



# ROTOKAURI NORTH SHA

## PRELIMINARY SITE INVESTIGATION

PROJECT NO: HD637  
GREEN SEED CONSULTANTS LTD  
REFERENCE: PSI/1  
11 JULY 2018

## Executive Summary

HD Consultants NZ Limited (HDC) has been engaged by Green Seed Consultants Limited (the Client) to conduct a Preliminary Site Investigation (PSI) for the Rotokauri North Special Housing Area (SHA). The SHA is comprised of approximately 113.11 ha and is located south of Te Kowhai Road and east of Exelby Road, north of Hamilton (the Site).

A PSI includes review of available information, including Council records and historical aerial photos, combined with a site inspection. The Site inspection was conducted by using unmanned aerial vehicle (drone) photography to identify areas of interest with regard to potential contamination. These areas were then inspected and photographed, and where possible, the property owners were interviewed.

The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) requires that Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) sites be identified and investigated to determine if there is potential risk to human health from subdivision, change in land use, or land disturbance. The purpose of the PSI is to identify HAIL activities and qualitatively evaluate potential risk based on the records review and site inspection. No sampling and analysis is included in the PSI.

The site is largely comprised of farms with pasture land and many have rural residences present. There is an orchard present at one parcel and dairy farms at two parcels. Many of the farms have sheds present which are used for various purposes, including storage of hazardous substances. There is a workshop/scrap yard present at one property.

While the pastures are not considered HAIL sites, there is potential for contamination if superphosphate fertilisers and/or persistent pesticides were used. Orchards, animal spray or dip stations, fuel tanks, and areas where hazardous substances are stored are considered HAIL activities. Buildings which used asbestos-containing materials or lead-based paint may also contribute to soil contamination. In addition, a workshop/scrap yard at one property is classified as a HAIL activity.

Based on the PSI findings, sampling and analysis is recommended to quantify the potential risk from activities conducted at the Site. This includes sampling and analysis of pastures to evaluate the presence of elevated cadmium (from fertiliser) or persistent pesticides. This sampling can be done in the near-term to determine whether activities within the pasture land are permitted activities or if they require consent. For example, sampling and analysis should be conducted for:

- The orchard to evaluate the presence of persistent pesticides;
- The workshop/scrap yard to evaluate the presence of heavy metals, pesticides, and hydrocarbons;
- The dairy farms to evaluate the presence of heavy metals, hydrocarbons, and pesticides; and

- Farm structures to evaluate the presence of asbestos, lead, and stored hazardous substances.

Because activities and land use can change with time, sampling and analysis is not recommended until activities cease at the properties where HAIL activities are (or were) present. Prior to sampling at these sites, a follow-up inspection is required to verify that these above recommendations are still correct (i.e., additional potentially contaminating activities have not occurred).

# Contents

Executive Summary .....	i
Introduction .....	1
Objectives .....	1
Scope .....	1
Site description .....	2
Current and proposed land use.....	2
Surrounding land use.....	2
Regional Geology.....	2
Hydrogeology .....	3
Site topography and drainage.....	4
Site history .....	4
Historical Aerial Photos.....	4
Council Records.....	4
Waikato Regional Council Records.....	5
Hamilton City Council Records .....	6
Previous Environmental Investigations .....	6
111 Burbush Road Soil Investigation Report Summary.....	6
223 Te Kowhai Road PSI Report Summary.....	6
335 Te Kowhai Road Land Contamination Screening Report Summary.....	7
Owner Interview.....	7
Site Inspection.....	7
Overview .....	7
Areas of Environmental Concern.....	8
Site Evaluation.....	8
Conceptual Site Model.....	8
Evaluation of Potential Risk .....	10
Recommendations .....	10
Limitations .....	11
Certification .....	11
Appendix A - Figures .....	A
Appendix B - Property Information .....	B
Appendix C - Historic Aerial Photos.....	C
Appendix D - Site Photos .....	D



Terre Nicholson

PREPARED Terre Nicholson  
BY:  
Principal Environmental  
Consultant  
Terre@hdgeo.co.nz  
Tel 021 061 3983



REVIEWED Andrew Holland  
BY:  
Director, Principal  
Engineer, CPEng  
Andrew@hdgeo.co.nz  
Tel 022 048 8441

## Introduction

HD Consultants NZ Limited (HDC) has been engaged by Green Seed Consultants Limited (the Client) to conduct a Preliminary Site Investigation (PSI) for the Rotokauri North Special Housing Area (SHA). The SHA is comprised of approximately 113.11 ha and is located south of Te Kowhai Road and east of Exelby Road north of Hamilton. The entire SHA is hereafter referred to as “the Site”, with individual parcels referred to by parcel number and street addresses. Figures showing the Site area and proposed development plan are provided in Appendix A. Parcel numbers and addresses are provided in Appendix B.

The majority of the Site has historically been used for grazing beef and sheep, with rural residential dwellings present, as well as two dairy farms. Numerous farm buildings (sheds, barns) are also present. The Site does not appear to have been used for intensive cropping, with the exception of one parcel that was used as an apple orchard.

With the proposed change in land use and planned future subdivision and earthworks, the National Environmental Standard for Assessing and Managing Contaminants in Soil (NESCS) must be considered. The NESCS applies when hazardous activities and industries list (HAIL) activities have been conducted at a site. These activities include storage and use of persistent pesticides. HAIL activities also include discharges to land which have the potential to cause contaminants to be present at concentrations above acceptable guidelines for protection of human health. In the case of pasture land and farm buildings, the “discharges” could include cadmium from superphosphate fertiliser use, lead from lead-based paint, and asbestos from building materials.

## Objectives

The key objective of this PSI is to provide an assessment to evaluate whether there is potential risk to human health from contaminants in soil due to current or past activities.

## Scope

To achieve the project objective, the following scope of works, outlined in Table 1 below, was undertaken.

Table 1: Scope of Works

Work Activity	Description
Site Inspection	A walk-over site inspection was undertaken to visually assess actual and potential contamination sources from a walk-over inspection of the Site. The areas inspected were identified from review of footage from aerial photography, including current images captured by a remote aerial vehicle (i.e., drone). The areas most likely to have HAIL activities present were targeted for the visual walk-over inspection.

Work Activity	Description
Site History Review	A desktop review of historical aerial photos and Regional and District Council records was undertaken to identify potentially contaminating practices which may have occurred on the Site. Searches included: review of permits and consents, reported incidents, and review of available previous environmental reports. Historic title records were not reviewed as it was considered unlikely (based on aerial photograph review) that they would reveal useful information.
Geological and hydrogeological review	A search of the Waikato Regional Council's database of bores within a 1 km radius of the site and a review of other relevant geological and hydrogeological resources to assess the general sensitivity of the environment within the vicinity of the site. In addition, this PSI was conducted concurrently with a geotechnical investigation of the Site. This investigation helped inform the geologic and hydrogeological conditions at the Site.
Reporting	Preparation of this report summarising the findings of the PSI.

## Site description

The Site is located in an area south of Te Kowhai Road and east of Exelby Road to the north west of Hamilton City. The land is currently owned by numerous parties. The site location and regional setting are shown in HDC Figure 1 in Appendix A. Parcel numbers, addresses, and sizes are listed in Appendix B.

## Current and proposed land use

The majority of the Site is used as pasture for grazing cattle. There was also historically some sheep grazing and two parcels are dairy farms. There are several rural residential dwellings as well as sheds and barns present. The Site is zoned Future Urban and is nearly flat with isolated high points. The site is located within the Waikato Regional Council and Hamilton City Council boundaries.

The site will be subdivided and developed for residential purposes.

## Surrounding land use

Table 2: Surrounding Land Use

Direction from site	Land Uses
North	State Highway 39 - Te Kowhai Road. Pasture land and rural residential properties further to the north.
South	Pasture land and rural residential properties.
East	Pasture land and rural residential properties. State Highway 1 (Waikato Expressway - Te Rapa Section) further to the east.
West	Exelby Road with pasture land further to the west.

