Attachment 8:

Soil and Land Use Capability

DESKTOP SOIL AND LAND USE CAPABILITY ASSESMENT

GABITES BLOCK, UPPER HUTT

Contents

Assessment undertaken by Landsystems.

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INTRODUCTION

BeatsonHill Limited trading as Landsystems ("Landsystems") has been contracted to undertake a preliminary desktop soil and Land Use Capability (LUC) assessment of the Gabites Block site using available soil and LUC map information. The purpose of the assessment is to provide an overview of the likely soils on site to assist with initial discussions with councils. Included in the report are an indication of the likely proportions of modified soil areas on the site.

The Gabites Block site is located on the north-eastern boundary of Upper Hutt and covers an area of approximately 72.6 ha comprising of approximately two individual land parcels (**Figure 1**).

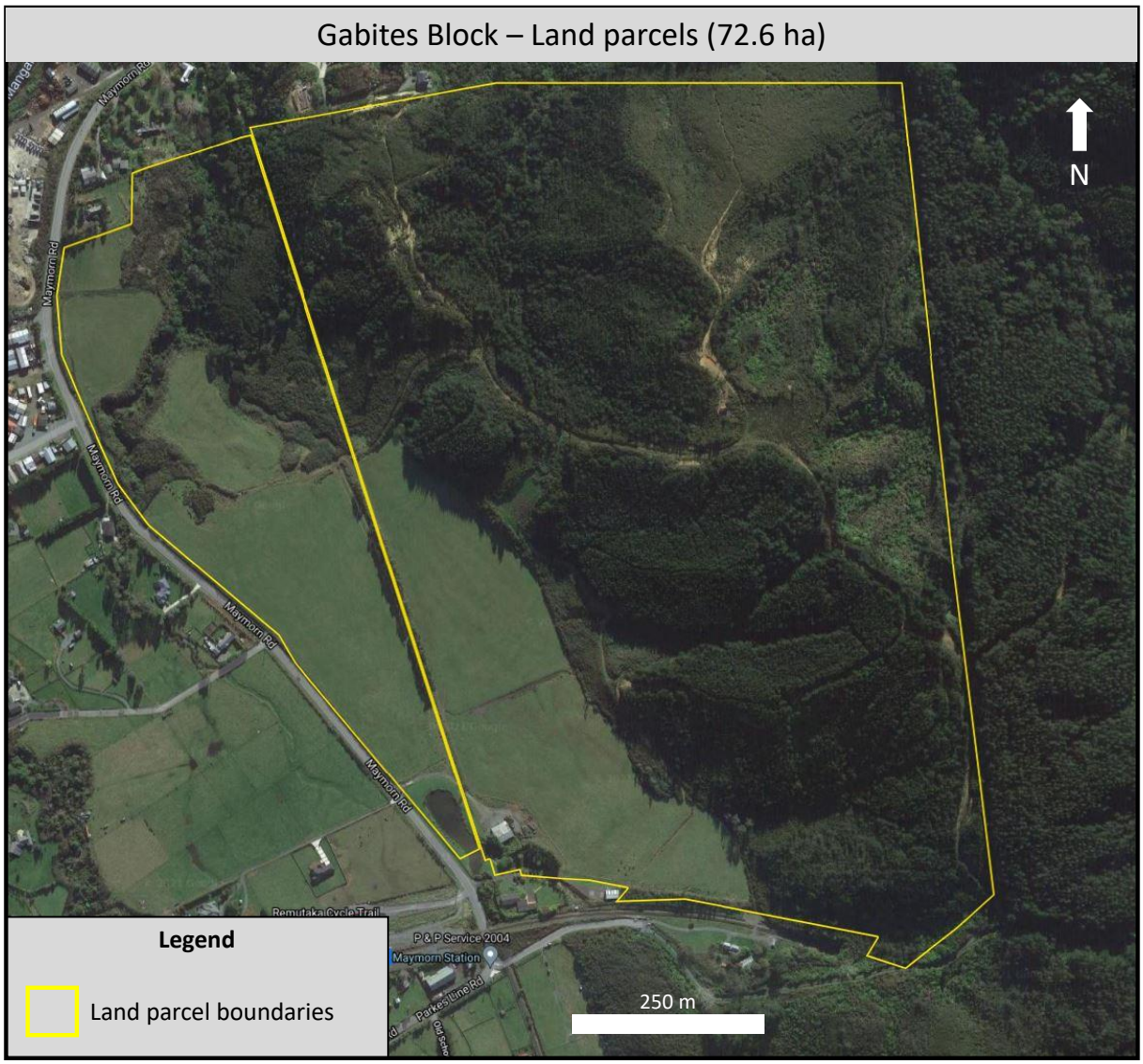

Figure 1. Location of the Gabites Block site.

BACKGROUND

The main purpose of this assessment is to provide a summary of available soil and LUC map information, as well as an estimation of areas that would be excluded from productive use or classification as high class soils (based on land use history) to help inform subdivision discussion and decisions.

SOILS

The soils are represented on a map as map units. These map units may contain one or more soils (this varies depending on the complexity of the soil map and the scale of mapping). Generally, there is one dominant soil in a map unit which will determine the LUC classification for that map unit.

Additionally, soil naming can vary for different sources of soil map information. This is a factor of when the soil mapping was undertaken and the soil classification that was being used nationally at the time of mapping. In most cases the soil names can be correlated across soil map information sources.

LAND USE CAPABILITY

Land Use Capability (LUC) assesses an area's capacity for sustained productive use, considering physical limitations, soil type, management requirements and soil conservation needs.

A Land Use Capability assessment is a systematic arrangement of the different types of land according to those properties that affect its capacity for long term and sustained production. It is a system that primarily assesses the land for arable (cropping) use.

The assessment is based on a national land classification system used by soil conservators for farm planning since the 1950s. A detailed description of the system is provided in the Land Use Capability Survey Handbook, a 3rd edition of which was published in 2009 (Lynn et al., 2009)[1].

The LUC assessment identifies areas with similar rock type, soil, slope, erosion types and degree and vegetation cover. Where any one of these factors changes significantly a boundary is drawn and a new map unit created. Based on this physical inventory, together with an understanding of climate an assessment is made of each unit's capacity for long term sustained use. Thus, the property is completely covered by mapped units which identify areas having similar physical attributes.

