12 November 2025

REFERRAL APPLICATION FOR RESOURCE CONSENT UNDER THE FAST TRACK APPROVAL ACT 2024

1080 STATE HIGHWAY 16

GEOTECHNICAL APPRAISAL REPORT

Halberd Holdings Ltd

Job No. AKL2025-0012AB | Version Rev. 3

AKL2025-0012AB		
Date	Revision	Comments
13 February 2025	A	Initial draft for internal review
27 March 2025	B	Final draft for internal review
01 April 2025	0	Final issue to support plan change application
22 May 2025	C	Revised draft for internal review
23 May 2025	1	Updated issue to support Fast Track Referral for a Resource Consent application
28 July 2025	D	Revised draft for internal review
29 July 2025	2	Updated with Solar Farm comments
12 November 2025	3	Updated to remove solar farm comments

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1 INTRODUCTION

1.1 Project Brief

CMW Geosciences (CMW) was engaged by Ian Humphrey and Barker & Associates to carry out a geotechnical appraisal of a site located at 1080 State Highway 16, which is being considered for urban development.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced AKL2025-0012AA, Rev0 dated 22 January 2025.

CMW has previously completed a geotechnical appraisal and geohazards assessment (Referenced: AKL2021-0058AB Rev. 0, dated 12 May 2021) for the potential development of the majority of the block of land at 1080 State Highway 16 (SH16) in Waimauku, which at the time was being considered for a Unitary Plan change to Future Urban zoning.

1.2 Scope of Work

As detailed in our proposal letter, the instructed scope of work to be conducted by CMW was defined as follows:

- Site walkover, including geomorphological field mapping by an experienced Engineering Geologist.
- An update to the above referenced report to assess the geotechnical effects of and geohazards of the developed scheme for future urban development. This report is to support a referral application for Resource Consent under the Fast Track Approval Act 2024.

2 SITE DETAILS

The site encompassing the proposed resource consent area, comprises an area of approximately 200 ha and is located in the southern portion of 1080 State Highway 16, Waimauku, Auckland as shown on *Figure 1* and *Figure 2*.

Details of the site are as follows:

- The site is generally gently to moderately graded with isolated steeper areas particularly along the northern boundary and in western areas of the site.
- The site is bound by State Highway 16 to the south, Waimauku township to the east, The North Auckland Line (railway) to the north and rural land to the west.

3 PROPOSED MASTERPLAN

CMW has been provided with an initial masterplan which shows the site subdivided into 1596 residential lots across a range of lot sizes, A neighbourhood centre, a light industrial area, 22 open spaces and a wastewater treatment plant. This plan currently shows that the lowest density development areas are located in the western and southeastern areas of the site with higher density areas filling in the centre. The updated masterplan is presented in *Appendix A* and in *Figure 2*.

Figure 1: Site Location Plan (Google Maps)

Figure 2: Site Masterplan (Barker Associates)

FACTUAL

4 DESKTOP STUDY

4.1 Landform

The current general landform, together with associated features located within and adjacent to the site is presented on the attached Geomorphology and Geology Plans, *Drawings 01* and *02* of *Appendix B.*

Topography is dominated by a steep generally north/south trending ridgeline, with a maximum elevation of approximately RL 81.5m in the eastern portion of the site (also referred to as Renall's Hill) that separates a relatively level terrace at RL10m to the north of the site. Several gully features extend from the principal ridgeline to the north, east and west, grading down steeply to elevations of approximately RL 10m at their base. Topography tapers off to the west of the site with gentler, rolling hills, that generate less gully and instability features.

There is a large historic rotational landslide that extends out from the principal ridgeline to the north, displaying slumped, rumpled, and hummocky ground from approximately RL 70m down to RL 14m to the north. Three other major escarpments and landslides are evident around the heads of gullies which extend from this ridge, with major head scarps sitting between approximately RL 70m and RL 40m. Copious minor head scarps are also present around the banks of gullies throughout the site.