## Regional Geology

The site is located roughly centrally within the Hamilton Basin which is characterized by low rolling hills (Hamilton Hills) and plains with low terraces and gullies draining into the Waikato and Waipa Rivers (Hamilton Lowlands).

The Hamilton Hills are linear, sinuous hills and ridges that are remnant of an older erosion surface. They consist of alluvial material and non-welded ignimbrites (Walton Subgroup) and are typically overlain by a number of metres of airfall volcanic ash (Kauroa Ash and Hamilton Ash). The Hamilton Lowlands are a broad, low angle alluvial fan created by the Waikato River in the Late Quaternary. The fan materials are derived from rhyolitic eruptions in the central North Island and generally consist of late Pleistocene primary and secondary volcaniclastic sediments with a wide variety of grain sizes (Piako Subgroup and Hinuera Formation). Deposition of the fan materials ceased when the Waikato River entrenched into its current course approximately 17 ka and thin airfall tephra layers accumulated on the fan surface (Hinuera Surface).

The New Zealand Geological map (QMap) for the Waikato Region maps Walton Subgroup, Hinuera Formation and Piako Subgroup materials at the site. The Walton Subgroup is located on the hills to the east and west of the site, and is described as alluvium dominated by primary and re-worked non-welded ignimbrite. The Hinuera Formation and Piako Subgroup are mapped in the low-lying areas of site. The Piako Subgroup is mapped in the south-eastern corner of the site and is described as locally derived lacustrine mud, silt, gravel and peat. The Hinuera Formation is mapped across the remainder of the site and is described as cross-bedded pumice sand, silt and gravel with interbedded peat.

The HDC geotechnical investigation<sup>1</sup> encountered Hinuera materials in all low-lying areas of the Site.

## Hydrogeology

There are three surface water bodies within three km of the Site:

- Lake Rotokauri, located approximately 1.3 km to the south from the southwestern-most extent of the Site;
- Horseshoe Lake, located approximately 2.5 km to the south/southeast from the southeastern-most extent of the Site; and
- The Waikato River, located approximately 2.5 km from the eastern-most extent of the Site.

Surface water flows are expected to generally follow local topography, toward the east, north and west along drainage trenches through the site. These drains flow towards Lake Rotokauri through what appears to be a stream tributaries feeding into the Waipa River. Groundwater is likely to be largely constrained from following the same route by the hills to the east, west and south and is likely to travel north east towards the Waikato River.

A geotechnical investigation conducted at the site by HDC revealed groundwater at a depth of approximately 0.1 to 1.5 m bgs in the low-lying areas and approximately 6 m bgs in the elevated areas.

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<sup>1</sup> HDC, 2018. Rotokauri SHA Geotechnical Suitability Report, 13 July.



## Site topography and drainage

The site is relatively flat, with two hills present. Drains run broadly north and east to the low-lying area east of the site, which eventually drains to the Waipa River.

## Site history

### Historical Aerial Photos

Historical aerial photographs were available from Retrolens for 1952, 1963, and 1974, and are provided in Appendix C. Google Earth photos were also available from 2004, 2008, 2010, 2013, and 2016. Observations from the photos are provided in Table 3 below.

Table 3 Historical Aerial Photo Summary

Year	Description
1952	The Site appears to be predominantly grassed, with buildings present at Lot 3 DPS 15123, Lot 1 DPS 46587, Lot 1 DPS 4129, Lot 5 DP 359488, Lot 485743, and Lot 6 DP 359488*. There are sheds and barns present on several properties, with what appear to be rural residential properties on the listed lots. There is a long rectangular structure and stained area at the (present) dairy farm on Lot 6 DP 359488.
1963	There are no significant changes. Additional sheds are present at some of the parcels.
1974	There are buildings present at Section 23 SO 495676 Lot 1 DPS 4129, and Lot 1 DPS 72047. The rectangular structure at the (present) dairy farm is gone and a new structure is present just east of Burbush Road. Some of the sheds present in 1952 and 1963 have been removed and new sheds are now present.
2004	Additional rural residential properties are present along Te Kowhai and Burbush Roads. Most of the sheds are gone. There appears to be an orchard present on a portion of Section 53 SO 495676. Rows which appear to be mowed grass are also present on Section 53 SO 495676. There is a residential dwelling and two rectangular buildings east of the dwelling present on Lot 6 DPS 15123.
2008	The soil in much of Lot 2 DP 485743 has been tilled. There are some additional residential dwellings along Exelby, Burbush, and Te Kowhai Roads. There are no other significant changes from the 2004 photo.
2010	The soil in most of Lot 3 DPS 15123 has been tilled and the previously tilled areas at Lot 2 DP485743 are now grassed. There are no other significant changes from the 2008 photo.
2013	The tilled area at Lot 3 DPS 15123 is now grassed. There are no other significant changes from the 2010 photo.
2016	The soil at Part Lot 2 DPS 15254 has been tilled. There are no other significant changes from the 2013 photo. The market garden and orchard are still present on Section 53 SO 495676.

\*Note that some of the lots listed are excluded from the Site. See Appendix A for Site layout.

### Council Records

Records were requested from Waikato Regional Council (WRC) and Hamilton City Council (HCC).

## Waikato Regional Council Records

Six parcels are on the WRC Land Use Information (LUI) Register. The information provided by WRC is shown in Table 4 below. Figure 2 in Appendix A shows the location of the Land Use Information Register areas.

Table 4. WRC Land Use Information Register Data

WRC Reference	Site Name	Classification	HAIL Activity	Comments
LUI05749	320 Te Kowhai Road	Unverified HAIL	A.10 - Persistent pesticide bulk storage or use	These sites are included on the register for land use information only; there are no reports regarding the presence or otherwise of hazardous substances in the soil.
LUI05751	NWM Trust Management Market Garden	Unverified HAIL		
LUI05752	301 Te Kowhai Road	Unverified HAIL		
LUI05753	HWM Trust Management Limited Orchard	Unverified HAIL		
LUI10871	111 Burbush Road - Soil Investigation	Review pending	Greenfields	A 2011 Soil Investigation Report* has been prepared but has not been reviewed by WRC.
LUI10880	223 Te Kowhai Road PSI	Sampled	Greenfields	A 2014 PSI Report* has been prepared. The PSI concludes that the site is highly unlikely to pose a risk to human health provided development does not occur in the vicinity of farm buildings on site that are to remain in productive use at this time. If development is to occur in these areas, a detailed site investigation may be required to the specific area of concern.

\*These reports are described in the next subsection. LUI 10871 is south of the Site. LUI05751 and LUI05749 are north of the Site. However, the land use (pasture) is similar.

The information from WRC also states:

"Rural Land Considerations: Examples of sites that are "more likely than not" to have soil contamination (HAIL sites) include timber treatment activities, service stations and/or petroleum storage, panel beaters, spray painters, etc. Whilst pastoral farming is not included on this list, typical farming activities of horticulture, sheep dipping, chemical storage, petroleum storage and workshops are; but are more difficult to identify and may not be as well represented on the Land Use Information Register. Therefore, individuals interested in pastoral land may be interested in completing further investigations in accordance with Ministry for the Environment Guidelines prior to land purchase and/or development."

"Additional Information: Please note that:

- Significant use of lead-based paint on buildings can, in some cases, pose a contamination risk; the use of lead-based paint is not recorded on the Land Use Information Register.

- Buildings in deteriorated or derelict condition which contain asbestos can result in asbestos fibres in soil; the use of asbestos in building materials is not recorded on the Land Use Information Register.
- The long term, frequent use of superphosphate fertilisers can potentially result in elevated levels of cadmium in soil; the use of superphosphate fertiliser is not recorded on the Land Use Information Register.”

## Hamilton City Council Records

A request for relevant information was provided to Hamilton City Council. Two environmental investigation reports were received from the Council - one for 223 Te Kowhai Road (also received from Waikato Regional Council) and one for 335 Te Kowhai Road. These reports are summarised below.

Hamilton City Council does not have records for the remaining properties but does note that there may have been HAIL activities, including use of pesticides and persistent pesticides, which should be considered.