There are eight (8) land use capability classes as recognised in the New Zealand Land Resource Inventory with limitations for use and land use versatility increasing from 1 to 8, with 8 considered unsuitable for productive use and best managed for catchment protection.

[1] Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome, PJF (2009) Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

DEFINITIONS OF HIGH CLASS SOIL

In New Zealand, high class soils are most commonly defined and mapped using LUC classification. High class soils are generally those soils that are on land with a LUC class of 1, 2 or 3 but may exclude some LUC subclasses in LUC 2 and 3.

The relevant definition for identifying high class soil (high quality soil) in the Wellington region is provided by the second generation Regional Policy Statement for the Wellington region (RPS)[2]:

The relevant policy is: *Policy 59: Retaining highly productive agricultural land (Class I and II land) – consideration*

The policy states:

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a district plan, particular regard shall be given to safeguarding productive capability on Class I and II land.

Explanation

This policy recognises the social, economic and environmental benefits from making use of highly productive agricultural land for its productive capabilities. *Class I* land is the most versatile multiple-use land with virtually no limitations to arable use; it is deep, well drained, fine textured, naturally fertile and flood free.

Class II land is very good land with slight limitations to arable use. Slight limitations include texture, structure, potential erosion and potential flooding. The New Zealand Land Resource Inventory (NZLRI), (Landcare Research New Zealand Ltd, 1975, electronic database), is the reference used to identify the locations of Class I and II land around New Zealand, including within the Wellington region.

According to that classification, Class I and II land is located in Kāpiti Coast, Masterton, Carterton and South Wairarapa districts, within the Wellington region. Resource management decision-making needs to consider the irreversible effects of losing Class I and II land, which is highly productive agricultural land, suitable for multiple uses such as for growing a wide range of crops, pasture and forest, and for supporting grazing animals. It is important to retain the productive capability of this land for future generations. The use of high quality soils for some activities – such as residential development and roading projects – will result in what is effectively permanent loss of these soils from productive use.

A further definition to consider is provided in the proposed National Policy Statement for Highly Productive land (NPS-HPL). The NPS-HPL definition for highly productive land (high class soil) is an interim definition until regional authorities have defined highly productive land for their region[3]:

.. a land parcel in a rural area that contains at least 50% land or 4 hectares (whichever is the lesser) of land defined as Land Use Capability 1, 2 and 3 as mapped by the New Zealand Land Resource Inventory or by more detailed site mapping.

[2] The second generation Regional Policy Statement for the Wellington region (RPS) was made operative on 24 April 2013.

[3] MPI/MfE. 2019. Valuing Highly Productive Land: a discussion document on a proposed national policy statement for highly productive land. Wellington, Ministry for Primary Industries & Ministry for the Environment.

MODIFIED SOIL AREAS

For an accurate assessment of LUC classification for a property, the assessment should be based on the current condition of the area. This is important because some land management practices (e.g. the placement of tracks, excavation for and placement of buildings, excavation of drains, soil remediation for soil contamination, and general earthworks) irreversible changes to the soil (i.e. changes other than those that can be remediated by management practices and return the soil to its intrinsic state. These areas are referred to as modified soil areas. In essence, these are soil areas classified as Anthropic Soils[4], and can no longer be considered high class soils.

DESKTOP ASSESSMENT - METHODS

An initial desktop LUC assessment was undertaken for the Gabites Block site. Available map information, soil reports and geospatial data included:

- New Zealand Land Resource Inventory layers (providing map units of dominant soil type and LUC unit)[5]
- Smap Online (providing map units of Soil Sibling) [6]
- Interim Report on soils of Wellington Region, scale 1:63 360 (providing soil descriptions but no map).[7]
- Google earth historic images (2003 – 2018)

Soil and LUC maps and are provided using NZLRI "SOIL" and "LUC" attributes.

Soil maps are provided for Smap soils (soil Siblings). LUC maps could not be derived from the Smap soil map information as the land characteristics information was insufficient.

Modified soil areas were identified and mapped based on aerial photography provided on Google Earth for the years 2003 to 2018 (**Figure 2**).

[4] Hewitt AE (2010) New Zealand Soil Classification. 3rd ed. Landcare Research Science Series No. 1. Lincoln, Manaaki Whenua Press.
[5] https://koordinates.com/from/lris.scinfo.org.nz/layer/48134/metadata/
[6] https://smap.landcareresearch.co.nz/app/; polygons used in this report are sourced from https://koordinates.com/from/lris.scinfo.org.nz/layer/105955/
[7] Heine JC 1975. Interim Report on soils of Wellington Region, scale 1:63 360.

Figure 2. Examples of aerial photography used for the assessment of modified soil areas, provided on Google Earth for the years 2003 to 2018.

SOIL AND LUC MAP INFORMATION - NZLRI

The soil map information provided in the NZLRI was originally sourced from the *Interim Report on soils of Wellington Region, scale 1:63 360*[8]. This soil survey was originally mapped at a scale of 1:63 360, and subsequently integrated into the NZLRI (at 1:50,000 scale). The NZLRI soil and LUC distributions for the site are shown in **Figure 3**.

