelines but higher than background values with the proposed works;

    (c) Reusing any disturbed soils from the HAIL sites deemed to be similar to background values within the project works;

(d) Removing and disposing of all unsuitable material offsite.

111. Once the properties are purchased, it is recommended that a DSI is undertaken for the A10 HAIL sites identified and located within the area to be disturbed, to inform if a CSMP needs to be developed as part of the overall site management systems and processes. If DDT or other pesticides are found, then the CSMP should include a methodology to encapsulate this soil within the embankments and Project works rather than reuse as topsoil. If no contaminants are found, then it can be reused on site within the Project as topsoil.

112. A DSI should also be undertaken at HAIL site ID 7 to further investigate the findings of the geophysical model and develop a remedial action plan where appropriate. If the Ō2NL Project is able to avoid disturbing the material within the landfill site, this would be preferable. If it is not practicable to avoid disturbance, any unsuitable material should be disposed of at a facility authorised to take the material. In such a case, and depending on the extent of the disturbance, it may be that remediation works will be appropriate to remove all historical landfill material and dispose of it properly. This will reduce the potential for future discharge of contaminants to the Ohau River from this site. Validation testing of the remaining soils should be undertaken following any remedial works.

113. Dewatering and sediment control within the proposed Ō2NL Project works is proposed within the Construction and Environmental Management Plan and specifically the Erosion and Sediment Control Plan (refer to the DCR and its appendices, Appendix Four of Volume II). This will reduce the potential for any contaminant migration.

114. While extensive investigations have been taken to try and locate all HAIL sites within the proposed Ō2NL Project designation, there is always the possibility that unknown/unrecorded areas of historical contamination could be encountered during the Ō2NL Project and will need to be managed via an unexpected discovery protocol.

CONCLUSION

115. The land within the proposed designations is predominantly agricultural or horticultural.

116. The thorough assessment of current and historical land use (via a PSI) determined that a historical landfill, markets gardens and orchard land exist

within the project designation and therefore the NESCS regulations shall apply.

117. Given that the PSI cannot at this stage state that it is "*highly unlikely that there will be a risk to human health if the activity is done to the piece of land*" the NESCS regulations shall apply.

118. Prior to construction works a DSI should be carried out for the following medium – high risk sites to determine the level of residual pesticides, associated metals or other contaminants that remain in the soils and inform the management of the soil as part of the CSMP, if and as required.

    (a) HAIL ID 5;

    (b) HAIL ID 6;

    (c) HAIL ID 9;

    (d) HAIL ID 12;

    (e) HAIL ID 20;

    (f) HAIL ID 21;

    (g) HAIL ID 22; and

    (h) HAIL ID 28.

119. Soil testing should be undertaken in accordance with Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils (Revised 2021).

120. Once the DSI work has been completed then the requirement for consents under the NESCS and relevant Regional Plan rules can be reviewed, and any necessary applications made.

121. It is also recommended that once final disturbance volumes and contaminant concentrations are known, further consideration be given to either reusing the soil within the Ō2NL Project or encapsulating soil within the Project works, or off-site disposal of any surplus soil (if required).

122. If a NESCS consent is required then it is also recommended that a CSMP is prepared in support of that application to ensure the safe handling of the disturbed soil within HAIL sites and appropriate reuse or disposal.

123. The presence of historic landfill material within the road alignment has a potential to impact on the structure of the new bridge and roadway at Ohau River. Consideration should be given within the design to either:

    (a) leaving the material undisturbed in situ and construct the road over the top; or

    (b) removal and disposal of all unsuitable material offsite. This will reduce the potential for future discharge of contaminants to the Ohau river from this site.

124. Once a designation is place, I recommend a DSI be undertaken at this site (HAIL ID 7) and, if waste material or soil contaminants are found above background levels, a remedial action plan and CSMP is developed for this site. Any unsuitable material should be disposed of at a facility authorised to take the material.

125. The presence of asbestos – cement sheet roofing material has been identified at one site and the removal of this material will need to be managed by a licensed operator. I recommend that all buildings, built prior to 1990, that are to be removed as part of the works should be inspected for the presence of asbestos by a suitably qualified person prior to being demolished.

126. An unexpected discovery protocol is recommended to be provided by conditions of consent. This will ensure that, should such discoveries be made, they will be thoroughly assessed and, if necessary, remediated and/or mitigated to reduce risks from contaminated soil to negligible levels.

Kathryn Halder
14 October 2022

APPENDIX I.1: PRELIMINARY SITE INVESTIGATION

ŌTAKI TO NORTH OF LEVIN

Preliminary Site Investigation

PREPARED FOR Waka Kotahi | September 2022

We design with community in mind

Stantec

Revision schedule

Rev No	Date	Description	Signature of Typed Name (documentation on file)			
			Prepared by	**Checked by**	**Reviewed by**	**Approved by**
00	11/06/2020	Initial PSI	P Heveldt	K Halder	K Halder	J England
01	15/07/2022	Updated PSI	K Halder	K Tearney	K Tearney	P Peet
02	14/09/2022	Updated PSI following Council comments	K Halder	S Stewart		
03	20/09/2022	Updated PSI following site visit	K Halder	K Tearney	K Tearney	J England

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Quality statement

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STATUS Final Draft | Project No 310203848

Executive summary

A Preliminary Site Investigation ("PSI") has been carried out for the proposed Ōtaki to North of Levin Highway Project ("Ō2NL Project" or "the Project"). The Ō2NL Project provides the final northern link of the Wellington Northern Corridor that extends from Wellington International Airport to north of Levin and has the purpose to "improve safety and access, support economic growth, provide greater route resilience, and better access to walking and cycling facilities".

This PSI is one of a suite of technical reports prepared for the Ō2NL Project and identifies contaminated or potentially contaminated land that could be affected by the Project and the potential impacts on human health and the environment from soil disturbance.

The objective of this PSI is to identify any past or present Hazardous Activities and Industries List ("HAIL") activities, or other activities that may results in contaminants being present on or near the Project alignment and to assess the risk that any such identified activities may pose to the Project. This PSI focuses on the footprint of works and the proposed designation boundary.

The Ō2NL Project passes through typically gently undulating pastoral farmland located along the Horowhenua plains, with the Tararua Range/foothills to the east, and the Tasman Sea sand-dune country to the west. The soils are free-draining and groundwater flow is generally in a westerly direction towards the coast or Lake Horowhenua. The current land use is characterised as largely agricultural; comprising dairy farming, extensive areas of market gardening, pockets of orchards, glasshouses, poultry farms, and a vineyard. The existing State Highway and the North Island Main Trunk Railway between Wellington and Palmerston North are generally located to the west of the Project. Some of these land uses are identified as HAIL activities.

The inclusion of a property on the HAIL does not, of itself, demonstrate the presence of land contamination at that property. However, it does provide an alert that land in and around that property may be contaminated and, on that basis and with the support of associated supplementary evidence (if available), allows a conclusion as to whether further investigation of the levels of possible land contamination should be undertaken.

An investigation of Manawatū-Whanganui Regional Council's ("Horizons") list of HAIL sites identified three sites next to the proposed designation. The investigation also found two further HAIL sites in close proximity to two of the material supply sites. These HAIL sites are outside the proposed designation and hydraulically downgradient in terms of groundwater flow direction and therefore possible contamination migration from any of these sites is likely to be away from the proposed works. No HAIL sites were identified on the GWRC Selected Land Use Register (SLUR) list within, or close to, the proposed Ō2NL Project alignment.

A review of aerial photography including scrutiny of historic images, drone footage and site walkover identified 30 potential HAIL sites within the designation. These were mainly market gardens or orchards, HAIL (A10) activities and a potential source of contaminations as there may have been historically bulk storage and use of persistent pesticides such as Dichlorodiphenyltrichloroethane, DDT in the 1950s and 1960s. A landfill / disposal site was also identified next to the Ohau River within the footprint of the new road. There are also several dwellings and associated outbuildings (including sheds) that will be removed as part of the proposed construction work and potential for lead and asbestos to have been used in these buildings.

The sites were screened in terms of potential risk to human and/or environmental health. Eight properties were identified as medium risk although some activities crossed multiple property boundaries. Asbestos was also detected at one of these sites bound within asbestos cement corrugated roofing material. One historical disposal site was identified as potential High risk and needing some further investigation and management as part of the proposed works.

For activities under R8(3) of the NESCS the preliminary site investigation concludes it is possible that there will be a risk to human health if activity is done to a piece of land identified as HAIL.

The PSI has recommended that a detailed site investigation (DSI) is undertaken at the sites identified as medium or high risk once the properties are purchased. Once the findings of the DSI are known, where contaminants above background levels are identified, a contaminated soil management plan ("CSMP") shall be prepared prior to works to ensure the safe handling of the disturbed soil within HAIL sites and appropriate reuse or remediation within the overall Ō2NL Project, management on site via encapsulation / mixing and treatment / disposal in spoil sites or disposed of at an appropriate landfill or facility authorised to take the material.

The requirement for a global resource consent under the NESCS for the Project works will be reviewed following the DSI work and appropriate land use consents applied for prior to construction.

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Abbreviations

Enter Abbreviation	Enter Full Name
CLMG	Contaminated Land Management Guidelines
DSI	Detailed Site Investigation
GWRC	Greater Wellington Regional Council
HAIL	Hazardous Activities and Industries List
HDC	Horowhenua District Council
Horizons	Manawatū-Whanganui Regional Council
KCDC	Kāpiti Coast District Council
MCA	Multi-criteria analysis
MfE	Ministry for the Environment
NESCS	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
NoR	Notices of Requirement
NZUP	New Zealand Upgrade Programme
Ō2NL	Ōtaki to North of Levin
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance and Quality Control
SH	State Highway
SLUR	Selected Land Use Register
SQEP	Suitably Qualified and Experienced Practitioner
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Introduction

Waka Kotahi NZ Transport Agency ("Waka Kotahi") is giving notices of requirement ("NoRs") for designations to the Horowhenua District Council ("HDC") and the Kāpiti Coast District Council ("KCDC") and is applying for the necessary resource consents from Manawatū-Whanganui Regional Council ("Horizons") and Greater Wellington Regional Council ("GWRC") for the Ōtaki to North of Levin Project ("the Ō2NL Project" or "the Project").

The Ō2NL Project is part of the New Zealand Upgrade Programme ("NZUP") and has the purpose to "improve safety and access, support economic growth, provide greater route resilience, and better access to walking and cycling facilities". The new State Highway route was selected following a staged multi-criteria analysis ("MCA") of route, interchange and local road options. The process involved a consideration of the investment and Project objectives, environmental, archaeological, built heritage and social impacts amongst other factors.

The Ō2NL Project provides the final northern link of the Wellington Northern Corridor that extends from Wellington International Airport to north of Levin.

As part of this process Waka Kotahi has engaged Stantec New Zealand (Stantec) to undertake a Preliminary Site Investigation (PSI) of the Project. This PSI is one of a suite of technical reports prepared for the Ō2NL Project and identifies contaminated or potentially contaminated land that could be affected by the Project and the potential impacts on human health and the environment from soil disturbance. It has been prepared to inform the AEE and to support the NoRs and application for resource consents.

This PSI has been undertaken in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 ("NESCS") and has been developed in general accordance with the Ministry for the Environment's ("MfE") Contaminated Land Management Guideline ("CLMG") No 1: *Reporting on Contaminated Sites in New Zealand (2021)*. Please refer to CLMG table of contents checklist in Appendix A.

This document has been prepared by Kathryn Halder a Suitably Qualified and Experienced Practitioner ("SQEP") as referenced in the NESCS and defined in the *User's Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (MfE (2012). Evidence of Kathryn Halder's SQEP qualification and experience is presented in Appendix B. This PSI has also been reviewed by Kevin Tearney, Technical Director – Land Quality & Remediation, SLR Consulting NZ limited and certified environmental practitioner site contamination specialist (CEnvP SC).

1.1 Investigation Objectives

The objective of this PSI is to identify contaminated land, including:

- any past or present Hazardous Activities and Industries List (HAIL) sites or
- land that might not be HAIL but contain contaminants eg, lead paint and asbestos in soil from buildings

on or near the Project alignment and to assess the risk that any such identified contaminated land may pose to the Project. This PSI focuses on the footprint of works and the proposed designation boundary.

1.2 Scope of Work

In order to identify the likelihood of encountering contaminated soil within the proposed designation, a systematic desktop assessment of historical and current land uses has been carried out. This assessment includes:

- A review of GWRC, KCDC, HDC and Horizons contaminated sites databases and historical records of known HAIL sites.
- A review of drone footage from March 2021 undertaken along the entire route of the Ō2NL Project to identify current land use. This was supported with imagery from Google Earth.
- A review of aerial photography including scrutiny of historic images (Retrolens (https://retrolens.co.nz/) for the pre 1990 imagery and LINZ (https://data.linz.govt.nz) for 1991-current imagery, indicating historical land uses at properties within the proposed designation boundary.
- Obtaining a general understanding of the surrounding environment, hydrology and hydrogeology and the nature of the geology to support contaminant migration, sourced from other technical studies being undertaken for the Project.
- Identification of known and potential HAIL sites that will be disturbed by the work, or within the proposed designation boundary that are relevant to the Project.
- Identification of potential contamination risks from the extraction of aggregate from 'material supply sites' situated along the Ō2NL Project because of historical activities.

- A review site investigation work previously undertaken on an area identified as historically being used as a landfill to assess the potential level of risk to human health and the environment, if disturbed.
- Site visit to verify ground features or current site uses and note any variations from what is visible on the photographic evidence.

1.2.1 Legislative setting

This PSI has been conducted in accordance with the Contaminated Land Management Guidelines, within the framework of the Resource Management Act 1991. Relevant specific guidelines include the following:

- MfE, 2021, Contaminated Land Management Guidelines No. 1, Reporting on Contaminated Sites in New Zealand;
- MfE, 2021, Contaminated Land Management Guidelines No. 5, Site Investigation and Analysis of Soils;
- Order in Council, 2011, Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011;
- MfE, 2012, Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health;
- Horizons Regional Council One Plan, The consolidated Regional Policy Statement, Regional Plan and Regional Coastal Plan for the Manawatu-Wanganui Region, 2014; and
- Greater Wellington Regional Council Proposed Natural Resources Plan (PNRP), 2022.

1.3 Site Identification

The Ō2NL Project involves the construction, operation, use, and maintenance of approximately 24km of new four-lane, median divided state highway between Taylors Road (to the north of Ōtaki) and State Highway 1 ("SH1") north of Levin. The proposed Ō2NL Project alignment is shown in Figure 1 and a site plan provided in Appendix C.

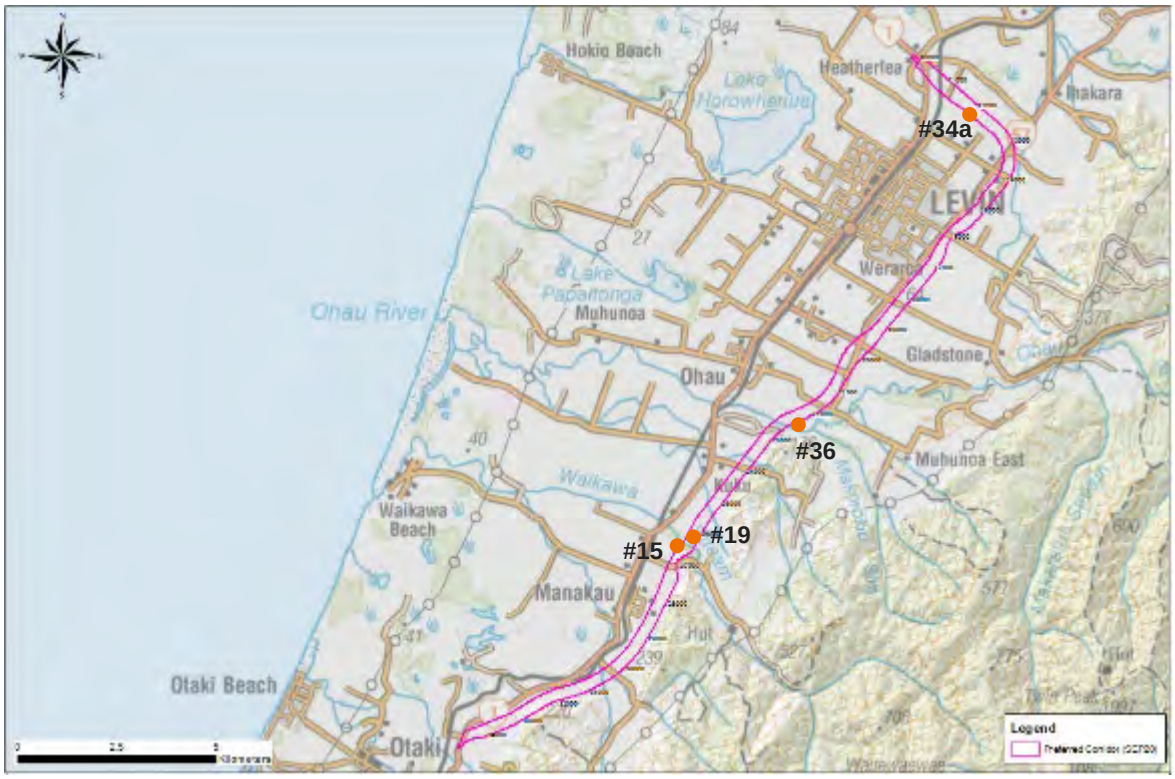


Figure 1: Ō2NL preferred alignment and material supply sites in relation to existing SH1.

Key: Ō2NL preferred alignment ● Material supply sites

Construction of the new highway will take place within the proposed designation and therefore this delineates the area where soil disturbance will be carried out. Typically, the road width will consist of 60m for the four-lane highway and up to 100m where slip lanes are required. While there may be certain works, such as interchanges and roundabouts, that require relatively extensive lateral excavation, these will be within the designation footprint. Further details of the proposed

site works are provided in Section 1.4. It follows that the investigation of potentially contaminating activities that might impact the road construction works should focus on land within the proposed designation boundary.

1.4 Proposed Site Use

The Ō2NL Project involves the construction, operation, use, maintenance, and improvement of approximately 24 kilometres of new four-lane median divided state highway (two lanes in each direction) and a shared use path ("SUP") between Taylors Road, Ōtaki (and the PP2Ō) and SH1 north of Taitoko/Levin.The Ō2NL highway will extend predominantly over farmland and will remain a road once construction is complete. As a summary, the Project comprises the following key features.

a) a grade separated diamond interchange at Tararua Road, providing access into Taitoko/Levin;

b) two dual lane roundabouts located where Ō2NL crosses SH57 and where it connects with the current SH1 at Heatherlea East Road, north of Taitoko/Levin;

c) four lane bridges over the Waiauti, Waikawa and Kuku Streams, the Ohau River and the North Island Main Trunk ("**NIMT**") rail line north of Taitoko/Levin;

d) a half interchange with southbound ramps near Taylors Road and the new Peka to Ōtaki expressway to provide access from the current SH1 for traffic heading south from Manakau or heading north from Wellington, as well as providing an alternate access to Ōtaki.

e) local road underpasses at South Manakau Road and Sorenson Road to retain local connections;

f) local road overpasses to provide continued local road connectivity at Honi Taipua Road, North Manakau Road, Kuku East Road, Muhunoa East Road, Tararua Road (as part of the interchange), and Queen Street East;

g) new local roads at Kuku East Road and Manakau Heights Road to provide access to properties located to the east of the Ō2NL Project;

h) local road reconnections connecting:

   i) McLeavey Road to Arapaepae South Road on the west side of the Ō2NL Project;

   ii) Arapaepae South Road, Kimberley Road and Tararua Road on the east side of the Ō2NL Project;

   iii) Waihou Road to McDonald Road to Arapaepae Road/SH57;

   iv) Koputaroa Road to Heatherlea East Road and providing access to the new northern roundabout;

i) the relocation of, and improvement of, the Tararua Road and current SH1 intersection, including the introduction of traffic signals and a crossing of the NIMT;

j) road lighting at conflict points, that is, where traffic can enter or exit the highway;

k) median and edge barriers that are typically wire rope safety barriers with alternative barrier types used in some locations, such as bridges that require rigid barriers or for the reduction of road traffic noise;

l) stormwater treatment wetlands and ponds, stormwater swales, drains and sediment traps;

m) culverts to reconnect streams crossed by the Ō2NL Project and stream diversions to recreate and reconnect streams;

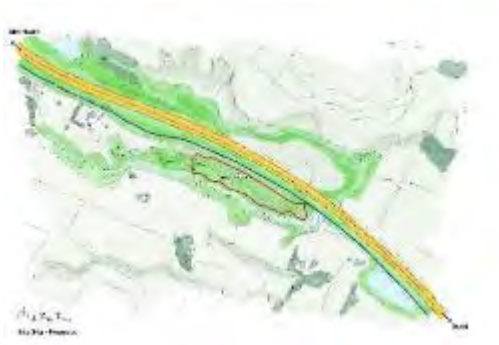
n) a separated (typically) three metre wide SUP, for walking and cycling along the entire length of the new highway (but deviating away from being alongside the Ō2NL Project around Pukehou (near Ōtaki)) that will link into shared path facilities that are part of the PP2Ō expressway (and further afield to the Mackays to Peka expressway SUP);

o) spoil sites at various locations along the length of the Project; and

p) five sites for the supply of bulk fill /earth material located near Waikawa Stream, the Ohau River and south of Heatherlea East Road.

Material supply sites have also been identified and selected along the route (Figure 1) through a MCA of all options. The selected sites lie outside the proposed designation and are shown in Figure 2 below. This PSI also assess the current and historical land use of these sites in terms of potential contamination.

Koputoroa Site
Site 34a



North Ōhau Site
Site 36

North Waikawa
Site 19

South Waikawa
Site 15

Figure 2: Ō2NL Material Supply Site ID

2 Site Description

2.1 Environmental setting

The following sections have been based on the suite of technical assessments being undertaken for the Project. For further details refer to the individual assessments.

2.1.1 Landscape

The following is summarised from Mr Gavin Lister's Landscape, Visual and Natural Character assessment provided as Technical Assessment D in Volume IV as part of the Assessment of Environmental Effects (AEE) for the Project.

The Ō2NL Project passes through typically gently undulating pastoral farmland located along the Horowhenua plains, with the Tararua Range/foothills to the east, and the Tasman Sea sand-dune country to the west. The plains are a combination of outwash terraces from the Tararua Range and former seabed and marine sands raised by tectonic activity. The plains originally supported lowland rainforest dominated by species such as tōtara, rimu, and tawa. The wetter soils, such as around the toe of Pukehou and on the upper tributaries of the Koputaroa Stream, would have been characterised by kahikatea pukatea forest.

Streams and small rivers originating in the Tararua Range flow directly across the plains to the coast. The most notable are the Ohau River, and the Kuku, Waikawa, Manakau, Waiauti, and Waitohu Streams. They typically have meandering channels in stony beds that reflect their origins in the greywacke foothills of the Tararua Range.

The Project extends from the Manawatū River in the north to the Waitohu Stream and Ōtaki in the south. The alignment also includes a limited number of major road intersections.

2.1.2 Geology

The following is summarised from Dr Jack McConchie's Hydrogeology and Groundwater assessment provided as Technical Assessment G in Volume IV as part of the Assessment of Environmental Effects (AEE) for the Project.

The geology along the Ō2NL Project is described as comprising glacial and interglacial sands and gravel deposits interspersed with riverine sediments.

The Project area is predominately characterised by alluvial deposits transported from the Tararua ranges during the late Pleistocene and Holocene interglacial periods. A large alluvial basin has been formed, which extends along the middle part of the Project area from the eastern plains and towards the coast and has overlain or incised older shoreline and dune sand deposits. The alluvial deposits forming localised fans and terraces around the existing and historical waterways, such as the Ohau River and Waikawa River, are also encountered.

Figure 3 shows the QMap (Heron, 2014), simplified 1:250,000 geological map for the overall area and Table 1 provides a description of each stratum.

Table 1: Geology Description

Regional map Unit Code	Strata Name	Description	Period	Approximate Age (ma)
Q1a	Holocene river deposits	Alluvial gravel, sand, silt, mud, and clay with local peat, includes modern riverbeds.	Quaternary	0 - 0.12
Q2a	Late Pleistocene river deposits	Poorly to moderately sorted gravel with minor sand or silt underlying terraces; minor fan gravels are included	Quaternary	0.12 - 0.24
Q3a	Late Pleistocene river deposits	Weathered; poorly sorted to moderately sorted gravel underlying loess-covered; commonly eroded aggregational surfaces.	Quaternary	0.24 - 0.59
Q5b	Late Pleistocene shoreline deposits	Beach deposits consisting of marine gravel with sand; commonly underlying loess and fan deposits.	Quaternary	0.71 -0.128
Q6a	Middle Pleistocene river deposits	Weathered; poorly sorted to moderately sorted gravel underlying loess-covered; commonly eroded aggregational surfaces.	Quaternary	0.128 - 0.186
Tt	Basement rock (Wellington Greywacke)	Alternating sandstone and mudstone, poorly bedded sandstone with minor coloured mudstone, conglomerate, basalt, chert.	Triassic	142 - 248

Figure 3: Simplified 1:250,000 geological map and road corridor.

The soils are free-draining and there is potential in such soils for the migration of contaminants to an extent that may impact soils some distance from any contamination source. The potential for migration will be dependent on the leachability characteristics of any contaminant encountered.

2.1.3 Hydrogeology and Hydrology

The following is summarised from Dr Jack McConchie's Hydrogeology and Groundwater assessment provided as Technical Assessment G in Volume IV as part of the Assessment of Environmental Effects (AEE) for the Project.

Near the Tararua Range, groundwater flows downwards into deeper semi-confined sand and gravel aquifers because of the positive hydraulic gradient. However, near the coast and Punahau / Lake Horowhenua, the vertical hydraulic gradient reverses and groundwater flow is upwards from the semi-confined aquifers into the shallow overlying unconfined aquifers and hydraulically connected surface water bodies.

The main surface water bodies are the Ohau River and Lakes Horowhenua and Papaitonga. Smaller streams include the Waiauti, Waikawa, Kuku and Koputaroa. All these surface water features interact with the groundwater system, either receiving or contributing water depending on the hydrogeology and hydraulic gradient.

The Ō2NL Project crosses the Ohau River approximately 5km south of Levin and there are other minor streams which the new highway alignment will cross in the stretch between the Ohau River and the northern outskirts of Ōtaki where the Project works commence.

Groundwater flow is generally in a westerly direction towards the coast or Lake Horowhenua, as shown in Figure 4.

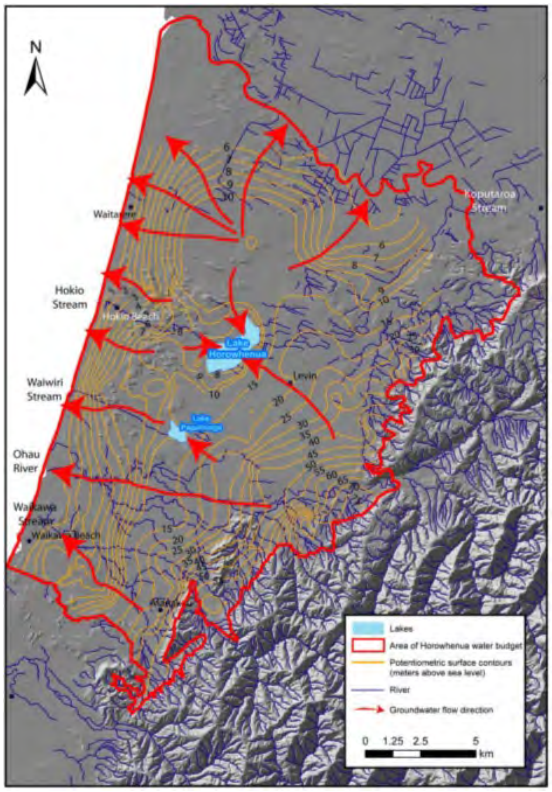


Figure 4: General Groundwater flow direction

In general, the water table mimics the topographic surface and ranges in depth from the ground surface to deeper than 20m. Springs and some wetlands occur where the water table intersects the ground surface, especially towards the northern and southern ends of the Project. The deepest groundwater levels generally occur at locations east of Levin (near Tararua Rd). The highest groundwater levels ranged from 0.5m to 2m below the ground surface in areas near Queen Street East (east of Levin), east of Manakau Township, and adjacent to Manakau Stream.

There are numerous bores in the area listed in Horizons' bore database,[1] and shown in Figure 5, however, most are down-gradient of the Project.

[1] Data obtained in 2022 from Horizons bore database that is accessible via their online data portal.

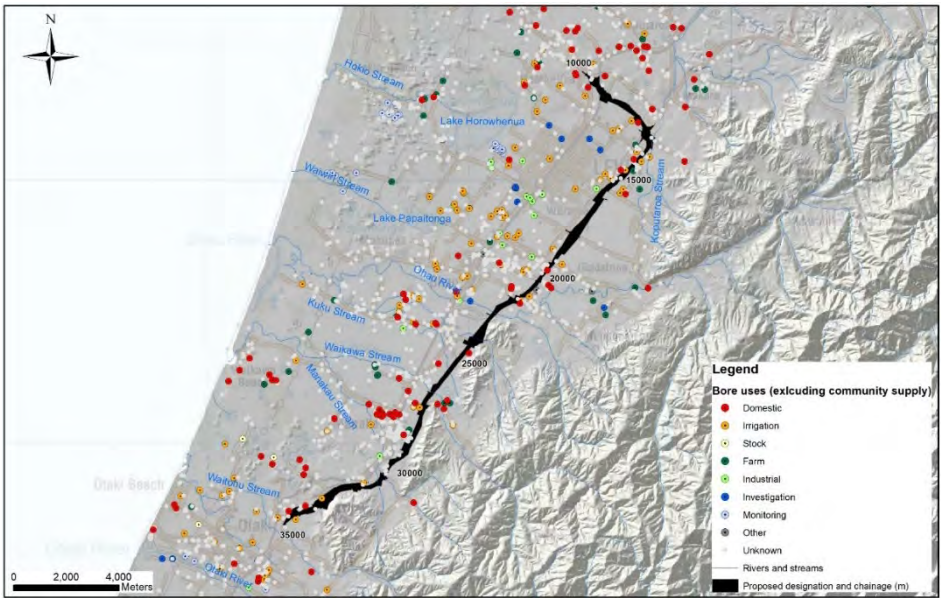


Figure 5 ***Consented groundwater abstractions and monitoring bores.*** *(Source: Horizons & GWRC online databases, September 2021)*

As of September 2021, one community water supply scheme was identified within the proposed designation (Glenmorgan Water Supply Scheme) as well as 34 bores, and a further 104 within 250 m. Only one bore within the designation (the Glenmorgan CS bore) has a permit to take water. Most bores with water permits are a sufficient distance from the Project that they are not adversely affected by the works. Consented takes were mainly for agriculture irrigation/water supply, horticultural irrigation/water supply and recreational irrigation/industrial use. Other shallow groundwater bores, with abstraction, are used for domestic and stock water supply.

The Ō2NL Project is designed to not alter the existing water balance of the area, avoid any direct interaction with the groundwater system; and maintain the existing hydraulic connections between surface water and groundwater.

2.2 Existing Land Use

2.2.1 Site inspection

An inspection of existing land use was undertaken in two stages. The first stage involved reviewing the drone footage and google earth street view images for the entire route. This provided an aerial view of the proposed designation and identification of existing use within the proposed designation boundary.

The second stage involved inspecting the proposed designation from public access points and inspecting several properties currently in ownership of the crown. Due to access arrangements, it was not possible to visit every site of interest. The site visit was undertaken by Kathryn Halder on 16 September 2022. The aim of the site visit was to verify ground features or current site uses and to note material variations from what was observed on the drone footage.

The following properties shown in Table 2 were accessed as part of this site visit. Not all sites inspected were considered to be HAIL but instead provided a good vantage point to view the proposed alignment and overall landuse.

Table 2: Properties accessed as part of site visit

Stantec Site ID	Address
132	55 Wi Tako Street
158	121A North Manakau Road
No ID	833 SH1, Manakau
337	379 Arapaepae Road Sth
311	380 Arapaepae Road Sth
326	378 Arapaepae Road Sth
506	50 Arapaepae Road
586	101 Waihou Road
604	32 McDonald Road
573	172 Fairfield Road
470	42 Sorensons Road
444	6 Heatherlea East Road

The proposed designation was also viewed at locations, considered safe to do so, along the following roads using a GIS map of the proposed alignment loaded into the Google Earth app for ground referencing on site.

- State Highway 1
- Manakau Heights Drive
- Mokena Kohere Street
- Kuku East Road
- Arapaepae Road South
- Kimberley Road
- Queen Street East
- Waihou Road
- Heatherlea East Road
- Koputaroa Road
- South Manakau Road
- Wi Tako Street
- North Manakau Road
- Muhunoa East Road
- McLeavey Road
- Tararua Road
- Arapaepae Road North
- McDonald Road
- Sorensons Road

This overview of the route confirmed its general land use as agricultural or horticultural land (Figure 6 and Figure 7). There are a number of rural properties and outbuildings within the Project designation boundary or close by (Figure 8) and the route crosses a number of local roads.

Figure 6 Farm and pastural land

Figure 7 Market Gardens, orchards, berry farms and horticultural land

Figure 8 Various buildings located within the Ō2NL Project designation

Due to access constraints, it was not possible to view all horticultural or pastoral land, nor the quarry and historic landfill next to the Ohau river, nor parts of the route that are not intersect by the existing road network, as part of this site visit. These will be reviewed in more detail once access is granted.

Current and historical land use are discussed in more detail in the sections below.

2.2.2 Current site uses

The existing environment within the proposed designation boundary is characterised by agricultural land uses, comprising dairy and sheep farming, extensive areas of market gardening, pockets of orchards, glasshouses, poultry farms, and a vineyard. The topography is typically gently rolling, with various streams running in a general east to west direction across the area of the proposed designation.

There are small pine plantations within the sand dune country and on the backdrop hills. The agricultural land is interspersed with pockets of lifestyle or rural-residential development.

The proposed Ō2NL Project alignment also includes a limited number of major road intersections and river crossings.

Further discussion around land use and associated potential contamination is included in Section 3.1.

2.2.3 Surrounding land uses

The surrounding land use is similar to that observed within the proposed designation, which bypasses both Manakau and Ohau townships by significant margins. However, a small portion of the proposed designation is positioned adjacent to an eastern residential area of Levin township, from near the intersections of Queen St East and Arapaepae South Roads to slightly north of the intersections of Arapaepae South Road and Tararua Roads.