## Previous Environmental Investigations

As described above, environmental investigations were conducted for the properties located at 111 Burbush Road, 223 Te Kowhai Road, and 335 Te Kowhai Road. Each is summarised below.

### 111 Burbush Road Soil Investigation Report Summary

A “Soil Contamination Investigation & Assessment” report was prepared for the property at 111 Burbush Road by Soil and Land Evaluation Ltd in August 2011. The report states that “the site has possibly been exposed to potentially contaminating activities such as fertilizer, herbicide and insecticide use in relation to horticulture and agricultural activities.” Samples were collected from around the proposed house site and a composite sample was analysed for heavy metals and organochlorine pesticides. All results were below NESCS Soil Contaminant Standards (SCS) for residential land use. The results were also below the NESCS SCS rural residential land use; however, cadmium was detected at 0.79 mg/kg and the NESCS SCS for rural residential land use is 0.8 mg/kg. The NESCS SCS for residential land use is 3 mg/kg.

The report found that the site is suitable for rural residential land use but did state that areas not investigated could have contamination present.

### 223 Te Kowhai Road PSI Report Summary

A PSI report was prepared by Envirochem Evaluation Limited in 2014 for Lots 1, 3, and 4 DPS 15254 and Pt Lot 7, Lots 9, 10, and 11 DPS 15244. Seven soil samples were collected from across the site and were analysed for cadmium. The NESCS SCS was not exceeded and the report stated that “the average levels of soil contamination in the general pastoral soil are highly unlikely to be a significant risk to human health. This soil is considered suitable for the proposed subdivision and the intended rural-residential land use.”

Farm buildings present at the lots investigated included sheds, a shearing barn and dairy milking shed. The report recommended that a detailed site investigation be conducted for those pieces of land where buildings were present due to possible

soil contamination. The report also recommended that any future dwellings be placed 40 to 70 metres away from existing buildings. It also noted that a new dairy effluent pond was proposed and should be taken into consideration with regard to construction of future side dwellings.

### 335 Te Kowhai Road Land Contamination Screening Report Summary

A *Land Contamination Screening and Heavy Metals Tests* report was prepared by Soil and Land Evaluation in 2004. The report states that there had been historical dairy farming at the site, but that it was currently being used for dry stock farming and grazing. The report also states that there is no history of horticulture or market gardening at the site.

Two samples, comprised of 18 composited single samples, were analysed for heavy metals and organochlorine pesticides. The results were reportedly below guideline values; however, the results were not included with the report provided. The organochlorine pesticide results were below laboratory reporting limits.

### Owner Interview

A telephone interview was conducted with the owner of the property located at Sec 53 SO 495676. She stated that the orchard had not been operational since they had purchased the property in 2001. The orchard was previously an apple orchard, and the previous owner had told her that “mainly organic practices” were used.

## Site Inspection

The site inspection was first conducted through review of photos and footage from a fly-over with an unmanned aerial vehicle (drone). Areas of interest were then inspected by a suitably qualified practitioner.

### Overview

Drone flyover photos were collected in early June 2018. These photos were reviewed by Terre Nicholson, HDC Principal Environmental Consultant, and Matt Moore, HDC Field Technician.

A site inspection was undertaken by Matt Moore, HDC Field Technician, on 14<sup>th</sup> June 2018. The inspection consisted of conducting a visual inspection while driving and walking around the site, targeting areas of potential environmental concern based on a review of the drone flyover information.

There were hazardous substances (e.g., pesticides, animal drench, paints, lubricants) found in multiple buildings across a majority of the Site. There was minor hydrocarbon staining found in the sheds in Lot 5 DPS 15123 (paved), and Lot 6 DPS 15123 and Lot 2 DP 485743 (unpaved). Rubbish, including empty containers of hazardous substances, was present around and within buildings in the site; the majority of this was located at a workshop/scrap yard in Lot 3 DPS 15123, three of the sheds in the northern side of Lot 6 DPS 15123, and the two sheds and rubbish pit located at the operational dairy farm (Lot 6 DP 359488, Pt Lot 7 DPS 15255). The sheds around the Site (Sec 23 SO 495676, Lots 3, 5, 6 DPS 15123, Lot 2 DP 485743, Lots 3-4 DP 15254, Pt Lot 7 DPS 15255, Lot 10 DPS 15255, Lot 6 DP 359488) are

mostly constructed of concrete and metal in varying states of disrepair. Potential asbestos-containing material was observed. There is a dairy effluent sump located next to and connecting to the milking shed, as well as an above ground diesel storage tank/pump within Pt Lot 7 DPS 15255.

Away from the buildings, the Site is predominately covered with grass and is used for grazing. The Site has an undulating terrain, with ridges located on the south, east, and west sides of the site. There are drainage ditches present across the Site running through the paddocks. There were several low-lying areas within the central and eastern sections of the site where surface water was visible. There are numerous gates and fences present which separate the paddocks.

## Areas of Environmental Concern

The areas and/or activities of environmental concern and contaminants of potential concern (CoPC) are listed in Table 5.

Table 5. Areas of Environmental Concern

Parcel No.	Areas/activities of concern	CoPC
Entire Site (all parcels)	Super-phosphate fertiliser application	Cadmium
	Persistent pesticide application	Organochlorine pesticides, arsenic, lead
	Buildings with asbestos and/or lead-based paint	Asbestos, lead
	Chemical storage	Hydrocarbons, pesticides, heavy metals
Dairy Farms (Pt Lot 7 DPS 15255, Lot 2 DP 485743)	Effluent ponds	Heavy metals, nitrates
	Animal dip or spray sites	Pesticides, arsenic
	Aboveground diesel tank	Hydrocarbons
Workshop/Scrap Yard (Lot 3 DPS 15123)	Chemical storage	Hydrocarbons, heavy metals, pesticides, solvents
Orchard (Sec 53 SO 495676)	Pesticides	Pesticides, arsenic, lead, copper

## Site Evaluation

### Conceptual Site Model

Based on the evaluation of available data and identification of the COPCs), a Conceptual Site Model (CSM) was constructed. Environmental considerations taken into account in constructing the CSM are shown in Table 6, below.

The primary COPCs for the pasture areas are heavy metals, particularly cadmium, from application of super phosphate fertiliser and organochlorine pesticides from historic use. It is likely that fertiliser was spread across the entire site in a relatively consistent manner as the grassed areas of the Site were used for pasture land rather than for specific crops. The same is true of pesticide application.

There are other COPCs associated with the sheds and buildings (such as hydrocarbons, solvents, animal drenches, lead-based paint, asbestos). In addition,

pesticides, anti-fungal treatments, herbicides, etc., may have been used in the orchard.

Table 6: Conceptual Site Model

Item	Description
Surface Water	Surface water and run off from rain and dust settlement activities may mobilise contaminants (dissolved and particulate) and therefore may contribute to migration of contamination.
Groundwater	Groundwater may contribute to migration of contamination of soluble and mobile contaminants. The depth to groundwater is estimated to be between 0.5 m and 2.1 m bgs in the low-lying areas and up to 6 m bgs in elevated areas. It is considered unlikely that groundwater would be impacted by heavy metals or pesticides; however, hydrocarbons and other organic contaminants may migrate to groundwater.
Subsurface Geology	Subsurface geology may influence migration pathways. For example, contaminants generally travel more quickly through gravel than through clay materials. The site is underlain by alluvium (sand and silt) with peat deposits.
Flora and fauna	The Site is an area which is surrounded by residential and agricultural properties. The Waikato Expressway is located next to the Site and there are no significant areas of native bush. Sensitive species may be present at the Site; however, as it has been pasture land for over 50 years, additional adverse effects are not expected from potential site contamination.
Sensitive Surface Water bodies	Lake Rotokauri is present approximately 1.3 km south of the Site. Horseshoe Lake is south of the Site and the Waikato River is approximately 2.5 km east of the Site.
Vapour Intrusion	Vapours from potential hydrocarbon contamination in soil or groundwater may travel through the gravel fill material on Site, (which will be replaced by vegetation), allowing vapours to pass freely to the atmosphere. Hydrocarbon contamination would be of particular concern, particularly if petrol or solvents have been released. Organochlorine pesticides and heavy metals do not present vapour intrusion risks.