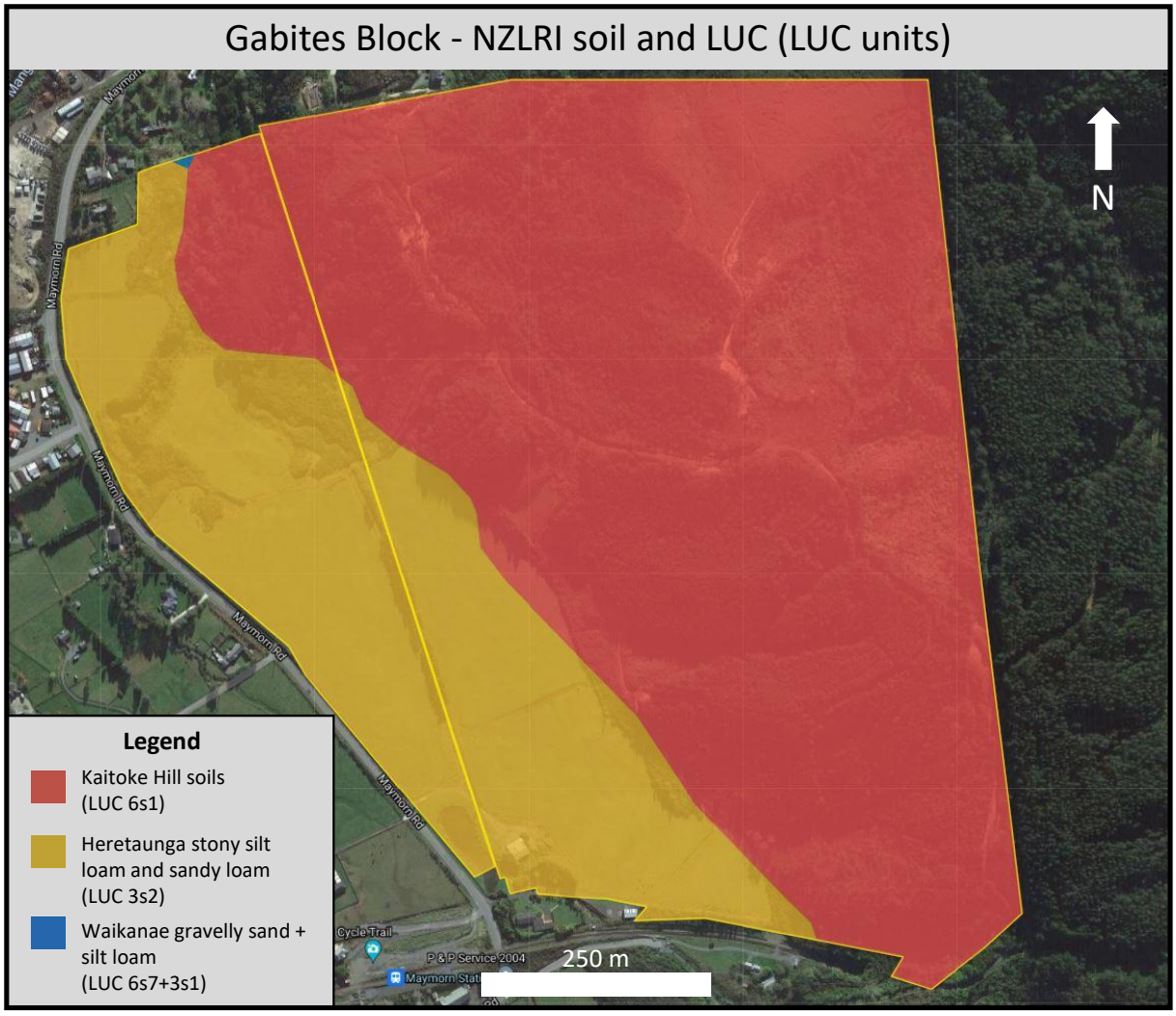

Figure 3. NZLRI soil and LUC map units for the Gabites Block site.

Table 1 provides a summary of the NZLRI soil and LUC map unit characteristics mapped for the site.

[8] Newsome PFJ, Wilde RH, Willoughby EJ. 2008. Land Resource Information System Spatial Data Layers Data Dictionary. Landcare Research New Zealand Ltd, Palmerston North.

Table 1. Summary of the NZLRI soil and LUC map unit characteristics on the Gabites Block site.

Smap soil map unit (Soil Siblings)	New Zealand Soil Classification	Parent material	Soil drainage	LUC unit
Kaitoke Hill soils	Typic Acid Brown Soils	Conglomerate & breccia	Well drained	6s1
Heretaunga stony silt loam + sandy loam	Typic Firm Brown Soils	Alluvium (fine)	Well drained	3s2
Waikanae gravelly sand + silt loam	Weathered Fluvial Recent Soils	Alluvium (rock)	Moderately well drained	6s7+3s1

SOIL AND LUC MAP INFORMATION - SMAP

The Smap soil map information is sourced from Smap Online and is mapped at 1:50,000 scale. Smap soil map polygons are only available on the Smap Online website[9]. The soil names for each map unit are "Soil Siblings", with the probability of occurrence (%). The Smap Online soil map information for the site is shown in **Figure 4**.

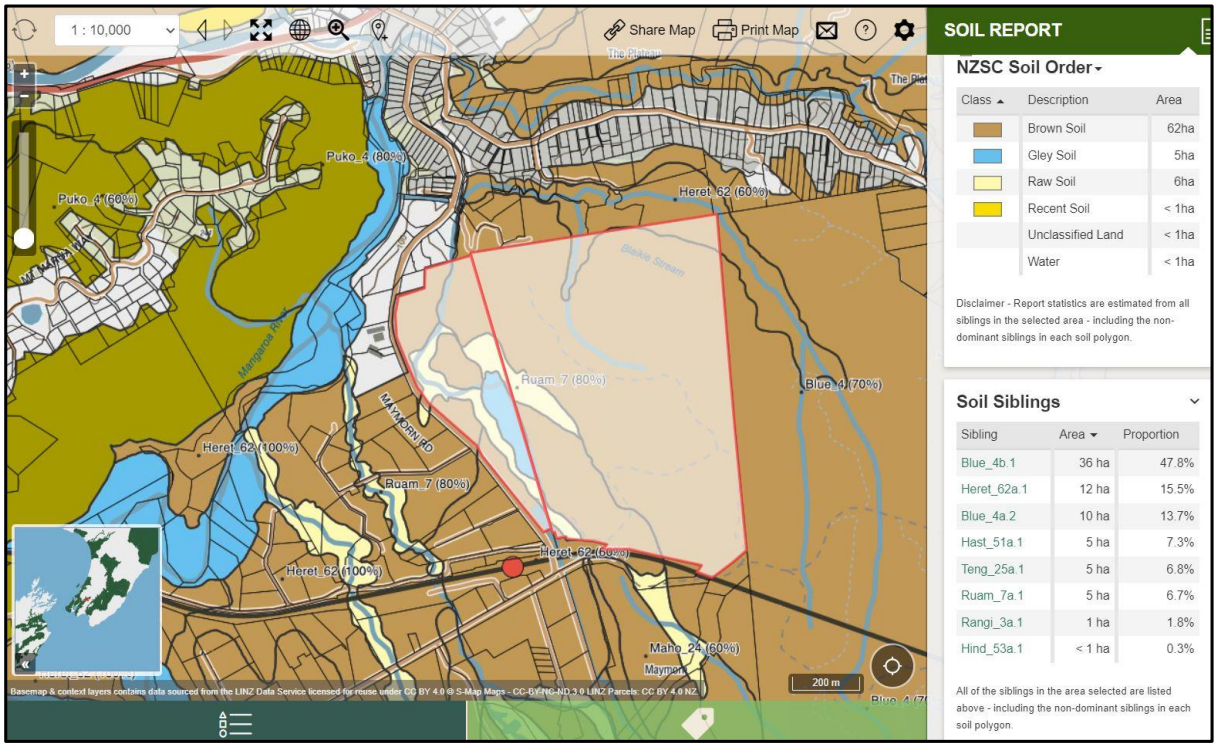

Figure 4. Smap Online soil map information for the Gabites Block site.