There are no industrial premises within the proposed designation or in close proximity (within 100m) of the proposed designation boundary.

The existing State Highway and the North Island Main Trunk Railway between Wellington and Palmerston North (Figure 9) are generally located to the west of the Project (Figure 1). Project works to the existing SH1 would be very limited and only occur at the tie-ins to the Ō2NL Project.

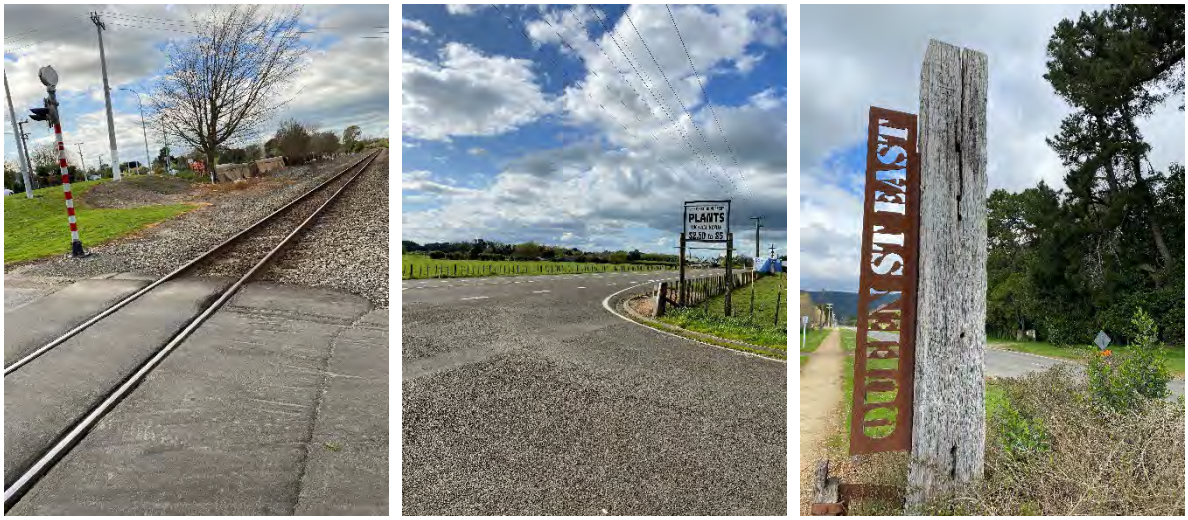


Figure 9 Roads and railway networks

The new road will connect to the current State Highway road improvements being completed south of Ōtaki and have similar features and stormwater management systems (Figure 10).

Figure 10 New State Highway being completed south of Ōtaki

3 Historical Site Use

3.1 Activities of Environmental Concern

The HAIL sets out a detailed list of both historic and current land use activities that, by their nature and the type of likely discharges, may have given rise to land contamination. The inclusion of a property on the HAIL does not, of itself, demonstrate the presence of land contamination at that property. However, it does provide an alert that land in and around that property may be contaminated and, on that basis and with the support of associated supplementary evidence (if available), allows a conclusion as to whether further investigation of the levels of possible land contamination should be undertaken. Similarly, land that is not HAIL, may be contaminated land owing to the presence of contaminants derived form building materials or similar, including asbestos.

Historic aerial photographs show that the major use of land along the proposed designation has been for pastoral and horticultural farming purposes, since the land was first developed in the early 1920s and 1930s. Common HAIL activities historically associated with such rural environments across New Zealand include:

- HAIL A2 (Chemical manufacture, formulation or bulk storage)
- HAIL A6 (Fertiliser manufacture or bulk storage)
- HAIL A8 (Livestock dip or spray race operations)
- HAIL A10 (Persistent pesticides bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds)
- HAIL A17 (Storage tanks or drums for fuel, chemicals or liquid waste)
- HAIL G3 (Landfill sites - General waste)
- HAIL G5 (Waste disposal to land / Farm dumps (excluding where biosolids have been used as soil conditioners)
- HAIL E1 (Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition)
- HAIL 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).

Key activities of Environmental Concern (AEC) for the proposed Ō2NL Project based on the major land uses, are outlined in Table 3 below.

Table 3 Key Activities of Environmental Concern within the Ō2NL Project

Activity	Potential contamination
Fertiliser use / pest control	The nature of pastoral farming and the presence of several orchards and market gardens implies the use of fertilisers for soil improvements is likely to have been widespread within the proposed designation. The presence of fertiliser storage structures is an indication of the bulk storage of fertiliser (HAIL A6), potentially associated with metals contamination. Agrichemical storage would also generally be associated with farming. Market gardens, orchards, glasshouses and spray sheds are listed as HAIL (A10) which is associated with bulk storage and use of persistent 'pesticides' including organochlorine pesticides (OCP) such as Dichlorodiphenyltrichloroethane (DDT). There is potential that organic and metals residues from pesticides may remain in soils within the proposed O2NL designation and will be disturbed as part of the works.
Fuel and chemical storage	Fuel supplies in limited volumes (typically diesel) are present on most farms and there is potential for storage of various chemicals typically in sheds. Losses to the ground could result in the contamination of soil which may be disturbed by the works. The eastern urban area of Levin is immediately adjacent to the proposed designation. This area of Levin is entirely residential in nature and there are no known facilities such as service stations present which border the proposed Ō2NL Project.
Animal husbandry	There is a poultry farm located at the northern end of the proposed designation. Pathogens, nutrients, Emerging Organic Contaminants (EOC's), viruses may be present depending on historical use of poultry waste on the site.

Activity	Potential contamination
	Sheep dips and offal pits may possibly be present on some farm properties which could be disturbed as part of the works, although there is no record of these in Horizons, HDC or GWRC records.
Mining / Quarry	A quarry is located adjacent to the proposed Ō2NL Project next to the Ōhau River. This site is not identified on the Horizons HAIL records. Gravel extraction is excluded from the HAIL list. Fuel is often stored at such locations (HAIL A17) and explosives may have been used.
Building demolition	There will be several dwellings and associated outbuildings (including sheds) that will be removed as part of the proposed construction works. There is potential for lead and asbestos to have been used in some of the old farm buildings. Poultry farms (especially older ones) are often constructed from asbestos containing material. Asbestos from buildings has not been investigated as part of the PSI but it is recommended that asbestos surveys are untaken for buildings that need to be demolished along the corridor prior to work commencing and licensed asbestos removalists appointed where appropriate. Contamination associated with buildings (as well as lead from flaked paint) will likely be within a couple of meters of the building exteriors. Septic tanks may be also present at some rural properties
Farm dumps	Waste generated on a farm (including burial of dead animals) has historically been permitted to be disposed of or burnt onsite. This has resulted in multiple small 'farm dumps' being established over time. These sites are unlined and often free draining, allowing contaminants to migrate in groundwater. There is potential that several farm dumps are located within the potential designation and could be disturbed as part of the works.
Railway	Fuels, oils, greases, lubricants, solvents, and related organic constituents, wood preservatives and heavy metals can be associated with railway activities particularly around yards. While the railway line will not be disturbed as part of the works there are two interfaces with the proposed Ō2NL Project. A new level crossing at SH1 / Tararua Road (remote from new highway alignment) and a bridge connection over the railway near Sorenson Road.

The identification of HAIL sites and activities of concern has been undertaken through:

- review of publicly available information held by Council,
- review of historical aerial photographs and recent drone footage and
- site visit to verify ground features or current site uses and note any variations from what is visible on the photographic evidence.

The locations of the identified sites within and adjacent to the proposed designation are presented in Appendix C. All sites are also listed in Appendix D, identified by a HAIL Site Number (Hail ID) allocated by Stantec. This numbering is used throughout the DSI.

3.1.1 Review of Council information of known HAIL sites

Horizons and GWRC each maintain a list of HAIL sites in their regions; such lists however are only as comprehensive and reliable as the information that has been obtained or provided in developing the lists. Thus, while the Horizons HAIL list was scrutinised (by Horizons, on Stantec's behalf) and Stantec has interrogated the GWRC Selected Land Use Register (SLUR) database in this work, the output of results cannot be considered the final or only the arbiter of contaminated sites in the region. This limitation must always be kept in mind when interpreting the findings of HAIL searches.

A .kmz file of the preferred Ō2NL Project alignment was presented to Horizons, who then interrogated their database of known or potentially contaminated sites (HAIL sites). This data was then provided to Stantec and further information requested from Horizons and HDC on specific sites of interest. A copy of the information supplied by Council is contained in Appendix D and maps showing the location of the HAIL sites identified are provided in Appendix C.2. No HAIL sites were identified within the proposed designation by the Horizons database, however three HAIL sites (Table 4) were identified along Arapaepae South Road adjacent to the proposed designation boundary.

Greater Wellington Regional Council's SLUR is freely available to use on the GWRC website and holds similar information about contaminated sites as the Horizons database. Accordingly, the GWRC SLUR was accessed and interrogated, given that the southern part of the Ō2NL Project (the first 6km) lies within the GWRC boundary. No HAIL sites were identified on the SLUR within or close to the proposed Ō2NL Project alignment.

Table 4: Known Historical HAIL Activities Adjacent to Designation Boundary

Title	Site HAIL ID 33	Site HAIL ID 10	Site HAIL ID 11
Horizons File No	ERM 0501AC	ERM 0501AV	ERM 0501AU
Address	26 Arapaepae South Road Levin 5510	380-386 Arapaepae Road Levin Rural 5571	378 Arapaepae Road Levin Rural 5571
Property Title	Lot: 1 DP: 322349	Lot: 4 DP: 25093	Lot: 2 DP: 427531
Status	Current	Current	Current
Contaminants	Landfill sites - General waste	Fuel Storage Tanks - Hydrocarbon	Fuel Storage Tanks - Hydrocarbon
Horizons SAHS	700518	700653	700652
Activity - HAIL	G3	A17	A17
Description	Arapaepae Road small dump - Landfill site	- Storage Tanks and drum storage - underground fuel tank in shed - back entrance to house	Storage tanks and drum storage - above ground fuel storage tanks
Current Status	Unverified history hazardous industry/act	Verified history hazardous industry/act	Verified history hazardous industry/act
Tank Removed?	No	No	No

The HAIL sites at 378 and 380-386 Arapaepae Road, Levin (Figure 11) were noted as having fuel storage tanks present and therefore the potential for losses of petroleum hydrocarbon-based fuels associated with refuelling of farm vehicles to be present within soils. These sites are outside the proposed designation and hydraulically downgradient in terms of groundwater flow direction and therefore the direction of possible contamination migration from any of these known sites is likely to be away from the proposed works. The likelihood of encountering petroleum hydrocarbons contaminants from these two HAIL sites as part of the works is therefore considered to be low.

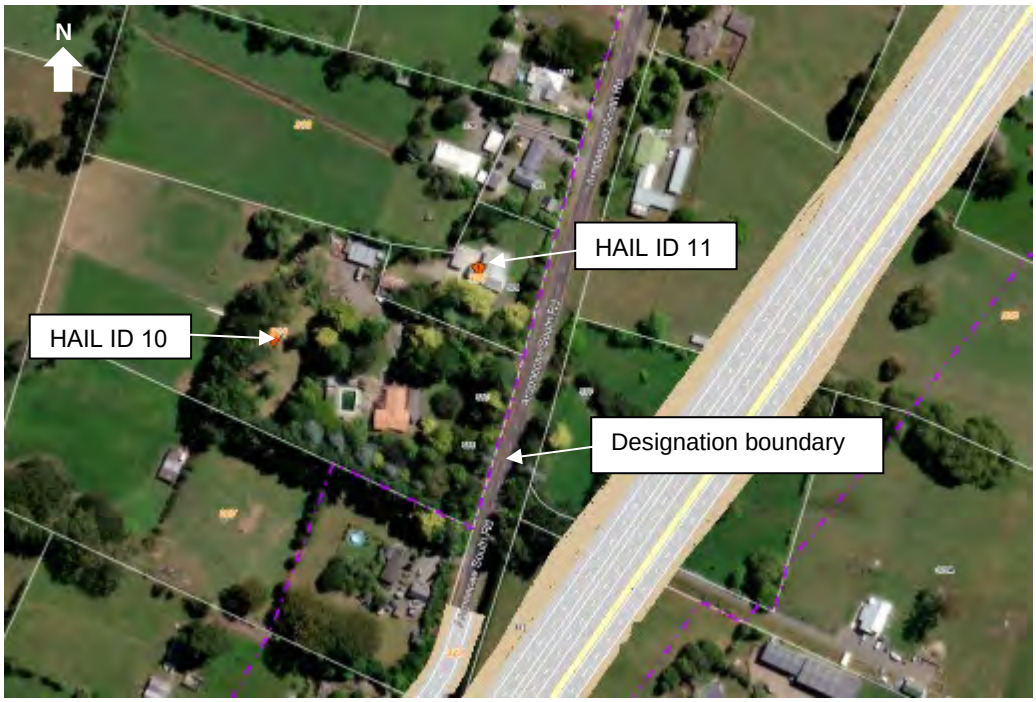


Figure 11: HAIL sites at 378 and 380-386 Arapaepae Road

During the September site visit, the location of the storage tanks at 378 Arapaepae Road was determined. These tanks were in the ground at the northern corner of the site behind the residential building (Figure 12), approximately 40m west of the designation boundary.

Figure 12 Storage tanks at 378 Arapaepae Road (HAIL ID 11)

The tanks at 380-386 Arapaepae Road were determined to be no longer present. The tenant was present at the site at the time of the inspection and confirmed that the fuel storage was associated with a machinery building that used to be located in the northwest corner of the property. The tenant located an old sump (Figure 13) and soak away area which he believed drained the machinery area. The sump outlet drained in a northern direction and away from the Ō2NL Project designation area.

Figure 13 Sump and soak away area at 380-386 Arapaepae Road (HAIL ID 10)

26 Arapaepae South Road Levin was recorded to be the location of a historic landfill site ((HAIL ID 33 on maps in Appendix C). There are no Council records of the age of the landfill, the quantity of material that may have been deposited here or its composition. There is an area of low ground observed in a 1940 aerial photograph (Figure 14) which is subsequently filled, and a dwelling is located on the site in the 1970s. The HAIL site is outside the proposed designation boundary and hydraulically downgradient of the works and will not be disturbed as part of the works.

Figure 14: HAIL Site 26 Arapaepae South Road (source Retrolens imagery 1940)

Horizons also provided details from their HAIL database of known or potentially contaminated sites near the material supply sites for the works.

No HAIL sites were identified next to material supply sites #34a and #36.

Two historic landfill sites (HAIL ID 34 and 35) were identified by Horizons next to the Waikawa Stream close to materials supply sites #15 (south Waikawa) and #19 (north Waikawa) (Figure 15). Council records note the following details (Table 5) for each site.

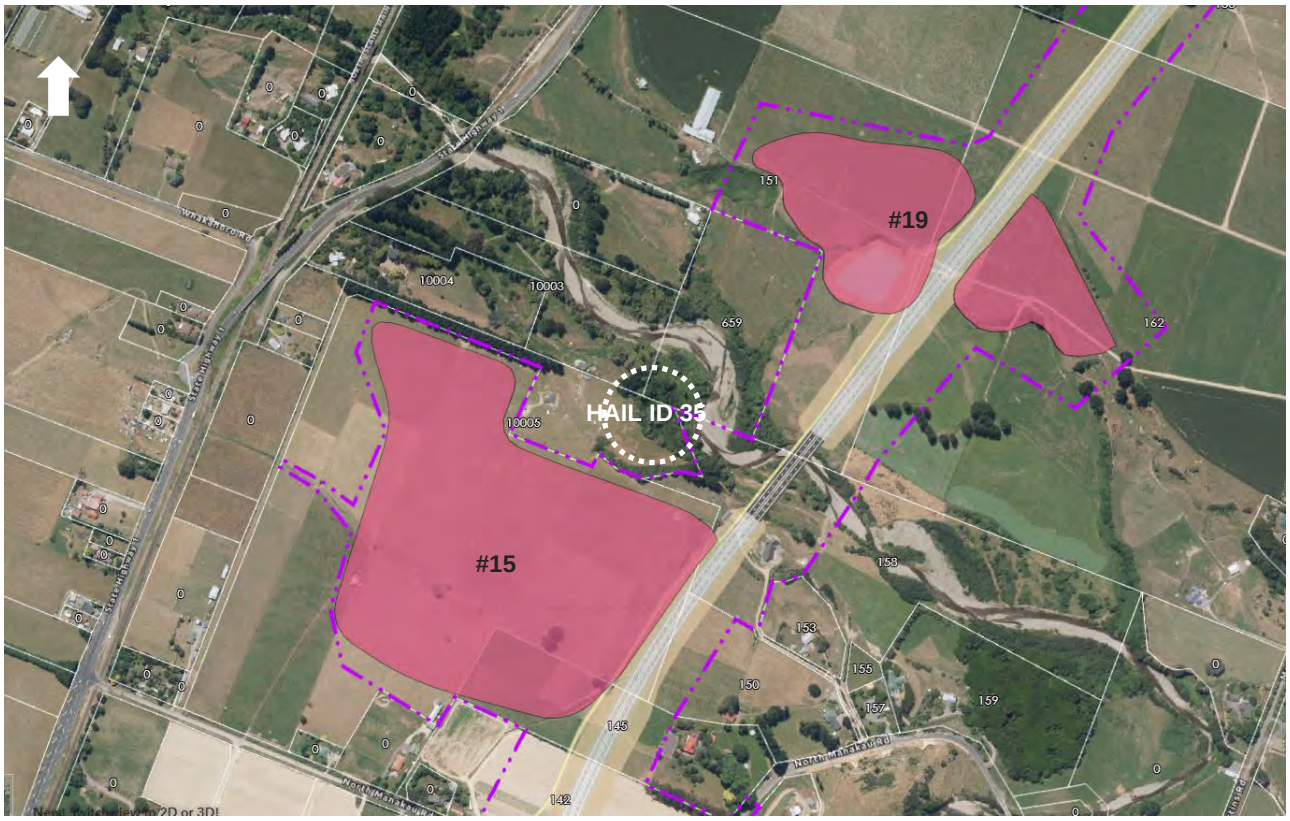


Figure 15 Material supply sites next to Waikawa Stream

Table 5 Known Historical HAIL Activities, from Council records, near Material Supply Sites

Title	Site HAIL ID 34	Site HAIL ID 35
Address	861 State Highway 1 Levin Rural 5570	887 State Highway 1 Levin Rural 5570
Property Title	WN7D/255	WN826/26
Status	Current	Current
Contaminants	Landfill sites – General waste	Landfill sites -– General waste
Horizons SAHS	700060	700692
Horizon File No	ERM 0501P	ERM 0501CL
Activity – HAIL	G3	G3
Description	Waikawa Stream Manakau – Landfill site	The Properties of Ransfield -– 891 State Highway 1 Levin South -– Old refuse landfill site -– Manakau -– near Waikawa Stream
Current Status	No identified Contamination. The land has been subdivided and Council no longer consider this property to be a HAIL site	Verified history hazardous industry/act. The land has been subdivided and the landfill extents is now located within 13 North Manakau Road next to Waikawa Stream and within part of 883 State Highway 1
Near material supply site	#19	#15

Historical imagery publicly available from Retrolens imagery (Figure 16) shows disturbed land at two main locations on the southern side of the Waikawa Stream, in close proximity to site #15. The full scale and location of landfill material is unclear from the imagery. Council records note that the area is “located within the Waikawa flood plain, the materials deposited have not been identified but some capping has been undertaken”.

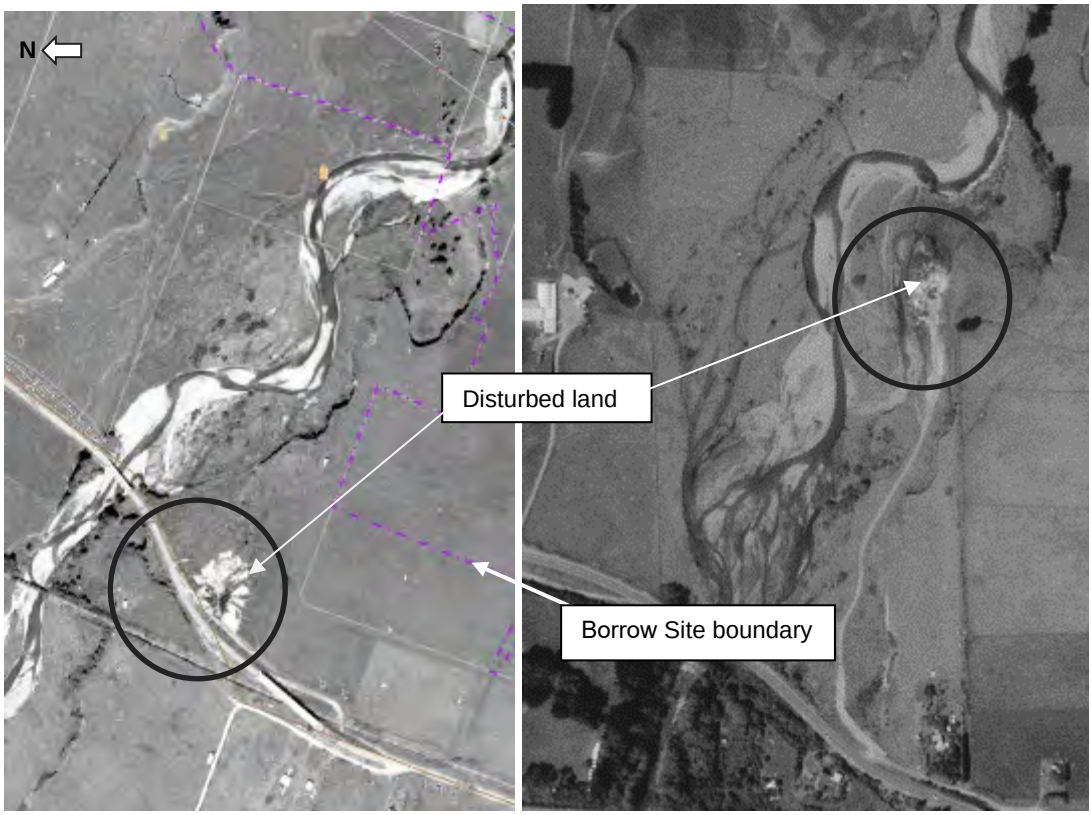


Figure 16: Potential Landfills Waikawa Stream (source Retrolens imagery 1940 & 1983)

The Council records additionally describe the location of the former (Manakau) landfill as “turn off east of SH1, 1.9km north of Manakau 200m south of the Waikawa stream. Take second left (going north), down a private road. The landfill is on the right in a garden, at the end of the private road”.

Discussions on site on 16 September 2022 during the site walkover with Mr N Bolton, one of the owners of 13 North Manakau Road, provided further information regarding the historic closed landfill. Mr Bolton understood that the landfill had been developed to service the local community and was closed in the 1960s and had accepted general domestic refuse, some of which was burnt onsite. Mr Bolton was also able to point out the extent of the landfill, which lies next to (south of) the Waikawa Stream within part of 13 North Manakau Road and part of 883 Sate Highway 1, as shown in Figure **17**. This corresponds with the southern part site HAIL ID 35.

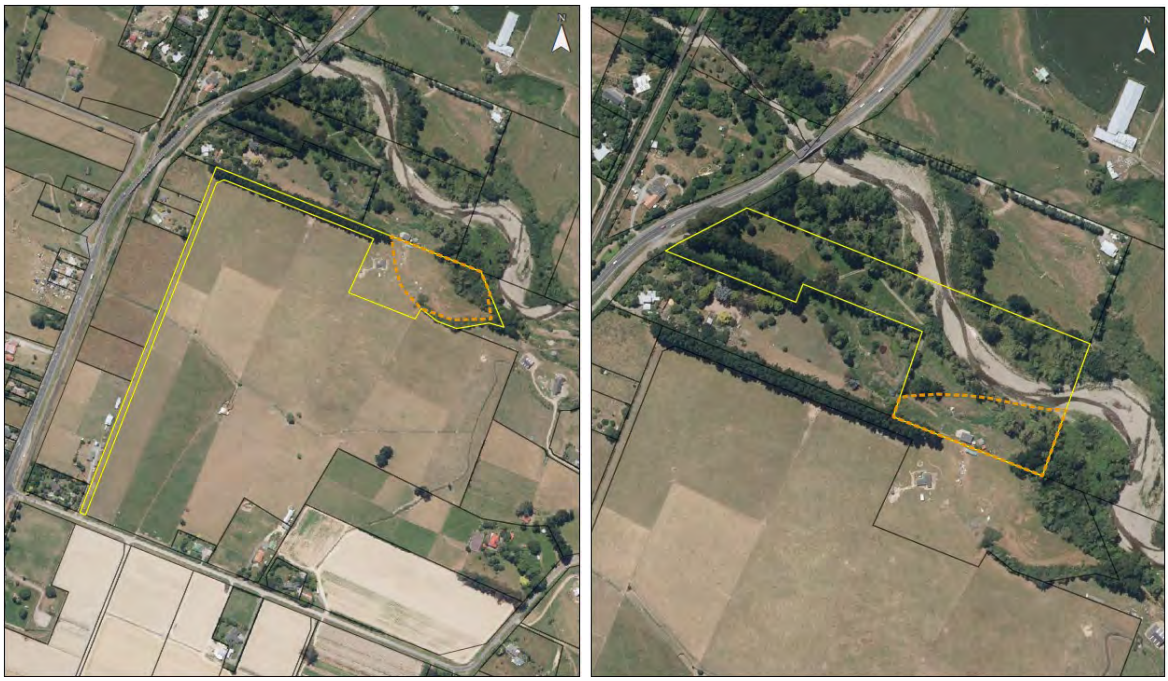


Figure 17 **Approximate location of the historic Landfill next to Waikawa Stream.**

Mr Bolton also noted that the cap was very thin in places and metal could be seen at the toe of the landfill. He currently has sheep grazing the site and has an air rifle shooting range set up on the lower area of the property. Current photographs taken on 16 September 2022 are presented in Figure 18 and Figure 19.

Landfill face

Top of landfill, view west

Figure 18 Closed Landfill located within 13 North Manakau Road

Toe of landfill, view north

Toe of landfill, view south

Figure 19 Closed Landfill toe, 13 North Manakau Road

On the basis of this information, it is concluded that:

- Material supply site #15 lies within 11North Manakau Road immediately to the south of the former landfill
- Material supply site #19 lies approximately 400 m northeast of the former landfill, across the Waikawa Stream on pastoral land.

3.1.2 Review of historical land use along Ō2NL proposed designation

Land covered by the NESCS includes pieces of land where an activity or industry described in the HAIL is or has been undertaken, whether it is included in Council records or not. For any PSI it has to be assumed that Council records may be incomplete and therefore a wider search of historical photographs is important.

3.1.2.1 Aerial Photographs

A review of aerial photography including scrutiny of historic images (Retrolens (https://retrolens.co.nz/) for the pre 1990 imagery and LINZ (https://data.linz.govt.nz) for 1991-current imagery, was undertaken for the entire O2NL route. Recent drone footage was also used. This review looked for evidence of historical and current HAIL land uses at properties within the designation boundary. Images from the following years were available for all or part of the route.

- 1939 – 1942
- 1961 – 1965
- 1970 – 1979
- 1999 – 2000
- 2010 – 2011
- 2015 – 2016
- Drone footage March 2021

Maps showing all the inferred HAIL sites based on the aerial photograph reviews are provided in Appendix C.3. Commentary is provided in Appendix D.

Table 6 provides summary details of the sites considered as potential HAIL sites within the potential designation. The relative risk associated with each based on is age and likelihood of being disturbed are considered in Section 4. Photos showing how the key sites of concern (market gardens or orchards in the 1960s and 70s) have developed overtime are provided in Appendix F.

Table 6: All Sites within the Potential Designation Identified as Potentially HAIL

HAIL SITE ID.	Location	Approx. Chainage (m)	Historical Land use of Concern	Possible Contaminants	Activity - HAIL
1	45 South Manakau Road	29,800	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
2	49 South Manakau Road	29,600	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
3	58 North Manakau Road, Manakau	27,300	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
4	51 North Manakau Road, Manakau	27,000	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
5	703 State Highway 1, Manakau	24,800	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
6	695-703 State Highway 1,	24,600	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
7	559 State Highway 1, Manakau	22,900	Landfilling	TPH, PAH, heavy metals and asbestos.	G5 waste disposal to land / G3 Landfill
8	559 State Highway 1, Manakau	22,900	Quarry / fuel storage	TPH/BTEX and PAH,	E7 mining industries (excl. gravel extraction)
9	416 Arapaepae South Road, Levin	20,400	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
12	232 Kimberley Road, Levin	19,500	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
13	273 Arapaepae South Road, Levin	19,000	Possible Orchard / Vines	Pesticides and Heavy Metals	A10 Orchard
14	237 Kimberley Road, Levin	19,500	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
15	259 Kimberley Road, Levin	19,500	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
16	1-7 Heatherlea East Road, Levin	10,000	Orchard / fruit trees	Pesticides and Heavy Metals	A10 Orchard
17	12-16 Heatherlea East Road, Levin	10,300	Possible small farm dump and small private orchard	Pesticides, Heavy Metals TPH, PAH, and asbestos.	A10 Orchard possible G5
18	148/138 SH1 Levin Foxton	10,800	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
19	32 Heatherlea East Road	10,500	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
20	34 Arapaepae Road, SH57 Levin	15,800	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
21	50 Arapaepae Road, Levin	15,600	Orchard / fruit trees	Pesticides and Heavy Metals	A10 Orchard
22	1051 Queen Street East, Levin	15,600	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
23	108 Arapaepae Road, Levin	15,100	Orchard / fruit trees	Pesticides and Heavy Metals	A10 Orchard
24	116 SH57 Arapaepae Rd, Levin	14,900	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
25	40 Waihou Road, Levin	15,100	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
26	116 SH57 Arapaepae Rd, LEVIN SHANNON	14,900	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
27	278 Heatherlea East Rd	12,600	Orchard / fruit trees	Pesticides and Heavy Metals	A10 Orchard
28	101 Waihou Road, Levin	14,200	Polly tunnels next to Valleyview Poultry Limited	Asbestos, Pesticides and Heavy Metals.*	A10 Glass houses

HAIL SITE ID.	Location	Approx. Chainage (m)	Historical Land use of Concern	Possible Contaminants	Activity - HAIL
29	1051 Queen Street East, Levin	15,200	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden
30	40 Waihou Road, Levin	14,900	Valleyview Poultry / Next to designation	Pathogens, Heavy Metals, nutrients, EOC's, viruses	
31	42 Waihou Road, Levin	14,800	Orchard / fruit trees	Pesticides and Heavy Metals	A10 Orchard
32	45 Waihou Road, Levin	14,700	Market Garden / horticultural	Pesticides and Heavy Metals	A10 Market Garden

* Note: Other contaminants, pathogens, nutrients, EOC's, viruses may be present depending on historical use of poultry waste as fertilizer from neighbouring property.

During the September site visit, several Polly Tunnels and outbuildings (Figure 20) were observed at 101 Waihou Road (Site 28, Table 6). The land is owned by the crown and is currently leased. The tenants had just recently moved in and were not aware of the history of the site and what the outbuildings had historically been used for.

Based on the observations on site there is potential for the roofing of some of these outbuildings to contain asbestos. A sample of the roofing material was taken during the site visit and sent to Hills Laboratories, an accredited lab, to confirm the presence or absence of asbestos. The analysis report identified the roofing material as fibre cement and detected the presence of Amosite (Brown Asbestos), Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos). While left undisturbed the asbestos remains bound within the corrugated asbestos cement roofing material. A licensed asbestos removalist will be required to manage the removal and disposal of these buildings appropriately. This property will also require further DSI once the buildings are removed to confirm any residual levels of contaminants within the soils, including asbestos.

Figure 20 Out buildings located at 101 Waihou Road, Levin

3.1.2.2 Site HAIL ID 7

Discussions with the owner of the quarry site next to the Ohau River (Appendix G) as part of geotechnical investigations noted that landfilling activities had historically occurred near the quarry. The site (HAIL ID 7 in Table 6) is located within the southern approach to the Ohau River bridge as shown in Figure 21 and will be disturbed as part of the Project construction works.

This site is not on the Council HAIL records. There is no evidence within the historical photos available that show ground disturbance at this location other than for quarry operations. The riverbed can be observed across part of the site in 1940 as the river meandered naturally.

Figure 21: Location of historic landfill within the southern approach to the Ohau River bridge

Further investigations of this location were undertaken as part of a geotechnical and contamination assessment in 2021. A summary of the findings is provided in section 3.2 below. The investigation report is presented in Appendix H.

3.2 Preliminary Sampling and Investigation Reports

An assessment of the HAIL site identified on the South Bank of the Ohau River (HAIL ID 7) was undertaken by Stantec in 2021. This included a geophysical survey, geotechnical bore and test pits to try to confirm the presence or absence of a landfill at this location.

Visual assessments of the site investigation test pits and groundwater boreholes logs noted evidence of landfill material including fence posts, a metal pipe, potentially a mattress, plastic, and bits of wire.

As part of the site investigations soil samples were taken at varying depths at four locations across the part of the site considered to have been used as a landfill and one location upstream but within the proposed alignment. Sample analysis was conducted by R J Hill Laboratories which is accredited by International Accreditation New Zealand (IANZ).

Samples were analysed for:

- Heavy metals
    - Cadmium
    - Copper
    - Lead
    - Chromium (total)
    - Nickel
    - Zinc
- Polycyclic Aromatic Hydrocarbons PAH)
- Semi volatile organic compound (SVOC)
- Organochlorine Pesticides (OCP)
- Asbestos (presence and absence)
- Total Petroleum Hydrocarbons (TPH)

All contaminants other than heavy metals were below detection limits and no asbestos was identified within the samples. Heavy metal contaminants were detected in the soils at concentrations that are generally comparable with background levels as recorded for category “Main Soil Type 1” in the Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (GWRC, August 2003), as shown in Table 7. Wellington Region Type 1 soils were selected as it comprises of Q1a soil from west of Levin and is therefore representative of local background levels.

Table 7: Analytical Results for Soil Samples at Southern Approach to Ohau River Bridge

	Wellington Background Concentration (Soil Type 1)[2]	Landfill Acceptance Criteria (Class B)	Average of Results for 12 Soil Samples
Total Recoverable Arsenic (mg/kg)	<2 - 7	10	6
Total Recoverable Cadmium (mg/kg)	<0.1 - 0.1	2	0.04
Total Recoverable Chromium* (mg/kg)	7 - 12	10	16
Total Recoverable Copper (mg/kg)	4 - 10	10	12
Total Recoverable Lead (mg/kg)	4.5 - 180	10	24
Total Recoverable Nickel (mg/kg)	4 - 9	20	14
Total Recoverable Zinc (mg/kg)	28 - 79	20	68
Benzo[a]pyrene (BAP) (mg/kg)	<0.002 - 0.08		0.005

The individual sample results are provided contamination assessment report is provided in Appendix H. Chromium and nickel total concentration were slightly above the background range across all samples, with copper slightly elevated in 50% of samples and zinc in 25% of samples.