Surface water runoff would be the most likely migration pathway for heavy metals and organochlorine pesticides. Therefore, it is assumed that concentrations in low-lying areas where there has been ponded water from storm events would be likely to have higher contaminant concentrations from the widespread application of pesticides and/or fertiliser.

Based on available information, with the exception of the orchard, the non-occupied areas of the Site have not been routinely tilled and have been used as pasture (grassland). Therefore, the contaminants would likely have the highest concentrations just below the root zone, in shallow near-surface soil.

At the orchard, ground may have been tilled and routinely sprayed with pesticides, anti-fungal treatments, etc. The contamination would likely be at the edges of the tree canopies, directly around the tree trunks, and in tilled rows between the trees.

At the farm buildings (past and present) there is potential for asbestos in building materials, lead-based paint, and hazardous substances storage. Some of the properties have other potentially contaminating activities present, such as rubbish dumps, an aboveground diesel storage tank, and offal pits.

The farm shed entrances also carry a higher risk of contamination because this is the area where fertilisers, pesticides, etc., are typically mixed and loaded into spreading equipment and there is a greater risk of spillage.

## Evaluation of Potential Risk

Several potential HAIL activities were noted, which could result in the presence of contamination in soil:

- Many farm buildings historically used asbestos-containing materials and/or with lead-based paint. Farm sheds are often used for storage of pesticides, diesel fuel and petrol, fertilisers, and other hazardous substances.
- Parcel Sec 53 SO 495676 was an apple orchard. According to the site owner, it is unlikely that organochlorine pesticides were used, but it cannot be ruled out, nor can the use of other persistent pesticides, such as those containing arsenic, copper, and lead.
- The workshop/scrap yard at Lot 3 DPS 15123 is used to store hydrocarbons and other hazardous substances. Workshops and scrap yards are considered HAIL activities.
- The dairy farms located at Pt Lot 7 DPS 15255 and Lot 2 DP 485743 may have had spray races present. Past and present effluent ponds are present, along with chemical storage and older buildings. An above ground diesel storage tank is also present.
- Superphosphate fertilisers and persistent pesticides may have been used, resulting in cadmium and pesticides being present in soil.

## Recommendations

Based on the review of available information and site inspection, the potential risk to human health from the greenfields (pasture) portions of the site is likely to be low. The risk from hazardous substances associated with farm structures is slightly higher.

Environmental investigations conducted at surrounding properties indicate that while cadmium concentrations are slightly above typical background concentrations, they tend to be well below residential guideline values (10% produce consumption) found in the NESCS. However, farming practices vary among owners, so without sampling and analysis, the potential risk cannot be fully quantified at this time. In the near-term, it is recommended that a strategic sampling plan be developed for the paddocks to confirm the presence or absence of contamination.

As a future activity, site inspections should be conducted as use ceases at properties where HAIL activities have occurred. A sampling and analysis plan

should be developed and implemented for each of the farm structures (current and historical) and the orchard. The sampling and analysis should be tailored to the activities conducted; for example, sampling and analysis for:

- Organochlorine pesticides in select samples from the paddocks;
- Asbestos and lead-based paint around structures;
- Heavy metals, hydrocarbons, and persistent pesticides at shed entrances;
- Heavy metals and hydrocarbons at the workshop/scrap yard;
- Heavy metals, organochlorine pesticides, and hydrocarbons at the dairy farms; and
- Lead, arsenic, copper, and organochlorine pesticides at the orchard.

Note that the activities at the HAIL sites may change over time; therefore, sampling and analysis should not be conducted until activities cease at these sites. Activities must be re-verified before sampling and analysis is conducted and the above example plan amended as appropriate. In addition, it is recommended that rubbish is removed prior to sampling and analysis.

All sample results should be compared with applicable guideline values to assess potential risk and whether remedial action will be required.

Should the samples from the paddocks indicate that there is no significant risk, they will not be classified as HAIL sites and only the areas around potentially contaminating activities (e.g., workshop/scrap yard, orchard, portions of the dairy, farm sheds) should be designated as "pieces of land" for purposes of HAIL classification

## Limitations

This document does not include any assessment or consideration of potential health and safety issues under the Health and Safety in Employment Act 1992. HDC has relied upon information provided by the Client and other third parties to prepare this document, some of which has not been fully verified by HDC. This document may be transmitted, reproduced or disseminated only in its entirety. This report has been prepared for the use of the client and may not be relied upon by others without the express written permission of HDC.

From a technical perspective, the subsurface environment at any site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water, vapour and chemical movement. HDC's professional opinions are based on its professional judgement, experience, and training. It is possible that testing and analysis might produce different results and/or different opinions. Should additional information become available, this report should be updated accordingly. No sampling and analysis was undertaken for this PSI.

## Certification

This report presents information from an environmental site investigation conducted by and under the oversight of a Suitably Qualified and Experienced Practitioner with contaminated land experience, as required by the National



Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health and who is a Certified Environmental Practitioner - Soil Contamination. Detailed qualifications are available upon request.

*Terre Nicholson*

Terre Nicholson, CEnvP-SC # 0509

# APPENDIX A - FIGURES

## ROKOKAURI NORTH SHA AREA (Figure 1)

### Map legend

- Site area
- 1 Stage 1 (53.39ha)
- 2 Stage 2 (79.72ha)

Stages 1 and 2 sought as an SHA.  
Total of 133.1109ha.