Based on the Smap Online soil map information, there are eight Soil Siblings represented across the site. These can be grouped into four Soil Orders. A simplified map is provided in **Figure 5**.

[9] https://smap.landcareresearch.co.nz/maps-and-tools/app/

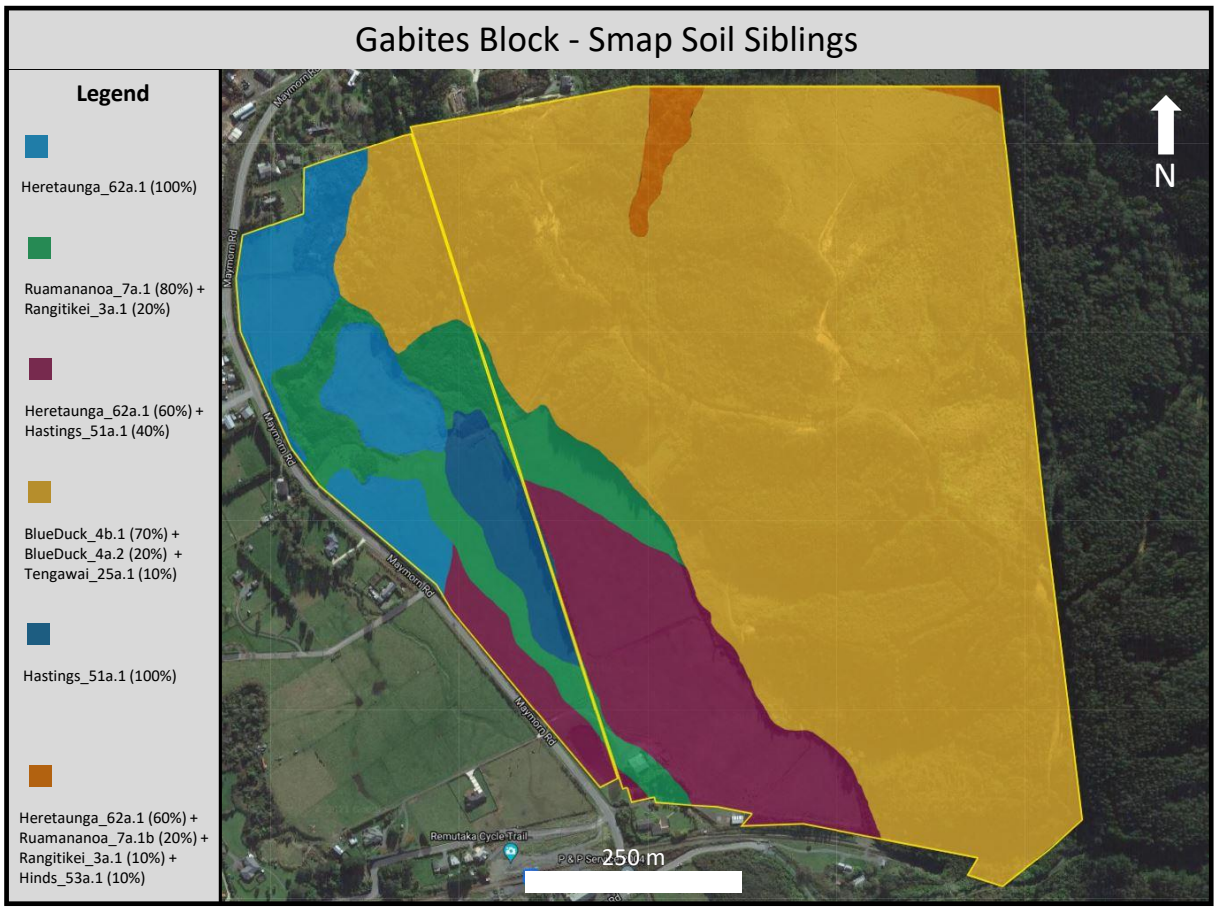

Figure 5. Smap Siblings map units for the Gabites Block site.

Table 2 provides a summary of the Smap Soil Sibling map unit characteristics mapped for the site.

Table 2. Summary of the Smap Soil Sibling map unit characteristics on the Gabites Block site.

Smap soil map unit (Soil Siblings)	New Zealand Soil Classification	Parent material	Soil drainage	Correlated soil series name
Heretaunga_62a.1	Pallic Orthic Brown Soils	Alluvium (rock)	Well drained	Heretaunga
Ruamananoa_7a.1 + Rangitikei_3a.1	Fluvial Raw Soils	Alluvium (fine)	Well drained	Rangitikei
Heretaunga_62a.1 + Hastings_51a.1	Pallic Orthic Brown Soils + Typic Orthic Gley Soils	Alluvium (rock and fine)	Well drained + poorly drained	Heretaunga + Kairanga
BlueDuck_4b.1 + BlueDuck_4a.2 + Tengawai_25a.1	Typic Acid Brown Soil + Typic Orthic Brown Soils	Loess and hard sandstone rock gravels	Moderately well drained	Kaitoke Hill soil + Ruahine steepland soil
Hastings_51a.1	Typic Orthic Gley Soils	Alluvium (fine)	Poorly drained	Kairanga
Heretaunga_62a.1 + Ruamananoa_7a.1b + Rangitikei_3a.1 + Hinds_53a.1	Pallic Orthic Brown Soils + Fluvial Raw Soils + Mottled Fluvial Recent Soils	Alluvium (rock and fine)	Well drained + imperfectly drained	Heretaunga + Rangitikei + Waiwhetu

The Smap soil map information provides a more detailed representation of the soils on the site than the NZLRI soil map information. However, because of the absence of land characteristics information (e.g. slope) for the soil map units, it is not possible to assign LUC units. Given that most of the Smap soil map units correlate to the soils identified by the NZLRI map information, it is likely the LUC units will be similar. To correctly identify and map the LUC units a property scale assessment using the LUC classification criteria described in Lynn et al. (2009) would be required.