The results indicate that the presence of historic landfill in this general vicinity has not resulted in widespread contamination of the soil. No contaminant concentrations exceeded the NESCS soil contaminant standards for commercial / industrial land use.

Several contaminant concentrations exceeded the MfE acceptance criteria for a Class B landfill, meaning that without further leachability testing, any soil to be disposed off-site should be disposed of to a Class A landfill. MfE guidelines for landfill acceptance criteria provide only a guideline disposal at various landfill types; the results should be compared to the specific landfill's acceptance criteria.

Given the low levels of contaminants encountered, the contamination assessment report concluded that there was no evidence of widespread landfilling having occurred in the area. However, the assessment report recommended that a CSMP is used to ensure the safe handling of the soil and that further considerations are made to determine if a consent is required under the NESCS for disturbance of soil and the off-site disposal of any surplus soil, to carry out the proposed Ō2NL Project works at this location.

A geophysical investigation was subsequently undertaken in August 2021. The geophysical data interpretation indicated that landfill material had historically been disposed of at this site. The model also provided an indication of the extent of the landfill material, Figure 22. The geophysical assessment also noted the potential for leachate to be present. Leachate is water that has percolated through the landfill material and leached out some of the contaminates. The quality of this leachate depends on how well the contaminants are bound to the soil.

3.3 Unknown Sites

While investigations have been taken to try and locate all HAIL sites within the proposed O2NL Project designation, there is always the possibility that unknown/unrecorded areas of historic contamination could be encountered during the Ō2NL Project works or discovered by other disciplines carrying out investigative activities, most particularly the geotechnical experts or within historical building inspections.

Such circumstances, if they occur, should be investigated by an expert in contaminated land assessments. The outcome may be that further investigation of soil contamination is, in the future and/or during construction, deemed necessary to understand the nature and extent of such contamination. This, in turn, may affect requirements for consent under the NESCS.

If unexpected, contaminated material is disturbed during Ō2NL Project works, the procedures of an unexpected discovery protocol should be implemented; the consequences of this may be that the nature and extent of suspected contamination need to be promptly investigated, including by sampling and analysis of potentially contaminated material. This may in turn invoke consenting requirements under the NESCS.

[2] Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (GWRC, August 2003)

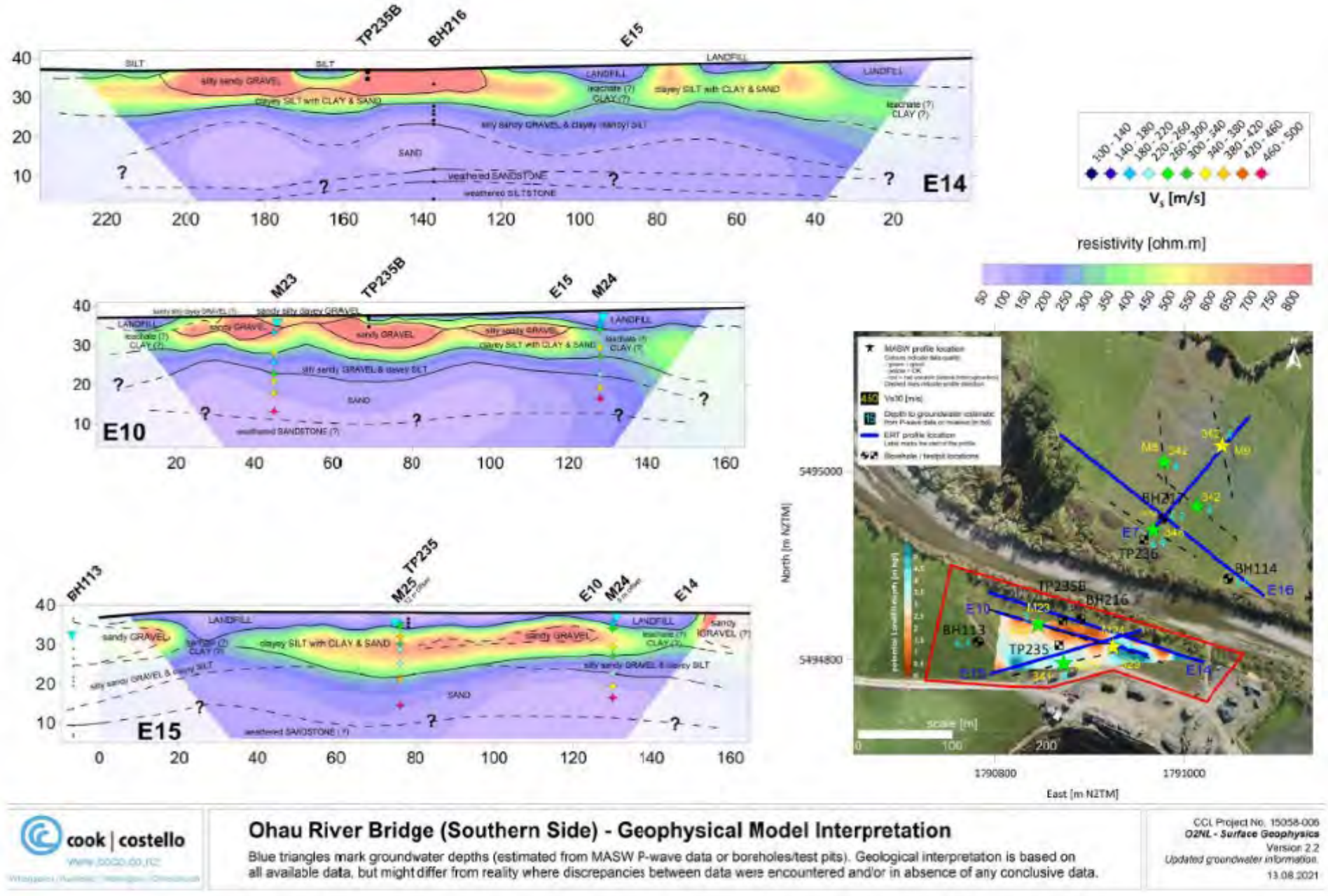


Figure 22: Geophysical model interpretation

4 Risk Assessment

4.1 Preliminary Conceptual Site Model

A preliminary Conceptual Site Model ("CSM") is a tool used in the determination of the potential risk to human health and/or the environment as a result of soil and/or groundwater conditions. An assessment is undertaken to identify the likely presence or absence of the following elements:

- ***Source*** - a substance that is capable of causing an unacceptable risk to human and/or environmental health.
- ***Pathway*** - a mode or route by which the substance/source can migrate to a receptor.
- ***Receptor*** - someone and/or something that could be adversely affected by the substance/source.

For instances where one or more of these elements are absent, an unacceptable risk to human and/or environmental health cannot exist. Where all of these elements are present, a complete or potentially complete pathway for contamination exists and there is a potential risk to human and/or environmental health that will require further investigation and possible remediation and/or management. The magnitude of the risk is primarily a function of the concentration, mobility and physico-chemical properties of the source, the sensitivity of the receptor and the nature of the migration pathway.

A risk screening has been undertaken and overall site ranking applied to each site to reflect the hazards that present the greatest risk. This is a qualitative assessment based on the likelihood and the nature of contamination existing at the site from a particular activity and has been based on the MfE Contaminated land management guidelines No. 3: Risk screening system. The risk ranking is intended to be a prioritisation tool to direct future site investigations and soil management during soil disturbance. A high-risk rating indicates a high potential for contamination that would require investigation and a low-risk ranking indicates a low potential for contamination, which may not require direct investigation. A medium risk rating indicates an uncertainty in whether an activity will have resulted in site contamination and further investigation is likely required to quantify this risk.

4.2 Potential Contamination Sources

Based on the historical records held by Horizons and HDC and the activities of environmental concern identified in Section 3, the following locations next to the proposed Ō2NL Project designation or material supply sites have been identified as known HAIL sites and therefore a potential source of contamination. A copy of council records for each site are provided in Appendix E.

4.2.1 Low Risk Sites

Table 8 presents sites considered to be low risk. As noted in Table 8, the likelihood of these sites being disturbed as part of the works and contaminants being encountered that pose a risk to human health is considered to be low, given that they are outside the area of disturbance and hydraulically downgradient of the works.

Table 8: HAIL Activities Identified by Council Records in the Vicinity of the Proposed Works

HAIL ID (Horizons SAHS no.)	Site ID	Location of Activity	HAIL Activity Identified	Contamination Status	Possible Contaminants	Risk Screening - Likelihood of exposure to contaminants
700653	10	380-386 Arapaepae Road Levin Rural 5571	A17	Verified history hazardous industry/act	TPH/BTEX and PAH,	Low Risk - Outside designation and hydraulically downgradient of works. Therefore, mobilisation of contaminants to the Project unlikely.
700652	11	378 Arapaepae Road Levin Rural 5571	A17	Verified history hazardous industry/act	TPH/BTEX and PAH,	Low Risk - Outside designation and hydraulically downgradient of works. Therefore, mobilisation of contaminants to the Project unlikely.
700518	33	26 Arapaepae South Road Levin 5510	G3	Unverified history hazardous industry/act	TPH, PAH, heavy metals and asbestos.	Low Risk - Outside designation and hydraulically downgradient of works. Therefore,

HAIL ID (Horizons SAHS no.)	Site ID	Location of Activity	HAIL Activity Identified	Contamination Status	Possible Contaminants	Risk Screening - Likelihood of exposure to contaminants
						mobilisation of contaminants to the Project unlikely.
700060	34	861 State Highway 1 Levin Rural 557	G3	Council records note no identified Contamination	TPH, PAH, heavy metals and asbestos.	No Risk – Council records note that this site should be removed from the HAIL register as it has been incorrectly left on the title when the land was subdivided and the landfill is located across the Waikawa Stream.
700692	35	0bserved on site to be located at 13 North Manakau Road and within part of 883 Sate Highway 1, next to Waikawa Stream	G3	Verified history hazardous industry/act	TPH, PAH, heavy metals and asbestos.	Low Risk - Outside material supply site boundary and hydraulically downgradient of works. This site is not to be disturbed as part of the works. The extents of the landfill is visible on site and known to the landowner.

4.2.2 Low-Medium, Medium and Medium-High Risk Sites

Orcharding practices prior to the 1970s entailed the use of various pesticides and agrichemicals that persist in the environment. Metals are often a co-contaminant for fertilisers and pesticides/herbicides and a survey undertaken by University of Waikato in 2003 found that "concentrations of arsenic in soils under orchard trees in the Tasman region and around the spray sheds and storage and handling areas at some historic orchards exceeded the Ministry for the Environment's residential soil guidelines."[3]

Table 9 provides a summary of the horticultural and orchard pieces of land that are considered to present a low- medium or medium risk of contaminants being encountered if the soil is disturbed. A full list of the agricultural sites investigated is provided in Appendix D. Land parcels where horticultural and/ or orchard activities have historically been undertaken were considered of low to medium risk to the Project if the activity was established later than 1980 or the activity was outside the footprint of the area of soil disturbance and/or downgradient of the works.

Table 9: Market Garden and Orchard HAIL Activities Identified by Aerial Photographs

HAIL ID	Site ID	Location of Activity	HAIL Activity Identified	Contamination Status	Possible Contaminants	Risk Screening - Likelihood of exposure to contaminants
5	169	703 State Highway 1, Manakau	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - Market Garden present in the 1970s and there is a likelihood that persistent pesticides and herbicides such as DTT could have been used at this time.
6	173	695-703 State Highway 1	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - Market Garden present in the 1970s and there is a likelihood that persistent pesticides and herbicides such as DTT could have been used at this time.

[3] University of Waikato June 2003 - Historic Pesticide Residues in Horticultural and Grazing Soils in The Tasman District, SK Gaw

HAIL ID	Site ID	Location of Activity	HAIL Activity Identified	Contamination Status	Possible Contaminants	Risk Screening - Likelihood of exposure to contaminants
9	298	416 Arapaepae South Road, Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - no imagery available to determine if present in the 1970s. Further testing required to confirm the presence of contaminants
12	367	232 Kimberley Road, Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - no imagery available to determine if present in the 1970s. Further testing required to confirm the presence of contaminants
14	374	237 Kimberley Road, Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Low - Medium Risk - only a small part of the site to be disturbed
15	381	259 Kimberley Road, Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Low - Medium Risk - only a small part of the site to be disturbed
20	499	34 Arapaepae Road, SH57 Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s. There is a likelihood that persistent pesticides and herbicides such as DTT could have been used at this time.
21	506	50 Arapaepae Road, Levin	A10 Orchard	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s. There is a likelihood that persistent pesticides and herbicides such as DTT could have been used at this time.
22	511	1051 Queen Street East, Levin	A10 Market Garden	Unverified Land use noted on the Project property information as current	Pesticides and Heavy Metals	Medium Risk - Imagery shows multiple fields and crops present in the 1970s. There is a likelihood that persistent pesticides and herbicides such as DTT could have been used at this time.
28	586	101 Waihou Road, Levin	A10 Glass houses	Unverified	Asbestos, Pesticides and Heavy Metals. Other contaminants Pathogens, nutrients, EOC's, viruses may be present depending on historical use of poultry waste on the site.	Medium - High Risk - no clear imagery available to determine if present in the 1970s s. Further testing required to confirm the presence of persistent pesticides etc. Site observations indicate that the shed roofing may contain asbestos. This is to be confirmed through additional testing.

Further soil analysis is recommended within these sites to determine the level of residual pesticides or associated metals that remain in the soils, prior to the proposed works.

4.2.3 Other Risk Sites

Other HAIL activities identified within the Ō2NL Project designation are assessed in Table 10.

Table 10: Other HAIL Activities Identified within the O2NL Designation

HAIL ID	Site ID	Location of Activity	HAIL Activity	Contamination Status	Possible Contaminants	Risk Screening - Likelihood of exposure to contaminants
7	209	559 State Highway 1, Manakau next to the Ohau River	G3 or G5	Verified field sampling has been undertaken	TPH, PAH, heavy metals and asbestos.	High Risk as waste material observed by geologist during site investigation. Soil contaminants tested low
8	209	559 State Highway 1, Manakau	E7 mining industries (excluding gravel extraction)	Unverified	TPH/BTEX and PAH,	Low - Medium Risk - subject to confirming quantity of any fuel, or hazardous substance stored on site
17	453	12-16 Heatherlea East Road, Levin	Possible G5	Unverified	Pesticides and Heavy Metals, TPH, PAH, and asbestos.	Low - Medium Risk - Possible risk of farm dump being encountered

Several dwellings and associated outbuildings (including sheds) have been identified within the Ō2NL Project designation and will be removed as part of the proposed construction works. There is potential for lead and asbestos to have been used in some of the old farm buildings and the storage of fuel and agrichemicals. Contamination associated with buildings (as well as lead from lead-based flaked paint) will likely be within a couple of meters of the building exteriors. Asbestos was used as a building material widely in NZ until1990 following the cease in production of asbestos building materials in 1987. Buildings inspections should be carried out on buildings built or renovated between 1940 and 1990 prior to demolition to identify the potential for asbestos to be present. Removal of any asbestos should be managed in accordance with the Health and Safety at Work (Asbestos) Regulations, 2016, the Code of Practice for the Management and Removal of Asbestos, 2016 and the BRANZ, New Zealand Guidelines for Assessing and Managing Asbestos in Soil, 2017.

While there are no records of farm dumps, sheep dips or offal pits within the Ō2NL Project designation, there is a potential that some may be encountered during works. If encountered these will be investigated by a SQEP and appropriate management taken in accordance with the unexpected discovery protocols.

4.3 Migration Pathways

A migration pathway is a means by which a receptor can be exposed to, or potentially affected by, a contaminant. The exposure pathway can be direct (i.e. stays within the same exposure medium) or indirect, where transport from one medium to another takes place. The following potential migration pathways (Table 11) are possible for this site depending on the type of contaminants.

Table 11: Potential Migration Pathways

Potential Migration Pathways	Description
Ingestion	Eating or swallowing of contaminated dust/soils from contaminated soils, either by deliberate consumption, or indirectly by eating with dirty hands.
Inhalation	Breathing in dust from contaminated soil, particularly when land disturbance or vehicle movements are in operation. Inhalation of volatilised organic contaminants within the excavation and its surrounds.

Potential Migration Pathways	Description
Dermal Contact	Direct contact with contaminated residues on the ground surface, potentially causing skin conditions such as dermatitis, etc. Certain contaminants can be absorbed into the body through the skin or enter directly through open cuts or abrasions.
Leaching and Sediment Runoff	Infiltration of water through contaminated soils that are exposed to rainfall could potentially leach out soluble contaminants. Sediment erosion can also move contaminants bound to the soil structure. Both mechanisms can result in pollution of local waterways, with the former also potentially impacting on groundwater.
Migration of Contaminated Water	Contaminated water can migrate laterally or vertically depending on permeability and preferential pathways such as drains or man-made voids and channels. Such migration of contamination may impact on shallow groundwater quality and local waterways. Surface water runoff can carry sediment-bound contamination into local waterways.

While it is understood that the works will avoid any direct interaction with the groundwater system, dewatering and sediment control within the proposed Ō2NL Project works should also consider the potential for contaminant migration as a result of disturbing HAIL sites, identified within the designation, particularly where close to streams and wetlands. The design shall also consider the ongoing treatment of stormwater run-off from the new road which may contain sediments, heavy metals and hydrocarbons.

4.4 Receptors

A receptor is something (such as people, a water body, or an ecosystem) that could be adversely affected by the contaminant.

During construction and operation of the Ō2NL Project, the following people could be affected by the works:

- Construction workers building the road who may be exposed to contaminated soil, groundwater, and dust.
- Off-site public, including workers at nearby properties who may be exposed to contaminated dust.
- Maintenance workers, including those workers who maintain subsurface utilities may be exposed to contaminated soil, groundwater, and dust.

Potential ecological receptors for contaminants in land that may be disturbed by the works include:

- Terrestrial flora and fauna.
- Off-site biota in freshwater bodies.

4.5 Source-Pathway-Receptor Linkages

A preliminary conceptual site model (CSM) has been developed or the Ō2NL Project on the basis of this PSI. Figure 23 shows the potential source-pathway-receptor relationships that have been identified, bearing in mind the proposed end land use.

The essential elements of a CSM are:

- Known and potential sources of contamination.
- Potentially affected environmental receiving environments.
- Human and ecological receptors; and
- Potential and complete exposure pathways.

Based upon the findings of this investigation, it can be concluded that several HAIL activities are present or have historically been present along or adjacent to the Ō2NL Project alignment. Historical horticultural and pastural practices have the potential to have caused localised contamination of soils and groundwater. Landfill material is likely to contain a variety of contaminants and water that has percolated through the landfill material may have leached out some of the contaminates. The quality of this leachate depends on the type of material it has moved through and the solubility of the contaminants. If not adequately contained, there is potential for this to migrate and effect surrounding waterbodies.

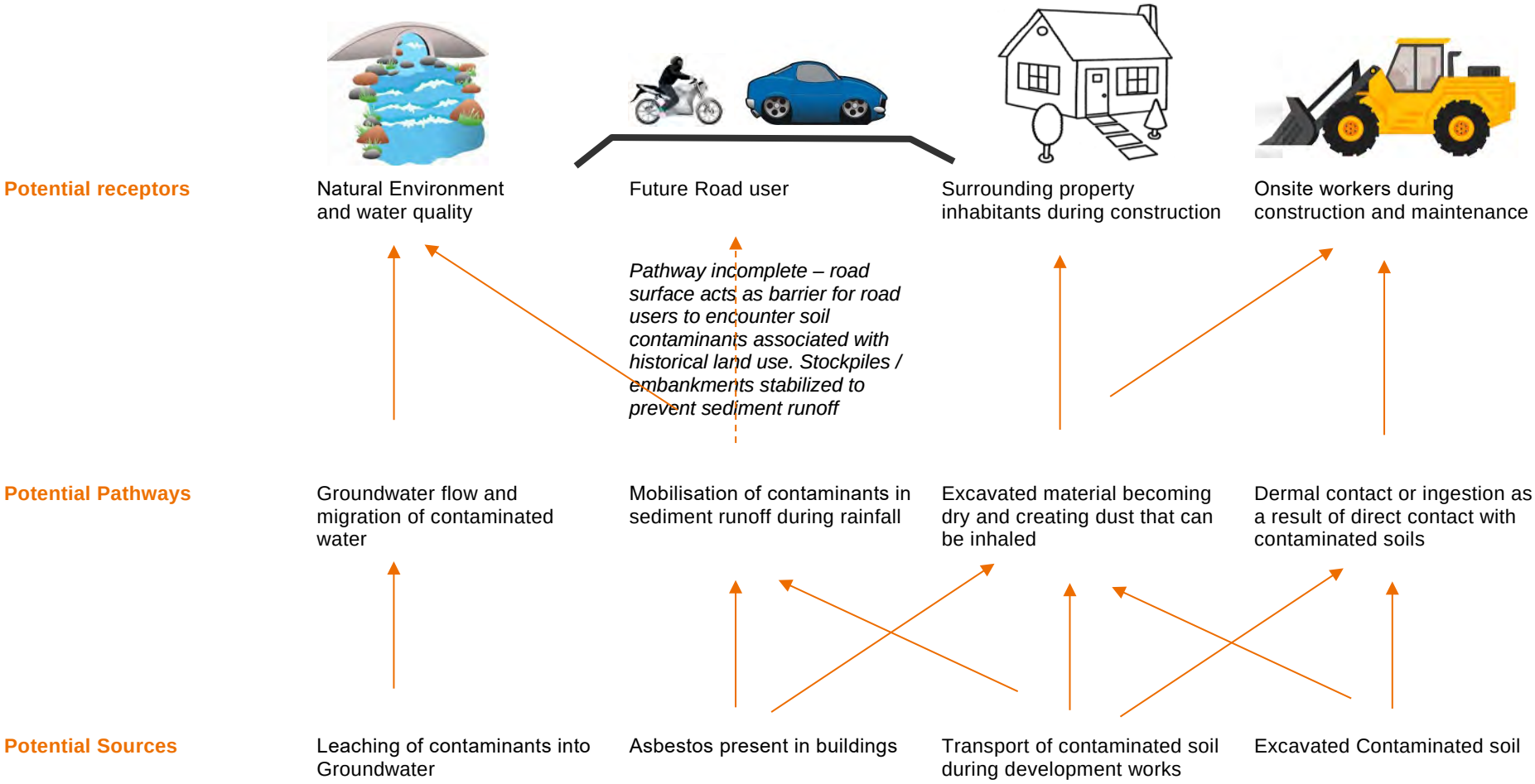


Figure 23 Preliminary Conceptual site model (CSM) for proposed works

The potential construction effects of the Ō2NL Project on contaminated land have been identified as:

- Disturbance of contaminants in soil and groundwater and consequential discharges of contaminants to air, land and water (surface and groundwater) where there may be an effect on the environment; and
- Discharge of such contaminants where there may be an effect on human health – including site workers and the public.

However, actual soil and groundwater quality data on the potentially affected sites is currently unknown which means that the scale of the risk to human and ecological receptors cannot be determined at this stage.

The main pathways identified for the Project are dermal contact, dust and sediment runoff during construction works and migration of contaminated water. Soils which have residual pesticide concentration could inhibit the success of any planting if used within the stormwater channel. Once the road is established the new road pavement will act as a barrier to direct migration pathways.

The main receptors identified for the Ō2NL Project are the site contractors / workers involved in the construction works and surface water ecosystems if contaminated soil is discharged from the site through runoff or reused within planted recreational areas.

The encapsulation of any contaminants where concentrations are above general background concentration within the embankments of the proposed work and disposal of refuse material offsite to a facility authorised to take the material will reduce to risk of exposure to potential receptors and break exposure pathways.

4.6 Additional Information

It is recommended that a DSI is undertaken within the A10 HAIL sites identified in Table 9 once the properties are purchased to allow the CSM to be reviewed and if concentrations are above background levels to inform a CSMP (to be developed as part of the overall site management systems and processes). If DDT or other pesticides are found in elevated concentrations at any site, then the CSMP should include a methodology to encapsulate this soil within the embankments and earthworks rather than reuse as topsoil. If no contaminants are found, then it can be reused on site within the Project as topsoil.

A DSI should also be undertaken at HAIL site ID 7 to further investigate the findings of the geophysical model and develop a remedial action plan where appropriate and at HAIL site ID 28 once the buildings and roofing containing asbestos has been removed to confirm any residual levels of contaminants within the soils.

The CSM would need to be reviewed and updated following the DSI's.

5 Evaluation of Relevant RMA and Regional Plan Rules

5.1 National Environmental Standard Requirements on the Project

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 ("NESCS") provides a nationally consistent set of planning controls for the management of activities that disturb contaminated and potentially contaminated land. The following table (Table 12) provides an overview of the requirements under the NESCS and their impact on the Project.

Table 12: NES-CS Regulatory Requirements

<table>
<tr><th>Rules</th><th>Description</th></tr>
<tr><td>Regulation 5(9) of the NESCS notes that "these regulations do not apply to a piece of land described in subclause (7) or (8) about which a detailed site investigation exists that demonstrates that any contaminants in or on the 'piece of land' are at, or below, background concentrations".</td><td>The proposed work currently falls under the requirements of the NESCS since, with the exception of site HAIL OD ID7, no DSIs currently exists for the HAIL sites within the proposed designation identified in this PSI. Soil testing would be required to determine if contaminant concentrations are below background and if Regulation 5(9) can be applied.</td></tr>
<tr><td>Section 5(1)(a) of the NESCS these regulations apply when a person wants to do an activity described in any of the subclauses (2) to (6) on a piece of land described in subclause (7) or (8)

Regulation 7 of the NESCS specifies that a piece of land under the NESCS is an area that has, or has had, or is more than likely to have or have had a HAIL activity undertaken upon it.</td><td>The works are subject to the NESCS given that HAIL sites identified in this PSI will be disturbed.</td></tr>
<tr><td>The method for determining if a piece of land is to be disturbed Regulation 6 (3) is to undertake a PSI that assesses the likelihood that the soil is contaminated as a result of activity or industry occurring</td><td>From this PSI it is determined that HAIL sites shall be disturbed as part of the works and therefore the regulations shall apply.</td></tr>
<tr><td>Regulation 8(3) of the NESCS outlines permitted activity criteria for disturbing of soil on a HAIL site. If the volume of soil to be disturbed or removed as a result of proposed activities at a site exceeds those ratios of volumes to site area set out below a resource consent is required under the NES-CS.
<table>
<tr><th></th><th>Max Permitted Quantity</th></tr>
<tr><td>Permitted Activity volume for reuse on site</td><td>25 m^3 per 500 m^2 of site area</td></tr>
<tr><td>Permitted Activity volume for removal off site</td><td>5 m^3 per 500 m^2 of site area</td></tr>
<tr><td>Duration of earthworks</td><td>Two months</td></tr>
</table>
The proposed construction works could encounter soils potentially impacted by horticultural chemicals at 10 locations along the alignment covering at least 4 km (~16%) of the alignment. Typically, such contamination affects upper soils to depths of about 0.3- 0.5 m. For the designation width of 60 m, this indicates the potential presence of 72,000-120,000 m^3 of impacted soils.</td><td>Final design is required to determine if the permitted activity volumes can be met otherwise the work must be considered under the controlled activity, restricted discretionary or discretionary activity rules and a resource consent applied for.</td></tr>
<tr><td>Regulation 8(4) of the NESCS outlines permitted activity criteria for subdividing land or changing the use of the piece of land as:

(a) a preliminary site investigation of the land or piece of land must exist:
(b) the report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land:</td><td>The Project constitutes a change of use and the activity must therefore be assessed under this regulation.

This document provides the PSI required by the regulations as there are HAIL sites located within the proposed works. Soil analysis would need to be undertaken for</td></tr>
</table>

Rules	Description
(c) the report must be accompanied by a relevant site plan to which the report is referenced: (d) the consent authority must have the report and the plan.	the works to considered under the permitted, controlled activity or restricted discretionary rules. If no DSIs are undertaken, the works would be subject to discretionary activity rules.
Under Regulation 7(4)(b) of the NESCS, guidelines criteria for the protection of human health must be chosen in accordance with the current edition of the Contaminated Land Management Guidelines No. 2 "Hierarchy and Application in New Zealand of Environmental Guideline Values", Wellington, Ministry for the Environment.	The PSI considered that the HAIL sites to be disturbed by the proposed works require detailed site investigation (DSI) to determine the risk to human health and the environment if disturbed. Given that the land will be mainly used as part of the Ō2NL Project designation, and the area will be sealed by the new road and shared paths, guideline criteria compatible with that land use should be considered when assessing the risk to human health. Where appropriate other relevant receiving environment guidelines and soil contaminant standards (SCS) should also be considered as part of the DSI depending on the contaminants encountered and the proximity to sensitive environments.

5.2 Regional Plan Rules

The Ō2NL Project is located with the Horizons and Greater Wellington Regions and therefore the following operative regional plans are relevant to the Project.

- Horizons One Plan
- Proposed Natural Resources Plan for the Wellington Region (Final Appeals Version 2022)

A statutory Rule Assessment (Volume II, Appendix One of this application) has been carried out for the Project and those rules relevant to the disturbance of HAIL material are summarised in the tables below. Once sufficient site access has been granted and DSI's have been carried out to determine the level of contaminants present within a site then a final planning assessment against permitted activity rules can be made and where appropriate resource consents applied for to allow for the disturbance of contaminated soil.

Table 13 Relevant regional rules with the Horizons One Plan

Rule Reference	Commentary
14-24 Discharges of persistent and harmful contaminants	In this case the past use of sites in the Horizons Region for market gardening means that there is a potential for persistent organochlorines to exist in the soils. Waka Kotahi has to date been unable to gain sufficient access to the relevant sites traversed by the Project to undertake soil testing to determine presence or absence of contaminants, and if contaminants are present, to what level. Subsequent soil testing as part of a DSI will determine the need or otherwise for any consent under this Rule. If persistent organochlorines exist in the soils then consent will be sought under 14-24 as a non-complying activity
14-28 Discharges of contaminants onto or into land that may enter water.	As above, Waka Kotahi has to date been unable to gain sufficient access to the relevant sites traversed by the Project to undertake soil testing as part of a DSI to determine presence or absence of contaminants.
14-30 Discharges of water or contaminants to land or	If contaminants above background levels are present, then consent will be applied for under Rule 14-30, which allows for discharges of water or contaminants to land or water not covered by other rules in the One Plan or Chapter 14 as a discretionary activity.

Rule Reference	Commentary
water not covered by other rules in this Plan or chapter	

Table 14 Relevant regional rules Proposed Natural Resources Plan for the Wellington Region

Rule Reference	Commentary
5.2.12 Contaminated Land and Hazardous Substances **Rule R81 :** Detailed Site Investigation	No sites traversed by the Project within the Greater Wellington Region are indicated as contaminated land on the GWRC SLUR database or have been identified as HAIL by this PSI. If contamination is encountered during the works, then a detailed site investigation will be undertaken in accordance with the requirements of this permitted activity rule.
5.2.12 Contaminated Land and Hazardous Substances **Rule R82:** Discharges from contaminated land	See above. This rule will be relied upon if any contaminated land is encountered, and a detailed site investigation undertaken.

6 Conclusions

This PSI has determined that contaminated land and HAIL sites, including a historic landfill, markets gardens and orchard land, exist within the Project designation. Ten of these sites have been identified on the basis of desk study or site walk over inspection as medium or higher risk sites in relation to the presence of contaminants in soil and groundwater that could be disturbed during highway construction works:

- HAIL ID 5
- HAIL ID 6
- HAIL ID 7
- HAIL ID 8
- HAIL ID 9
- HAIL ID 12
- HAIL ID 20
- HAIL ID 21
- HAIL ID 22
- HAIL ID 28

Further investigation of these sites will be required to quantify the contamination, human health and environmental risk, resource consenting requirements and management.

Full access to the proposed designation was not available during the period of the PSI. Further sites could be identified in the future.

While application of the national and regional planning rules cannot be fully assessed at this stage with certainty. It appears likely that works within at least certain parts of the alignment will be subject to the NESCS for change of use and soil disturbance, and to One Plan rules on discharges to land and water.

7 Recommendations

Prior to construction works detailed site investigations are recommended within the medium risk sites to determine the level of residual pesticides or associated metals that remain in the soils and inform the appropriate management of the soil to be adopted as part of the proposed road construction methodology. Soil testing should be undertaken in accordance with Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils (Revised 2021).

It is also recommended that once final disturbance volumes and contaminant concentration are known, further considerations are made to either reuse the soil within the construct footprint of the Project, encapsulate soil within the earthworks, or, if off-site disposal of any surplus soil is required.

The presence of historic landfill material within the road alignment has a potential to impact on the structure of the new bridge and roadway at Ohau River. Consideration should be given within the design to either:

- leaving the material undisturbed in situ and design the road over the top or
- removal and disposal of all unsuitable material offsite.

There is also an opportunity to consider remediation of the site as part of the Ō2NL Project works and remove all historical landfill material and dispose of it properly. This will reduce the potential for future discharge of contaminants to

the Ohau river from any historical material disposed of here. It is recommended that a DSI is undertaken to confirm the exact quantity of contaminated material to be managed. Any unsuitable material should be disposed of at a facility authorised to take the material.

It is recommended that a CSMP is provided, for any sites requiring NESCS consent, to ensure the safe handling of the disturbed soil within HAIL sites and appropriate reuse or disposal. This should be based on the findings of the DSIs.

An unexpected discovery protocol is also recommended as part of the overall project; this will ensure that, should such discoveries be made, they will be thoroughly assessed and, if necessary, remediated and/or mitigated to reduce risks from contaminated soil to negligible levels.

8 Statement of Limitations

Stantec New Zealand (Stantec) has prepared this report for the use of Waka Kotahi in accordance with the usual care and thoroughness of the consulting profession. It has been prepared in accordance with the scope of work and for the purpose outlined in this report. It is based on accepted practices and standards at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report. Stantec makes no determination or recommendation regarding a decision to provide or not to provide financing with respect to the site.