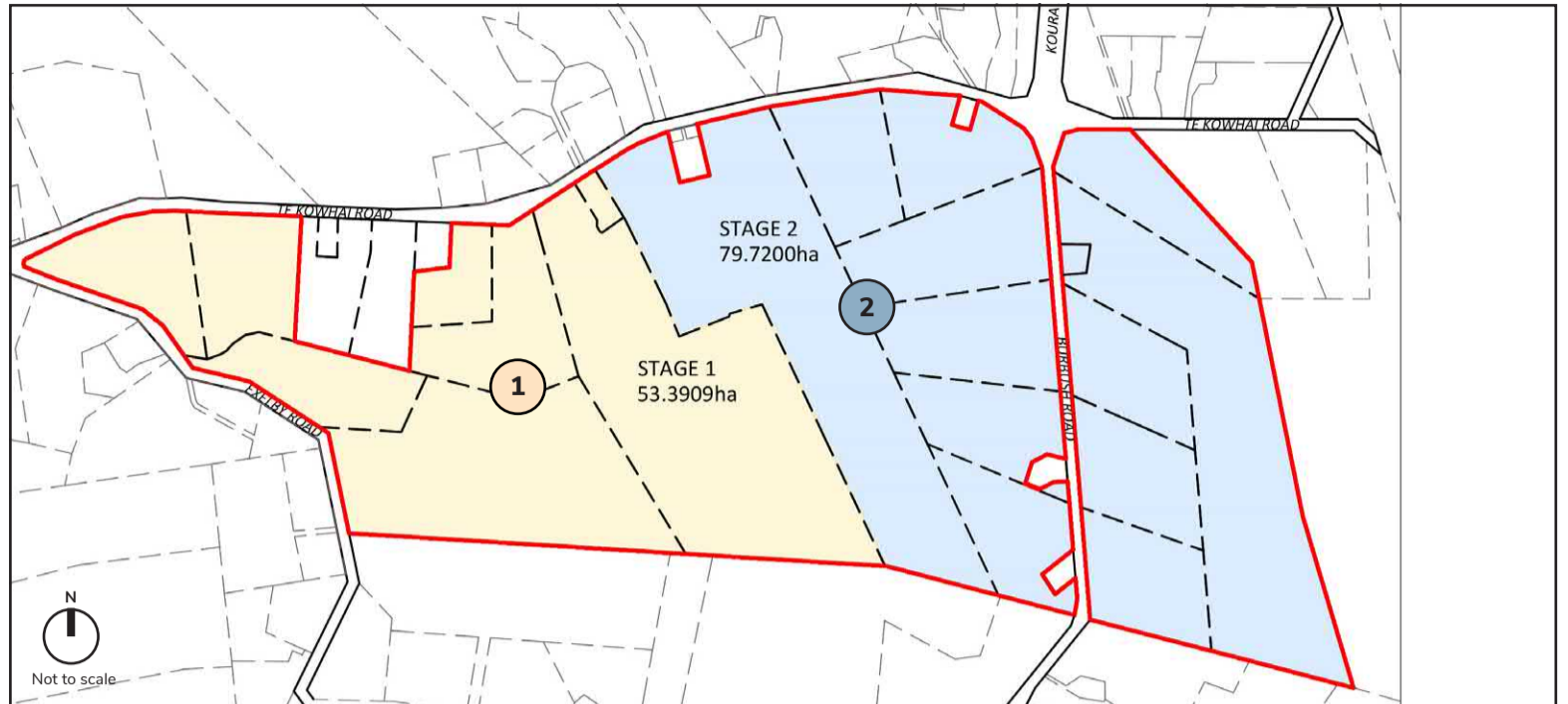


Figure 1: Rotokauri North SHA area

## ROKOKAURI NORTH SHA CONCEPT (Figure 2)

### Map legend

- Site area
- 1 Optimise connections to east (jobs) as well south.
- 2 Ensure each small centres is focused on its local community.
- 3 Maximise residential catchment around a small centre, and integrate movement network around the centre.
- 4 Provide for necessary stormwater conveyance and storage.
- 5 Provide district-level open space so as to maximise exposure and accessibility to all. Size will be determined by Council acquisition agreement.
- 6 Ensure sensitive slopes can be appreciated as landscape features.

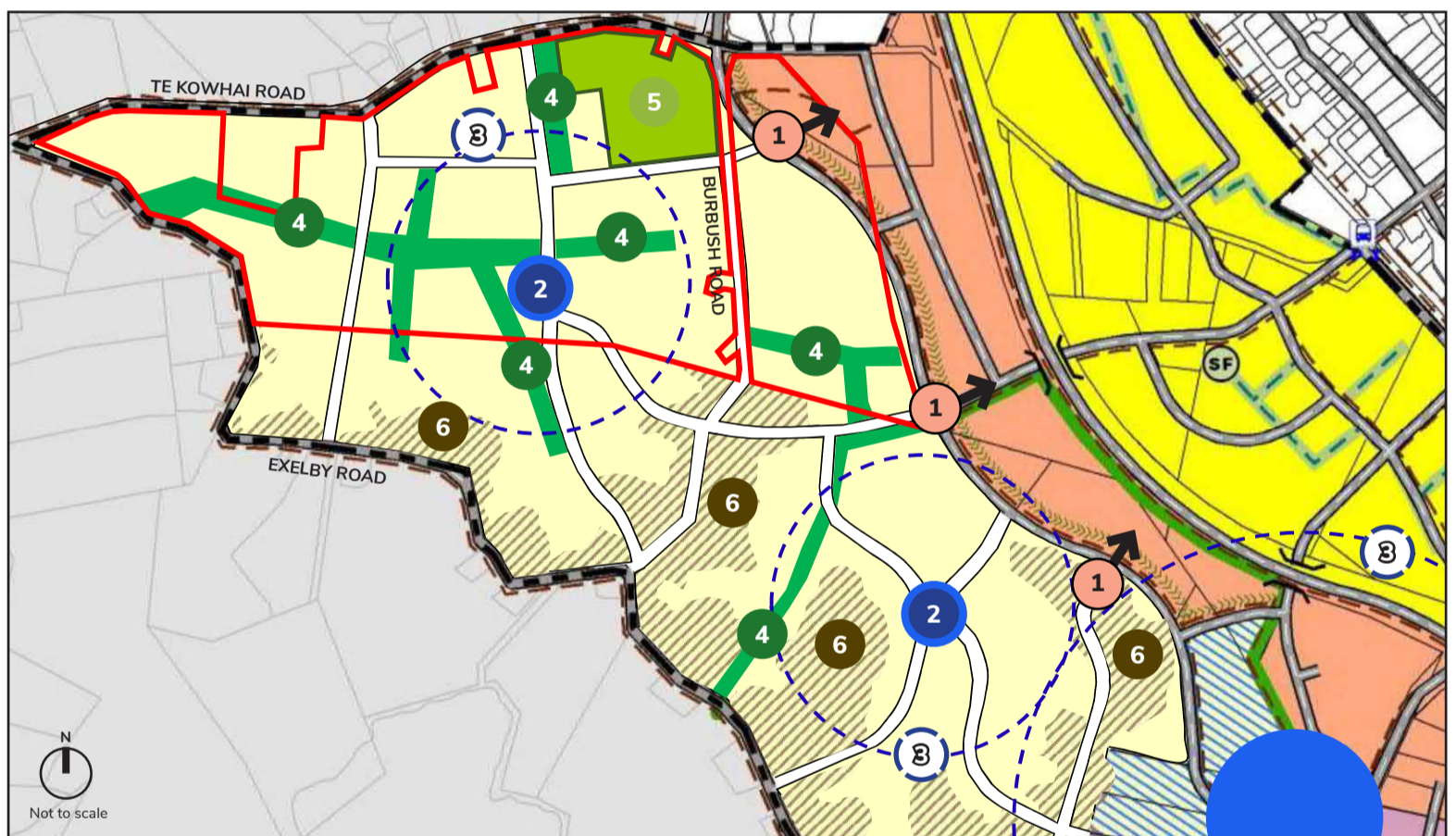


Figure 1: Key structuring elements of Rotokauri North SHA concept

## ROKOKAURI NORTH SHA OPTIONS FOR STORMWATER (Figure 3)

### Map legend

- Site area
- Floodway basin (conveyance and flood storage)
- Swale (conveyance only)
- Treatment wetlands
- Discharge locations