MODIFIED SOIL AREAS

The modified soil areas for the site (as identified using aerial photo interpretation) are shown in **Figure 6**.

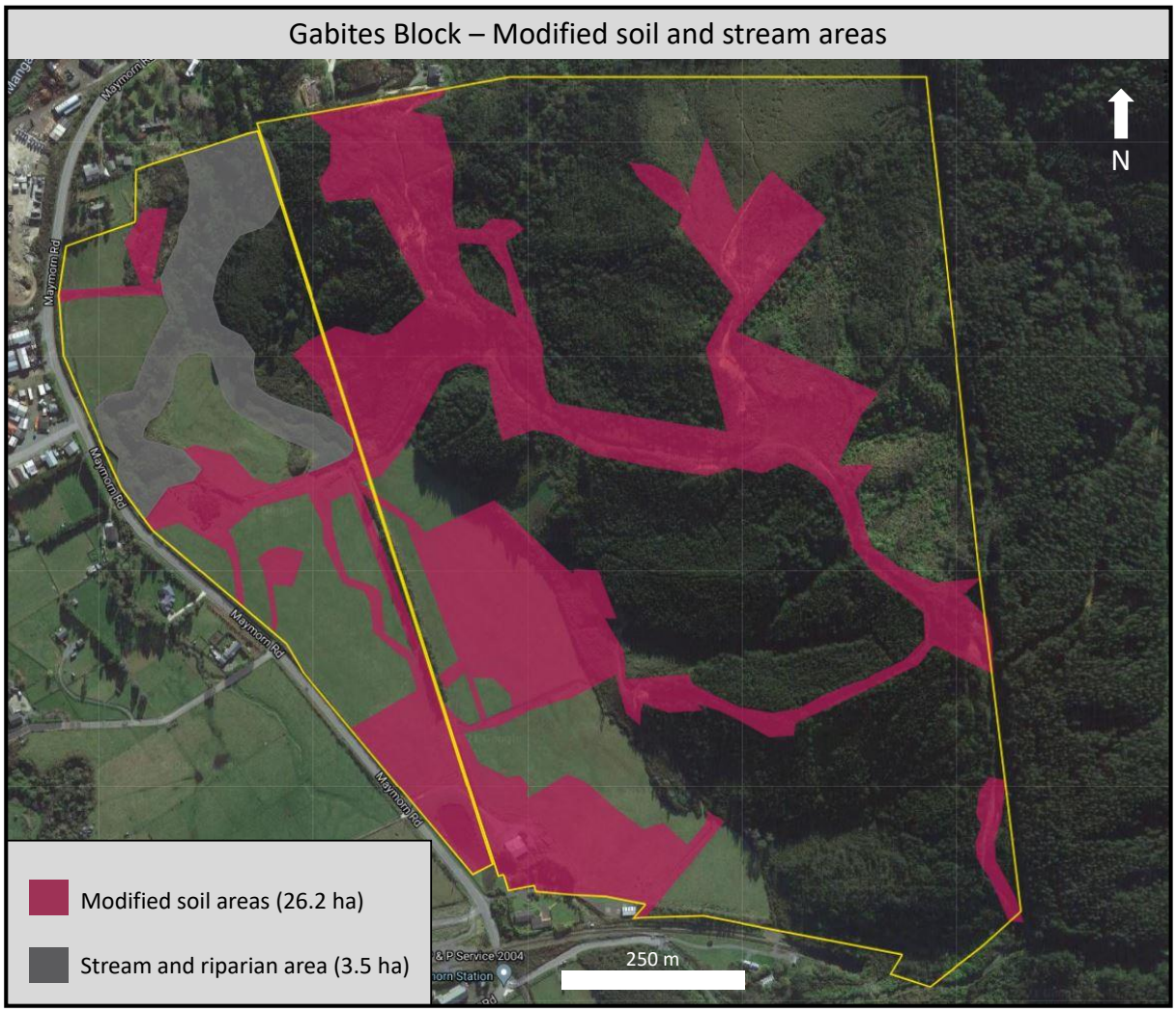

Figure 6. Modified soil areas and stream and riparian area identified for the Gabites Block using aerial photographic interpretation.

Modified soil areas identified included roads houses and curtilage, buildings large ponds, earthworks and forestry landing. These areas are excluded from high class soil or highly productive land areas in the assessment of high class soil and highly productive land. The total modified soil area for the site is estimated at 26.2 ha. An additional area which comprised a

steep sided stream and riparian area was also identified. This areas is estimated at 3.5 ha and combined with the modified soil areas, the total excluded area equates to 29.7 ha of the site.

The NZLRI and Smap map units with the excluded areas are shown in **Figure 7** and **Figure 8** respectively.