There is no investigation that is thorough enough to preclude the presence of materials at the site which presently, or in the future, may be considered hazardous. As regulatory evaluation criteria are subject to change, concentrations of contaminants present and considered acceptable may, in the future, become subject to different regulatory standards which cause them to become unacceptable and require remediation for the site to be suitable for the existing or proposed land use activities.

The methodology adopted and sources of information used by Stantec are outlined in this report. Stantec has made no independent verification of the information beyond the agreed scope of works and Stantec assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to Stantec was false.

This report was finalized in September 2022 and is based on the conditions encountered and information reviewed at the time of preparation. Stantec disclaims any responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

9 SQEP Certification of the Report

I Kathryn Halder of Stantec New Zealand certify that:

This preliminary site investigation meets the requirements of the Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health) Regulations 2011 because it has been:

- done by a suitably qualified and experienced practitioner, and
- reported on in accordance with the current edition of Contaminated land management guidelines No 1 – Reporting on contaminated sites in New Zealand, and
- the report is certified by a suitably qualified and experienced practitioner.

For activities under R8(3) of the NESCS this preliminary site investigation concludes it is possible (without further soil analysis) that there will be a risk to human health if the activity is done to the piece of land identified at HAIL and therefore a resource consent should be sought for the Project works.

The activity to be undertaken as defined in R 5(4) is described on page 3 of this preliminary site investigation and the areas of land addressed are described in section 3 of this preliminary site investigation.

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and have certified this report is appended to the preliminary site investigation report in Appendix A.

Signed: ……Kathryn Halder……..

Dated: ……20 September 2022…… ……

10 References

Heron, D.W. (custodian) (2014). Geological Map of New Zealand 1:250 000. GNS Science Geological Map 1. Lower Hutt, New Zealand. GNS Science.

Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

BRANZ, 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil.

MfE, 2012, User's Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, Ministry for the Environment.

MfE, 2021a, Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites in New Zealand.

MfE, 2021b, Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils.

MfE, 2011c, Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand.

MfE, 2004, Module 2 – Hazardous waste guidelines: Landfill waste acceptance criteria and landfill classification, Ref: ME 510.

Ōtaki to North of Levin Project – Contamination Assessment at the South Bank of the Ōhau River. Prepared for Waka Kotahi NZ Transport Agency June 2021. Report prepared by Stantec, reference 310203848, Status Final (the 'South Bank contamination assessment').

University of Waikato June 2003 - Historic Pesticide Residues in Horticultural and Grazing Soils In The Tasman District, SK Gaw

Technical assessments provided as part of the Project

Mr Andrew Craig's Hydrology and Flooding assessment provided as Technical Assessment F in Volume IV;

Mr Gavin Craig Lister's Landscape, Visual and Natural Character assessment provided as Technical Assessment D in Volume IV;

Dr Jack McConchie's Hydrogeology and Groundwater assessment provided as Technical Assessment G in Volume IV

Appendices

We design with community in mind

Appendix A PSI requirements

A1: PSI Table of contents: s: 'subdivision' or 'change in use' as a permitted activity

Content	Required	Required if relied on[4]	CLMG 5 section
1. Introduction			
investigation objectives	Section 1.1		2.1
site identification (site name, address, legal description; site boundaries; a map reference and geographic coordinates)	Section 1.3		3.3.1
proposed site use		Section 1.4	3.3.2
2. Site description			
environmental setting		Section 2.1	3.3.3
site layout	Appendix C		3.3.4
current site uses	Section 2.2.2		3.3.5
surrounding land uses	Section 2.2.3		3.3.6
geophysical surveys		Figure 22	5.1
site inspection		Section 2.2.1	3.3.8
3. Historical site use			
summary of site history gained from:	Section 3		3.3.7
• review of existing investigation reports		☐	
• review of council information		Section 3.1.1	
• review of aerial photographs		Section 3.1.2	
• interviews		Appendix G	
• review of other historical Information		☐	
preliminary sampling (if carried out)		Section 3.2	3.3.9
• description (including diagram)			
• justification for sample location and analyte selection			
• results			
• comparison of results to guidelines			
4. Risk assessment			3.3.11
conceptual site model	Section 4.1		
evaluation of the probability that contamination exists on the site	Sections 4.2 – 4.5		
identification and characterisation of potential pathways and receptors for each exposure area across the site (e.g. assessment of geology, hydrogeology, building construction, site use)	Sections 4.2 – 4.5		
likelihood that contamination poses a risk to identified receptors including potential receptors	Sections 4.2 – 4.5		

[4] Any evidence relied upon to form an opinion and/or conclusion must be included in the report including sampling. If sampling is relied upon, then headings 3, 4 and 5 of table A4 apply

Content	Required	Required if relied on[4]	CLMG 5 section
magnitude of the risk to receptors, pursuant to regulation 8(4)(b): is it highly unlikely that there will be a risk to human health if the activity is done to the piece of land? evaluate the magnitude of any identified risk to other receptors (eg, ecological) describe the limitations of the data collected and the assumptions and uncertainties inherent in the data and models used **Note: If the regulation 8(4)(b) 'highly unlikely' test cannot be achieved, then the activity is not permitted.**	Section 4 Section 4	☐	3.3.11 7.3.2
5. Conclusions	Section 6		
6. Recommendations (if relevant to report purpose)		Section 7	
7. Report limitations	Section 8		
8. SQEP certification of report (refer appendix C)	Section 9		1.2
9. References	Section 10		
Appendices: relevant supporting information			

Supporting information	Required	Required if relied on[5]
Figures (including site plan – regulation 8(4)(c))	Appendix C	
Conceptual site model (if not included in report body)	In body of report	
Land titles		☐
Site photographs (if site inspection carried out)		Drone footage available on GIS Maps Site photos contained within body of report
Laboratory reports and chain of custody documentation (if sampling carried out)		Appendix H
Calibration information for any field screening instruments used		☐
Other supporting information		☐
Statement of qualification of the author and, if not the author, the certifying SQEP	Appendix B	

5 Any evidence relied upon to form an opinion/conclusion must be included in the report.

Appendix B Evidence of SQEP Qualifications and Experience

KATHRYN HALDER

Kathryn is a Principal Environmental Scientist and has worked both in New Zealand and throughout the UK in contaminated land and waste management. Kathryn has over 20 years' experience working closely with Local Councils, Regulatory Authorities, Governmental bodies and businesses. She has also worked with the Ministry for the Environment in developing waste assessment guidance document and developing a NZ waste minimisation infrastructure database.

Kathryn's undergraduate and master studies were in contaminated land and site risk assessments based on historic land. She has also experience in applying the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health having carried out contaminated land investigations. She has also overseen the successful bioremediation of a number of these sites. Kathryn also has experience in working with developing 'source, pathway, receptor' models to assess risk to human health and reporting to the standard of the Ministry for the Environments Contaminated Land Management Guidelines. Kathryn has been involved as Contaminated Land technical advisor on several Waka Kotahi projects including Woodend Corridor Alignment, Ō2NL and SH58.

While in NZ, Kathryn has undertaken over 100 projects with respect to risk assessment of contaminated soil, contaminated land investigations, and contaminated soil management. Kathryn has also been responsible for:

- Preparation of preliminary site investigations (PSI)
- On site test pitting, core sample investigations, hydrovac pothole investigations and sample collection
- Preparation of detailed site investigation reports (DSI)
- Development of Waste Assessments and Waste Management and Minimisation Plans (WMMPs)
- Site Management and sediment control plans
- Hazardous Waste Management
- Landfill waste acceptance
- Environmental Monitoring
- Coal tar assessment
- Consenting applications under the National Environmental Standard for Assessing and Managing Contaminants in Soil (NESCS)

She has also spent seven years assessing special and contaminated soil waste acceptance applications for the Tasman District landfill in terms of the environmental effect, safe handling, and disposal protocols, where appropriate.

EDUCATION

- MSc (Environmental Engineering), Queens University Belfast, 1999
- BSc (Environmental Science), Aberdeen University, 1998

MEMBERSHIPS

Chartered member of CIWM while in the UK
Environmental Practitioner - CIWM
Member, WasteMINZ

Appendix C Figures

Site Plans

REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 1

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1000

Rev.: B

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OTAKI TO NORTH OF LEVIN

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SHEET 2

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1001
Rev.: B

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LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED DESIGNATION BOUNDARY
- TEMPORARY WORKS AREA

NOTE

1. IT IS LIKELY THAT SMALLER TEMPORARY COMPOUNDS WILL BE ESTABLISHED AT EACH OF THE BRIDGE SITES TO SPECIFICALLY SUPPORT THE CONSTRUCTION OF THE BRIDGES. THESE ARE LIKELY TO VARY IN SIZE FROM 400m2 TO 800m2 FOR THE LARGER BRIDGES. COMPOUNDS FOR CONSTRUCTING BRIDGES MAY BE LOCATED AT EITHER ABUTMENT OF THE BRIDGE, OR BOTH.

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WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 3

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Drawing No.: 310203848-01-500-C1002
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Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 4

Status Stamp: FOR CONSENT
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Rev.: B

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DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 5

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1004
Rev.: B

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\100 - Geometric Design\310203848-01-100-C1004

REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 6

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1005

Rev.: B

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REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 7

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1006
Rev.: B

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REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 8

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1007 Rev.: B

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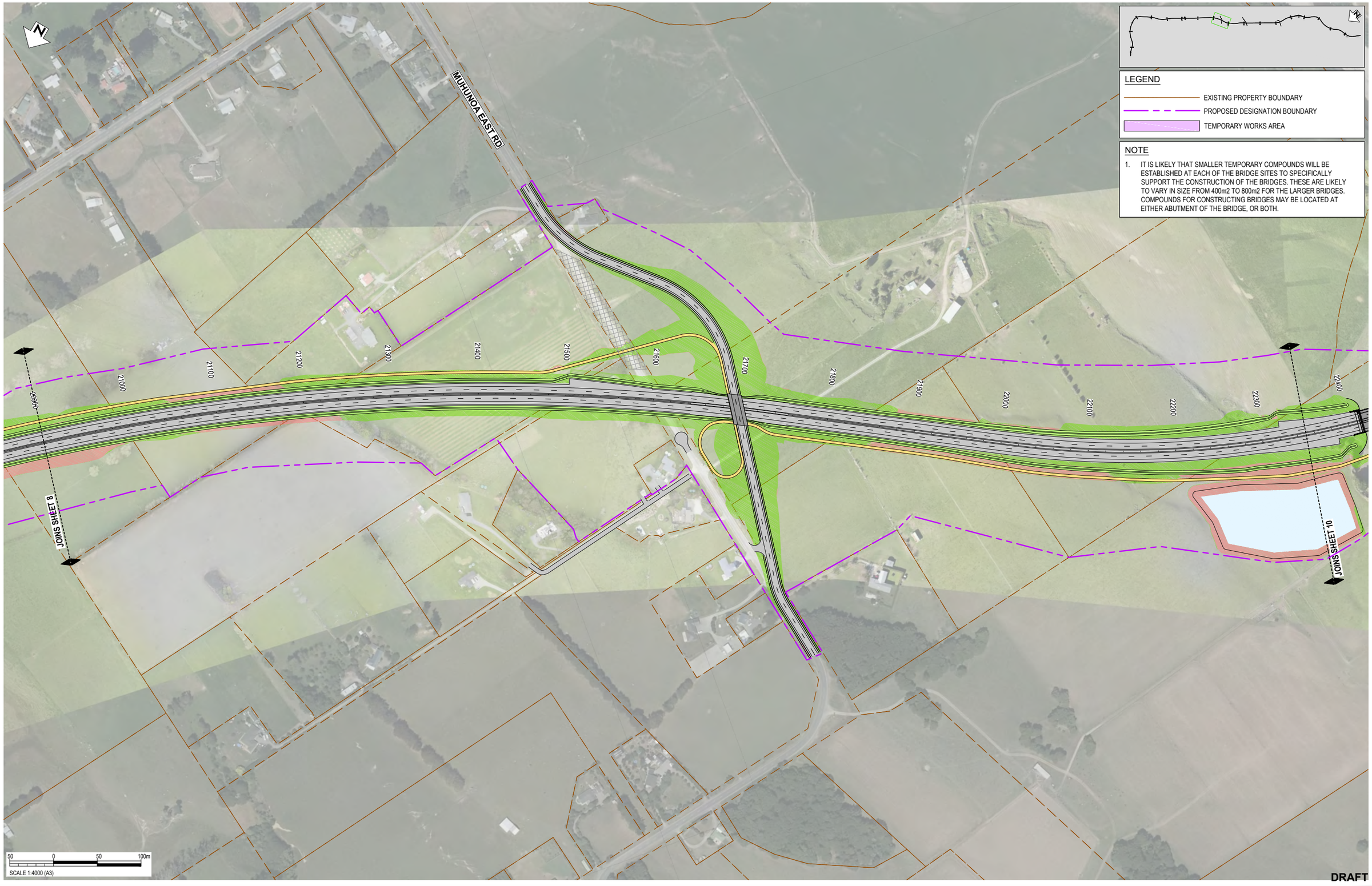

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B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
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DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 9

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1008
Rev.: B

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LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED DESIGNATION BOUNDARY
- TEMPORARY WORKS AREA

NOTE

1. IT IS LIKELY THAT SMALLER TEMPORARY COMPOUNDS WILL BE ESTABLISHED AT EACH OF THE BRIDGE SITES TO SPECIFICALLY SUPPORT THE CONSTRUCTION OF THE BRIDGES. THESE ARE LIKELY TO VARY IN SIZE FROM 400m2 TO 800m2 FOR THE LARGER BRIDGES. COMPOUNDS FOR CONSTRUCTING BRIDGES MAY BE LOCATED AT EITHER ABUTMENT OF THE BRIDGE, OR BOTH.

REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 10

Status Stamp: FOR CONSENT

Date Stamp: 20.04.22

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1009

Rev.: B

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LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED DESIGNATION BOUNDARY
- TEMPORARY WORKS AREA

NOTE

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B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 11

Status Stamp: FOR CONSENT

Date Stamp: 20.04.22

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1010

Rev.: B

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REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 12

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1011
Rev.: B

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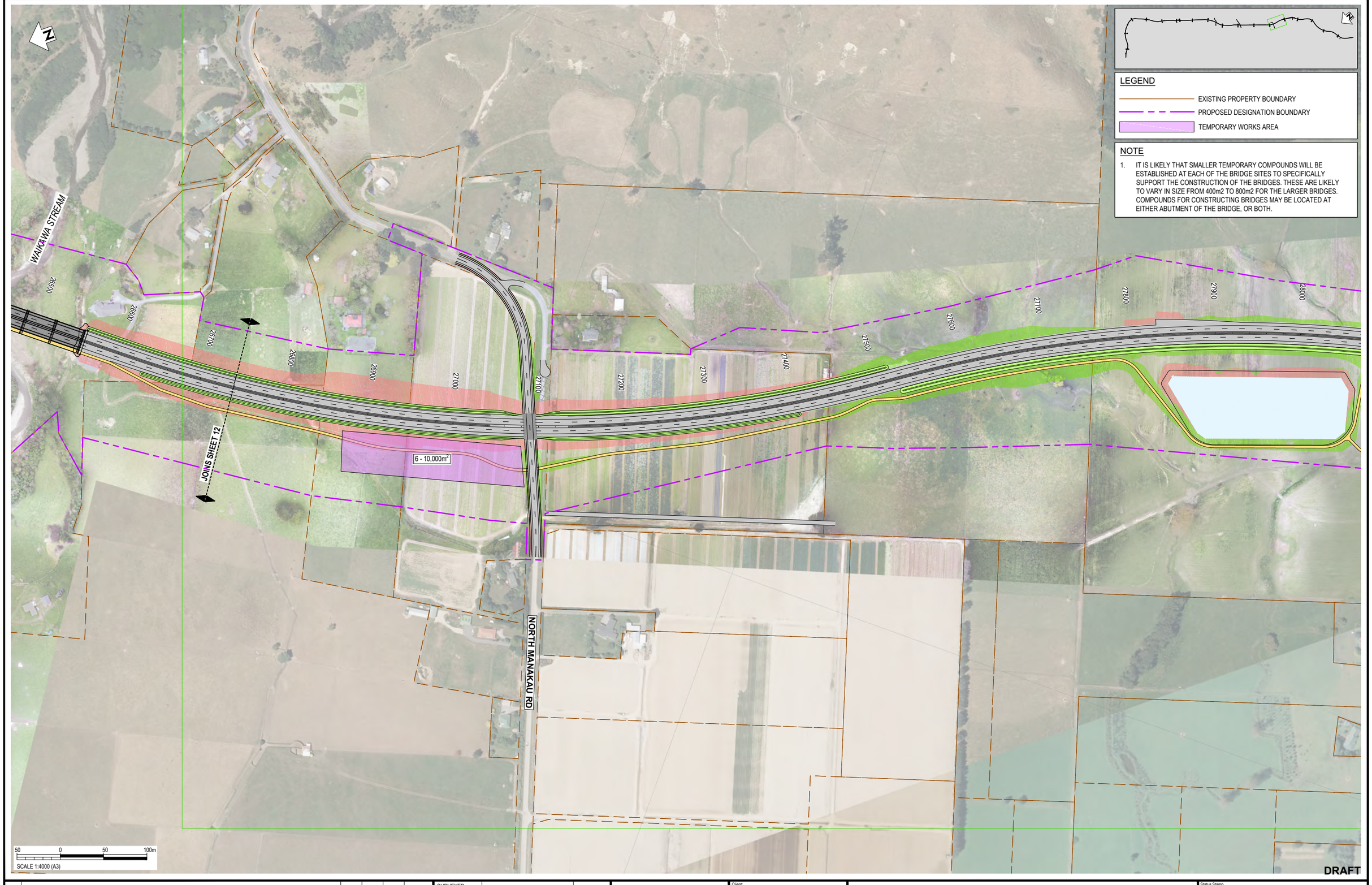

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B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

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DRAWN	Steve Sutton	11.11.21
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DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 13

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1012

Rev.: B

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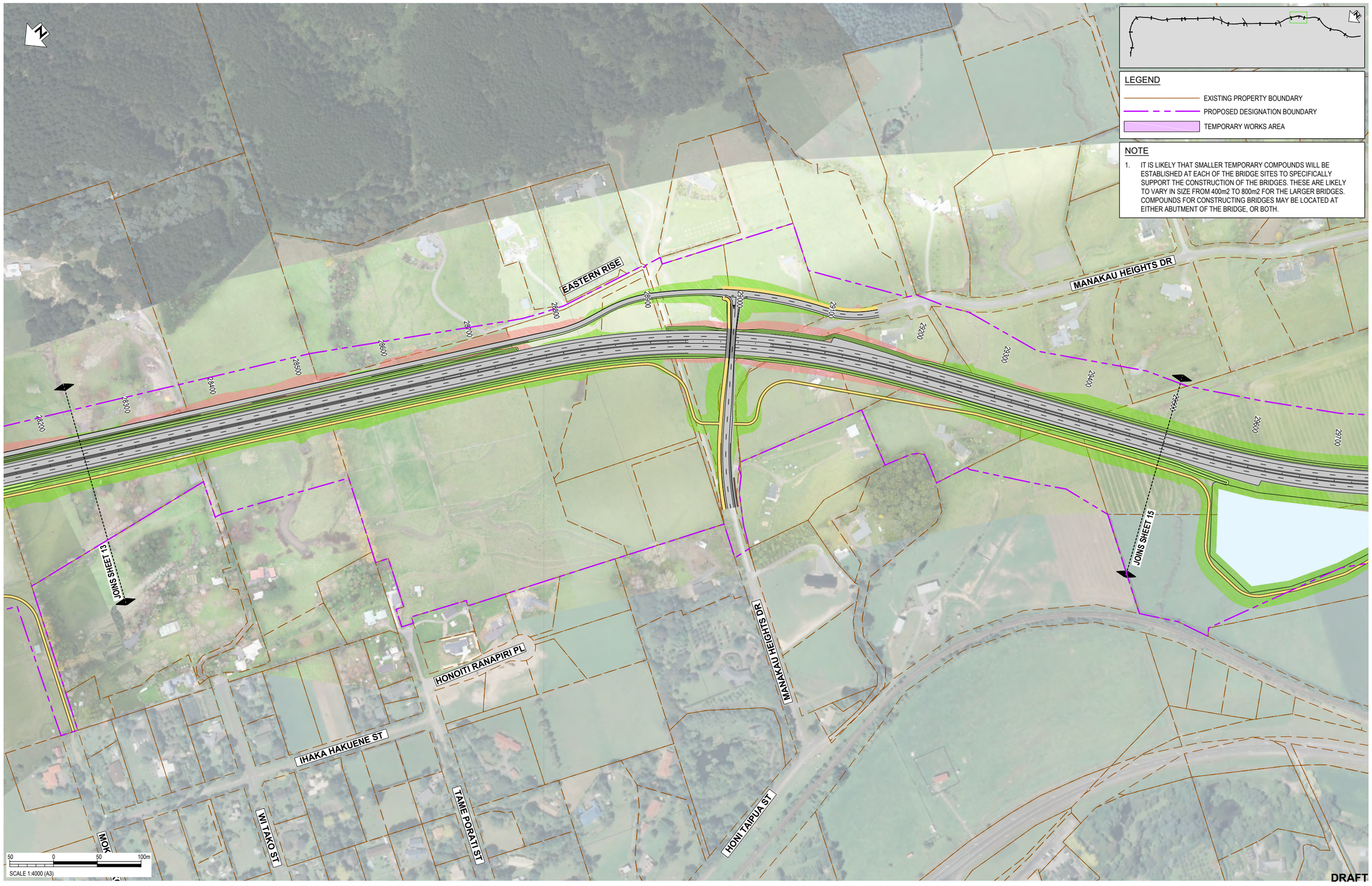

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B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
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DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 14

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1013

Rev.: B

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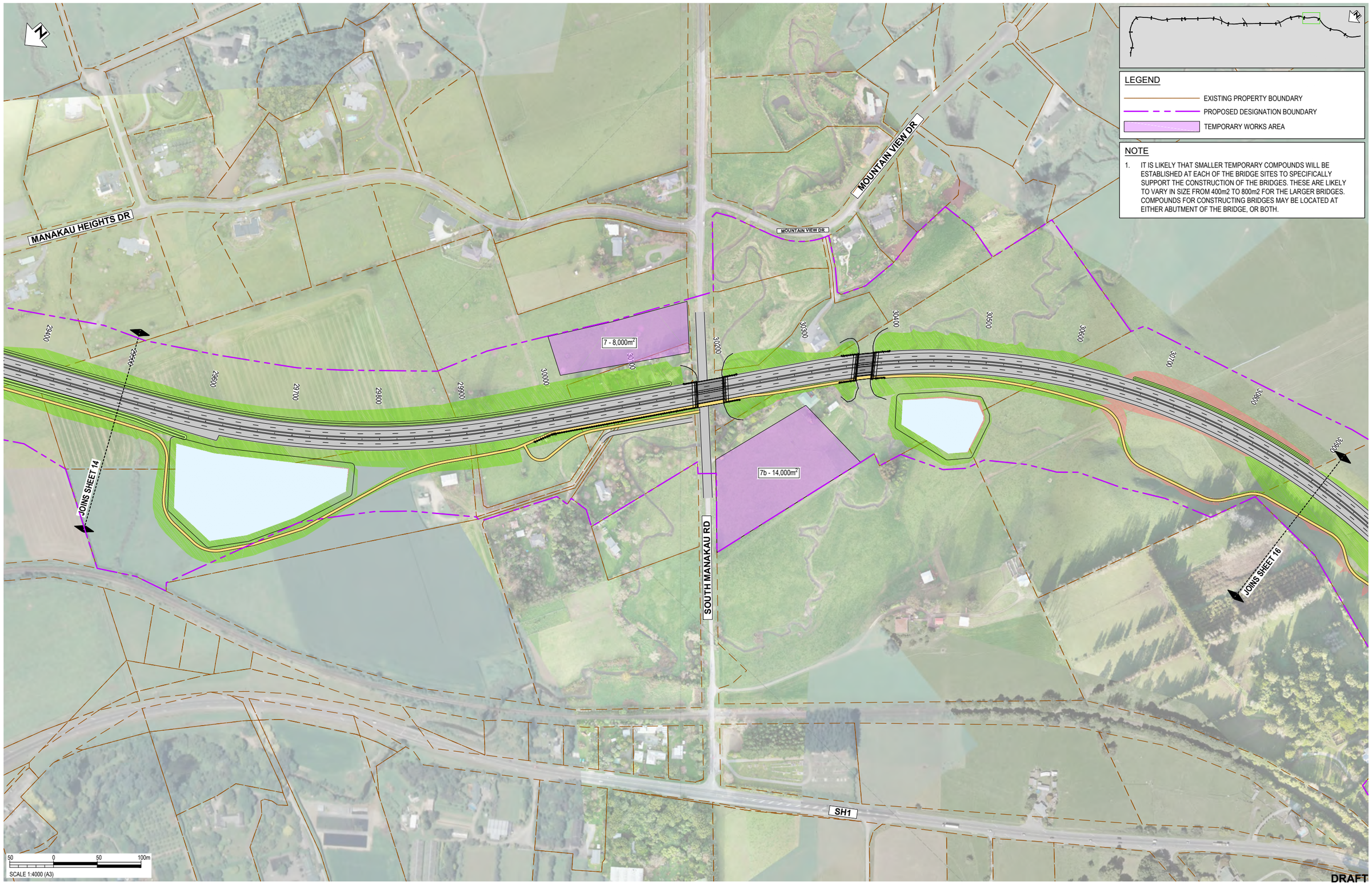

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED DESIGNATION BOUNDARY
- TEMPORARY WORKS AREA

NOTE

1. IT IS LIKELY THAT SMALLER TEMPORARY COMPOUNDS WILL BE ESTABLISHED AT EACH OF THE BRIDGE SITES TO SPECIFICALLY SUPPORT THE CONSTRUCTION OF THE BRIDGES. THESE ARE LIKELY TO VARY IN SIZE FROM 400m2 TO 800m2 FOR THE LARGER BRIDGES. COMPOUNDS FOR CONSTRUCTING BRIDGES MAY BE LOCATED AT EITHER ABUTMENT OF THE BRIDGE, OR BOTH.

REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 15

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1014
Rev.: B

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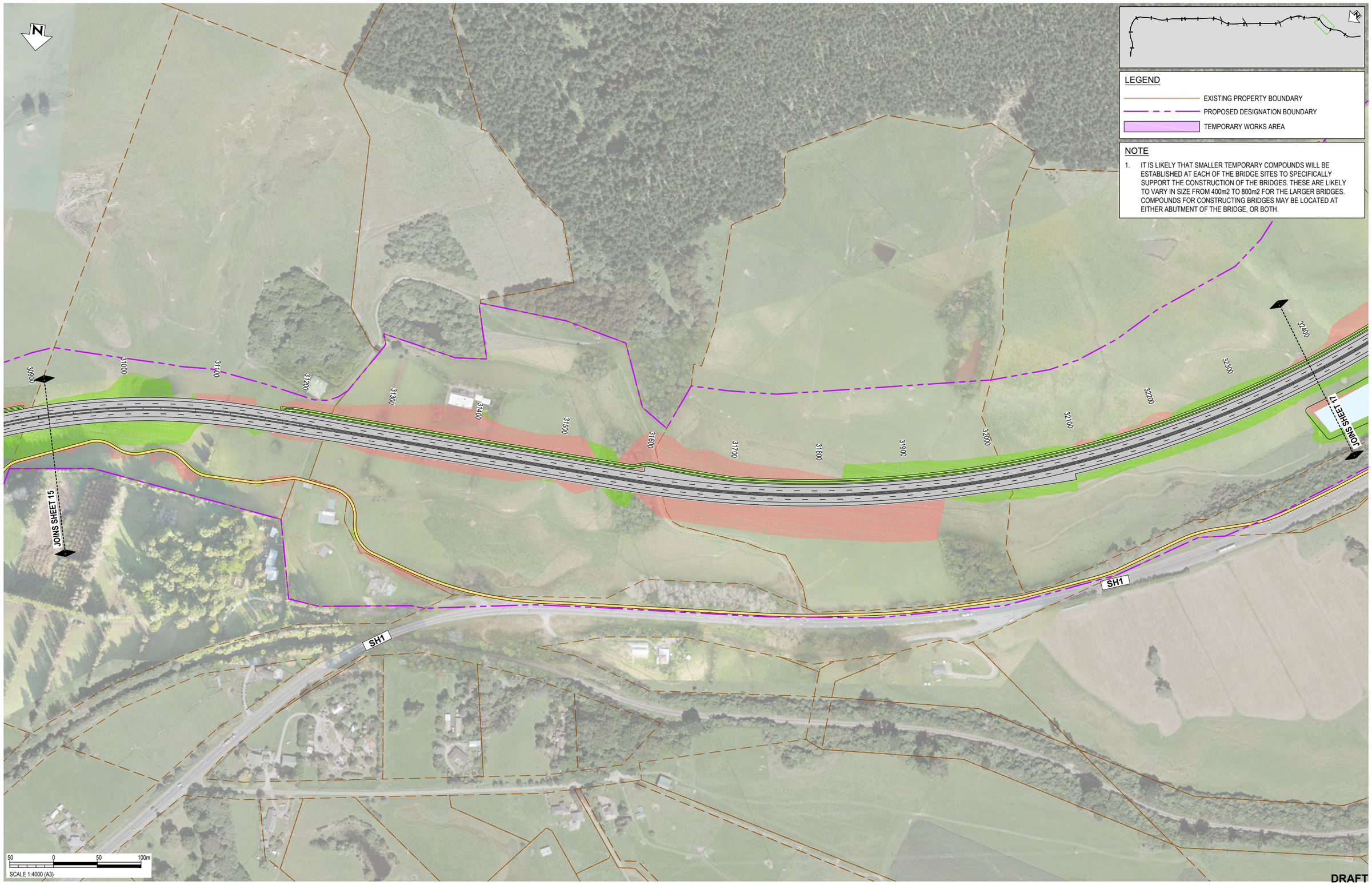

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A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 16

Status Stamp: FOR CONSENT
Date Stamp: 20.04.22
Scales: 1 : 4000 (A3)
Drawing No.: 310203848-01-500-C1015
Rev.: B

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REV	REVISIONS	DRN	CHK	APP	DATE
B	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	20.04.22
A	ISSUED FOR CONSENT - DRAFT	SS	AW	JP	09.12.21

SURVEYED		
DESIGNED	Jamie Povall	11.11.21
DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
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DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 17

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1016

Rev.: B

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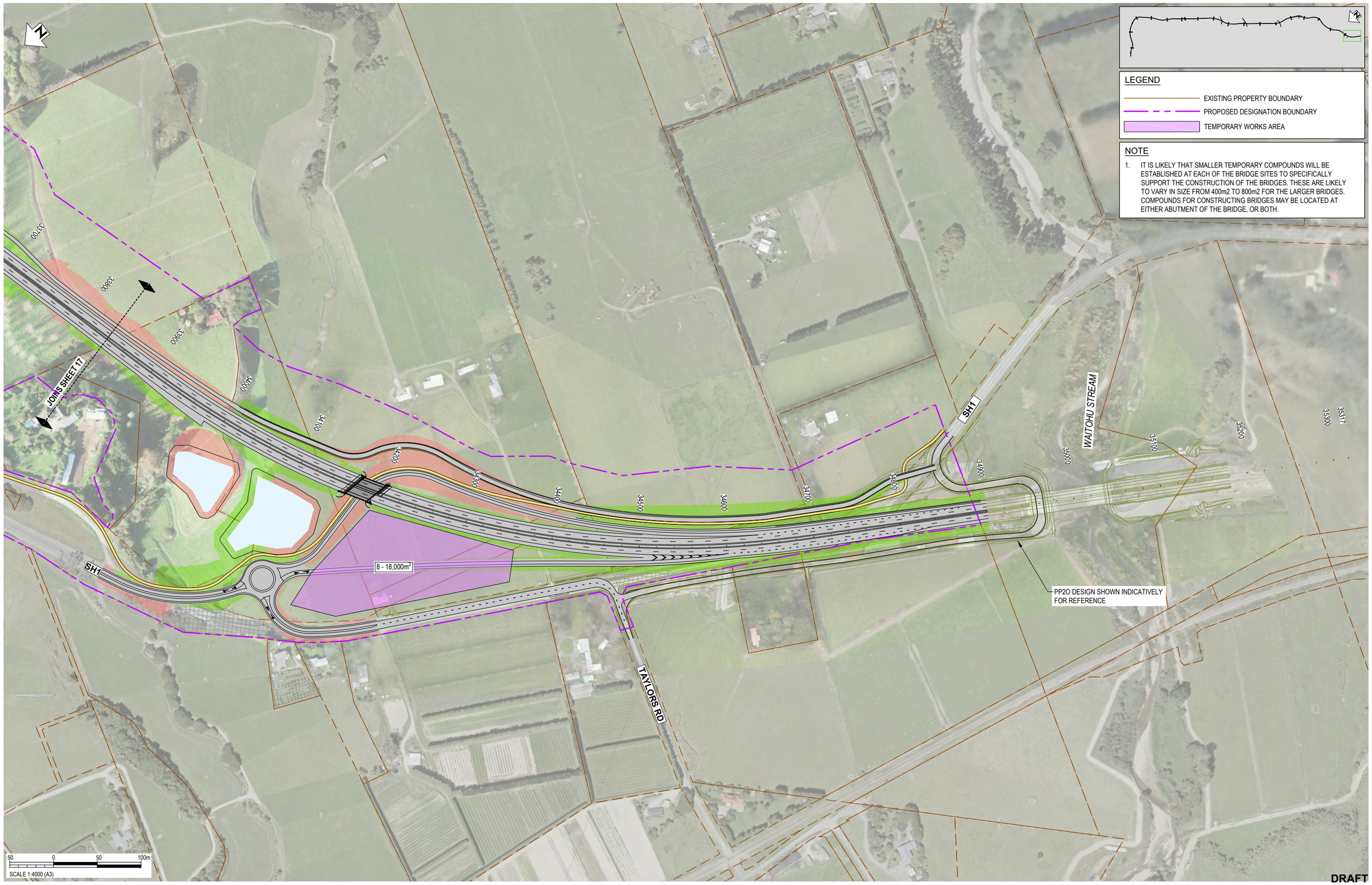

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DRAWN	Steve Sutton	11.11.21
CAD REVIEW	Steve Sutton	08.12.21
DESIGN CHECK	Jamie Povall	08.12.21
DESIGN REVIEW	Andy Wright	14.04.22
APPROVED	Jamie Povall	18.04.22
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

ACCOMMODATION WORKS
SHEET 18

Status Stamp: **FOR CONSENT**

Date Stamp: **20.04.22**

Scales: 1 : 4000 (A3)