Two pockets of vegetation are present in the north and east sections of the site, which are classified as Significant Ecological Areas. There is also a Ridgeline Protection established on the prominent ridgeline and the eastern slopes (Renall's Hill) within the site.

The rural site is largely covered in pasture and is currently leased for grazing purposes. There are numerous farm dwellings and buildings located toward the western portion of the site and associated farm tracks leading from these buildings to pastoral areas, mainly spanning across ridges. The North Auckland railway line borders the northern and eastern boundaries of the site, servicing the township of Waimauku to the east.

The wider land parcel encompasses approximately 260Ha of land to the north of the railway line.

4.2 Site History

Historical aerial photographs show that the site has been exclusively used for agricultural purposes since aerial documentation in the early 1940s (See *Figure 3*). They also reveal clear images of the previous instability along the principal ridgeline, which appears to be relatively deep-seated with typical rotational landslide blocks evident. Since this aerial there has been very little change to the site as shown by *Figure 4* and by the current state of the site.

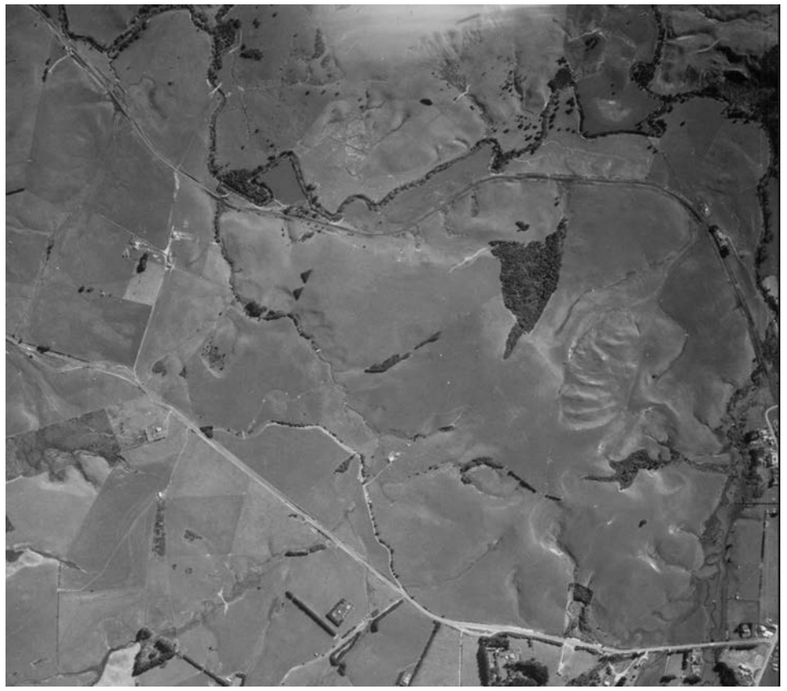

Figure 3: 1940 Site Aerial Image (RetroLens)