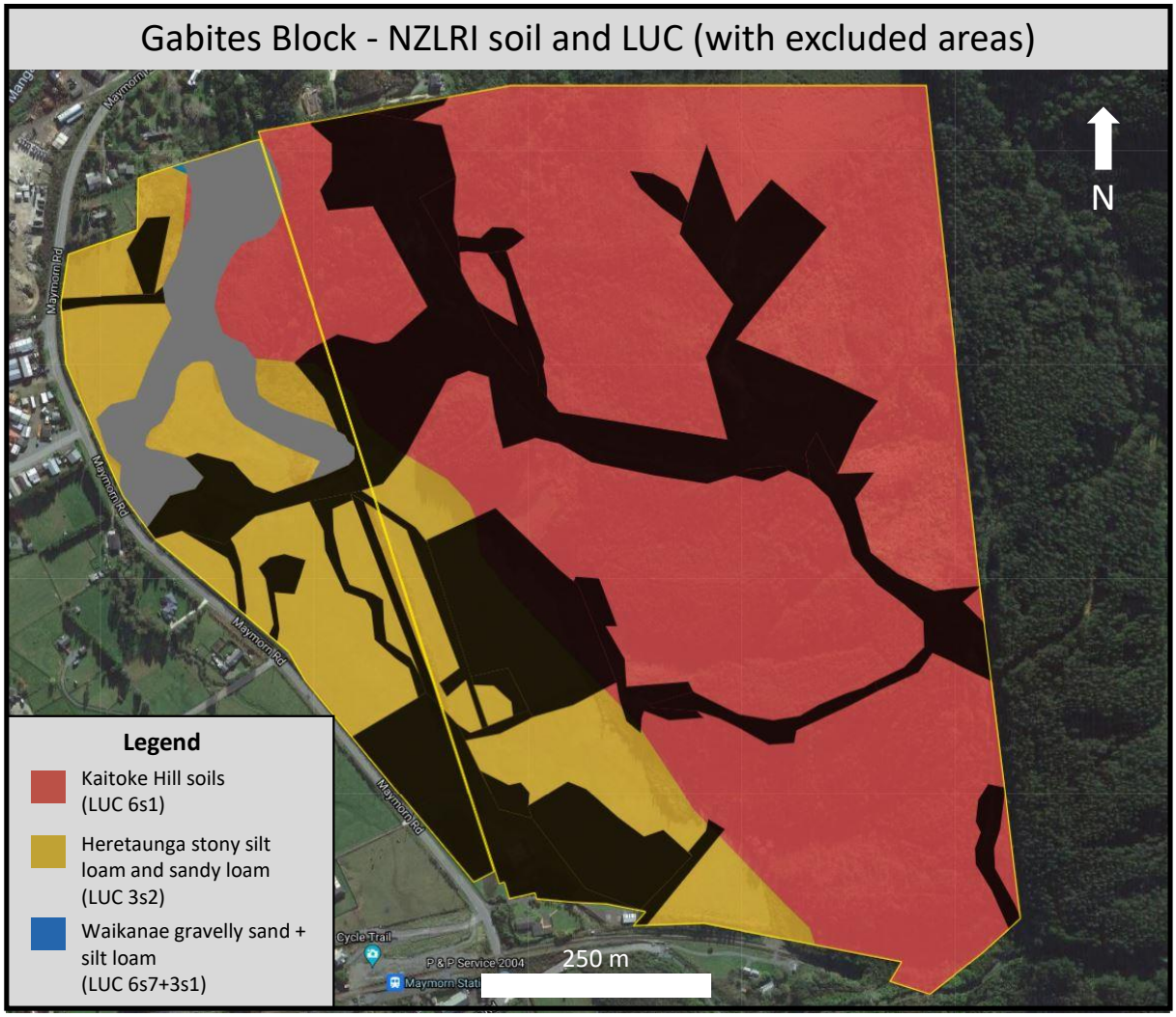

Figure 7. NZLRI soil and LUC map units with excluded areas for the Gabites Block site.

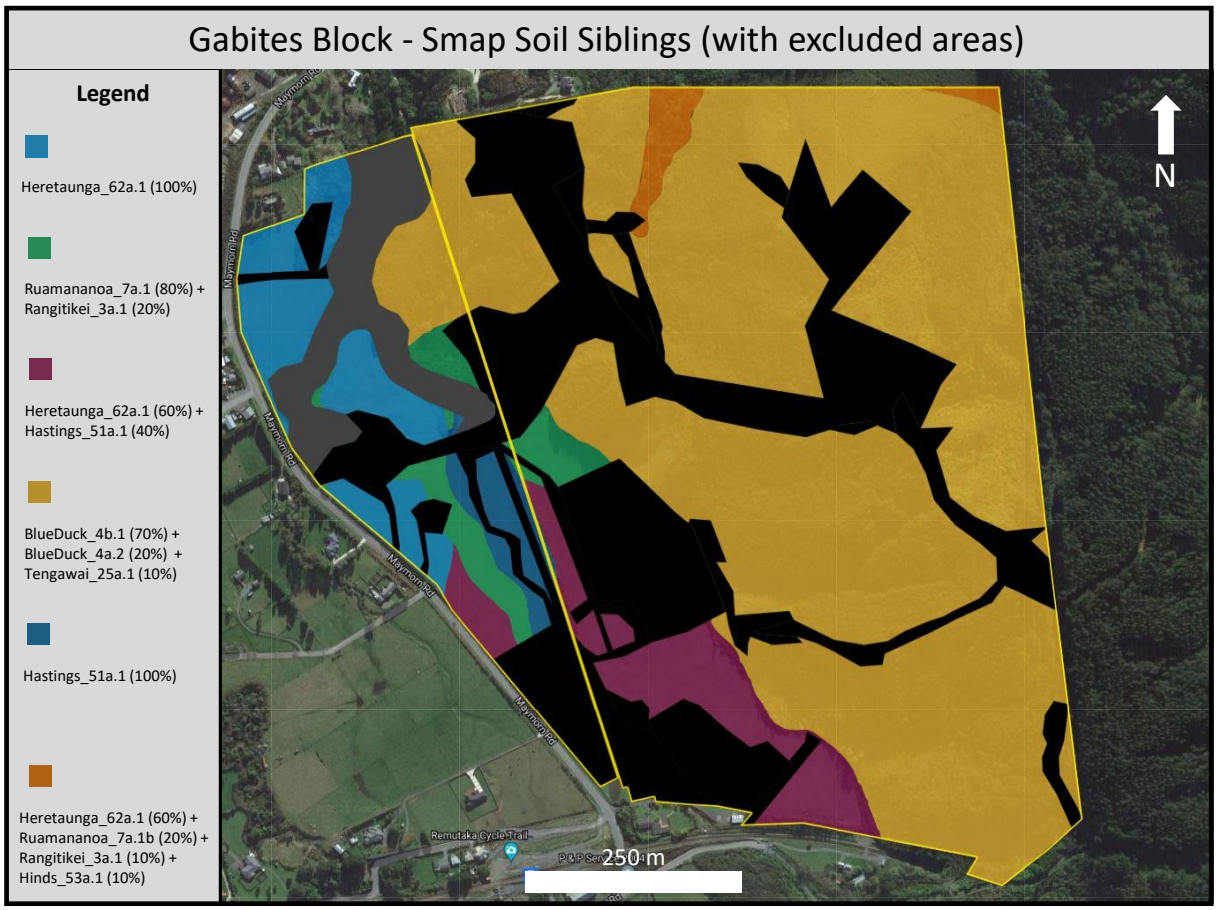

Figure 8. Smap Siblings map units with excluded areas for the Gabites Block site.