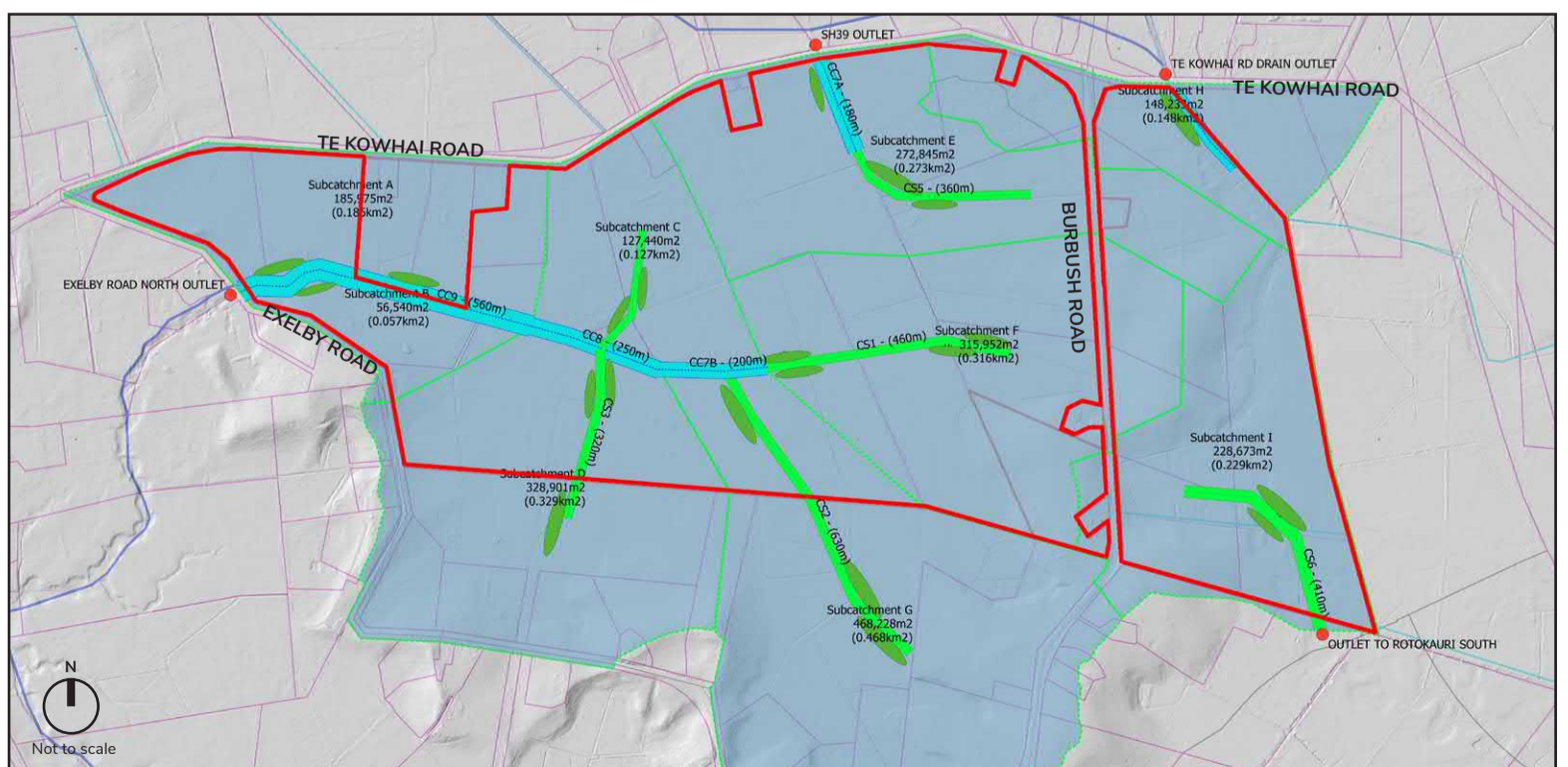


Figure 3: Rotokauri North SHA options for stormwater

Source: CKL Stormwater Solutions

# Rotokauri North Special Housing Area

February 2018  
Green Seed Consultants Ltd

## ROKOKAURI NORTH SHA REFINED MASTERPLAN (Figure 4)

### Masterplan concept summary

- Concept delivers approximately 45% developable land at this stage:
  - 18% stormwater
  - 30% roads
  - 5% open space.
- 60ha assumed developable - estimate only, no accounting for geotech or stormwater (-) or other efficiencies (+).
- Assumed density range of 200-800m<sup>2</sup> (350m<sup>2</sup> average).
- Yield range 1,450-1,800 units.
- 1,450-1,800 units can support:
  - a small node of 2,000-3,000m<sup>2</sup> GFA, likely to include a single small Four Square type store
  - a primary school (all things being equal).

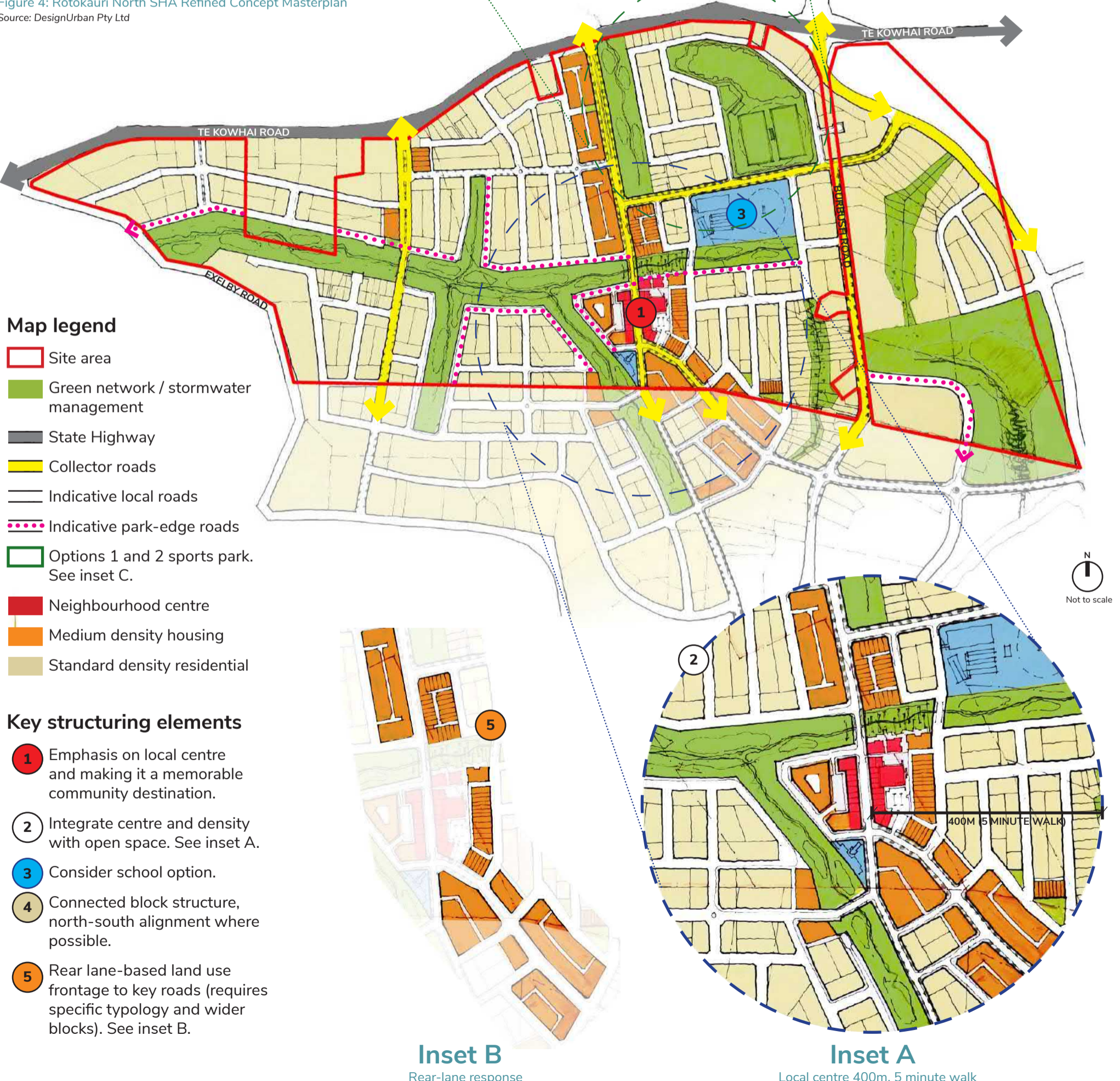
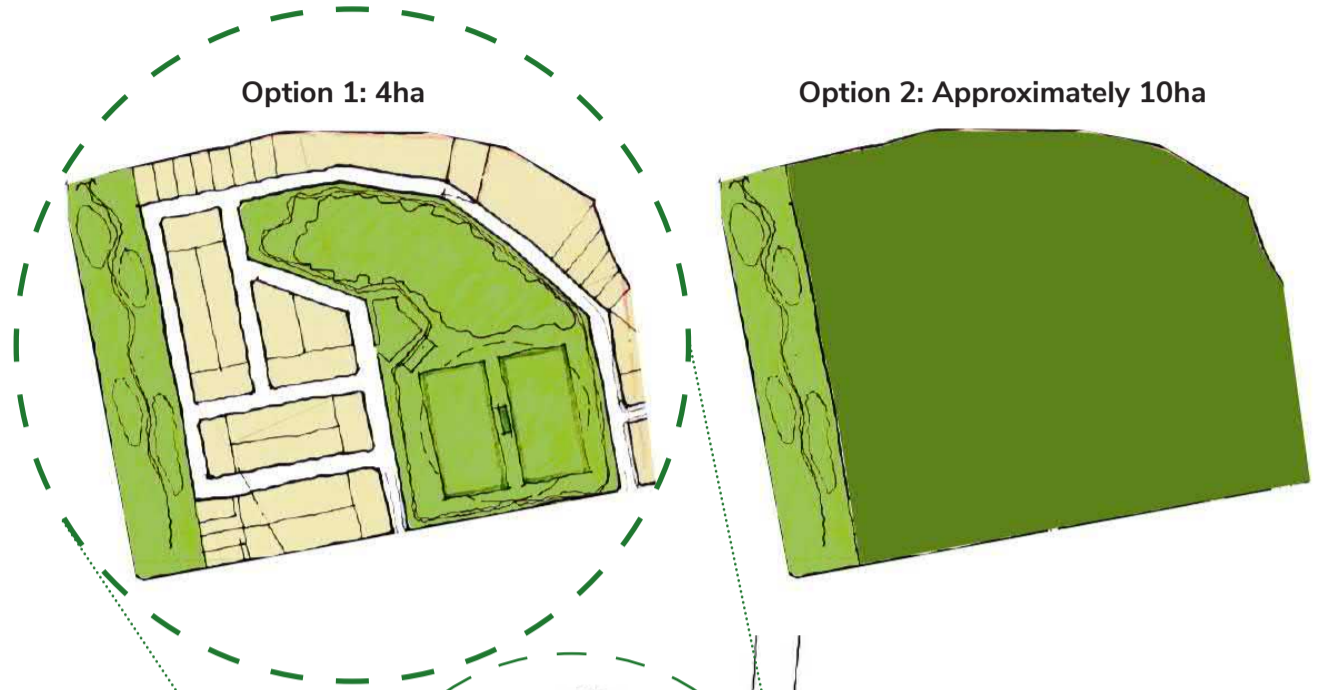
Figure 4: Rotokauri North SHA Refined Concept Masterplan  
Source: DesignUrban Pty Ltd