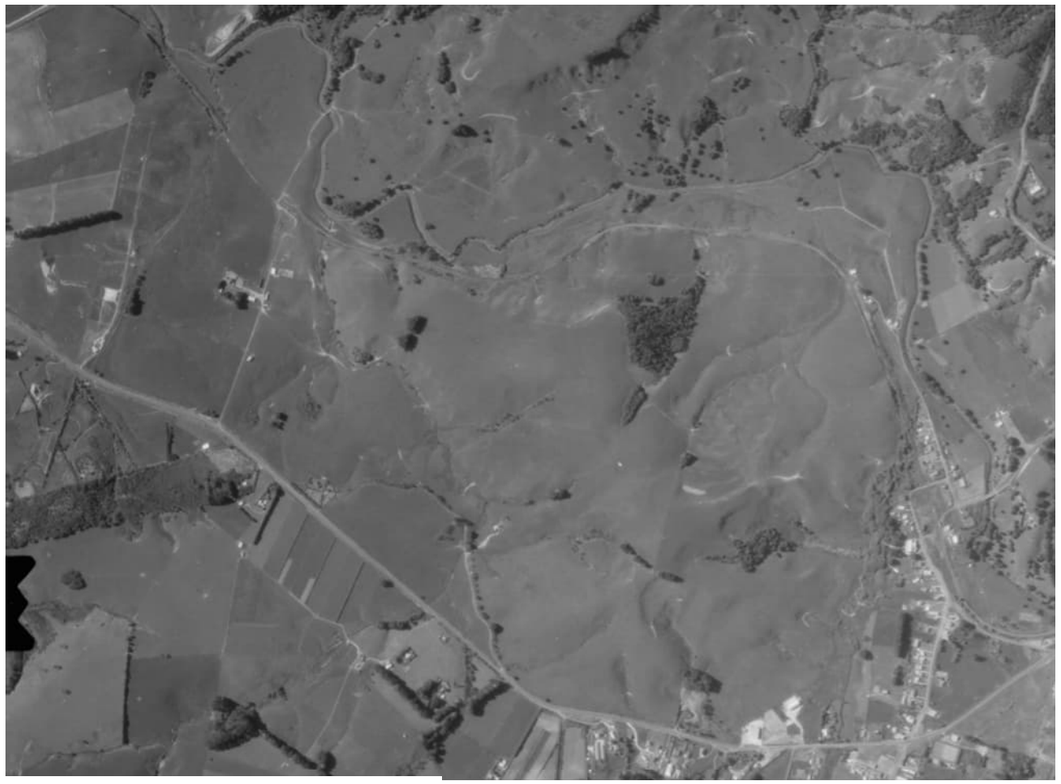

Figure 4: 1981 Site Aerial Image (RetroLens)

FACTUAL

5 GEOLOGY

5.1 Published and Interpreted Geology

Published geological maps[1] for the area depict the regional geology for the area as illustrated in *Figure 5*. The table below contains information about the published geology as well as other units which have been identified on site.