Drawing No.: 310203848-01-500-C1017

Rev.: B

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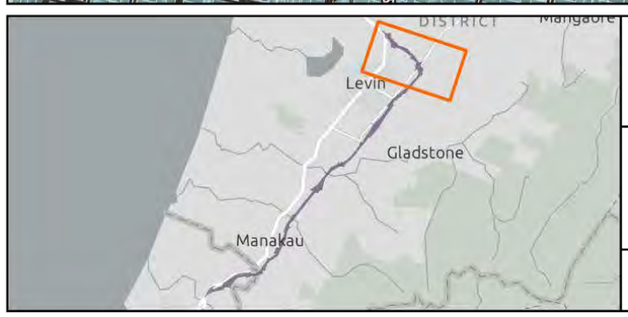
Ō2NL Council known HAIL sites



Stantec

Ōtaki to north of Levin HAIL Sites

Zone 1: SH1 to SH57

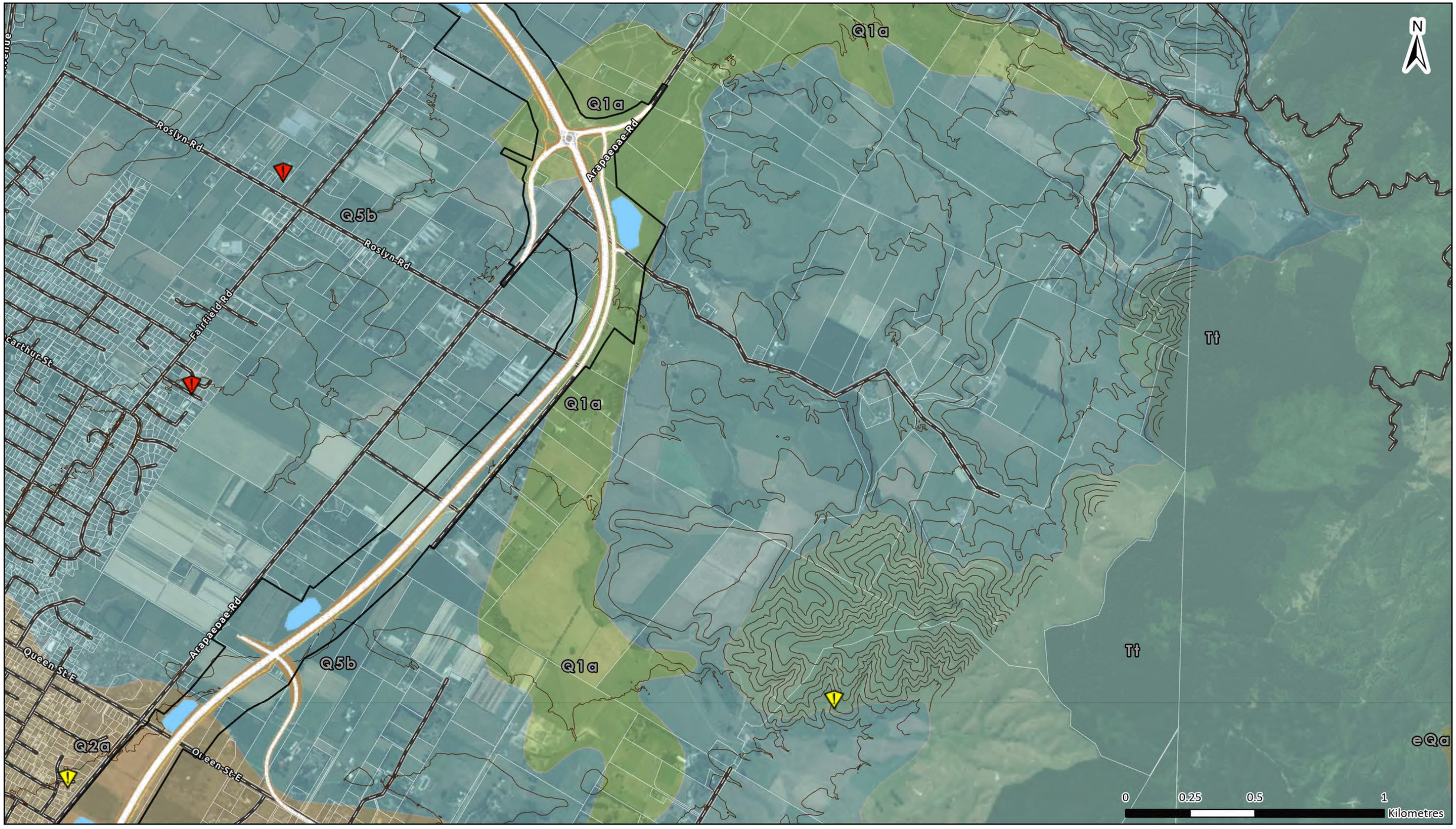
WAKA KOTAHI NZ TRANSPORT AGENCY

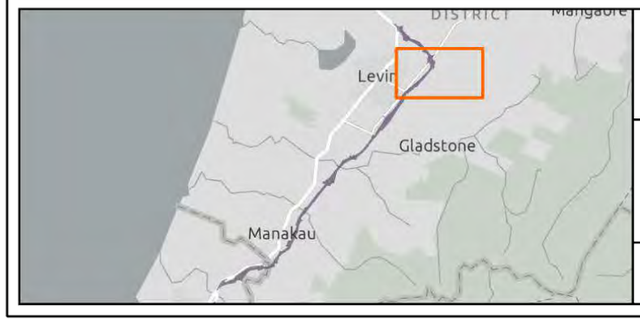
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 2: SH57 to Queen St

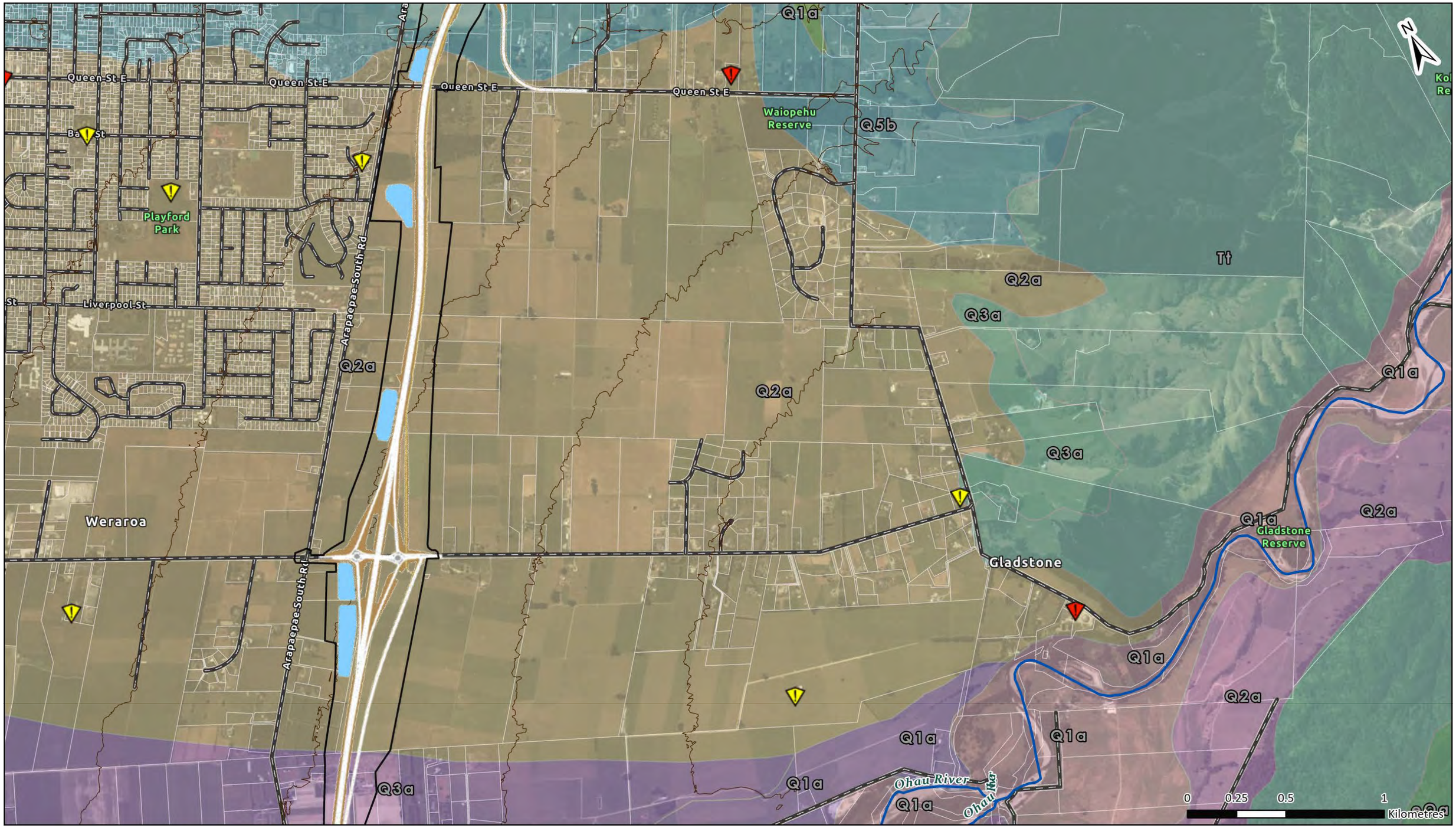
WAKA KOTAHI NZ TRANSPORT AGENCY

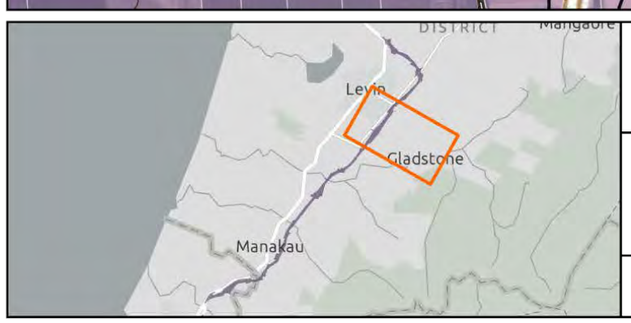
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 3: Queen St to Lutz Property Boundary

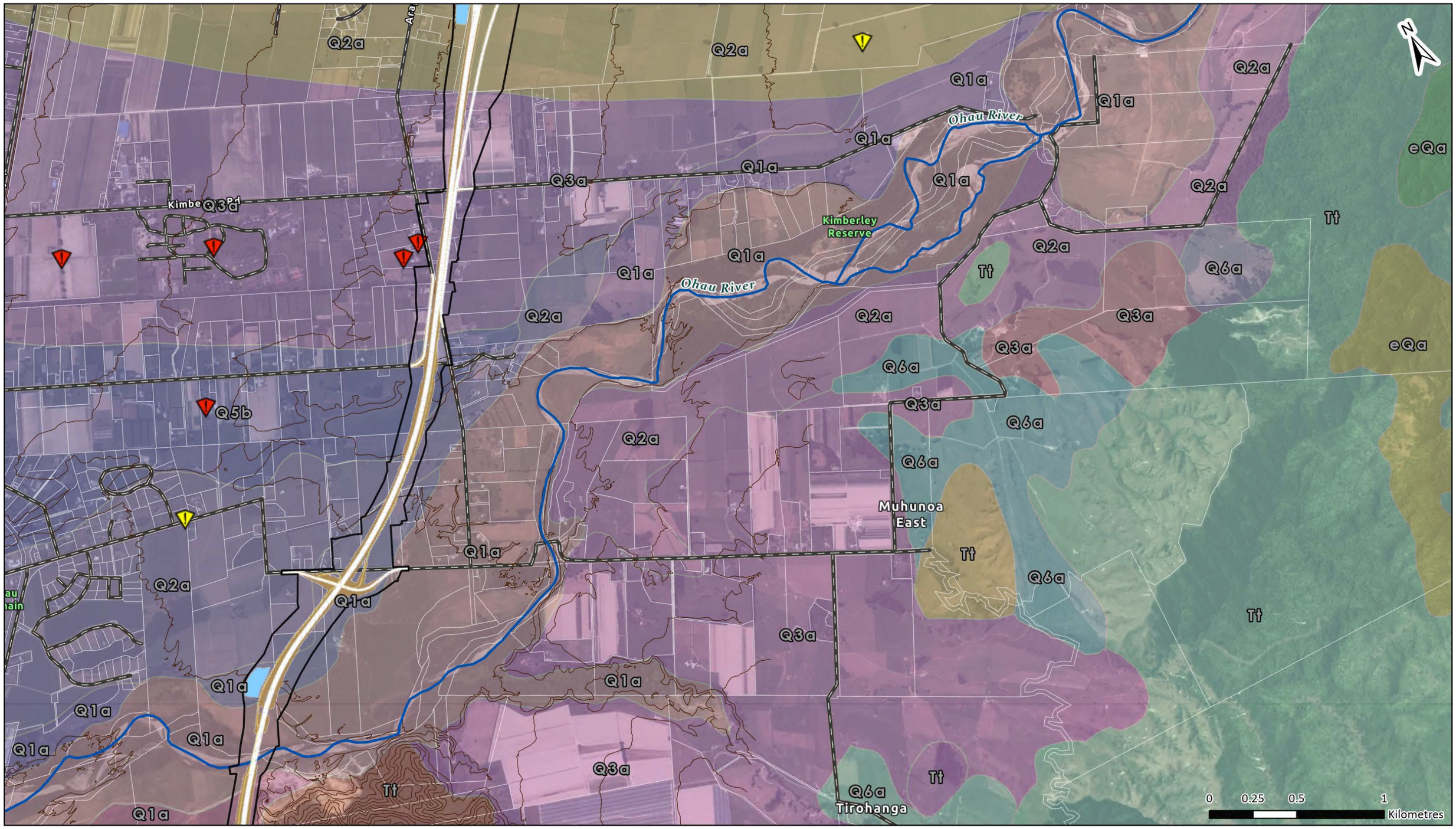
WAKA KOTAHI NZ TRANSPORT AGENCY

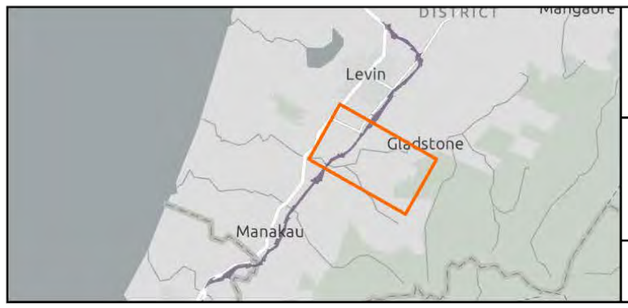
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 4: Lutz Property Boundary to Ohau River

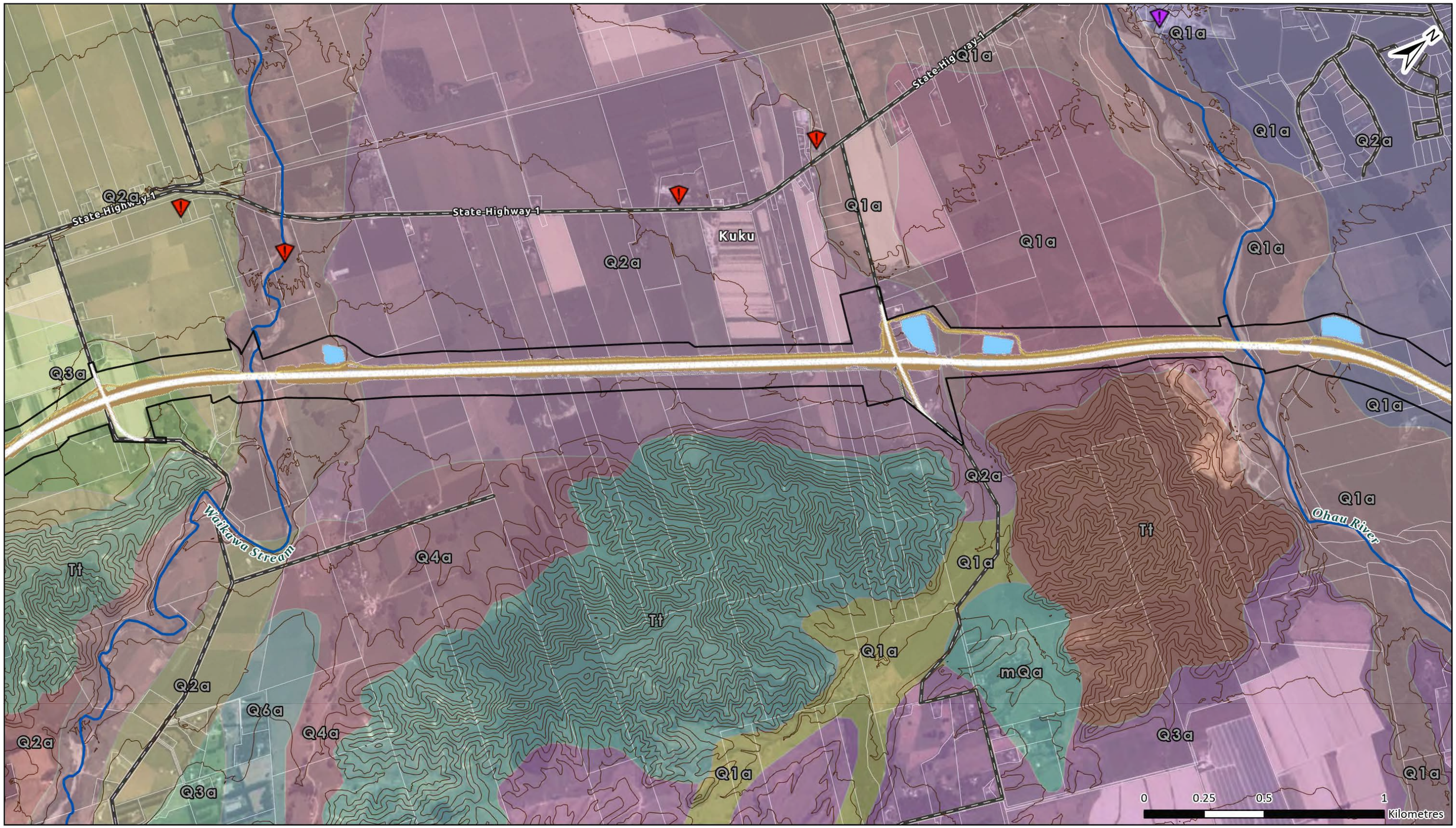
WAKA KOTAHI NZ TRANSPORT AGENCY

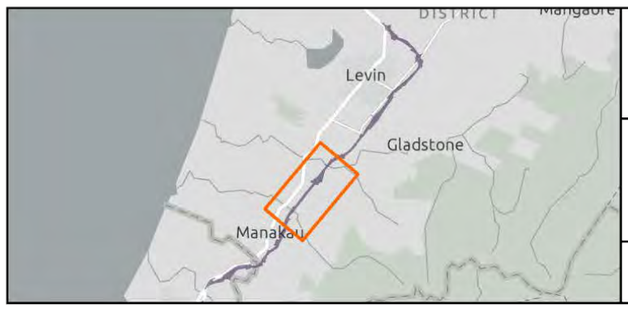
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 5: Ohau River to North Manukau Road

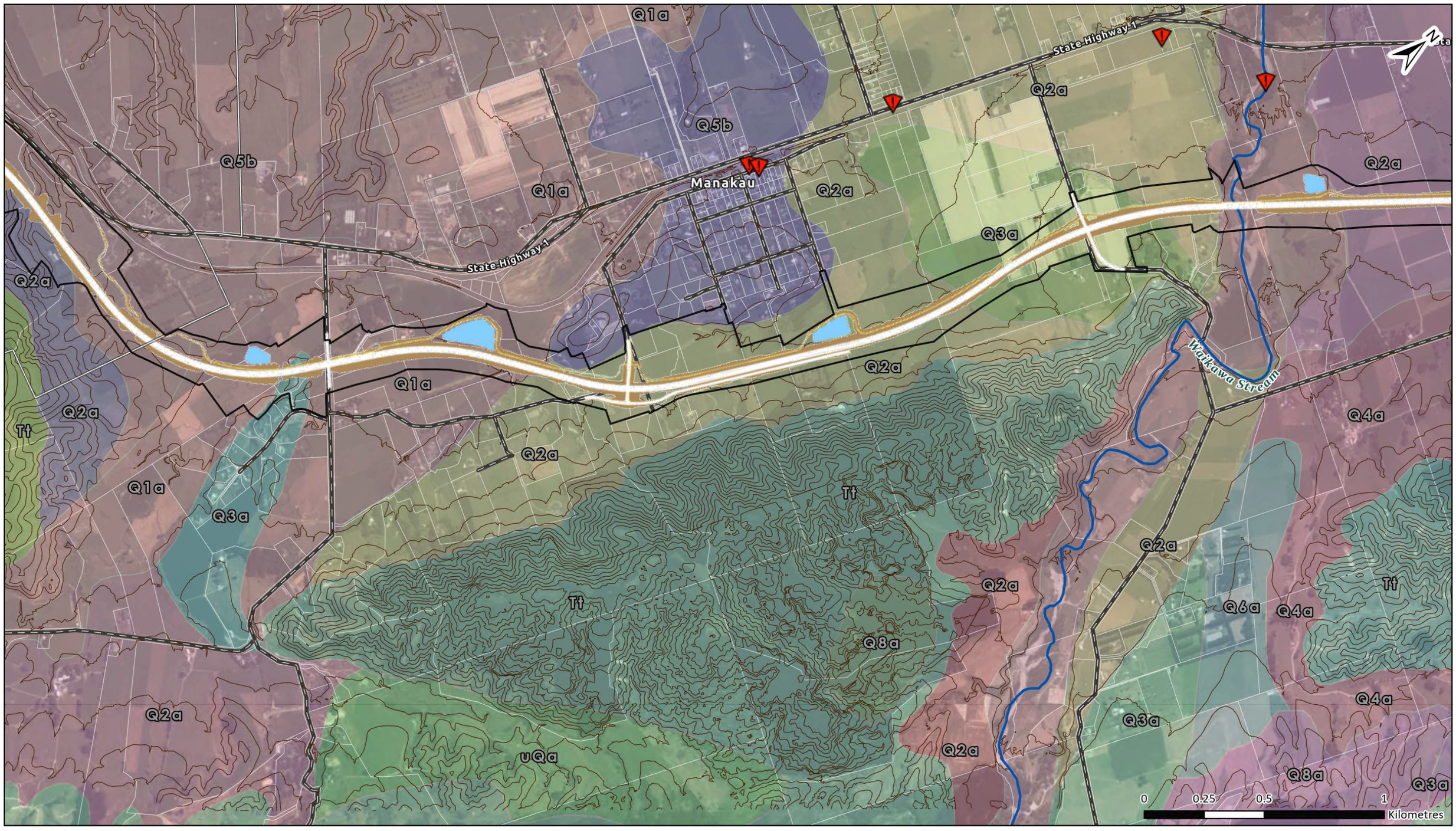
WAKA KOTAHI NZ TRANSPORT AGENCY

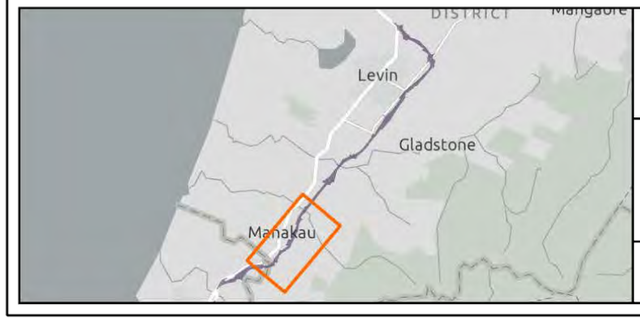
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 6: North Manukau Road to Regional Boundary

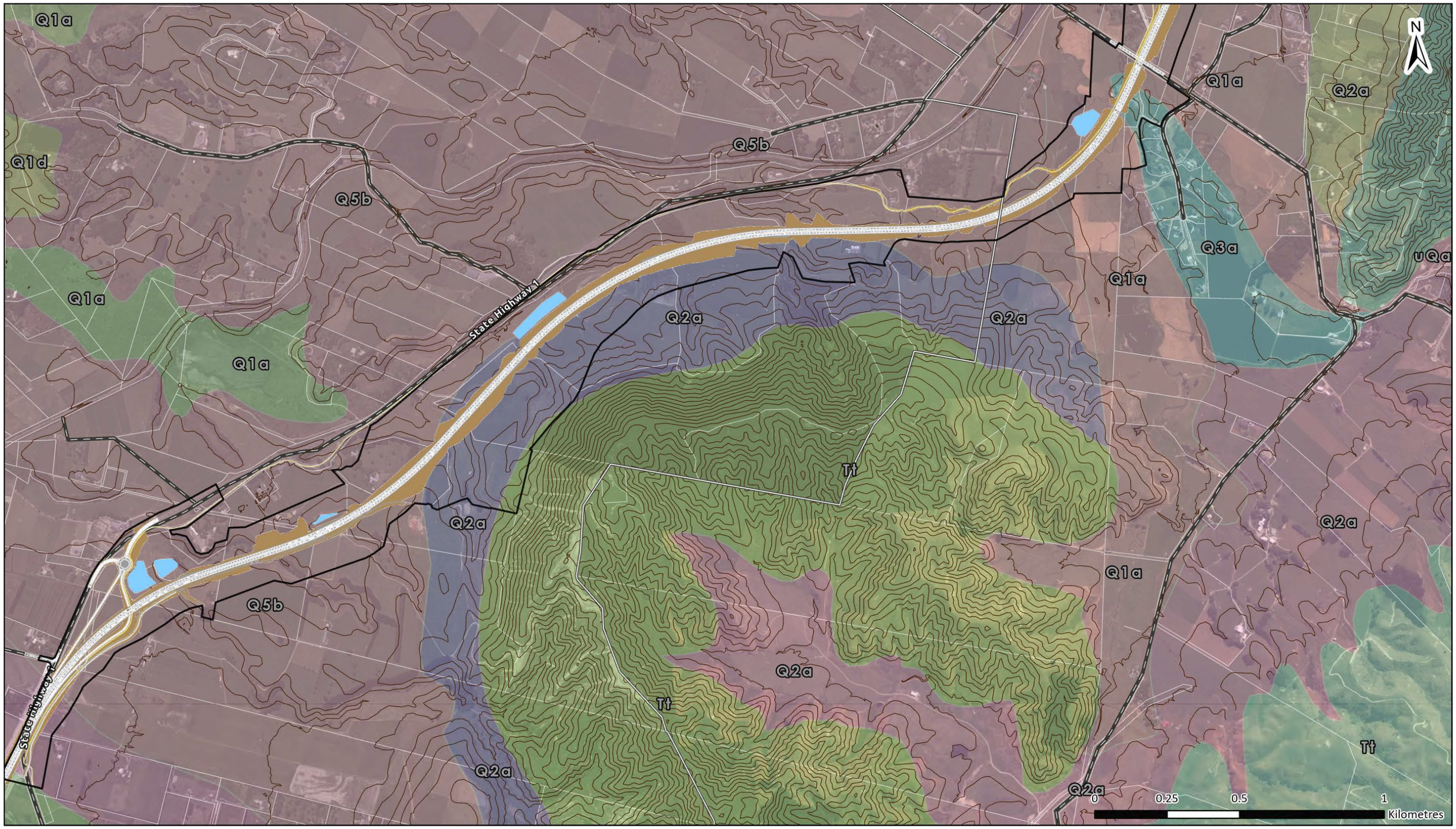
WAKA KOTAHI NZ TRANSPORT AGENCY

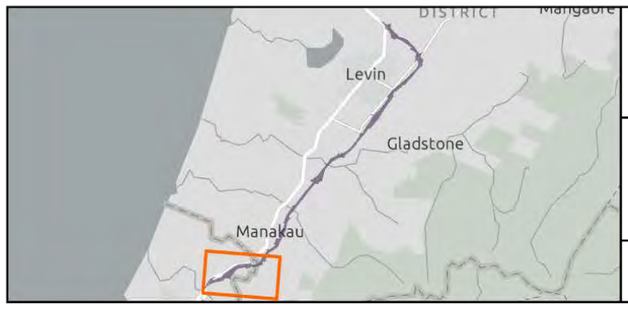
Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads





Stantec

Ōtaki to north of Levin HAIL Sites

Zone 7: Regional Boundary to SH1

WAKA KOTAHI NZ TRANSPORT AGENCY

Data Sources: Stantec, Land Information New Zealand
Basemap Service Credits: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, FAO, METI/NASA, USGS
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

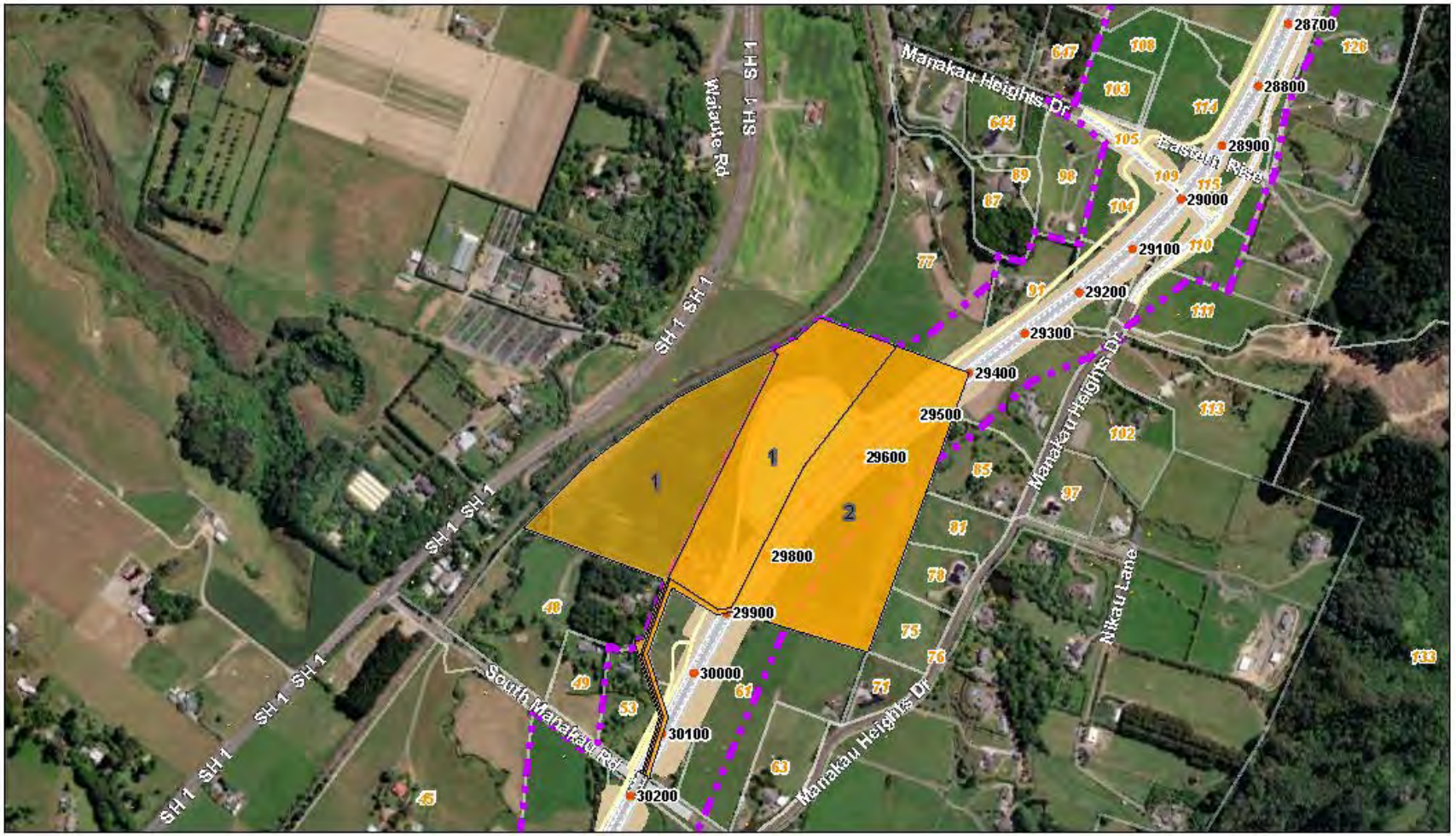
Author: rmcpherson, Stantec (2022)
Project Code: 310203848
Export Date: 2022-03-04 1:34 PM

HAIL Site
- Confirmed contamination
- Unknown or suspected contamination
- Managed or remediated contamination

O2NL Proposed Designation
10m Contours
River / Stream
Property Parcels
Roads

Additional HAIL sites identified as part of PSI

O2NL HAIL site



7/14/2022

Hail Sites Sublist
Proposed Designation
Chainage
Street Address
Proposed Centreline
Road Markings
Shared Use Path
Bridges
Road Surface
Ponds
Earthworks
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations

1:10,000
0 0.05 0.1 0.2 mi
0 0.1 0.2 0.4 km
Maxar

O2NL HAIL Sites

10/12/2022

- Culvert Endpoints
- Bridge or Culvert Inlet (for C200x)
- Culverts
- Hail Sites Sublist
- Proposed Designation
- Road Markings
- Shared Use Path
- Bridges
- Road Surface
- Ponds
- Earthworks
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery
- Citations
- 2.4m Resolution Metadata

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0 0.15 0.3 0.6 km

Maxar

O2nL HAIL site

7/14/2022

- Hail Sites Sublist
- Proposed Designation
- Constraints Data - Contaminated Sites
- Confirmed
- Chainage
- Street Address
- Proposed Centreline
- Road Markings
- Shared Use Path
- Bridges
- Road Surface
- Ponds
- Earthworks
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery

1:10,000

0 0.05 0.1 0.2 mi

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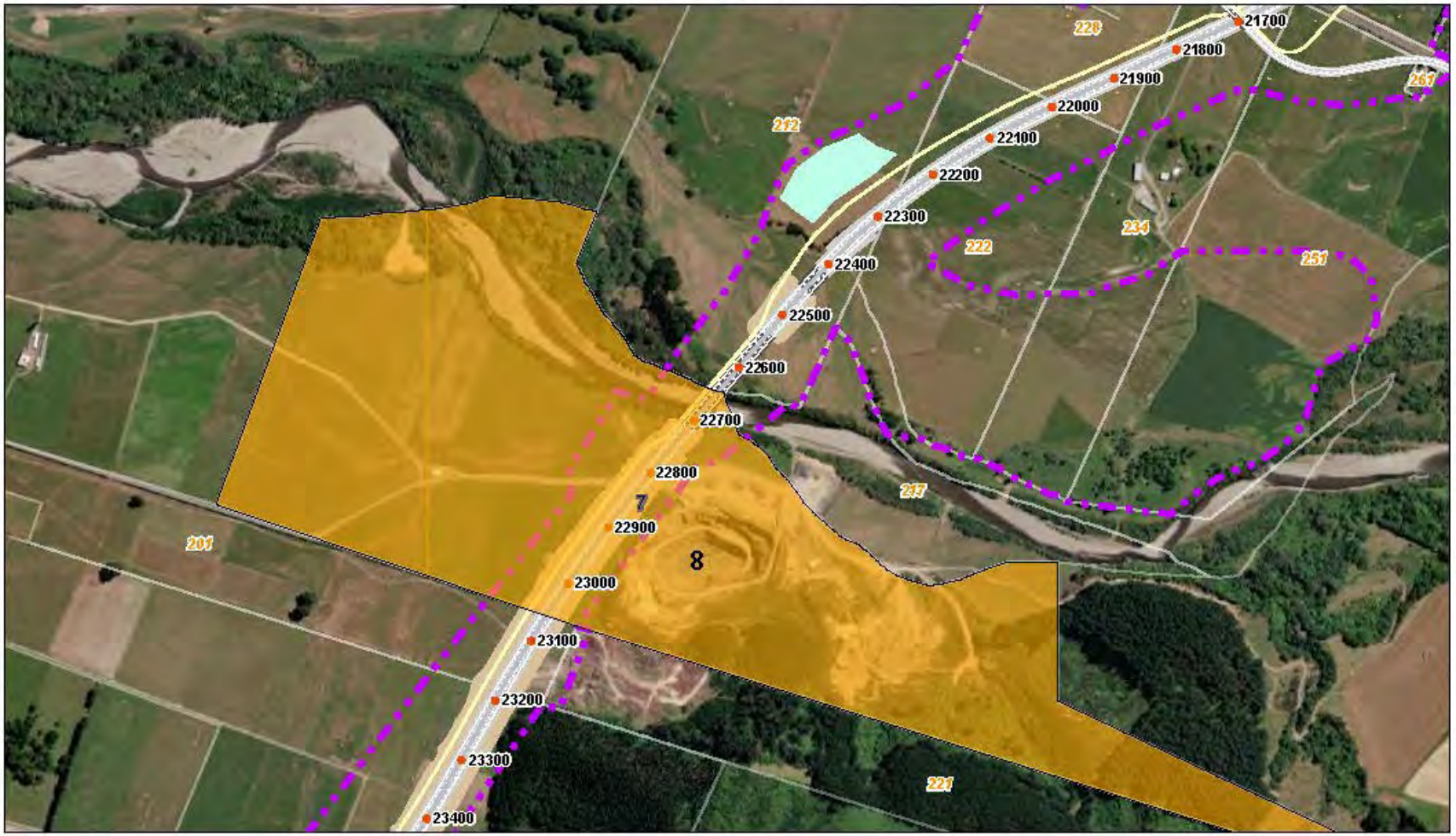
Maxar

O2NL HAIL site



7/14/2022

Hail Sites Sublist
Proposed Designation
Chainage
Street Address
Proposed Centreline
Road Markings
Shared Use Path
Bridges
Road Surface
Ponds
Earthworks
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations

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0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Maxar

O2NL HAIL site

7/14/2022

Hail Sites Sublist
Proposed Designation
Constraints Data - Contaminated Sites
Confirmed
Chainage
Street Address
Proposed Centreline
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Road User Markings
Shared Use Path
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Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery

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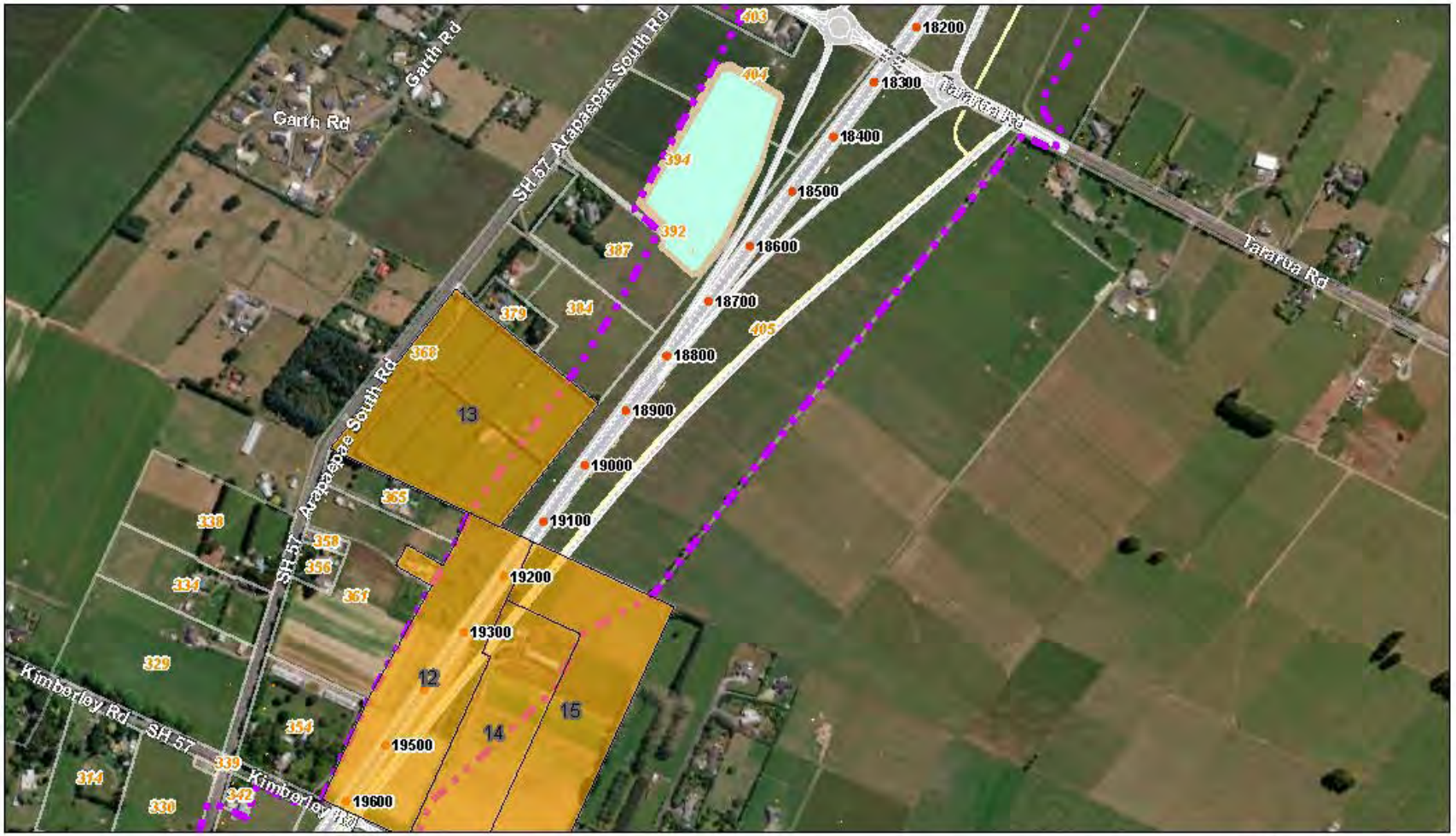
0 0.05 0.1 0.2 mi
0 0.1 0.2 0.4 km
Maxar

O2NL HAIL site



7/14/2022

Hail Sites Sublist	Proposed Centreline	Bridges	World Imagery
Proposed Designation	Road Markings	Road Surface	Low Resolution 15m Imagery
Chainage	Road User Markings	Ponds	High Resolution 60cm Imagery
Street Address	Shared Use Path	Earthworks	High Resolution 30cm Imagery

1:10,000

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Maxar

O2NL HAIL site

7/14/2022

- Hail Sites Sublist
- Proposed Designation
- Constraints Data - Contaminated Sites
- Unknown / suspected
- Chainage
- Street Address
- Proposed Centreline
- Road Markings
- Road User Markings
- Shared Use Path
- Bridges
- Road Surface
- Ponds
- Earthworks
- World Imagery
- Low Resolution 15m Imagery

1:10,000

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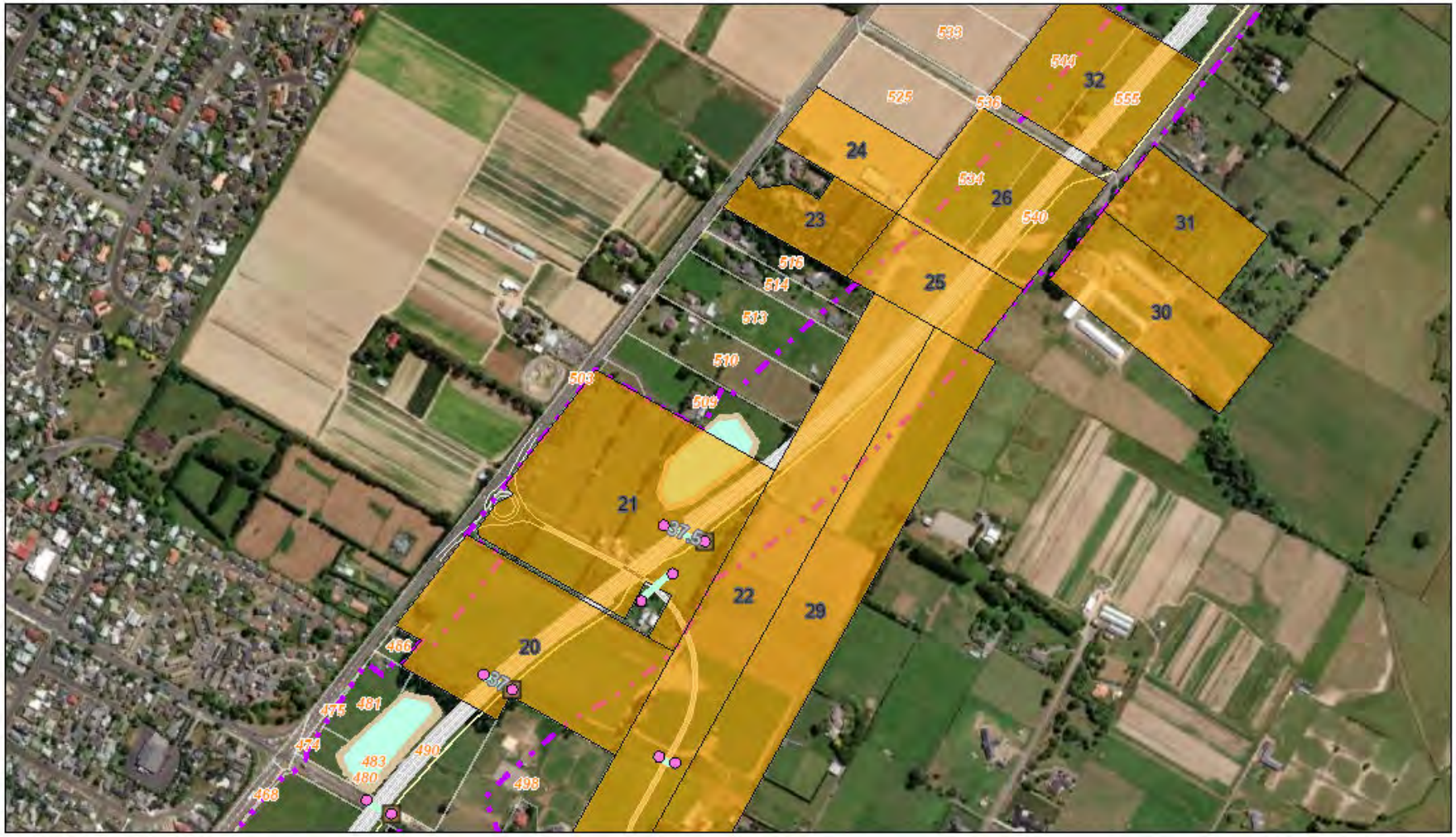
0 0.1 0.2 0.4 km

Maxar

O2NL HAIL Sites



O2NL HAIL site

7/14/2022

Hail Sites Sublist	Proposed Centreline	Road Surface	Low Resolution 15m Imagery
Proposed Designation	Road Markings	Ponds	High Resolution 60cm Imagery
Chainage	Road User Markings	Earthworks	High Resolution 30cm Imagery
Street Address	Shared Use Path	World Imagery	Citations

1:10,000

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Maxar

O2NL HAIL Sites

10/12/2022

- Culvert Endpoints
- Bridge or Culvert Inlet (for C200x)
- Culverts
- Hail Sites Sublist
- Proposed Designation
- Road Markings
- Shared Use Path
- Road Surface
- Ponds
- Earthworks
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
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- Citations
- 2.4m Resolution Metadata

1:10,000

0 0.07 0.15 0.3 mi

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Maxar

O2NL HAIL Sites

10/12/2022

- Culvert Endpoints
- Bridge or Culvert Inlet (for C200x)
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- Road Markings
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- Earthworks
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- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery
- Citations
- 2.4m Resolution Metadata

1:10,000

0 0.07 0.15 0.3 mi

0 0.15 0.3 0.6 km

Maxar

Appendix D Ō2NL HAIL site assessment

HAIL SITE Map ID	Address	Risk	Historical land use of concern	Possible Contaminants	Horizons SAHS	Stantec-Ref-ID	Activity - HAIL	Contamination Status	Area (ha)	1939-42	1961-1965	1966 - 1969	1970 - 1979	1999 - 2000	2010-2011	2015-2016	Google earth image	Drone footage March 2021	Drone image 2021
1	45 South Manakau Road	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	57 & 64	A10 Market Garden	Unverified Land use noted on project property information as current	5.02	farm land	limited image suggests farmland	farm land	farm land	farm land	southern part of field ploughed in strips multiple crops visible	southern part of field ploughed in strips vegetation limited	lush green crop over entire area	no drone image	
2	49 South Manakau Road	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	70	A10 Market Garden	Unverified Land use noted on project property information as current	3.45	Farmland - low depression observed	limited image suggests farmland	farm land	farm land	farm land	southern part of field ploughed in strips multiple crops visible	southern part of field ploughed in strips vegetation limited	lush green crop over entire area	rows of single crop visible	
3	58 North Manakau Road, Manakau	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	137	A10 Market Garden	Unverified Land use noted on project property information as current	3.17	farm land	farm land	farm land	farm land	windbreaks established but no sign of orchards	field ploughed in strips indicating multiple crops	Market Garden / horticulture field ploughed in strips with various crops visible	field ploughed in strips indicating multiple crops	multiple crops visible	
4	51 North Manakau Road, Manakau	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	142	A10 Market Garden	Unverified Land use noted on project property information as current	2.86	farm land	farm land	farm land	farm land	farm land	field ploughed in strips indicating multiple crops	ploughed field	lush green single crop visible	Field planted in strips	
5	703 State Highway 1, Manakau	Medium Risk - market garden established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	169	A10 Market Garden	Unverified Land use noted on project property information as current	15.14	farm land	limited image suggests farmland	farm land	Area divided into two main paddocks but looks to be part of site 173	field ploughed in strips could indicated multiple crops	various grass / crop in each paddock	lush green single crop visible	field ploughed in strips indicating multiple crops	Field planted in strips	
6	695-703 State Highway 1,	Medium Risk - market garden established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	173	A10 Market Garden	Unverified Land use noted on project property information as current	13.85	farm land / paddock / livestock observed	limited image suggests farmland	limited image suggests farmland	1978 Large area of multiple crops extended on both sides of the SH - market garden more defined on western side of SH	field ploughed in strips indicating multiple crops	field ploughed in strips indicating multiple crops	field ploughed in strips indicating multiple crops	field ploughed in strips indicating multiple crops	Field planted in strips	
7	559 State Highway 1, Manakau	High Risk as waste material observed by geologist during site investigation. Soil contaminants tested low	Landfill site - General waste	TPH, PAH, heavy metals and asbestos.	Not Identified	209	G3 or G5	Verified field sampling has been undertaken		part of the river channel	no image	no image	vegetated area next to the river	grassed paddock	grassed paddock	grassed paddock some disturbed ground	grassed paddock	grassed paddock	
8	559 State Highway 1, Manakau	Low - Medium Risk - subject to confirming quantity of any fuel, or hazardous substance stored on site	Quarry / fuel storage	TPH/BTEX and PAH,	Not Identified	209	E7 mining industries (excluding gravel extraction)	Unverified		No Quarry observed	no image	no image	quarrying operations have commenced	Quarry at 1/2 extents	Quarry at current extents	Quarry at current extents	Quarry	Quarry	
9	416 Arapaepae South Road, Levin	Medium Risk - no imagery available to determine if established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	298	A10 Market Garden	Unverified Land use noted on project property information as current	3.28	farm land	no image	no image	Low resolution image shows multiple crops and small fields in the area unclear what is being grown.	field ploughed in strips indicating multiple crops	Market Garden / horticulture field ploughed in strips with various crops visible	Market Garden / horticulture field ploughed in strips with various crops visible	Market Garden / horticulture field ploughed in strips with various crops visible	Market Garden / multiple crops visible	
10	380-386 Arapaepae Road Levin Rural 5571	Low Risk - Outside designation and downgradient of works	Fuel Storage Tanks - Hydrocarbon	TPH/BTEX and PAH,	700653	311	A17	Verified history hazardous industry/act		farmland	no image	no image	Low resolution image unclear but indicates single property	Tress established on 1/2 the site	single property surrounded by tress with swimming pool	single property	single property	single property	
11	378 Arapaepae Road Levin Rural 5571	Low Risk - Outside designation and downgradient of works	Fuel Storage Tanks - Hydrocarbon	TPH/BTEX and PAH,	700652	326	A17	Verified history hazardous industry/act		single property surrounded by farmland	no image	no image	Low resolution image unclear but indicates single property	single property surrounded by farmland	single property surrounded by farmland and other houses	single property surrounded by farmland and other houses	single property surrounded by farmland and other houses	single property surrounded by farmland and other houses	
12	232 Kimberley Road, Levin	Medium Risk - no imagery available to determine if established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	367	A10 Market Garden	Unverified Land use noted on project property information as current	1.67	farm land no buildings	no image	no image	Low resolution image shows multiple crops and small fields in the area unclear what is being grown.	field ploughed in strips indicating multiple crops	field ploughed in strips could indicated multiple crops	field ploughed in strips could indicated multiple crops	field ploughed in strips could indicated multiple crops	Market Garden / multiple crops visible	
13	273 Arapaepae South Road, Levin	Low Risk - Outside the footprint of the new road and downgradient of works	Possible Orchard / Vines	Pesticides and Heavy Metals	Not Identified	373	A10 Orchard	Unverified Land use noted on project property information as current	6.92	farm land / livestock observed	no image	no image	Low resolution image shows single crop	wind sheltered paddocks with crops visible	vines, berries, trees at edge of designation	vines, berries, trees at edge of designation	vines, berries, trees at edge of designation	vines, berries, trees at edge of designation	
14	237 Kimberley Road, Levin	Low - Medium Risk - only a small part of the site to be disturbed	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	374	A10 Market Garden	Unverified Land use noted on project property information as current		farm land	no image	no image	Low resolution image shows multiple crops and small fields in the area unclear what is being grown.	property with orchard trees and farm building to the northern end	property with orchard trees and farm building to the northern end and ploughed field to the south	property with land cleared to the north multiple crops to the south	property with grass paddock to the north, multiple crops to the south	Part of fields is site ID 381 Market Garden / multiple crops visible	
15	259 Kimberley Road, Levin	Low - Medium Risk - only a small part of the site to be disturbed	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	381	A10 Market Garden	Unverified Land use noted on project property information as current	5.48	farm land	no image	no image	Low resolution image shows multiple crops and small fields in the area unclear what is being grown.	orchard trees and paddock to the northern end, field to the south	orchard trees and paddock to the northern end, ploughed field to the south	land cleared to the north multiple crops to the south	Grass paddock to the north, multiple crops to the south	Part of fields is site ID 374 Market Garden / multiple crops visible	
16	1-7 Heatherlea East Road, Levin	Low Risk - Orchard established post 2000	Orchard / fruit trees	Pesticides and Heavy Metals	Not Identified	446	A10 Orchard	Unverified Land use noted on project property information as current		farm land / livestock observed	farm land / livestock observed	farm land	farm land	farm paddocks with multiple dwellings and treelines established	trees / bushes / vines in south west corner. Rest of site farmland with livestock observed	trees / bushes / vines in south west corner with netting observed over tress. Rest of site farmland	Blueberries noted in property road sign	bushes seem to have thinned	
17	12-16 Heatherlea East Road, Levin	Low - Medium Risk - Trees / bushes established post 2000. Possible risk of farm dump being encountered	Possible farm dump and small private orchard	Pesticides, Heavy Metals TPH, PAH, and asbestos.	Not Identified	453	A10 Orchard possible G5	Unverified		Property and field. Patch of disturbed soil observed may indicate a historical building location, or farm dump!	Property and fields. Patch of disturbed soil observed in 1940 has reduced in size	Property and fields. Small patch of disturbed soil remains	Property and fields. Small patch of disturbed soil remains	Property and paddocks / fields. Disturbed area no longer visible.	Property and paddocks fields recently cut for hay/silage. Small stand of bushes / tress to north west corner	Property and paddocks fields. Small stand of bushes / tress to north west corner	bushes observed from road side on Heatherlea East Road, Multiple crops observed from SH1	field ploughed in strips could indicated multiple crops. Small stand of bushes / tress to north east corner	
18	148/138 SH1 Levin Foxton	Low Risk - market garden established post 1980	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	459	A10 Market Garden	Unverified Land use noted on project property information as current	7.90	farm land	farm land	limited image suggests farmland	farm land	Paddocks ploughed in different orientations suggesting variation in crops	field ploughed in strips could indicated multiple crops.	multiple crops observed	ploughed field	Market Garden / multiple rows of crops visible	

HAIL SITE Map ID	Address	Risk	Historical land use of concern	Possible Contaminants	Horizons SAHS	Stantec-Ref-ID	Activity - HAIL	Contamination Status	Area (ha)	1939-42	1961-1965	1966 - 1969	1970 - 1979	1999 - 2000	2010-2011	2015-2016	Google earth image	Drone footage March 2021	Drone image 2021
19	32 Heatherlea East Road	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	461	A10 Market Garden	Unverified Land use noted on project property information as current	1.89	farm land	farm land	farm land	farm land, large paddocks observed	Property and paddocks /fields.	northern end field ploughed in strips could indicated multiple crops. Southern end grazing or scrub	field ploughed in strips could indicated multiple crops.	ploughed field to the north with multiple crops. Scrub area to the south	scrub area and paddock to the south. Single crop to the north	
20	34 Arapaepae Road, SH57 Levin	Medium Risk - Imagery shows multiple fields and crops established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	499	A10 Market Garden	Unverified Land use noted on project property information as current	4.60	farm land	no image	no image	Low resolution image shows multiple crops being grown in this area unclear where property boundaries finish	ploughed field	ploughed field	ploughed field	Grassed field observed from road side	lush green crop observed	
21	50 Arapaepae Road, Levin	Medium Risk - Imagery shows multiple fields and crops established in the 1970's	Orchard / fruit trees	Pesticides and Heavy Metals	Not Identified	506	A10 Orchard	Unverified Land use noted on project property information as current		farm land	no image	no image	Low resolution image shows multiple crops being grown in this area unclear where property boundaries finish	Orchard trees	Orchard trees	historical orchard trees patchy	Apples, blueberries, dried fruit and feijoas noted on road sign	historical orchard trees patchy	
22	1051 Queen Street East, Levin	Medium Risk - Imagery shows multiple fields and crops established in the 1970's	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	511	A10 Market Garden	Unverified Land use noted on project property information as current	4.77	farm land	no image	no image	Low resolution image shows multiple crops being grown in this area unclear where property boundaries finish	ploughed field	ploughed field	various crops in paddocks	ploughed fields	Market Garden / multiple rows of crops visible	
23	108 Arapaepae Road, Levin	Low Risk - Outside the designation and downgradient. No works proposed	Orchard / fruit trees	Pesticides and Heavy Metals	Not Identified	517	A10 Orchard	Unverified		Property and paddock with small stand of trees at the east corner	no image	no image	Low resolution image shows house and surrounding gardens. Unable to determine if fruit trees are established	Orchard bushes / trees	Orchard bushes / trees at various stages	Orchard bushes / trees	Orchard bushes / trees observed from the road. Property advertised as a B&B	Orchard bushes / trees	
24	116 SH57 Arapaepae Rd, Levin	Low Risk - Outside the designation and downgradient. No works proposed	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	522	A10 Market Garden	Unverified Land use noted on project property information as current	4.08	farm land	no image	no image	Low resolution image shows ploughed field	field planted in strips	ploughed field	lush green crop	single crop observed from road side	ploughed field	
25	116 SH57 Arapaepae Rd, Levin 40 Waihou Road, Levin	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	531	A10 Market Garden	Unverified Land use noted on project property information as current	1.70	farm land	no image	no image	Low resolution image shows ploughed field	farm land	ploughed field	lush green crop	ploughed field	single crop observed	
26	116 SH57 Arapaepae Rd, LEVIN SHANNON	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	534	A10 Market Garden	Unverified Land use noted on project property information as current	4.08	farm land / livestock observed	no image	no image	Low resolution image shows ploughed field	farm land	ploughed field	farm land	single crop observed to be recently planted	ploughed field	
27	278 Heatherlea East Rd	Low Risk - Trees / bushes established post 1980.	Orchard / fruit trees	Pesticides and Heavy Metals	Not Identified	583	A10 Orchard	Unverified		farm land	no image	no image	Low resolution image shows site part of wider farmland	Orchard with alignment covering SW portion of the site	tree have been removed and returned to paddocks	farm land / livestock observed	farm land	farm land	
28	101 Waihou Road, Levin	Medium Risk - no clear imagery available to determine if established in the 1970's	Polly tunnels next to Valleyview Poultry Limited	Asbestos, Pesticides and Heavy Metals. Other contaminants Pathogens, nutrients, EOC's, viruses may be present depending on historical use of poultry waste on the site.	Not Identified	586	A10 Glass houses	Unverified		farm land / livestock observed	no image	no image	Low resolution image shows neighbouring poultry farm. Polly tunnels not clearly visible	multiple polly tunnels and rounded tunnels observed, uncertain of use.	multiple polly tunnels and rounded tunnels observed, uncertain of use.	polly tunnels in various states of repair	polly tunnels in various states of repair. Rounded tunnels also observed, uncertain of use.	polly tunnels and tunnels in various states of repair	
29	1051 Queen Street East, Levin	Low Risk - only a small part of the site next to Queen St E to be disturbed. Various crops elsewhere on the property established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	615	A10 Market Garden	Unverified Land use noted on Property information	9.20	farm land	no image	no image	Low resolution image shows multiple crops being grown in the area unclear what is being grown. Area where road intersects looks to be part of property garden	ploughed fields	ploughed fields	ploughed field with variation in crops	Part of fields ID 511 ploughed field with variation in crops, House and farm buildings observed	limited drone imagery	
30	40 Waihou Road, Levin	Low Risk - Outside designation	Valleyview Poultry / Next to alignment	Pathogens, Heavy Metals, nutrients, EOC's, viruses	Not Identified	638	0	Unverified		farm land	no image	no image	Property with single poultry building present	poultry buildings present	two poultry buildings present	two poultry buildings present	two poultry buildings present	limited drone imagery	
31	42 Waihou Road, Levin	Low Risk - Outside designation. Orchard established in the 1970's	Orchard / fruit trees	Pesticides and Heavy Metals	Not Identified	0 / 572	A10 Orchard	Unverified		farm land	no image	no image	Trees / bushes planted in rows	Trees / bushes planted in rows	trees / bushes more sparse	trees more sparse surrounding multiple dwellings	trees more sparse surrounding multiple dwellings	limited drone imagery	
32	45 Waihou Road, Levin	Low Risk - market garden established post 2000	Market Garden / horticultural	Pesticides and Heavy Metals	Not Identified	544	A10 Market Garden	Unverified		farm land	no image	no image	Low resolution image	ploughed field	ploughed field	ploughed field with variation in crops	ploughed field with variation in crops	ploughed field	
33	26 Arapaepae South Road Levin 5510	Low Risk - Outside designation and downgradient of works	Landfill site - General waste	TPH, PAH, heavy metals and asbestos.	700518	no ID	G3	Unverified history hazardous industry/act		low lying excavated area visible	no image	no image	grassed field, surrounding land being developed for housing	area filled in and house constructed on the site. Surrounding area built up with housing	single property	single property	second property established on the site and additional surrounding housing	no drone image	
34	861 State Highway 1 Levin Rural 5570	Low Risk - Outside material supply site boundary and downgradient of works	Landfill site - General waste	TPH, PAH, heavy metals and asbestos.	700692	no ID	G3	Verified history hazardous industry/act		Farmland / river terrace	Farmland / river terrace	River floodplain and terrace	River floodplain and terrace	River meander has moved, river terraces are vegetated	River meander has continued to move, river terraces remain vegetated new access and building observed beside the river	Vegetation continues to mature along the river	no change	no drone image	
35	887 State Highway 1 Levin Rural 5570	Low Risk - Outside material supply site boundary and downgradient of works	Landfill site - General waste	TPH, PAH, heavy metals and asbestos.	700060	no ID	G3	Council records note no identified Contamination		land disturbed close to SH 1	Area of previous disturbance grassed over, surrounding area farmland	New area of disturbed soil now visible to the east of the property near the river could indicate disposal area	Disturbed soil to the east of SH1 near the river still visible could indicate disposal area	Area of previous disturbance now vegetated	Buildings now observed near areas of previous disturbance	Vegetation continues to mature, additional dwelling now observed in the area. Surrounding land farmland	vegetation along river well established	Limited image. River, trees and vegetation and several houses / outbuildings	

Appendix E Council Records on known HAIL sites next to the Project designation

Account	Document Precis	Address	Property Title	Status	Contaminants	Horizons SAHS	Horizon File No	Activity - HAIL	Current Status	Tank Removed?
505.2012.00000087.001	Arapaepae road small dump - Landfill site	26 Arapaepae South Road Levin 5510	Lot: 1 DP: 322349	Current	Landfill sites - General waste	700518	ERM 0501AC	G3	Unverified history hazardous industry/act	No
505.2012.00000066.001	The Properties of Ransfield - 891 State Highway 1 Levin South - Old refuse landfill site - Manakau - near Waikawa Stream	891 State Highway 1 Levin Rural 5570	Pln: 4D12A2B	Current	Landfill sites - General waste	700692	ERM 0501CL	G3	Verified history hazardous industry/act	No
505.2012.00000031.001	Brian John Cox - Storage Tanks and drum storage - underground fuel tank in shed - back entrance to house	380-386 Arapaepae Road Levin Rural 5571	Lot: 4 DP: 25093	Current	Fuel Storage Tanks - Hydrocarbon	700653	ERM 0501AV	A17	Verified history hazardous industry/act	No
505.2012.00000020.001	Waikawa Stream Manakau - Landfill site	887 State Highway 1 Levin Rural 5570	Pt: MANAWATU KUKUTAUAKI 4E3 2A1D	Current	Landfill sites - General waste	700060	ERM 0501P	G3	No idenitfied Contamination	No
505.2012.00000030.001	Paul C Ireland 378 Arapaepae South Road Levin - Storage tanks and drum storage - above ground fuel storage tanks	378 Arapaepae Road Levin Rural 5571	Lot: 2 DP: 427531	Current	Fuel Storage Tanks - Hydrocarbon	700652	ERM 0501AU	A17	Verified history hazardous industry/act	No

Ewen Robertson

From: Glenn London
Sent: Monday, September 09, 2002 9:07 AM
To: Ewen Robertson
Subject: FW: Manakau Dump Site Excavation - hard copy to follow

-----Original Message-----
From: Alan Cowie [mailto:acowie@xtra.co.nz]
Sent: Sunday, September 08, 2002 11:46 AM
To: PearceA@LandcareResearch.co.nz
Cc: help@horizons.govt.nz; greet@paradise.net.nz; rod.donald@parliament.govt.nz; helen.clark@parliament.govt.nz; richard@raukawa.iwi.nz
Subject: Manakau Dump Site Excavation

Attention - Andy Pearce - Landcare NZ
Ewen Robertson - Horizon MW
Richard Orzecki - Te Runanga O Raukawa
Caroline Greig, Green Party Aoteroa NZ
Rod Donald, Green Party Aoteroa NZ
Helen Clark - Labour NZ

I am trying to obtain information and assistance regarding the potential hazards of site excavation of an uncontrolled county dump that was closed in the mid - late 1980's. The site in question is located in Manakau, south of Levin. Prior to closing, this dump site was basically used as a general dump as well as an easy alternative for the dumping of a wide variety of substances that in the 1980's would not have been tolerated in the controlled tips of Otaki or Levin . When this site was closed by the Horowhenua District Council it was not properly capped by normal standards of the day. To my knowledge and according to information from Horizon it was capped with effluent from septic tanks. Subsequent to its closure the purchaser of the site planted the entire area in Pinus Radiata. Recently the property changed hands and the purchaser has proposed to turn the area into a Game and Bird Park, Accommodation etc. It appears that the council has given approval for these activities which in my mind was a good idea for the development of the area. By happen chance I visited the site last week and to my surprise I found that diggers had removed a majority of the trees, excavated ponds, and cleared off areas including the top of original tip face. As a layman and a person who was quite familiar with the layout of the original dump I was quite surprised to find excavation happening within 10 metres or so of the Waikawa Stream and with 20 metres or so of the tip face. In many ways I feel that New Zealanders have been deluding themselves with our "clean green image" - to me it's still a society of "out of sight, out of mind" - I have spent many years of my working life in Europe, the Middle East, Asia, and the Americas. Somehow we fit in the middle - I've seen the bad where economic issues overpower the environment (Asia) and I've seen where the economic changes overpower the environment (Middle East). I contacted Horizon MW and was absolutely bedazzled by Barry Goodwin of Horizon MWs response to this work being done on this former tip site. I scratched my head for while and wondered what century I was in. Whilst I am not against development, I believe that any project must be properly managed and the risks and returns must be carefully balanced. My expertise is not in the area of land management. I am a Contract Project Manager. I have recently returned from Saudi Arabia working for IBM on a project considerably larger than the size of New Zealands GNP. I understand risks and I understand the management of those risks. To a degree I understand the risks of the work undertaken on this site but I do not see the management by the Horowhenua District Council or Horizon MW. As an individual, I assess these risks on my own judgment as a layman, an awareness of knowledge gleaned from my father, and the opinion of my father and discussions with him, who for many years was New Zealands Chief Pedologist for DSIR. Whilst I have 7 figure sums to invest in this country, my believes based on my observation of these local authorities, I am loathe to invest in a region with such short sighted views. Whilst we all take risks, I believe that they should be carefully managed. I believe that development is good, but only properly managed that gives a good cost benefit to the community - this requires assessment - I don't believe a cavalier attitude with diggers excavating anaerobic mud from near the base of a tip site within the flood zone of the Waikawa stream represents good management - with Horizon MWs blessing - based on a visual assessment. In any case, in view of Horizon MWs lazzaire faire attitude I will action this further if necessary by private legal and scientific assessment. In any case I look forward to your assistance and feedback. For your information I am copying this email to other interested parties.