ESTIMATED MAP UNIT AREAS

The estimated NZLRI and Smap map unit areas, with and without excluded areas are summarised in **Table 3**.

Table 3. Estimated NZLRI and Smap map unit areas for the Gabites Block.

Soil (LUC) map unit	Map unit area (ha)	Excluded areas (ha)	Map unit area with excluded areas (ha)
NZLRI map units			
Kaitoke Hill soils (6s1)	51.6	13.7	37.9
Heretaunga stony silt loam + sandy loam (3s2)	21.0	12.5	8.5
Waikanae gravelly sand + silt loam (6s7+3s1)	<0.01	<0.01	<0.01
Totals	72.6	26.2	46.4
Smap map units			
Heretaunga_62a.1	5.2	1.7	3.5
Ruamananoa_7a.1 + Rangitikei_3a.1	5.7	4.0	1.8
Heretaunga_62a.1 + Hastings_51a.1	8.5	4.8	3.7
BlueDuck_4b.1 + BlueDuck_4a.2 + Tengawai_25a.1	50.3	14.7	35.6
Hastings_51a.1	2.0	1.0	1.0
Heretaunga_62a.1 + Ruamananoa_7a.1b + Rangitikei_3a.1 + Hinds_53a.1	0.9	0.0	0.8
Totals	72.6	26.2	46.4

ESTIMATED HIGH CLASS SOIL/HIGHLY PRODUCTIVE LAND AREAS

Based on the NZLRI LUC units for the site and applying the high class soil definition provided by Policy 59 in the RPS, the site does not contain high class soil (i.e. there is no LUC 1 or LUC 2 on the site).

Based on the proposed NPS-HPL interim definition for highly productive land, a minimum area of 4 ha of LUC 1, 2 or 3 is required to classify a rural land parcel as highly productive land[10]. The definition does not state whether the 4 ha has to be contiguous. However, it is likely it does need to be contiguous as non-contiguous areas of highly productive land would be impractical and unviable to manage intensively.

The individual LUC 3s2 land areas (with excluded areas considered) for the two land parcels of the Gabites Block site are provided in **Table 4**.

[10] .. "a land parcel in a rural area that contains at least 50% land or 4 hectares (whichever is the lesser) of land defined as Land Use Capability 1, 2 and 3 as mapped by the New Zealand Land Resource Inventory or by more detailed site mapping".

Table 4. Individual LUC 3s2 land areas (with excluded areas considered) for the two land parcels of the Gabites Block site (72.6 ha).

	Land parcel	
	Part Section 299 Hutt DIST (57.9 ha)	Lot 2 DP 356697 (14.7 ha)
Individual LUC 3s2 land areas with excluded areas considered (ha)	2.0	2.2
	1.0	1.1
	0.6	1.1
	0.5	0.8
	0.1	0.4
	-	0.3
	-	0.3
	-	0.1
	-	<0.01
Totals	**4.2**	**6.4**

Based on the NZLRI map units (with excluded areas considered), only the 3s2 land could be considered highly productive land, providing a minimum area of 4ha is available. LUC 3s2 land is present in both parcels.

For land parcel *Part Section 299 Hutt DIST (57.9 ha),* the area of 3s2 (with excluded areas considered), is estimated at 4.2 ha in total. However, the 4.2 ha comprises five non-contiguous areas, ranging in area from 0.1 ha to 2.0 ha. Given the fragmented distribution of these areas I do not consider they would be of sufficient individual size to be suitable for intensive cropping or any other intensive use (highly productive use) and are only suitable for pastoral grazing. Additionally, the balance of the parcel area (53.7 ha or 92.7%) is either LUC 6s1 or unproductive land (modified soil or stream and riparian reserve).

For land parcel *Lot 2 DP 356697 (14.7 ha),* the area of 3s2 (with excluded areas considered), is estimated at 6.4 ha in total. However, the 6.4 ha comprises nine non-contiguous areas, ranging in area from <0.01 ha to 2.2 ha. Given the fragmented distribution of these areas I do not consider they would be of sufficient individual size to be suitable for intensive cropping or any other intensive use (highly productive use) and are only suitable for pastoral grazing. The balance of the parcel area (8.3 ha or 56.5%) is either LUC 6s1 or unproductive land (modified soil or stream and riparian reserve).

Other considerations that limit land in these land parcels from being highly productive are that they do not have access to reticulated water supply, and not in close proximity to horticultural contracting, produce storage, or marketing infrastructure.

For the Smap soil map information, no LUC classes are provided. However, given the similarity of the soil characteristics and distribution of the Smap soil map units to those of the less detailed NZLRI map units, it would be fair to assume that the soil limitations, and therefore the LUC classes on the site are likely to be similar. Applying the Smap soil map units in place of the NZLRI map units is unlikely to greatly alter the high class soil and highly productive land classification for the land parcels on the site.

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GEOTECHNICAL BOREHOLE LOG DATA

Geotechnical borehole data for the Gabites Block site was provided by ENGEO limited. The data consisted of ten borehole logs to a depth of ~19.5 m. Borehole log descriptions for the upper one metre (0-1 m) were used to identify additional locations of modified soil. The depth of 0-1 m was used as this aligns to the depth a of a standard soil profile description. Modified soil was indicated in the bore hole log descriptions as "FILL". Additional general soil texture information could also be inferred from the 0-1 m bore hole log descriptions. A summary of the bore hole log descriptions for the 0-1 m of each bore hole log is provided in **Table 5**.

Table 5. A summary of the geotechnical bore hole log descriptions (0-1 m) for the Gabites Block site.

Bore hole	Latitude	Longitude	General borehole log description (0-1m)
BH01	-41.107395	175.138782	Well drained silts and gravels
BH02	-41.106307	175.13709	Poorly drained peaty silt over silt over gravels
BH03	-41.105972	175.134408	Fill - indicating modified soil
BH04	-41.104721	175.133335	Fill - indicating modified soil
BH05	-41.104223	175.132025	Fill - indicating modified soil
BH06	-41.103291	175.134098	Fill - indicating modified soil
BH07	-41.103244	175.132242	Fill; buried soil at 0.7 m - indicating modified soil
BH08	-41.102647	175.130689	Poorly drained silt
BH09	-41.101653	175.130045	Well drained silt
BH10	-41.100448	175.131075	Well drained silt over gravels

Based on the borehole log descriptions, five boreholes indicated modified soil (BH03, BH04, BH05, BH06, BH07). A map of the borehole locations relative to the remaining soils for the Gabites Block site (**Figure 9**). Borehole log descriptions indicating modified soil are coloured blue. Borehole log descriptions indicating intact soil are coloured green.