Summary of Typical Conditions of Mapped Geological Units	
Uncontrolled Fill	
Location on Site	Based on the known history of the site and surrounding land levels, some superficial depths of uncontrolled fill should be anticipated as a result of landscaping. A recently filled gully is present near the northern boundary as presented on *Drawing 01* of *Appendix B*.
Formation	No records on the quality or contents of this filling have been reviewed and it is expected to have been "uncontrolled" from an engineering perspective.
Typical Composition, Weathering / Layering and Variability	-
Behaviour, Instability Mechanism(s) and Principal Potential Geohazards	Poorly consolidated deposits, particularly organics, will usually settle / subside if unsupported or overloaded. Prone to comparatively poor bearing capacity characteristics Shallow circular instability and soil creep in moderately graded slopes
Takaanini Formation (Tauranga Group) Alluvium/Colluvium	
Location on Site	Both Holocene (Q1a) and Mid to Late Pleistocene (IQa) alluvial deposits of the Tauranga Group are found along the northeastern boundary of the site.
Formation	River and stream deposits, including landslide debris and erosion deposits
Typical Composition, Weathering / Layering and Variability	Recent Holocene alluvium generally comprises sand, silt, mud and clay deposits with local gravel and peat beds. Mid to late Pleistocene alluvium predominantly comprises pumiceous sand, silt, mud, and clay deposits, interbedded with gravel and peat. These are the most recent naturally deposits on site, so where present, will overlie the other geological units at depth.
Behaviour, Instability Mechanism(s) and Principal Potential Geohazards	Poorly consolidated deposits, particularly organics, will usually settle / subside if unsupported or overloaded. Liquefaction (if sandy lenses are present below groundwater level) Lateral Spread if liquefiable near a free face High shrink/ swell/ expansivity of clay deposits Prone to comparatively poor bearing capacity characteristics
Awhitu Group Dunes	
Location on Site	Predominant geology in the western half of the site.
Formation	Windblown sediments
Typical Composition, Weathering / Layering and Variability	These dune deposits typically comprise moderately to poorly consolidated, large-scale cross-bedded, plane-parallel, and ripple-laminated sandstones, with pockets of paleosols, lignite and carbonaceous material. The weathered profile typically comprises weakly cemented sands.
Behaviour, Instability Mechanism(s) and Principal Potential Geohazards	Liquefaction (if low density sands are present below groundwater level) Poorly cemented sands are highly erodible. Interdune organic material is likely to be highly compressible
Cornwallis Formation of the Waitemata Group	
Location on Site	Cornwallis Formation of the Waitemata Group (Mwc) is found within the central and eastern portions of the site.
Formation	Deposit is derived from a mixture of andesite and Northland Allochthon sedimentary and igneous rock types, inferred to have come from northwestern source area.
Typical Composition, Weathering / Layering and Variability	This formation consists of thick, graded turbidite sandstone, typically 0.5-3m thick, interbedded with laminated siltstone and fine-grained sandstone, typically 0.05-0.2m thick. It unconformably overlies East Coast Bays Formation in west and northwest Auckland, from Manukau Harbour to North Makarau.
Behaviour, Instability Mechanism(s) and Principal Potential Geohazards	Potential for high shrink/ swell/ expansivity of near-surface clays Shallow circular instability and soil creep in moderately graded slopes Deep seated block failures governed by unfavourable rock defects and bedding orientations and inclinations and trapped groundwater deposits
Helensville Conglomerate of the Waitemata Group	
Location on Site	Helensville Conglomerate (Mwl) is locally present within the Cornwallis Formation, north of Waimauku. This conglomerate is present within the central and eastern potions of the site, overlying the Cornwallis Formation along the principal ridgeline.
Formation	Helensville Conglomerate is interpreted to have been as a submarine channel, canyon and/or fan deposit.
Typical Composition, Weathering / Layering and Variability	It predominantly comprises well rounded, andesitic (derived from Kaipara Volcano), cobble and pebble clasts, with boulders up to 2m in diameter. Less common microdiorite, basalt, limestone and chert are also present, derived from the Northland Allochthon.
Behaviour, Instability Mechanism(s) and Principal Potential Geohazards	Potential for high shrink/ swell/ expansivity of near-surface clays Shallow circular instability and soil creep in moderately graded slopes Deep seated block failures governed by unfavourable rock defects and bedding orientations and inclinations and trapped groundwater deposits

[1] GNS Science 1:250k Geological Map – data.gns.cri.nz/geology/

5.2 Structural Geology

It is evident from historical aerial photographs, geological maps and geomorphology of the surrounding area that the topography of the subject site and region are controlled by structure and geology.

An inactive normal fault runs outside the northern boundary of the site, approximately 1km to the north, in an approximate SW/NE orientation, where a total historic slip displacement of less than 10m has been observed. This fault alignment is consistent with ridge and river alignments and extends somewhat to the northeast of the site. This fault may be interpreted as being part of / or a subsidiary fault of the Huapai Fault line extending approximately from the northwest of Waimauku, out eastward where it intersects with inlets of the Waitemata Harbour. The majority of this inactive fault is buried, with no surface fault trace evident.

5.3 Geomorphology

The geomorphology of the site was mapped by examination of aerial photographs and during a site walkover, and is shown in the appended Geomorphology and Geology Plans, *Drawings 01* and *02* of *Appendix B*.

The geomorphology strongly reflects the underlying geology and associated slope processes. The dominant regional structure is evident in the subject and neighbouring sites in the form of features (i.e., persistent alignments of gullies, ridgelines, rivers etc.) oriented approximately NW/SE and NE/SW.

The subject site is dominated by a NW/SE trending principal ridgeline and two main south to north/northwest trending gullies, the orientation of which is likely to be structurally controlled given that the same orientation is seen in both regional structure and neighbouring gully alignments.