### Inset C

Options for sports park

Option 1: 4ha

Option 2: Approximately 10ha



### Map legend

- Site area
- Green network / stormwater management
- State Highway
- Collector roads
- Indicative local roads
- Indicative park-edge roads
- Options 1 and 2 sports park. See inset C.
- Neighbourhood centre
- Medium density housing
- Standard density residential

### Key structuring elements

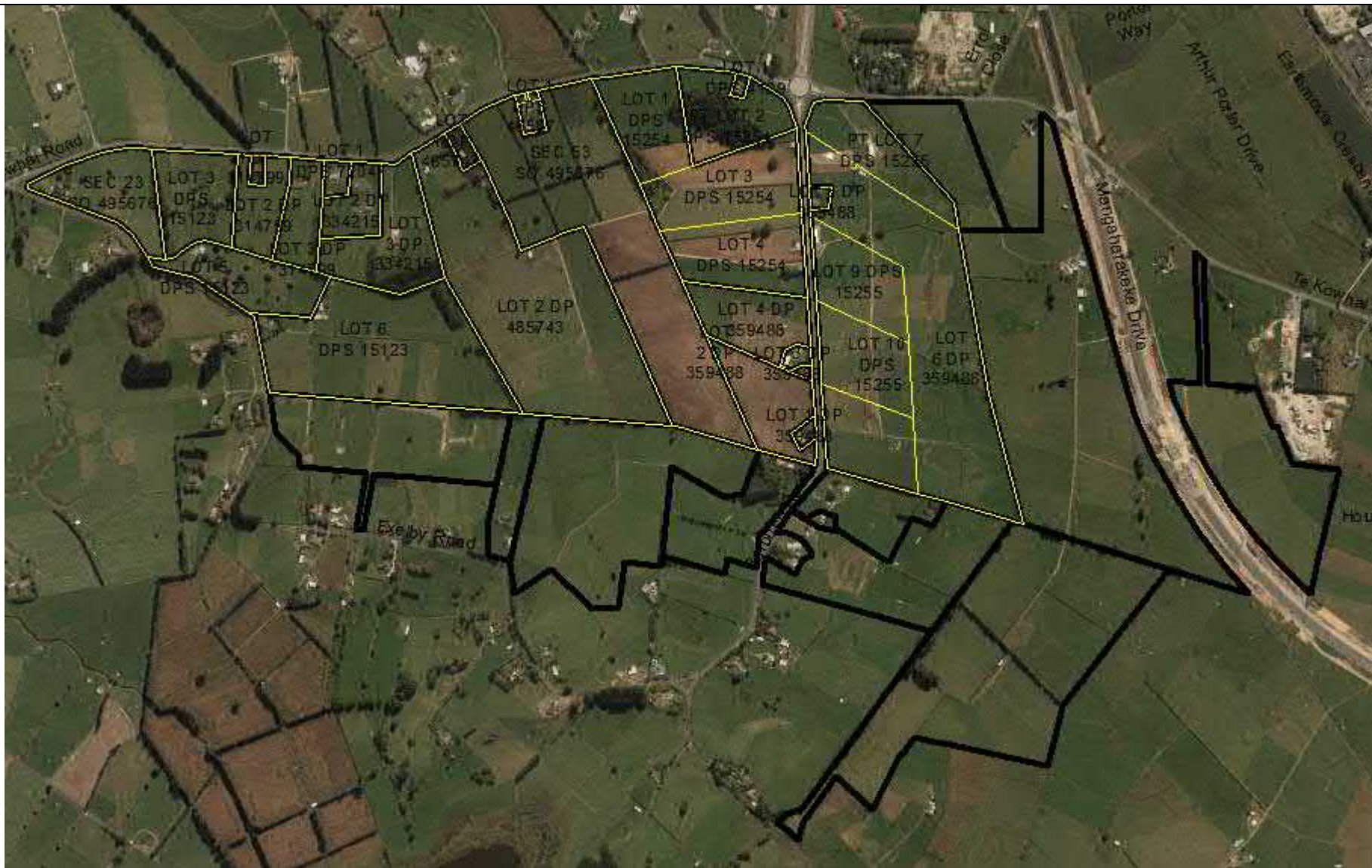
- 1 Emphasis on local centre and making it a memorable community destination.
- 2 Integrate centre and density with open space. See inset A.
- 3 Consider school option.
- 4 Connected block structure, north-south alignment where possible.
- 5 Rear lane-based land use frontage to key roads (requires specific typology and wider blocks). See inset B.

### Inset B

Rear-lane response

### Inset A

Local centre 400m, 5 minute walk



— Approximate Site Boundary

PROJECT: Rotokauri  
SHA

PROJECT NO: HD637

CLIENT: Mark  
Tollemache

TITLE: Site Location

SCALE: NTS

Drawing No. 1

Drawing by: TN

Rev Number

0	Initial



LUIR Areas

PROJECT: Rotokauri SHA	
PROJECT NO: HD637	
CLIENT: Mark Tollemache	
TITLE: LUIR Locations	
SCALE: NTS	
Drawing No. 2	
Drawing by: TN	
Rev Number	
0	Initial

# APPENDIX B – PROPERTY INFORMATION

## Rotokauri Special Housing Area Property Information

Parcel Number	Address*	Area (square metres)**
Sec 23 SO 495676	415 Te Kowhai Road	42,547
Lot 3 DPS 15123	383 Te Kowhai Road	42,134
Lot 2 DP 334215	341 Te Kowhai Road	20,005
Lot 3 DP 334215	335 Te Kowhai Road	51,425
Lot 2 DP 485743	329 Te Kowhai Road	195,546
Lot 1 DP485743	321 Te Kowhai Road	4,501
Sec 53 SO 495676	Te Kowhai Road	197,859
Lot 1 DPS 15254	Te Rapa Road	42,589
Lot 2 DPS 15254	153 Te Kowhai Road	41,241
Lot 3 DPS 15254	Te Rapa Road	57,876
Lot 4 DPS 15254	38 Burbush Road	50,733
Lot 4 DP 359488	56 Burbush Road	39,486
Lot 2 DP 359488	76 Burbush Road	39,309
Pt Lot 7 DPS 15255	153 Te Kowhai Road	39.451
Lot 6 DP 359488	17 Burbush Road	164,788
Lot 5 DPS 359488	29 Burbush Road	2,626
Lot 9 DPS 15255	Burbush Road	40,475
Lot 10 DPS 15255	223 Te Kowhai Road	40,475
Lot 11 DPS 15255	223 Te Kowhai Road	40,476
Lot 5 DPS 15123	372 Exelby Road	40,643
Lot 6 DPS 15123	350 Exelby Road	137,239

\*Source: <http://gisviewer.hcc.govt.nz/templates/PropQuery/>. Accessed 18 June 2018

\*\* Source: <https://data.linz.govt.nz/data/category/property-ownership-boundaries/global/oceania/new-zealand/waikato/hamilton-city/?s=n>. Accessed 18 June 2018.