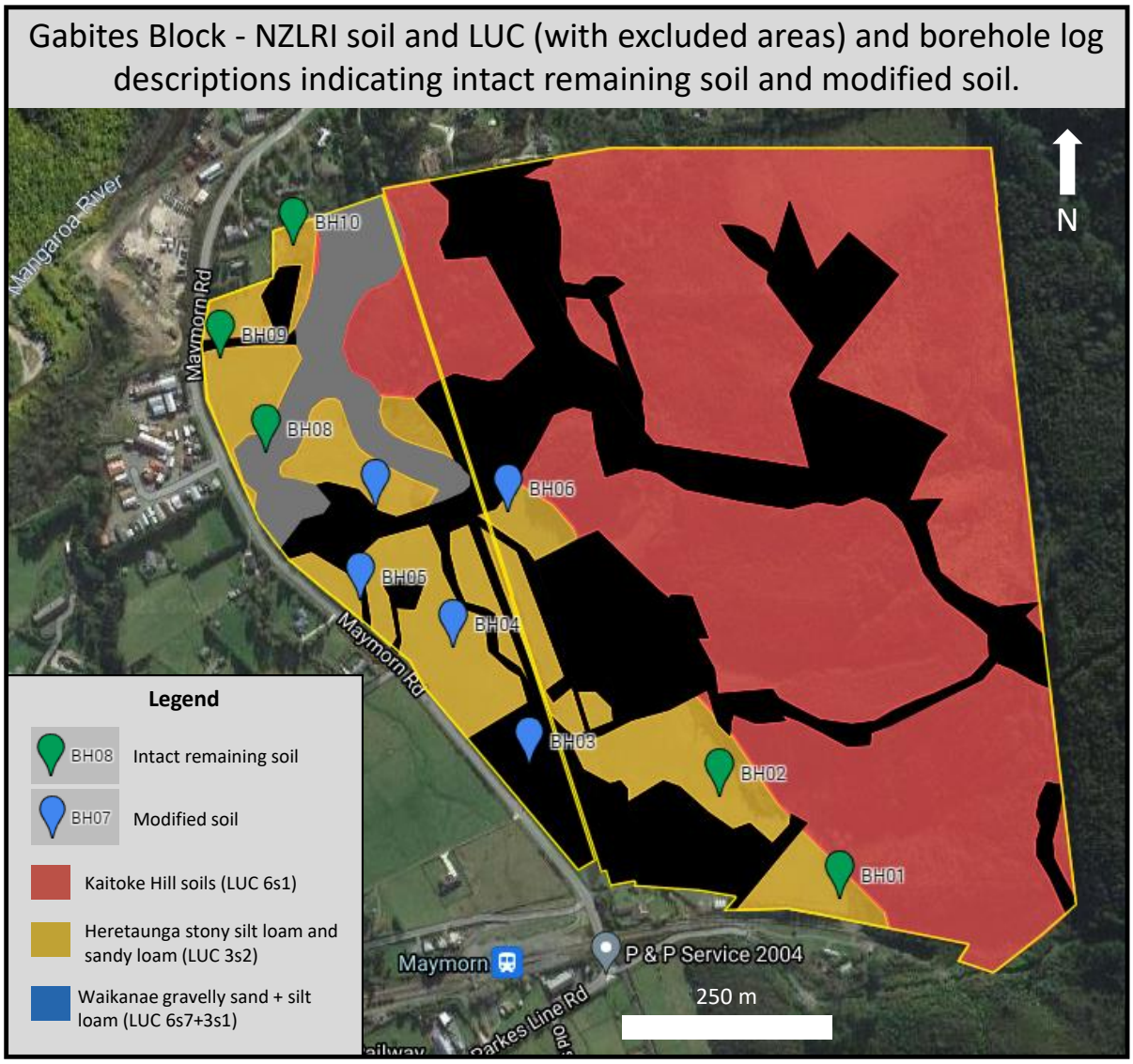

Figure 9. Map of the borehole locations relative to the remaining soils for the Gabites Block site (borehole log descriptions indicating modified soil are shown in blue).

Of the five borehole log descriptions indicating modified soil, all but one (BH03) are located on areas identified using aerial photographic interpretation as having intact soil remaining. Although the borehole log location data cannot be extrapolated spatially to indicate extent, the data does indicate that the extent of soil modification is likely to be more extensive than identified using aerial photographic interpretation.

ADDITIONAL COMMENTS

1. The NZLRI soil and LUC map information is somewhat broad and only provides a very general representation of the likely soils and LUC map units for the site. Compared with the NZLRI map information, the Smap map information is more detailed. That sad, the broad soils (and likely LUC classes) are similar.
2. The NZLRI map units indicates that the site is LUC class 6 and LUC class 3. This suggests that the site does not contain high class soil (high quality soil) based on Policy 59 in the Operative Regional Policy Statement for the Wellington region.

3. The Smap map information does not have the land characteristics information to allow the classification of LUC units However, given that most of the Smap soil map units correlate to the soils identified by the NZLRI map information, it is likely the LUC units will be similar and the site does not contain high class soil as based on Policy 59 in the Operative Regional Policy Statement for the Wellington region.
4. The desktop assessment suggests that the site has approximately 26.2 ha that has either modified soils (not considered high quality soil) or stream and riparian area (that is not available for productive use).
5. In general, the Smap soil map information likely provides a fair estimate of the range and location of soils on the site. A field assessment could potentially identify new soils on the site or spatially refine some of the map unit boundaries (especially around the base of the hills). However, these changes are unlikely to greatly change the overall soil and LUC classes across the site as a whole.
6. The desktop assessment of the modified soil areas indicated that the Gabites Block land has undergone extensive modification over the years, and the remaining soil areas are highly fragmented. It should be noted that the assessment only identified visually obvious modified soil areas. It is likely that soils surrounding these areas could also be modified, further reducing the area and productive capacity of the remaining soils.
7. The borehole log descriptions provided by the geotechnical assessment indicate that the extent of soil modification is likely to be more extensive than identified using aerial photographic interpretation.