There is a large historic rotational landslide that extends out from the principal ridgeline to the north, displaying a series of rotated blocks of land. This landslide is confined by gullies up its western and eastern flanks and is contained entirely within the site. As depicted on *Drawing 02*, three other major instability features/landslides are evident around the heads of gullies which extend from this ridge, with major head scarps sitting between approximately RL 70m and RL 40m. The head scarps appear to generally align with the interface of the Helensville Conglomerate and Cornwallis Formation. Numerous minor head scarps are also present around the banks of gullies across the remainder of the site.

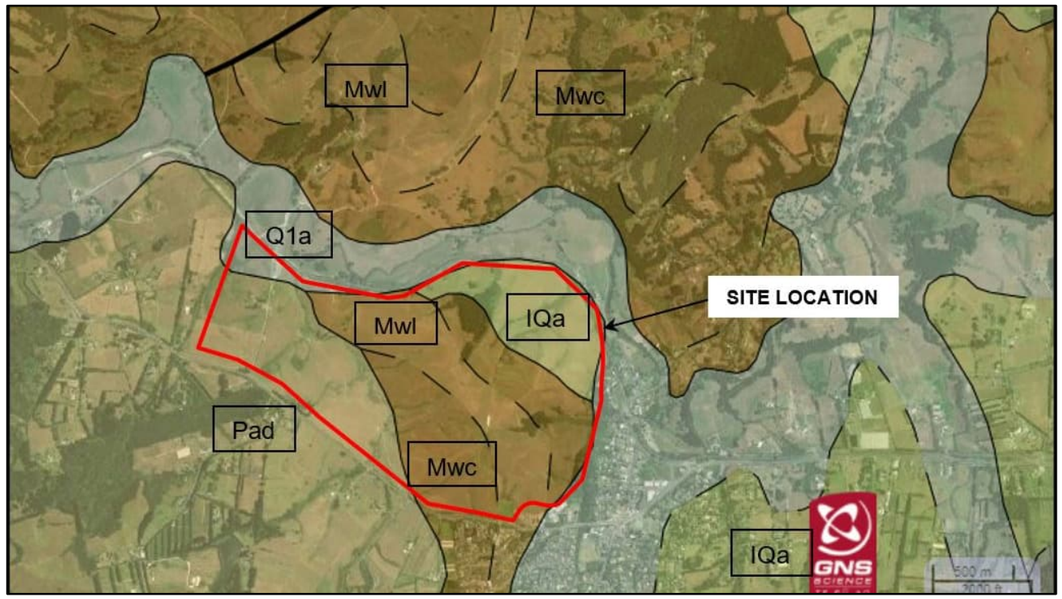

Figure 5: Regional Geology (GNS Science)

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6 GEOHAZARDS ASSESSMENT

The table below is a summary of critical geohazards to this project and is based on information available to date.