# APPENDIX C - HISTORIC AERIAL PHOTOS

Historical Aerial Photos – Rotokauri Special Housing Area

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1952

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1963



©Sourced from <http://retrolens.nz> and licensed by LINZ CC-BY 3.0

1974

# APPENDIX D - SITE PHOTOS

Site Photos – Rotokauri North SHA – 21<sup>st</sup> June, 2018



Photo 1. Hydrocarbon staining on floor of shed, facing west. Lot 5 DPS 15123.



Photo 2. Unknown storage tank, facing north. SEC 23 SO 495676.



Photo 3. Unknown metal tank (leaking) with generator & herbicide tank, facing west. SEC 23 SO 495676.



Photo 4. Fuel and oxidizing bottles, facing north. LOT 6 DPS 15123.



Photo 5. Potentially hydrocarbon stained soil, inside barn facing north-east. LOT 6 DPS 15123.



Photo 6. Glyphosate (organophosphorus) herbicides in shed. LOT 6 DPS 15123.





Photo 7. Formalin containers. LOT 3 DPS 15123.



Photo 8. Shelves of paint in storage shed. LOT 3 DPS 15123.



Photo 9. Multiple engine components in storage shed. LOT 3 DPS 15123.



Photo 10. Dairy cattle milking station, facing south. LOT 2 DP 485743.



Photo 11. Hydrocarbon staining under vehicles in storage shed, facing south. LOT 2 DP 485743.



Photo 12. Storage shed, facing south-east. LOT 2 DP 485743.



Photo 13. IntenSE container and picloram+triclopyr herbicide in storage barn. LOT 6 DP 359488.

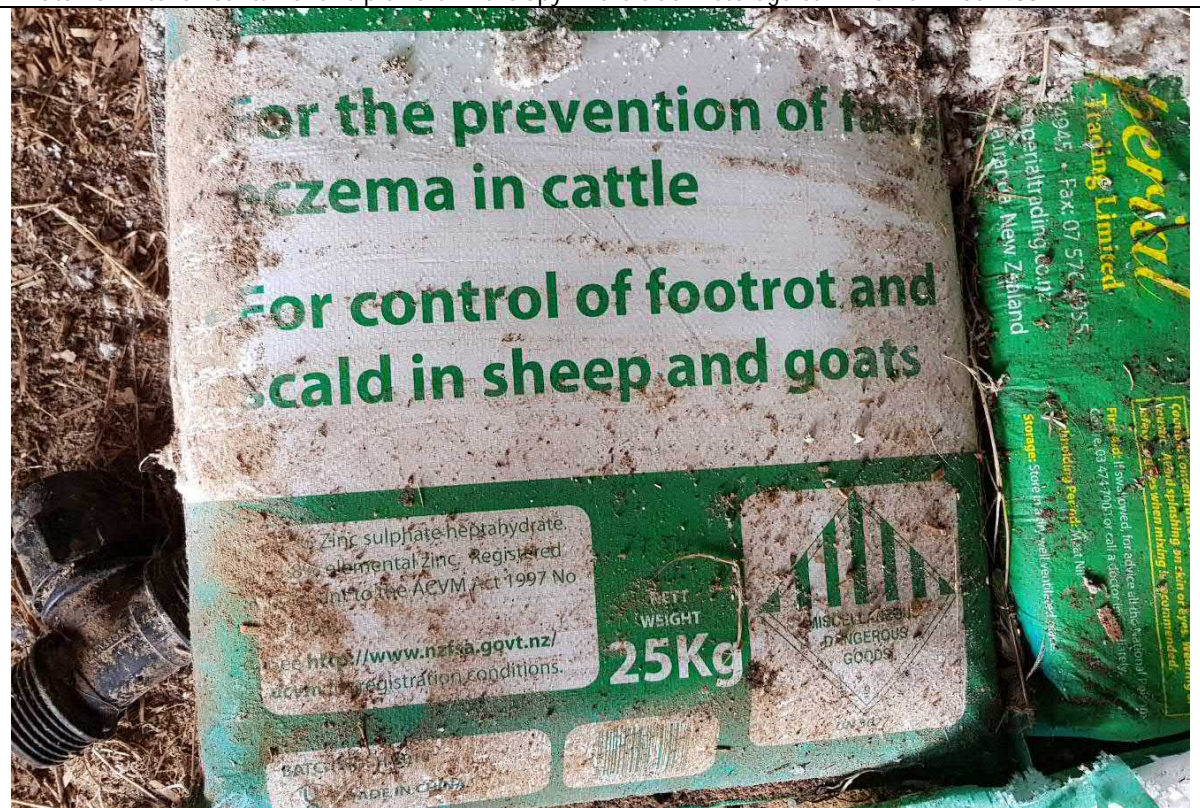


Photo 14. Zinc sulphate heptahydrate in storage barn. LOT 6 DP 359488.



Photo 15. Rubbish pit, facing south-west. PT LOT 7 DPS 15255.



Photo 16. Standing diesel tank, facing south-west. PT LOT 7 DPS 15255.

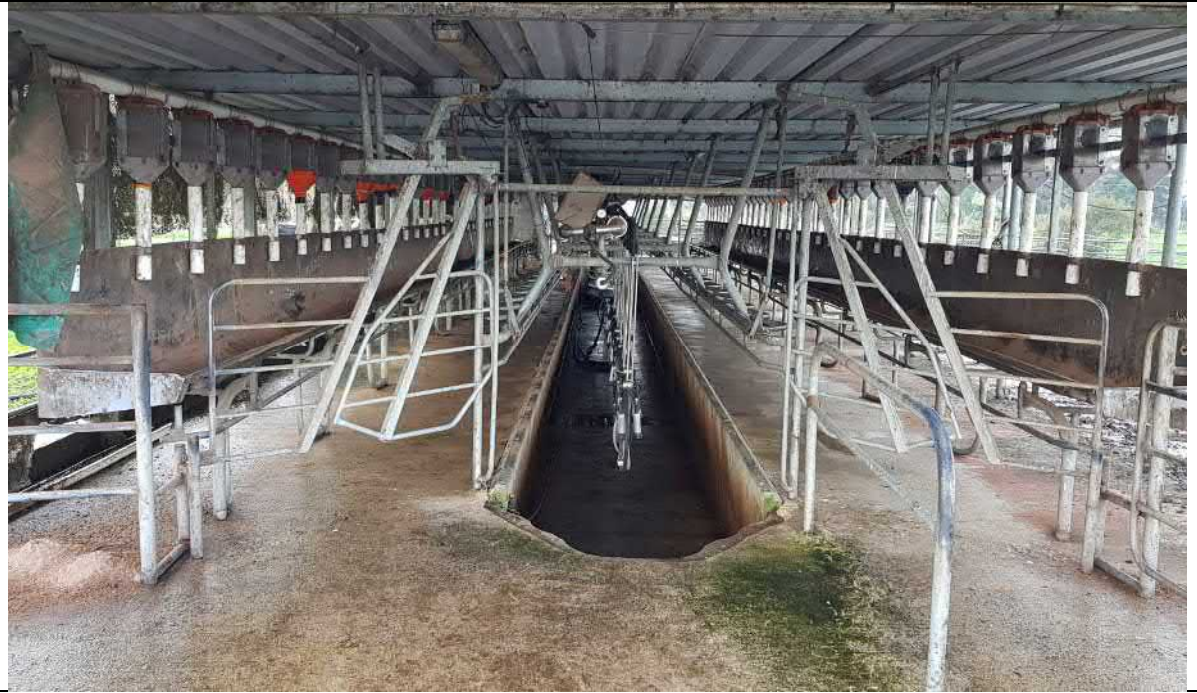


Photo 17. Operational dairy milking shed, facing south. PT LOT 7 DPS 15255.



Photo 18. Effluent sump, connected to milking shed. PT LOT 7 DPS 15255.



Photo 19. Wood storage shed with connecting pig pen, facing west south-west. LOT 3 DPS 15254.