Alan Cowie

10/09/2002

03 September 2002

EM 08 06
I/0/HOR
BLG:FAC

Mr P Burlace
C/- 51 Stephens Crescent
PALMERSTON NORTH

Dear Sir

OLD RUBBISH TIP, WAIKAWA RIVER

This confirms the matters we discussed today relating to your development of land around the old rubbish tip site, adjacent to the Waikawa River.

At the time of my inspection, I noted that the capping of the rubbish tip appeared to range from very thin to almost non-existent in places.

Our records show that the Waikawa River has actively eroded the toe of the tip during the mid 1990's and may have removed all cover from that area.

The variety of materials within the tip have not been identified, but you should essume that material in the body of the tip is relatively uncompacted and may contain material that will produce noxious or toxic gases as the material breaks down.

There is also the likelihood that leachates will move through the material in the tip and out into the adjacent river gravels.

If you wish to undertake an analysis of the tip material and stability, I suggest you contact Montgomery Watson Harza of 118 Fitzherbert Avenue, Palmerston North (06-357 4034), who have considerable experience in this area. Such a report may be valuable in relation to possible future liability.

To ensure stability of the tip area, I suggest the following:

- The depth of capping over the fill should be increased by another 3-400mm of compacted clay and topsoil.
- No further excavation of the riverbank or terrace on the immediate upstream toe of the tip (i.e. no further excavation beyond the existing upstream excavation limit);
- No stormwater to be discharged onto the tip capping, and no septic tank effluent soakage to take place within the body or capping of the fill; and
- You may wish to work with the Scheme Manager of the Ohau-Manakau Scheme to install some subsidised protection works on the upstream toe of the tip area to protect against possible future erosion of the toe. Planting of the berm area between the toe of the tip and the river channel with native trees and shrubs will help to avoid erosion. (Contact details of the Scheme Manager – John Foxall at **horizons.mw**: Phone 06-350-1772 or 025 230 6602.).

A copy of our letter to the Horowhenua District Council relating to the subdivision of the Miles block accompanies this letter for your records.

If you have any further queries, please contact me. I will continue to monitor the tip area while development progresses.

Yours faithfully

B L Goodwin
RESOURCE OFFICER

Encl Copy of Horowhenua District Council letter

horizons.mw
Your Regional Council

MEMORANDUM

FILE: EM 08 06

DATE: 16 September 2002

TO: E Robertson

FROM: B Goodwin

SUBJECT: **RUBBISH TIP, WAIKAWA RIVER**

Ewen

In response to the rather upset e-mail from Alan Cowie.

Mr Cowie rang me on Tuesday 3 September following my inspection of the Burlace native wildlife development site. My inspection was in response to the complaint from Ms Gordon handed to me by you the previous day.

I advised Mr Cowie that the activities being undertaken by Mr Burlace fall within the Permitted Activity criteria of the Beds of River & Lakes Plan (i.e. vegetation removal and excavation within a berm area). I also advised Mr Cowie that Mr Burlace had been advised of the existence of the old rubbish tip, a very small portion of which is actually on Burlace's land.

I advised him that the Horowhenua District Council had given the neighbour, Miles, consent to subdivide their property adjacent to Burlace's, and that the recommendation with the subdivision included transfer of the whole of the old tip site to Burlace.

At the time of my inspection, vegetation had been removed from the old tip cap on Burlace's property, with the balance under grass on the neighbouring property. The capping on the tip is very thin, and some solid rubbish was visible on the surface in Burlace's. (I do not believe it has been unearthed by excavation of the capping, but is a result of inadequate capping). The Burlace excavation did not cut into the capping, but removed the vegetation layer.

Mr Burlace has been advised that the tip site is likely to be relatively unconsolidated, that the materials dumped there have not been identified, and that the tip is likely to produce gases and leachates as material breaks down. He was also advised that the Waikawa River has actively eroded the toe of the tip in the past.

I have made the following suggestions to Mr Burlace:

- that he employ the services of MWH to undertake a check on the tip site for stability and likely content;
- that he will need to increase the compacted depth of capping over the tip by another 3 – 400 mm;
- that there should be no excavation of the berm area upstream of the site, that no stormwater or septic tank effluent be discharged onto or into the tip site; and
- that he work with the Scheme Manager of the Ohau-Manakau Scheme to protect the toe of the tip from the risk of erosion by the river.

A copy of my letter to Mr Burlace, dated 3 September, accompanies this memo for your information. With the exception of the recommendation to protect the toe of the tip site, *all* this information was given to Mr Cowie during our phone conversation of 3 September. The

information was reiterated several times, as Mr Cowie appeared not to want to hear that we were looking after the situation, but preferred to be "amazed" that we would allow such activities "unchecked".

It is to be noted here that the excavation he speaks of has taken place over a small area of berm, several metres away from the toe of the tip, and from the active channel of the river.

An uncleared riparian margin approximately 8 – 10 metres in width has been maintained alongside the active channel of the river.

Excavation, as opposed to vegetation removal, has been limited to the clearing of weed (mainly alligator weed) and accumulated silt from three areas within the berm where a previous channel alignment had cut into the gravel of the berm. Further excavation to cut a channel parallel to the river leading a sizeable flow of water down through these ponds to a lower pond adjacent to Ms Gordon's (and the cause of her complaint), where excess water would flow to the river. The clearance of this lower pond has reduced levels in Ms Gordon's ponds by approximately 200 mm, but I would expect the water levels to recover when the lower pond refills. (Mr Burlace has offered to deepen Ms Gordon's ponds to ensure a good water supply if this does not occur).

Mr Cowie expresses concern that the development is not being "properly managed", and states that his area of expertise is not in land management. This is quite apparent, as he appears to be quite unwilling to accept any assurances from me that we are monitoring the situation, and that both horizons and Mr Burlace are well aware of the old tip and the problems that may be associated with such a site.

In my view, Mr Burlace has taken a responsible approach to the project, and has been on site most of the time work has been in progress. He has sought such information as the previous owner has been able to supply, and has not hesitated to seek further advice from horizons.

Mr Burlace is the (NZ expatriate) owner of several overseas businesses, and includes among his previous experience the development of a similar project for a native bird reserve in Bali, Indonesia. I am satisfied from my dealings with Mr Burlace that he intends to manage the project in a responsible manner. I am also satisfied that we have all the necessary tools available to ensure this happens.

B L Goodwin
Resource Officer

RESULTS EM14 01 P

xx closed landfills were identified in the Manawatu Wanganui Region.

The confirmation of the existence (by records or inspection) of 4 of the landfills could not be done.

IDENTIFIED AND CHARACTERISED LANDFILLS:

Horowhenua District

Manakau

General Information

Map Reference: S25: 26983-60537

Location: Turn off east of State Highway 1, 1.9 km north of Manakau 200m south of the Waikawa stream. Take second left (going north), down a private road. The landfill is on the right in a garden, at end of the private road (past house and bird coups and through the gardens).

Date Closed:

Alternative Waste Disposal:

Recent Weather: Dry, no rain for a week.

info limited, based off map ref. given.

Landfill Details

Community Served by old landfill: Manakau

Size (area) and Type of Landfill: 80 m^3. – prefer dimensions ~~max~~ y x z.

Cover Details: Site soils were used. The cover was not spread evenly. There were many mounds. * combination of lack of compaction & cover maybe cf. just cover.

Amount of Refuse:

Surveyed by

Site Description

Soil Type: Silt

Present Landuse: Flower garden growing on it. - really.

Restrictions to and Evidence of Continued Dumping: On private land, and reasonably isolated from access from general public.

Adjacent Landuse: Gardens (incorporate into Present landuse).

Landfill Area Covered in Vegetation: 95%

Ponding: None Observed (incorporate this into landform contour)

Landform Contour: The landfill was generally flat (apart from the mounds). The mounds had a grade of about 3:1, and were about one metre high. There were many natural channels on the landfill. eg. no evidence of ponding observed

Environmental Effects

Discharges to land or water: none observed

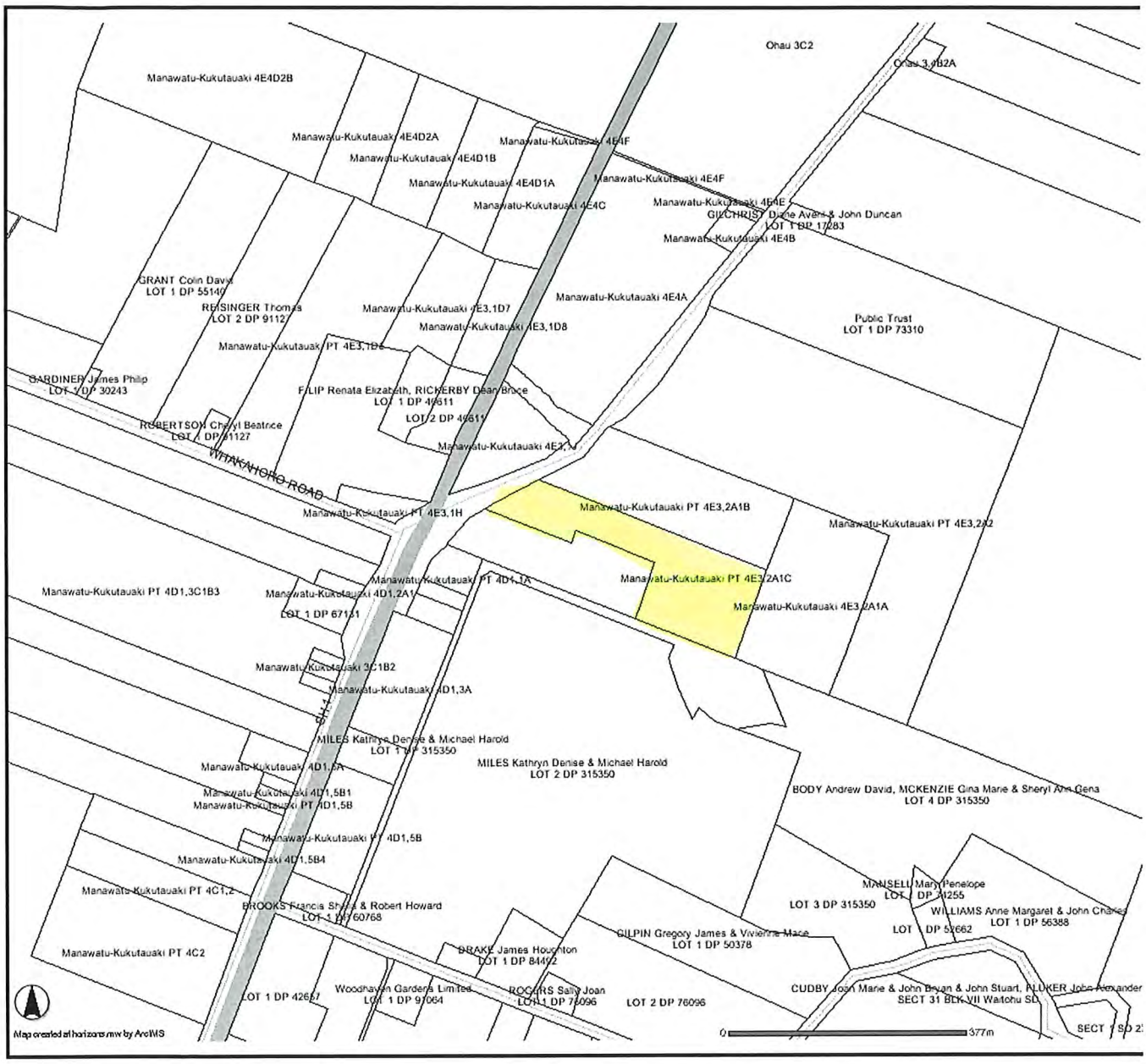
Proximity and Quality of Receiving Water: The Waikawa stream was about 200m away. There was also a garden pond constructed about 15m from the landfill

Air Discharges: None detected

Natural Hazards: The landfill was more or less on the Waikawa flood plain, but there was a stop bank. There still may be a possibility of flooding.

Environmental Protection Measures Taken: None observed

General Comments


Ohau 3C2
Ohau 3B2A
Manawatu-Kukutauaki 4E4D2B
Manawatu-Kukutauaki 4E4D2A
Manawatu-Kukutauaki 4E4F
Manawatu-Kukutauaki 4E4D1B
Manawatu-Kukutauaki 4E4D1A
Manawatu-Kukutauaki 4E4F
Manawatu-Kukutauaki 4E4C
Manawatu-Kukutauaki 4E4E
GILCHRIST Diane Averil & John Duncan
LOT 1 DP 17283
Manawatu-Kukutauaki 4E4B
GRANT Colin David
LOT 1 DP 55140
REISINGER Thomas
LOT 2 DP 9112
Manawatu-Kukutauaki 4E3,1D7
Manawatu-Kukutauaki 4E4A
Manawatu-Kukutauaki 4E3,1D8
Public Trust
LOT 1 DP 73310
Manawatu-Kukutauaki PT 4E3,1D6
GARDINER James Philip
LOT 1 DP 30243
FLIP Renata Elizabeth, RICHERBY Dean Bruce
LOT 1 DP 46611
LOT 2 DP 46611
ROBERTSON Cheryl Beatrice
LOT 1 DP 31127
Manawatu-Kukutauaki 4E3,1
WHAKAHORO ROAD
Manawatu-Kukutauaki PT 4E3,1H
Manawatu-Kukutauaki PT 4E3,2A1B
Manawatu-Kukutauaki PT 4E3,2A2
Manawatu-Kukutauaki PT 4D1,3C1B3
Manawatu-Kukutauaki PT 4D1,1A
Manawatu-Kukutauaki 4D1,2A1
LOT 1 DP 67131
Manawatu-Kukutauaki PT 4E3,2A1C
Manawatu-Kukutauaki 4E3,2A1A
Manawatu-Kukutauaki 3C1B2
Manawatu-Kukutauaki 4D1,3A
SH1
MILES Kathryn Denise & Michael Harold
LOT 1 DP 315350
MILES Kathryn Denise & Michael Harold
LOT 2 DP 315350
Manawatu-Kukutauaki 4D1,5A
Manawatu-Kukutauaki 4D1,5B1
Manawatu-Kukutauaki PT 4D1,5B
BODY Andrew David, MCKENZIE Gina Marie & Sheryl Ann Gena
LOT 4 DP 315350
Manawatu-Kukutauaki PT 4D1,5B
Manawatu-Kukutauaki 4D1,5B4
MANSELL Mary Penelope
LOT 1 DP 31255
Manawatu-Kukutauaki PT 4C1,2
BROOKS Francis Shane & Robert Howard
LOT 1 DP 60768
LOT 3 DP 315350
WILLIAMS Anne Margaret & John Charles
LOT 1 DP 56388
LOT 1 DP 52662
GILPIN Gregory James & Vivienne Mace
LOT 1 DP 50378
Manawatu-Kukutauaki PT 4C2
DRAKE James Houghton
LOT 1 DP 84402
LOT 1 DP 42667
Woodhaven Gardens Limited
LOT 1 DP 97064
ROGERS Sally Joan
LOT 1 DP 76096
LOT 2 DP 76096
CUDBY Josh Marie & John Bryan & John Stuart, FLUKER John Alexander
SECT 31 BLK VII Waiohu SD
SECT 1 SD 2
Map created at horizons.mw by ArcIMS
0
377m

Manakau (map Ref)

Manaratu - Kukutauaki
PT 4E3, 2A1C
4.2441 Ha.

SCANNED
11/08/2021
11313

horizons regional council

MEMORANDUM

FILE: ERM 5 01P

DATE: 4 November 2009

TO: File

FROM: Leigh Christensen

SUBJECT: **CHANGE OF PROPERTY CLASSIFICATION – SAHS 700060**

- File was checked on the 2 November 2009
- Original property has been subdivided.
- The property north and over the stream from the landfill is now under a separate title - legal description Pt Manawatu-Kukutauaki 4E3,2A1B.
- As this property does not contain the landfill it is now not considered a Contaminated or Hail site
- Letter sent to Isaac McIntyre of HDC stating that this site is now not considered a Contaminated or Hail site.
- Email sent to Nathan Batchelor of HRC to change Legal Description on SAHS database

L P Christensen

Leigh Christensen
ENVIRONMENTAL PROTECTION OFFICER

Updated by L. Christensen in SAHS on 26.11.09.

4 November 2009

FILE COPY

horizons
regional council

Private Bag 11025
Manawatu Mail Centre
Palmerston North 4442

P 06 952 2800
F 06 952 2929

www.horizons.govt.nz

Isaac McIntyre
C/- Horowhenua District Council
Private Bag 4002
LEVIN 5540

ERM 5 01P
LPC:JHC

10621

Dear Isaac

SAHS 700060: 861 STATE HIGHWAY 1, OHAU – LEGAL DESCRIPTION MANAWATU-KUKUTAUAKI 4E3 PT 2A1B

Regarding the property located at 861 State Highway 1, Ohau, which is currently owned by Timothy John and Robyn Avis Ralton, this property was part of a larger property that contained a landfill which was classified as a HAIL site on our Contaminated Site database.

As the original property was subdivided and the Ralton's now own the northern part, which does not contain a landfill, we do not consider their property to be a Contaminated or HAIL Site and therefore we will amend our database to reflect this.

If you have any questions or concerns please contact me on freephone 0508 800 800.

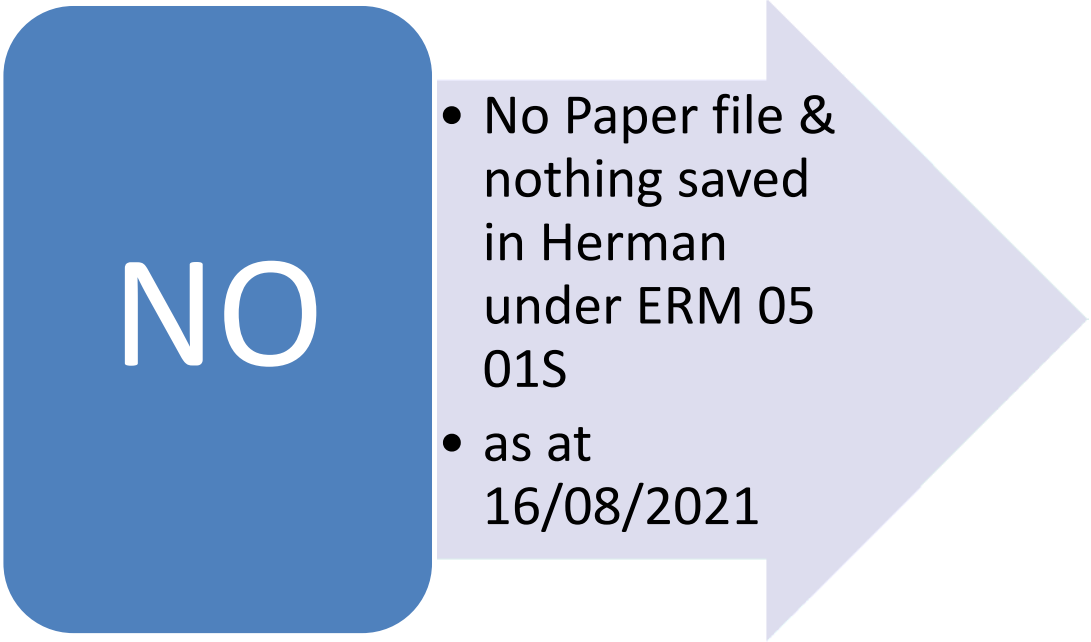
Yours sincerely

Leigh Christensen
ENVIRONMENTAL PROTECTION OFFICER

Contaminated Site Enquiry

Date Requested	16/08/2021
Old File Number	EM 14 01S- Scanned
New File Number	ERM 05 01S
Site Name	BC Resources Incident Number 15342
Site Address	39 Chester Street, Levin

Information found



From: HAIL
To: Gibbs, Emma
Cc: hail.enquiries@horizons.govt.nz
Subject: Re: [Request ID :##55176##] HAIL Info Request | Kirkcaldie Grove, Levin, Horowhenua District.
Date: Tuesday, April 5, 2022 3:39:55 PM

Hi,

I have checked Horizons Regional Council Site's Associated with Hazardous Substances (SAHS) database and I can advise that none of the properties on Kirkcaldie Grove, Levin, are recorded on our SAHS database.

I would recommend that you check with Horowhenua District Council as they may have records relating to the aforementioned properties.

Yours faithfully

Pita Kinaston | Team Leader Consent Monitoring

Horizons Regional Council | 11-15 Victoria Avenue | Palmerston North 4410

0508 800 800 | DD: 06 9522841 | Mobile: 021 2277448 |

From: Gibbs, Emma <Emma.Gibbs@stantec.com>
Sent: Thursday, 5 May 2022 4:28 pm
To: Customer Services - Public <CustomerServices@horowhenua.govt.nz>
Cc: Halder, Kathryn <Kathryn.Halder@stantec.com>
Subject: RE: [Request ID :##55178##] HAIL Info Request | 378 Arapaepae South Road, Levin, Horowhenua District.

Hi Leigh,

I thought I would send you a bit more detail on the sites we are requesting additional information on.

We are requiring the below information for a Preliminary site investigation report we are undertaking so any information regarding the below would be much appreciated.

The site with SahsID-700653:This is a confirmed HAIL site with fuel storage tanks.

- Does the team have any photos of these fuel tanks?
- What is the approx. volume of the tank(s)
- And where on the property are these tanks located?

The site with SahsID-700518: This is a suspected landfill site.

- What information does Council have on file to suspect a landfill was present at this site?
- Any additional info on this would be great.

The site with SahsID-700692: This is a confirmed landfill site

- What information does council have on file that confirms this site was / is a landfill site?
- Any information on size, location, photographs, what type of waste, is it lined / unlined would be great.

The site with SahsID-700060: this is a confirmed landfill site

- What information does council have on file that confirms this site was / is a landfill site?
- Any information on size, location, photographs, what type of waste, is it lined / unlined would be great.

Kind regards,

Emma Gibbs
MSc (Hons)
Senior Environmental Scientist
Direct: +64 3 281 7574
Mobile: +64 27 381 7845
Stantec New Zealand
Hazeldean Business Park
Level 2, 2 Hazeldean Road
P O Box 13-052
Christchurch 8141, New Zealand

From: Customer Services - Public <CustomerServices@horowhenua.govt.nz>
Sent: Tuesday, May 3, 2022 3:11 PM
To: Gibbs, Emma <Emma.Gibbs@stantec.com>
Subject: RE: [Request ID :##55178##] HAIL Info Request | 378 Arapaepae South Road, Levin, Horowhenua District.

Hi Emma,

Thank you for your response, sorry you haven't heard back yet

Our Team have a very heavy work load at the moment and are taking longer than usual to get back to people. I will check the request went through properly and I would hope they get back to you soon.

Kind regards

Leigh

Customer Experience
| Whakawhanaunga Kiritaki

Waea Mahi | (06) 366 0999

126 Oxford Street, Levin
Private Bag 4002, Levin 5540

From: Gibbs, Emma <Emma.Gibbs@stantec.com>
Sent: Tuesday, 3 May 2022 2:27 pm
To: Customer Services - Public <CustomerServices@horowhenua.govt.nz>
Subject: RE: [Request ID :##55178##] HAIL Info Request | 378 Arapaepae South Road, Levin, Horowhenua District.

Hi Leigh,

I have not had a response on the below as yet.

Are you able to let me know where this one is at please?

Cheers

Emma

From: Customer Services - Public <CustomerServices@horowhenua.govt.nz>
Sent: Friday, April 8, 2022 4:54 PM
To: Gibbs, Emma <Emma.Gibbs@stantec.com>
Subject: RE: [Request ID :##55178##] HAIL Info Request | 378 Arapaepae South Road, Levin, Horowhenua District.

Hi Emma,

Thank you for your email.

I have put your request through tour team , to be actioned.
Your Customer Reference number is 204161.

If you have any more questions, feel free to get in touch.

Kind regards

Leigh

Customer Experience
| Whakawhanaunga Kiritaki

Waea Mahi | (06) 366 0999

126 Oxford Street, Levin
Private Bag 4002, Levin 5540

From: HAIL <Hail.Enquiries@horizons.govt.nz>
Sent: Tuesday, April 5, 2022 4:27 PM
To: Gibbs, Emma <Emma.Gibbs@stantec.com>
Cc: hail.enquiries@horizons.govt.nz
Subject: Re: [Request ID :##55178##] HAIL Info Request | 378 Arapaepae South Road, Levin, Horowhenua District.

Hi,

I have checked Horizons Regional Council Site's Associated with Hazardous Substances (SAHS) database and I can advise that 378 Arapaepae South Road is recorded on our SAHS database.

The information on record is;

Sahs ID	700652
File No	ERM 05 01AU
Date Created	10/08/2012
File Name	PC IRELAND 378 ARAPAEPAE SOUTH ROAD LEVIN
Classification	02. Verified Hail. No Site Investigation
Hail	A 17 (A=Chemical manufacture, application and bulk storage; 17= Storage tanks or drums for fuel, chemicals or liquid waste)
Potential Contaminants	Fuel Storage Tanks - Hydrocarbons
Letter Comments	Received from Horowhenua District Council May 2012. This site is on their contaminated sites register. Fuel tanks (above ground)
Location Comment	Approximate location sourced from valuation number.
Territorial Authority	HOROWHENUA DISTRICT
Easting	1792868
Northing	5496709

I would recommend that you check with Horowhenua District Council as they may also have records relating to the aforementioned property.

Yours faithfully

Pita Kinaston | Team Leader Consent Monitoring

Horizons Regional Council | 11-15 Victoria Avenue | Palmerston North 4410

0508 800 800 | DD: 06 9522841 | Mobile: 021 2277448 |

From:	HAIL
To:	Gibbs, Emma
Cc:	hail.enquiries@horizons.govt.nz
Subject:	Re: [Request ID :##55187##] HAIL Info Request | 861 State Highway 1, Manakau, 5573
Date:	Tuesday, April 5, 2022 4:56:30 PM
Attachments:	ERM0501_P 20020902 Manakau Dump Site Excavation.pdf ERM0501_P 20020903 Old Rubbish Tip Waikawa River.pdf ERM0501_P 20020916 Rubbish Tip Waikawa River.pdf ERM0501_P 20041104 Identified _ Characterised Landfills.pdf ERM0501_P 20091104 Change of Property Classification SAHS 700060.pdf ERM0501_P 20210811 Waikawa Stream .docx

---

Hi,

I have checked Horizons Regional Council Site's Associated with Hazardous Substances (SAHS) database and I can advise that 861 State Highway 1, Manakau, is recorded on our SAHS database.

The information summary is as follows;

Sahs ID	700060
File No	ERM 05 01P
Date Created	02/12/2004
File Name	WAIKAWA STREAM MANAKAU
Classification	06. Verified Hail. At Or Below Background Levels
Hail	G3 - Landfill sites
Potential Contaminants	Landfill sites -
Letter Comments	Information on site limited; valuation number, area, zoning based off map reference. 26/11/09. Classification changed from 'Unverified of Hazardous Industry or Activity' to 'No Identified Contamination'.
Location Comment	
Territorial Authority	HOROWHENUA DISTRICT
Easting	1788243
Northing	5492266

I have also attached the further information held by Horizons.

I would recommend that you check with Horowhenua District Council as they may also have records relating to the aforementioned property.

Yours faithfully

Pita Kinaston | Team Leader Consent Monitoring

Horizons Regional Council | 11-15 Victoria Avenue | Palmerston North 4410

0508 800 800 | DD: 06 9522841 | Mobile: 021 2277448 |

Exclusion of Liability Arising from Supply of Information

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Appendix F Historical Aerial Images

This information is included within the Project GIS mapping and access can be requested.

Appendix G File Note

Stantec

FILE NOTE

DATE 20 May 2021
JOB No. 310203848

PROJECT O2NL

SUBJECT Site Investigation

FOR INFORMATION OF

FOR ACTION BY

THIS NOTE RECORDS:
- ☐ MEETING
- ☐ PHONECALL
- ☑ THOUGHT/IDEA
- ☐

☑ WITH
☐ ABOUT

☐ CLIENT
☑ CONTRACTOR
☐ SUPPLIER ☐

BETWEEN Roy Ching
AND Quarry Manager
TIME 9.00am

Detail:

TP235 - Ohau Quarry
20-5-2021

TP encountered household refuse (mattresses, pipes, fabric) along with green waste (stumps, cut branches) from ~1m to ~2m. Refuse was covered in gravelly clay FILL.

Discussion with Quarry Manager on site

Quarry manager mentioned that historic refuse was dumped here, likely when customers came to fill there trailers from the quarry.

He pointed out an area approximately extending out 20m in each direction where the refuse would likely be dumped however could not be certain.

INITIALS

Appendix H Contamination Assessment at the South Bank of the Ohau River

Ōtaki to North of Levin Project - Contamination Assessment at the South Bank of the Ōhau River

PREPARED FOR Waka Kotahi NZ Transport Agency |
June 2021

We design with community in mind

Stantec

Revision Schedule

Rev No.	Date	Description	Signature or Typed Name (documentation on file)		
			Prepared by	Checked and reviewed by	Approved by
0	22/06/2021	Draft for internal review	Julia O'Brien	Paul Heveldt	
1	25/06/2021	Final	Julia O'Brien	Paul Heveldt	Jon England

Quality Statement

This document has been prepared for the benefit of Waka Kotahi NZ Transport Agency. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to Waka Kotahi NZ Transport Agency and other persons for an application for permission or approval to fulfil a legal requirement.

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Jon England	Paul Heveldt

PREPARED BY

Julia O'Brien  22 / 06 / 2021

CHECKED & REVIEWED BY

Paul Heveldt  22 / 06 / 2021

APPROVED FOR ISSUE BY

Jon England  25 / 06 / 2021

WELLINGTON
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PO Box 13-052, Armagh, Christchurch 8141
TEL +64 4 381 6700

STATUS Final | Project No 310203848

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1.0 INTRODUCTION

The Ōtaki to North of Levin project (Ō2NL; the project) is the northernmost section of the Wellington Northern Corridor and will improve the safety and resilience of the transport network connecting Ōtaki and Levin, and the wider region.

As of March 2021, Waka Kotahi NZ Transport Agency (Waka Kotahi) has selected a refined draft alignment for the project (Figure 1-1). On behalf of Waka Kotahi, Stantec is progressing with engineering designs and optioneering, including understanding environmental and social effects, and how these can be avoided, minimised or mitigated. As part of this, ground investigations have been undertaken and these investigations, prompted by anecdotal evidence, have identified an area of land that will be developed within the proposed road corridor alignment as potentially having been used as a landfill. This site is located at 559 State Highway 1, Ōhau (Figure 1-2), on the south bank of the Ōhau River.

As part of these ground investigations, the potential presence of contaminated soil related to the possible historic landfill has been assessed by intensive soil sampling and laboratory analysis for contaminants likely to be associated with landfill material. The findings of this investigation will determine the risks posed by any identified contamination, the precautionary measures that should be taken regarding health & safety in handling such excavated soil during construction, and the most suitable disposal location for any surplus soil.

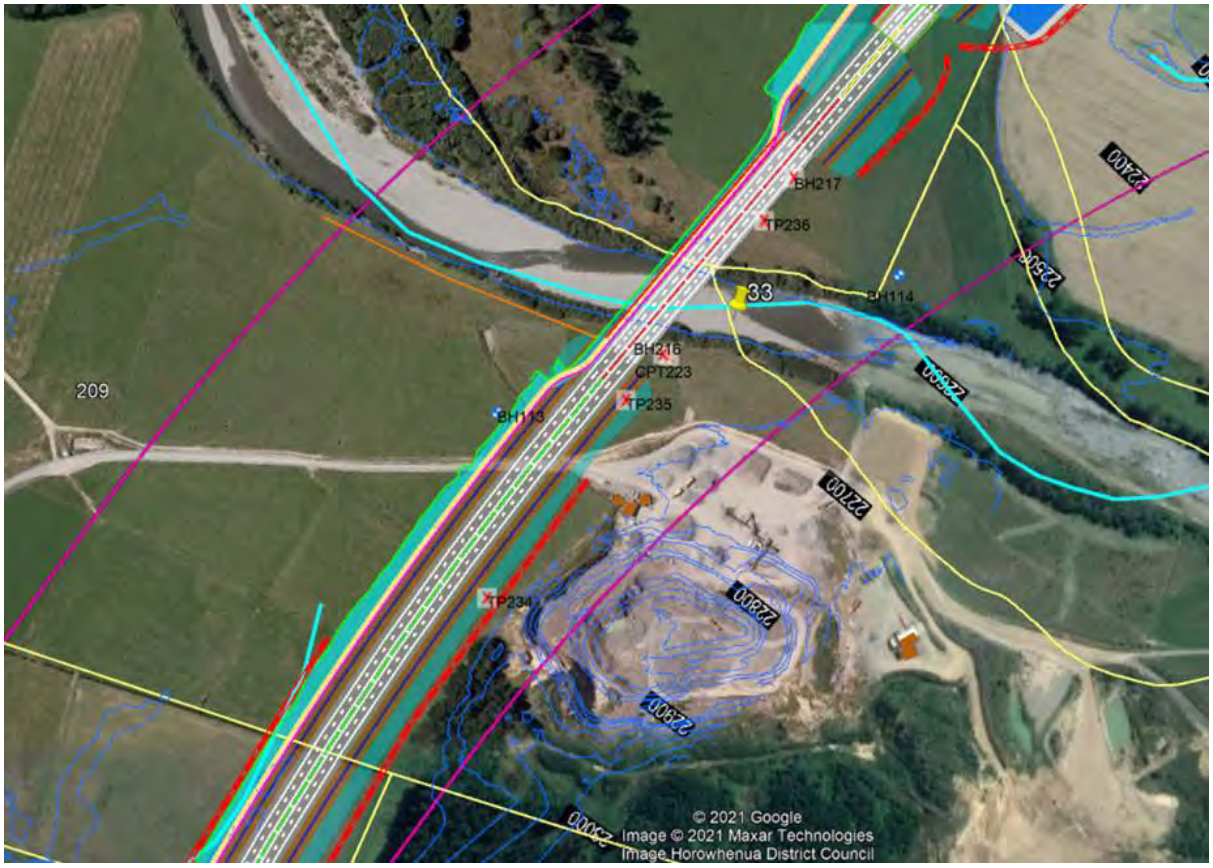

Figure 1-1 Depiction of where the draft alignment for the project intercepts with the potential historical landfill suspected near the south bank of the Ōhau River

Figure 1-2 Location of sampling sites on the south bank of the Ōhau River

1.1 SITE LOCATION

The site of this investigation is located approximately 8km south of Levin and is situated immediately adjacent to Webb's quarry on farmland, as shown in the view above. The Ōhau River is to the north of the sample sites, with the individual sites being between 10 m and 100 m away from the river. There were five sampling locations, as seen in Figure 1-3. These sample locations reflect the form of the Ō2NL proposed bridge approach on the south side of the Ōhau River.