Geohazard Assessment Summary												
Item	Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures			
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
1	Earthquake	Seismicity	Application Site	Site subsoil class = Class C SLS PGA = 0.05g, ULS PGA = 0.19g		Not applicable		Some areas of this site may be site subsoil class B where future significant cuts are made to the landform.		Not applicable		
		Fault Rupture	Application Site	Nearest active fault = Waikopua Fault, approximately 52km from the site.	1	5	5	Not applicable	1	5	5	
		Liquefaction and Lateral Spread	Low Lying Areas within the Application Site	The vast majority of case history data compiled in empirical charts for liquefaction evaluation come from Holocene deposits or man-made fills. Pleistocene aged alluvium (>12,000 years) is also considered to have a very low to low risk of liquefaction. In addition to the low-lying areas of Holocene deposits mapped in the north-western corner of the site, recent colluvium (landslide debris) and alluvium from normal stream processes found within the low-lying valley floors are young in terms of geological age and are considered susceptible to liquefaction. Within the gullies, these deposits are expected to be quite limited in depth and lateral extent. On the basis of our initial assessment above, we have mapped only limited portions of the site as being likely to be susceptible to liquefaction and lateral spread. The extents are depicted on Drawings 03 and 04. There is potential for lateral spread where liquefiable soils are located near a free-face. Areas of potential liquefaction hazard are shown in *Drawings 03* and *04* of *Appendix C*.	3	4	12	Preliminary options for remediation include ground improvement via earthworks and/or specific foundation design	3	1	3	
2	Slope Instability / Landslide	Global Instability	Western portion of the application Site	Existing instability features present in the western portions of the site are predominantly shallow and limited to the residual soil mass within the Awhitu Group and on the fringes of the Helensville Conglomerate. Areas of potential deep-seated slope instability hazard are shown in *Drawings 03* and *04* of *Appendix C*.	3	4	12	These features are expected to be readily remediated through engineering solutions during earthworks operations. The notable exception is deeper seated movement on the western fringes of the Cornwallis Formation. Setbacks can be applied to crests of slopes to account for potential future slope instability and/or debris inundation.	1	4	4	
			Eastern portion of the Application Site	The instability features in the eastern section of the site are extensive and deep-seated failures that typically appear to have initiated at the geological contact between the Helensville Conglomerate and the Cornwallis Formation. Areas of potential deep-seated slope instability hazard are shown in *Drawings 03* and *04* of *Appendix C*.	4	5	20	Specific slope stability analyses will need to be undertaken as part of detailed design to assess construction requirements for the overall design of any future subdivision to ensure appropriate slope stability factors of safety are achieved. Extensive engineering works will be required to develop these areas and mitigate risk of future land movement in these portions of the site.	1	4	4	

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Geohazard Assessment Summary												
Item	Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures			
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
								Setbacks can be applied to crests of slopes to account for potential future slope instability and/or debris inundation. However, it should be noted that some of these areas may not be able to be developed.				
		Soil Creep	Application Site	Across the site, soil creep will be likely on the steeper areas where land gradients exceed 1V:4H. Areas of potential shallow slope instability / soil creep hazard are shown in *Drawings 03* and *04* of *Appendix C*.	3	3	9	These features are expected to be readily remediated through engineering solutions during earthworks operations.	1	3	3	
		Stream bank instability and erosion	Within existing stream features	Based on site observations, minor erosion of stream banks is currently taking place in most streams which cross the site.	3	3	9	Setbacks can be applied to crests of slopes to account for potential future erosion.	1	3	3	
		Expansive Soils	Application Site	Based on our testing and experience in the west Auckland area, we anticipate that site soils in the east of the site will fall within moderately to highly expansive soil classifications. Soils to the west of the site, within the Awhitu Group dune deposits, are likely to fall within the stable or slightly expansive soil range.	5	3	15	Specific foundation design to be undertaken by structural engineer.	1	3	3	
3	Problematic Soils	Uncontrolled Fill	Application Site	It is evident from our site walkover that uncontrolled/uncertified fills are present on site, placed as part of historic landscaping operations. A gully above the northern boundary of the site in particular has been filled recently, as shown on the appended drawings.	5	3	15	Existing, non-engineered fills will need to be undercut and replaced or reworked with engineered fill. We anticipate that most of the deposits, other than any organic material, should be able to be used as engineered fill once dried and blended.	1	3	3	
		Contamination	Application Site	Contamination reporting is being completed by SLR Consulting New Zealand and is not a part of this assessment				Not assessed herein				
		Compressible Soils	Awhitu Group	Loose sands may be susceptible to compression when loaded. Interdune organic deposits such as peats or lignite's are likely to be highly compressible	4	3	12	All settlement within sands is expected to be primary. As such, the settlement risk within loose sands can be removed during earthworks. Following assessment of their presence, depth, extent and strength, organic deposits may need to be remediated. Typically, this would incorporate either undercutting and removal, or preloading the soils to drive settlement prior to the development of infrastructure and buildings.	1	3	3	
4	Settlement		Takaanini Formation	Organic layers such as peats within recent alluvial deposits are likely to be highly compressible	4	3	12	Following assessment of their presence, depth, extent and strength, organic deposits may need to be remediated. Typically, this would incorporate either undercutting and removal or preloading the soils to drive settlement prior to the development of infrastructure and buildings.	1	3	3	
			Waitemata Group	Waitemata group soils are unlikely to be compressible outside of Building Code tolerances.	1	3	3	Not applicable	1	3	3	