Figure 1-3 Locations of individual samples

2.0 SAMPLING METHODLOGY

Soil samples were taken at five locations over a total of three days. The details are:

- Site ORSL_1 was sampled on 14 June 2021 at 0.4 m, 2 m, and 3.5 m depth
- Site ORSL_2 was sampled on 14 June 2021 at 0.5 m, 2 m, and 3.5 m depth
- Site TP235 was sampled on 20 May 2021 at 0.5 m and 3.6 m depth
- Site TP235B was sampled on 20 May at 0.5 m and 2.5 m depth
- Site TP234 was sampled on 19 May 2021 at 0.5 m and 3.5 m depth

A total of 12 individual soil samples were obtained from the five locations.

Due to time constraints on site, samples at sites TP234, TP235, and TP235B were taken by a geotechnical engineer. Clean plastic bags were used to store the soil samples and clean disposable gloves were used to take each sample. The soil samples were dropped off at Stantec's Wellington office and a Stantec environmental scientist transferred the soil into the appropriate laboratory containers while wearing clean disposable gloves when handling each sample. The samples were then placed in a chilly bin with ice packs and taken to R J Hill Laboratories for analysis.

For sites ORSL_1 and ORSL_2, a Stantec environmental scientist took the samples. Prior to taking the samples at each location, the environmental scientist cleaned the drill with Decon90. After taking the soil samples, the samples were stored in a chilly bin with ice packs and taken directly to R J Hill Laboratories for analysis.

The only refuse identified while sampling was at:

- TP235 between 1.5 m and 2.5 m depth. The material observed included fence posts, a metal pipe, potentially a mattress, plastic, and bits of wire.

  ORSL_2 at 0.5 m depth. One sheet of black plastic was observed at this site.

As rubbish was only identified at TP234 and ORSL_2 in limited quantities, it is assumed these are small deposits of domestic dumped rubbish, rather than being indicative of a landfill.

Photographs were taken while sampling and can be found in Table 2-1 below.

Table 2-1 Photos of soil sampling

Left image: Clean drill before sampling ORSL1

Middle image: Paddock where all samples except TP234 were taken. This is on farmland beside Webb's quarry

Right image: Webb's quarry beside sampling sites

Left image: Site ORSL_1 at 0.4 m depth. The soil is similar in colour throughout.

Middle image: Site ORSL_1 at 2 m depth shows a darkening of the soil indicating the presence of disposed material.

Right image: Site ORSL_1 at 3.5 m depth shows a darker soil than the earlier depths and indicates the potential presence of disposed material.



Left image: Site ORSL_2 at 0.5 m depth shows similar soil throughout suggesting it has not been disturbed previously.

Middle image: Plastic sheet found at site ORSL_2 at 0.5 m depth

Right image: Site ORSL_2 at 2 m depth shows similar soil throughout.



Left image: Site ORSL_2 at 3.5 m depth. No rubbish is seen in the drill flights and the soil is similar throughout suggesting it has not been disturbed.

Middle image: Site TP234 showing no evidence of rubbish. The soil is similar throughout.

Right image: Site TP235 showing rubbish found.


Left image: Site TP235 showing a sudden change in soil colour indicating there may have been disturbance at some point in time.

Right image: Site TP235B shows no indication of rubbish, however the change in soil colour may indicate imported material.

3.0 RESULTS AND DISCUSSION

The analytical results that were above the laboratory detection limits are shown in Table 3-1. The complete set of the analytical results is provided in Appendix A.

The results have been compared to the following guidelines:

- National Environmental Standard for assessing and managing contaminants in soil to protect human health (MfE, April 2012) (NESCS). The category of commercial/industrial outdoor worker (unpaved) was used.
- Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (GWRC, August 2003). The category of soil type 1 was used.
- Module 2: Hazardous Waste Guidelines Landfill Waste Acceptance Criteria and Landfill Classification (MfE, May 2004). Both guidelines for class A and class B landfills were used.

Asbestos was also tested for “presence/absence” in all samples; no asbestos was detected.

None of the concentrations of analysed contaminants exceeded the NESCS criteria for a commercial/industrial landuse or the landfill acceptance criteria for a Class A landfill. However, as shown in Table 3-1, several contaminant concentrations exceeded the acceptance criteria for Class B and the Wellington background concentrations for soil type 1.

The exceedances of the Class B landfill criteria mean that any soil to be disposed off site should be disposed of to a Class A landfill. It is important to note that the MfE guidelines for landfill acceptance criteria provide only a guideline and prior to disposal of any soil offsite, the results should be compared to the specific landfill’s acceptance criteria.

Please note, any implications of the sample results with respect to possible consent requirements of the NESCS have not been assessed in this report.

Table 3-1 Analytical results for soil samples

	Wellington background concentration (Soil type 1)[1]	Landfill acceptance criteria (Class B)	ORSL_1_0.4m	ORSL_1_2m	ORSL_1_3.5m	ORSL_2_0.5m	ORL_2_2m	ORSL_2_3.5m	TP235B_0.5m	TP235B_2.5m	TP235_0.5m	T235_3.6m	TP234_0.5m	TP234_3.5m
Total Recoverable Arsenic (mg/kg)	<2 - 7	**10**	5	**17**	5	5	5	3	4	4	4	4	4	4
Total Recoverable Cadmium (mg/kg)	<0.1 - 0.1	**2**	0.11	0.34	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total Recoverable Chromium* (mg/kg)	7 - 12	**10**	**19**	**24**	**14**	**14**	**14**	**12**	**16**	**13**	**14**	**15**	**14**	**16**
Total Recoverable Copper (mg/kg)	4 - 10	**10**	**15**	**18**	**11**	10	**11**	9	**18**	10	**11**	10	10	8
Total Recoverable Lead (mg/kg)	4.5 - 180	**10**	**81**	**24**	**26**	**14.7**	**17.6**	**13**	**26**	**15.6**	**22**	**16.3**	**15.3**	**12.5**
Total Recoverable Nickel (mg/kg)	4 - 9	**20**	15	12	13	14	15	13	17	13	10	13	13	13
Total Recoverable Zinc (mg/kg)	28 - 79	**20**	**98**	**94**	**80**	**61**	**63**	**53**	**77**	**57**	**57**	**67**	**60**	**50**
Benzo[a]anthracene (mg/kg)			0.012	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo[a]pyrene (BAP) (mg/kg)	<0.002 - 0.08		0.016	0.015	BDL	BDL	BDL	BDL	BDL	BDL	0.012	BDL	BDL	BDL

[1] Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (GWRC, August 2003)

	Wellington background concentration (Soil type 1)[1]	Landfill acceptance criteria (Class B)	ORSL_1_0.4m	ORSL_1_2m	ORSL_1_3.5m	ORSL_2_0.5m	ORL_2_2m	ORSL_2_3.5m	TP235B_0.5m	TP235B_2.5m	TP235_0.5m	T235_3.6m	TP234_0.5m	TP234_3.5m
Benzo[b]fluoranthene + Benzo[j]fluoranthene (mg/kg)			0.018	0.016	BDL	BDL	BDL	BDL	BDL	BDL	0.014	BDL	BDL	BDL
Chrysene (mg/kg)			0.013	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene (mg/kg)	<0.002 - 0.14		0.019	0.019	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene (mg/kg)	<0.002 - 0.07		0.013	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pyrene (mg/kg)	<0.002 - 0.12		0.022	0.022	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C15 - C36 (mg/kg)			79	139	54	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total hydrocarbons (C7 - C36) (mg/kg)			81	139	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Please note:

*Chromium is compared against VI in the guidelines

BDL means Below Detection Limit

4.0 CONCLUSIONS AND RECOMMENDATIONS

Twelve soil samples were taken over three days at a site on the south bank of the Ōhau River on the proposed alignment of the Ōtaki to North of Levin project to determine if a landfill is present at this location and, if so, the implications of this for project health & safety and disposal of surplus excavated soil.

While the sampling and analysis did not identify any contamination associated with landfill material, small quantities of what appeared to be recently discarded household waste were found. This appears to be a limited area of historic fly tipping on the ground surface.

It is concluded that there is no historic landfill in this location and excavated soil can be disposed of at a Class A landfill.

It is recommended that a site management plan is used to ensure the safe handling of the soil. Due to the exceedances of Wellington background levels for soil type 1, it is also recommended that further considerations are made to determine if a consent is required under the NESCS for disturbance of soil and the off-site disposal of any surplus soil, to carry out the proposed Ō2NL project works at this location.

Appendix

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Appendix A LABORATORY ANALYTICAL RESULTS

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Stantec New Zealand	**Lab No:**	2617956 SPv1
Contact:	Julia O'Brien	**Date Received:**	21-May-2021
	C/- Stantec New Zealand	**Date Reported:**	27-May-2021
	PO Box 13052	**Quote No:**	111545
	Armagh	**Order No:**	
	Christchurch 8141	**Client Reference:**	
		Submitted By:	Julia O'Brien

Sample Type: Soil

Sample Name:		T235_3.6m 20-May-2021 9:00 am	TP235B_0.5m 20-May-2021 9:45 am	TP235_0.5m 20-May-2021 8:20 am	TP231_0.5m 19-May-2021 2:50 pm	TP234_3.5m 19-May-2021 3:20 pm
Lab Number:		2617956.1	2617956.2	2617956.3	2617956.4	2617956.5
Individual Tests						
Dry Matter	g/100g as rcvd	94	87	87	84	92
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	4	4	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	15	16	14	14	16
Total Recoverable Copper	mg/kg dry wt	10	18	11	10	8
Total Recoverable Lead	mg/kg dry wt	16.3	26	22	15.3	12.5
Total Recoverable Nickel	mg/kg dry wt	13	17	10	13	13
Total Recoverable Zinc	mg/kg dry wt	67	77	57	60	50
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Acenaphthene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Benzo[a]anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	< 0.012	0.012	< 0.012	< 0.011
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	< 0.012	0.014	< 0.012	< 0.011
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Chrysene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Fluoranthene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Fluorene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Phenanthrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011
Pyrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.012	< 0.011

Sample Type: Soil						
Sample Name:		T235_3.6m 20-May-2021 9:00 am	TP235B_0.5m 20-May-2021 9:45 am	TP235_0.5m 20-May-2021 8:20 am	TP231_0.5m 19-May-2021 2:50 pm	TP234_3.5m 19-May-2021 3:20 pm
Lab Number:		2617956.1	2617956.2	2617956.3	2617956.4	2617956.5
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitrobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
alpha-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
beta-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
delta-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDD	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDE	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDT	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dieldrin	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan I	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Endosulfan II	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Endosulfan sulphate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Endrin	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Endrin ketone	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Heptachlor	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor epoxide	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hexachlorobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS*						
Acenaphthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluorene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Methylnaphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3

Sample Type: Soil						
Sample Name:		T235_3.6m 20-May-2021 9:00 am	TP235B_0.5m 20-May-2021 9:45 am	TP235_0.5m 20-May-2021 8:20 am	TP231_0.5m 19-May-2021 2:50 pm	TP234_3.5m 19-May-2021 3:20 pm
Lab Number:		2617956.1	2617956.2	2617956.3	2617956.4	2617956.5
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
2-Chlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Nitrophenol	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
Phenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
Butylbenzylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diethylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dimethylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-octylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Hexachlorobutadiene	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Hexachloroethane	mg/kg dry wt	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 10	< 10	< 10	< 10	< 10
Carbazole	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibenzofuran	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Isophorone	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70	< 70
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.14	< 0.17	< 0.16	< 0.18	< 0.15
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	< 0.3	< 0.4	< 0.4	< 0.4	< 0.3
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Sample Type: Soil						
Sample Name:		T235_3.6m 20-May-2021 9:00 am	TP235B_0.5m 20-May-2021 9:45 am	TP235_0.5m 20-May-2021 8:20 am	TP231_0.5m 19-May-2021 2:50 pm	TP234_3.5m 19-May-2021 3:20 pm
Lab Number:		2617956.1	2617956.2	2617956.3	2617956.4	2617956.5
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 4	< 4	< 4	< 3
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Styrene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 30	< 40	< 40	< 40	< 30
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 6	< 7	< 7	< 7	< 6
Acetone	mg/kg dry wt	< 30	< 40	< 40	< 40	< 30
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Sample Type: Soil						
Sample Name:		T235_3.6m 20-May-2021 9:00 am	TP235B_0.5m 20-May-2021 9:45 am	TP235_0.5m 20-May-2021 8:20 am	TP231_0.5m 19-May-2021 2:50 pm	TP234_3.5m 19-May-2021 3:20 pm
Lab Number:		2617956.1	2617956.2	2617956.3	2617956.4	2617956.5
Trihalomethanes in VOC Soils by Headspace GC-MS						
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Sample Name:		TP235B_2.5m 20-May-2021 10:05 am				
Lab Number:		2617956.6				
Individual Tests						
Dry Matter	g/100g as rcvd	90	-	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	13	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	10	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	15.6	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	13	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	57	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.012	-	-	-	-
Anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	-	-	-	-
Chrysene	mg/kg dry wt	< 0.012	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.012	-	-	-	-
Fluorene	mg/kg dry wt	< 0.012	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	-	-	-	-
Perylene	mg/kg dry wt	< 0.012	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.012	-	-	-	-
Pyrene	mg/kg dry wt	< 0.012	-	-	-	-
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5	-	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-

Sample Type: Soil						
Sample Name:		TP235B_2.5m 20-May-2021 10:05 am				
Lab Number:		2617956.6				
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
Nitrobenzene	mg/kg dry wt	< 0.5	-	-	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7	-	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 0.5	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.5	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 1.0	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.5	-	-	-	-
Endosulfan I	mg/kg dry wt	< 1.0	-	-	-	-
Endosulfan II	mg/kg dry wt	< 2	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 1.0	-	-	-	-
Endrin	mg/kg dry wt	< 0.7	-	-	-	-
Endrin ketone	mg/kg dry wt	< 1.0	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.5	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.5	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS*						
Acenaphthene	mg/kg dry wt	< 0.5	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.5	-	-	-	-
Anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Chrysene	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Fluorene	mg/kg dry wt	< 0.5	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.5	-	-	-	-
Pyrene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 1.3	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 1.3	-	-	-	-
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	-	-	-	-
2-Chlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4-Dichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4-Dimethylphenol	mg/kg dry wt	< 3	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	-	-	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0	-	-	-	-
2-Nitrophenol	mg/kg dry wt	< 5	-	-	-	-

Sample Type: Soil						
Sample Name:		TP235B_2.5m 20-May-2021 10:05 am				
Lab Number:		2617956.6				
Phenols in SVOC Soil Samples by GC-MS						
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	-	-	-	-
Phenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5	-	-	-	-
Butylbenzylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0	-	-	-	-
Diethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Dimethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-butylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-octylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachloroethane	mg/kg dry wt	< 0.7	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 10	-	-	-	-
Carbazole	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzofuran	mg/kg dry wt	< 0.5	-	-	-	-
Isophorone	mg/kg dry wt	< 0.5	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.16	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.4	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 4	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		TP235B_2.5m 20-May-2021 10:05 am				
Lab Number:		2617956.6				
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 40	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 7	-	-	-	-
Acetone	mg/kg dry wt	< 40	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-6
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-6
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-6
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-6
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-6
Semivolatile Organic Compounds Screening in Soil by GC-MS	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 30 mg/kg dry wt	1-6
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace GC-MS analysis. Tested on as received sample. In-house based on US EPA 8260 and 5021.	-	1-6
Total Petroleum Hydrocarbons in Soil			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	8 mg/kg dry wt	1-6
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-6
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-6
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 25-May-2021 and 27-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Stantec New Zealand	**Lab No:**	2618023	A2Pv1
Contact:	Julia O'Brien	**Date Received:**	21-May-2021	
	C/- Stantec New Zealand	**Date Reported:**	26-May-2021	
	PO Box 13052	**Quote No:**	111545	
	Armagh	**Order No:**		
	Christchurch 8141	**Client Reference:**		
		Add. Client Ref:	Sampled: 20/05/21	
		Submitted By:	Julia O'Brien	

Sample Type: Soil

Sample Name	Lab Number	As Received Weight (g)	Dry Weight (g)	<2mm Subsample Weight* (g dry wt)	Asbestos Presence / Absence	Description of Asbestos Form
TP235_3.6m	2618023.1	398.3	351.3	53.4	Asbestos NOT detected.	-
TP235B_0.5m	2618023.2	365.7	327.0	50.2	Asbestos NOT detected.	-
TP235_0.5m	2618023.3	376.9	334.5	50.4	Asbestos NOT detected.	-
TP231_0.5m	2618023.4	343.4	299.0	50.4	Asbestos NOT detected.	-
TP234_3.5m	2618023.5	467.6	436.8	50.1	Asbestos NOT detected.	-
TP235B_2.5m	2618023.6	440.5	408.3	50.6	Asbestos NOT detected.	-

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
- Trace - Trace levels of asbestos, as defined by AS4964-2004.

For further details, please contact the Asbestos Team.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-6
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	0.1 g	1-6
<2mm Subsample Weight*	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1-6
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-6
Description of Asbestos Form	Description of asbestos form and/or shape if present. Analysed at Hill Laboratories - Asbestos; 28 Heather Street, Auckland.	-	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 25-May-2021 and 26-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Minzi (Laura) Liu MSc
Laboratory Technician - Asbestos

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Certificate of Analysis

Client:	Stantec New Zealand	**Lab No:**	2635023 SPv1
Contact:	Julia O'Brien C/- Stantec New Zealand PO Box 13052 Armagh Christchurch 8141	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:** **Submitted By:**	14-Jun-2021 17-Jun-2021 111545 Julia O'Brien

Sample Type: Soil

Sample Name:		ORSL_2_3.5m 14-Jun-2021 12:55 pm	ORL_2_2m 14-Jun-2021 12:36 pm	ORSL_1_2m 14-Jun-2021 11:55 am	ORSL_2_0.5m 14-Jun-2021 12:30 pm	ORSL_1_3.5m 14-Jun-2021 12:16 pm
Lab Number:		2635023.1	2635023.2	2635023.3	2635023.4	2635023.5
Individual Tests						
Dry Matter	g/100g as rcvd	93	90	68	86	88
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	5	17	5	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.34	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	12	14	24	14	14
Total Recoverable Copper	mg/kg dry wt	9	11	18	10	11
Total Recoverable Lead	mg/kg dry wt	13.0	17.6	24	14.7	26
Total Recoverable Nickel	mg/kg dry wt	13	15	12	14	13
Total Recoverable Zinc	mg/kg dry wt	53	63	94	61	80
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.4	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Benzo[a]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	< 0.011	0.015	< 0.012	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	< 0.04	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	< 0.04	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	< 0.011	0.016	< 0.012	< 0.012
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Chrysene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Fluoranthene	mg/kg dry wt	< 0.011	< 0.011	0.019	< 0.012	< 0.012
Fluorene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.08	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Phenanthrene	mg/kg dry wt	< 0.011	< 0.011	< 0.015	< 0.012	< 0.012
Pyrene	mg/kg dry wt	< 0.011	< 0.011	0.022	< 0.012	< 0.012

Sample Type: Soil						
Sample Name:		ORSL_2_3.5m 14-Jun-2021 12:55 pm	ORL_2_2m 14-Jun-2021 12:36 pm	ORSL_1_2m 14-Jun-2021 11:55 am	ORSL_2_0.5m 14-Jun-2021 12:30 pm	ORSL_1_3.5m 14-Jun-2021 12:16 pm
Lab Number:		2635023.1	2635023.2	2635023.3	2635023.4	2635023.5
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4	< 0.4	< 0.5	< 0.4	< 0.4
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitrobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
alpha-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
beta-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
delta-BHC	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDD	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDE	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4,4'-DDT	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dieldrin	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan I	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Endosulfan II	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Endosulfan sulphate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Endrin	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
Endrin ketone	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Heptachlor	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor epoxide	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hexachlorobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS*						
Acenaphthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluorene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Methylnaphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3

Sample Type: Soil						
Sample Name:		ORSL_2_3.5m 14-Jun-2021 12:55 pm	ORL_2_2m 14-Jun-2021 12:36 pm	ORSL_1_2m 14-Jun-2021 11:55 am	ORSL_2_0.5m 14-Jun-2021 12:30 pm	ORSL_1_3.5m 14-Jun-2021 12:16 pm
Lab Number:		2635023.1	2635023.2	2635023.3	2635023.4	2635023.5
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
2-Chlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Nitrophenol	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
Phenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5	< 5	< 5	< 5	< 5
Butylbenzylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diethylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dimethylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-octylphthalate	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
Hexachlorobutadiene	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
Hexachloroethane	mg/kg dry wt	< 0.7	< 0.7	< 0.9	< 0.7	< 0.7
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 10	< 10	< 10	< 10	< 10
Carbazole	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibenzofuran	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Isophorone	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 9	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	139	< 40	54
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	139	< 70	< 70
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.15	< 0.16	< 0.3	< 0.18	< 0.17
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	< 0.3	< 0.4	< 0.5	< 0.4	< 0.4
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Sample Type: Soil						
Sample Name:		ORSL_2_3.5m 14-Jun-2021 12:55 pm	ORL_2_2m 14-Jun-2021 12:36 pm	ORSL_1_2m 14-Jun-2021 11:55 am	ORSL_2_0.5m 14-Jun-2021 12:30 pm	ORSL_1_3.5m 14-Jun-2021 12:16 pm
Lab Number:		2635023.1	2635023.2	2635023.3	2635023.4	2635023.5
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 4	< 5	< 4	< 4
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Styrene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 30	< 40	< 50	< 40	< 40
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 6	< 7	< 10	< 7	< 7
Acetone	mg/kg dry wt	< 30	< 40	< 50	< 40	< 40
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Sample Type: Soil						
Sample Name:		ORSL_2_3.5m 14-Jun-2021 12:55 pm	ORL_2_2m 14-Jun-2021 12:36 pm	ORSL_1_2m 14-Jun-2021 11:55 am	ORSL_2_0.5m 14-Jun-2021 12:30 pm	ORSL_1_3.5m 14-Jun-2021 12:16 pm
Lab Number:		2635023.1	2635023.2	2635023.3	2635023.4	2635023.5
Trihalomethanes in VOC Soils by Headspace GC-MS						
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

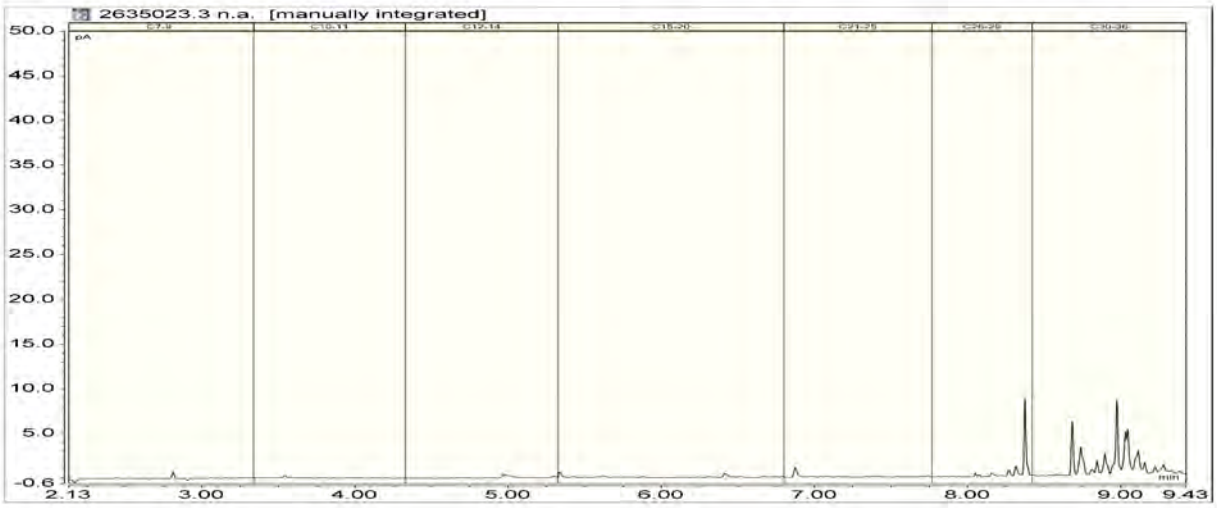
Sample Name:		ORSL_1_0.4m 14-Jun-2021 11:45 am				
Lab Number:		2635023.6				
Individual Tests						
Dry Matter	g/100g as rcvd	88	-	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.11	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	19	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	15	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	81	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	15	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	98	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.012	-	-	-	-
Anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.012	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.016	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.018	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	-	-	-	-
Chrysene	mg/kg dry wt	0.013	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Fluoranthene	mg/kg dry wt	0.019	-	-	-	-
Fluorene	mg/kg dry wt	< 0.012	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	-	-	-	-
Perylene	mg/kg dry wt	< 0.012	-	-	-	-
Phenanthrene	mg/kg dry wt	0.013	-	-	-	-
Pyrene	mg/kg dry wt	0.022	-	-	-	-
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5	-	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-

Sample Type: Soil						
Sample Name:		ORSL_1_0.4m 14-Jun-2021 11:45 am				
Lab Number:		2635023.6				
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
Nitrobenzene	mg/kg dry wt	< 0.5	-	-	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7	-	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 0.5	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.5	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 1.0	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.5	-	-	-	-
Endosulfan I	mg/kg dry wt	< 1.0	-	-	-	-
Endosulfan II	mg/kg dry wt	< 2	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 1.0	-	-	-	-
Endrin	mg/kg dry wt	< 0.7	-	-	-	-
Endrin ketone	mg/kg dry wt	< 1.0	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.5	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.5	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS*						
Acenaphthene	mg/kg dry wt	< 0.5	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.5	-	-	-	-
Anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Chrysene	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Fluorene	mg/kg dry wt	< 0.5	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.5	-	-	-	-
Pyrene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 1.3	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 1.3	-	-	-	-
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	-	-	-	-
2-Chlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4-Dichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4-Dimethylphenol	mg/kg dry wt	< 3	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	-	-	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0	-	-	-	-
2-Nitrophenol	mg/kg dry wt	< 5	-	-	-	-

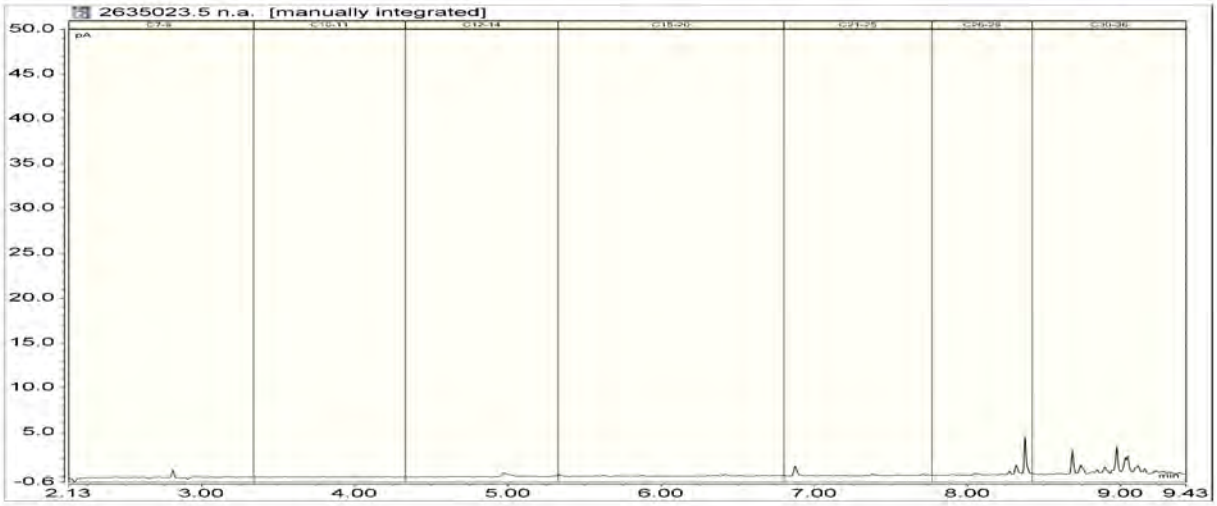
Sample Type: Soil						
Sample Name:		ORSL_1_0.4m 14-Jun-2021 11:45 am				
Lab Number:		2635023.6				
Phenols in SVOC Soil Samples by GC-MS						
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	-	-	-	-
Phenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5	-	-	-	-
Butylbenzylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0	-	-	-	-
Diethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Dimethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-butylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-octylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachloroethane	mg/kg dry wt	< 0.7	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 10	-	-	-	-
Carbazole	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzofuran	mg/kg dry wt	< 0.5	-	-	-	-
Isophorone	mg/kg dry wt	< 0.5	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	79	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	81	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.16	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.4	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 4	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		ORSL_1_0.4m 14-Jun-2021 11:45 am				
Lab Number:		2635023.6				
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 40	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 7	-	-	-	-
Acetone	mg/kg dry wt	< 40	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

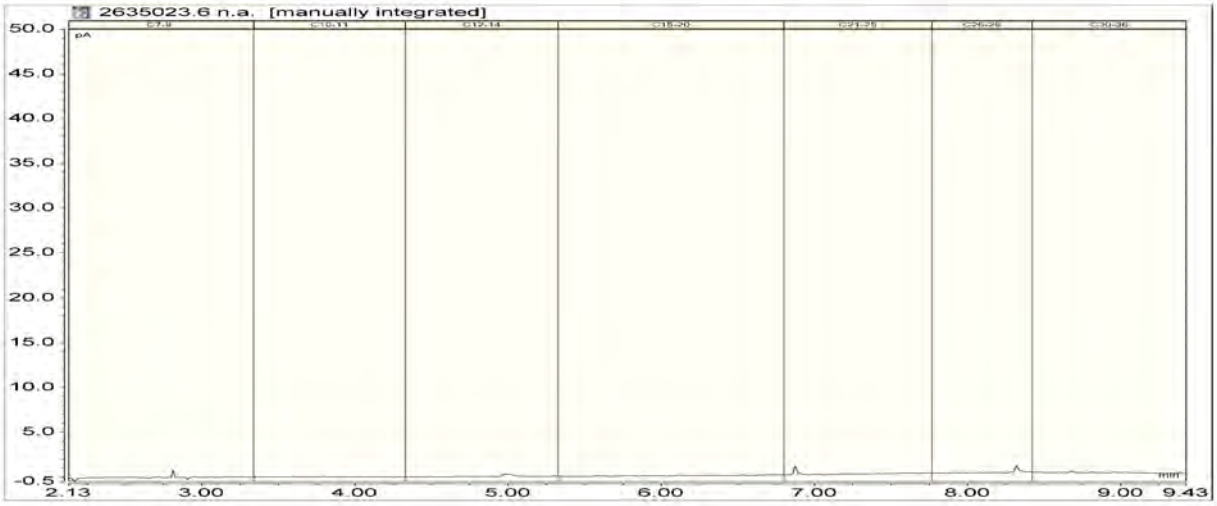
2635023.3
ORSL_1_2m 14-Jun-2021 11:55 am
Client Chromatogram for TPH by FID



2635023.5
ORSL_1_3.5m 14-Jun-2021 12:16 pm
Client Chromatogram for TPH by FID



2635023.6
ORSL_1_0.4m 14-Jun-2021 11:45 am
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-6
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-6
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-6
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1-6
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-6
Semivolatile Organic Compounds Screening in Soil by GC-MS	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 30 mg/kg dry wt	1-6
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace GC-MS analysis. Tested on as received sample. In-house based on US EPA 8260 and 5021.	-	1-6
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	3, 5-6
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	8 mg/kg dry wt	1-6
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-6
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-6
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 17-Jun-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Stantec New Zealand	**Lab No:**	2635799	A2Pv1
Contact:	Julia O'Brien	**Date Received:**	15-Jun-2021	
	C/- Stantec New Zealand	**Date Reported:**	18-Jun-2021	
	PO Box 13052	**Quote No:**	111545	
	Armagh	**Order No:**		
	Christchurch 8141	**Client Reference:**		
		Submitted By:	Julia O'Brien	

Sample Type: Soil

Sample Name	Lab Number	As Received Weight (g)	Dry Weight (g)	<2mm Subsample Weight (g dry wt)	Asbestos Presence / Absence	Description of Asbestos Form
ORSL_2_3.5m	2635799.1	431.4	403.5	50.4	Asbestos NOT detected.	-
ORL_2_2m	2635799.2	418.4	380.8	56.3	Asbestos NOT detected.	-
ORSL_1_2m	2635799.3	398.9	328.4	53.8	Asbestos NOT detected.	-
ORSL_2_0.5m	2635799.4	395.2	359.4	58.3	Asbestos NOT detected.	-
ORSL_1_3.5m	2635799.5	415.7	371.4	56.4	Asbestos NOT detected.	-
ORSL_1_0.4m	2635799.6	421.1	364.3	58.2	Asbestos NOT detected.	-

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
- Trace - Trace levels of asbestos, as defined by AS4964-2004.

For further details, please contact the Asbestos Team.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-6
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-6
<2mm Subsample Weight	Sample dried at 100 to 105°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	1-6
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-6
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 18-Jun-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Dexter Paguirigan Dip Chem Engineering Tech
Laboratory Technician - Asbestos

DESIGN WITH COMMUNITY IN MIND

Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always design with community in mind.

We care about the communities we serve—because they're our communities too. This allows us to assess what's needed and connect our expertise, to appreciate nuances and envision what's never been considered, to bring together diverse perspectives so we can collaborate toward a shared success.

We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

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