INTERPRETIVE

Geohazard Assessment Summary												
Item	Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures			
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating	
5	Construction Risks	Bearing Capacity	Application Site	Following future earthworks, it is likely that a geotechnical ultimate bearing capacity of 300 kPa will be available for shallow piled or strip footing foundations.				Not applicable				
		Excavatability	Application Site	The majority of site soils should be considered easily excavatable. Where significant cuts are proposed within the Cornwallis Formation and Helensville Conglomerate, transition zone and/or rock materials may become difficult to excavate.	3	2	6	Larger earthworks machinery may be required to excavate materials should the become too hard.	1	2	2	
		Sediment Retention Ponds	Application Site	There are plenty of suitable locations across site for sediment retention ponds. Locations of these should be determined once proposed cuts and fills are known.				Not applicable				
		Stockpile locations	Application Site	There are plenty of suitable locations across site for soil stockpiles. Locations of these should be determined once proposed cuts and fills are known, however, any significant soil stockpiles should be located away from existing landslides or slopes with a gradient steeper than 1V:3H.				Not applicable				
		Subgrade Preparation	Application Site	Topsoil is expected to be present across the whole site and undocumented fills have been identified in some locations as mentioned in Section 5.1 and Item 3 of this table.	5	2	10	Topsoil and undocumented fill should be removed prior to any filling taking place. Stripped topsoil should be respread and hydroseeded following site earthworks to reduce erosion to the landform.	1	2	2	
		Service Trenches (trench collapse / long term settlement)	Area of Awhitu Group Sands	Service trenches with the Awhitu Group maybe prone to collapse where they cross areas of loose sands.	4	2	8	Sands should be compacted prior to excavation of service trenches.	2	2	4	
		Land Instability as a Result of General Works	Application Site	Works near the crests of existing landslides or steep slopes may increase the likelihood of slope instability.	3	4	12	Care to be taken when working near the crests of existing landslides or steep slopes. Stockpile and sediment retention ponds should not be placed near these locations	2	4	8	

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7 DEVELOPMENT POTENTIAL

The following zones have been applied to specific areas of the development site based on our desktop study. These assessments will need to be confirmed by site specific investigations.

Low development premium (cost) areas are considered to have less geotechnical constraints/hazards and are likely to be the most simple and economical to develop.

It does not mean that development cannot occur in medium or high premium (development cost) areas, although these areas will require a higher degree of engineering input for successful development than for areas classified as low development cost premium. They may also require greater investment in construction works/earthworks to minimise any identified geotechnical risk.

For clarity, our assessment is based solely on the geotechnical hazards/constraints that have been identified and outlined above. At this stage we have made the following assumptions, which we consider to be appropriate for the site:

- That no significant contamination issues are present which would preclude future residential development (Based on SLR Consulting Report dated 20 March 2025, Ref: 810.031375.00001_PPC).
- That no filling operations will be undertaken in wetland/or gully areas.

Based on our work to date, we have depicted the following areas on the appended Geotechnical Zoning Plans, *Drawings 05* and *06* in *Appendix D*.

7.1 Low Development Cost Areas

These areas typically incorporate gently to moderately sloping areas within the site but exclude recent alluvial deposits. In essence they include:

- The rolling hills of the Awhitu Group Dune deposits,
- Stable ridgelines of the Helensville Conglomerate and Cornwallis Formation,
- Older (Pleistocene) alluvial deposits. These deposits are gently to moderately contoured, having a landform that suggests the absence of significant organic deposits.

Following relatively minor earthworks that include reworking of surface deposits of any uncertified fills and/or shallow instability features, these areas are expected to be suitable for land development, residential development, school centres, employment areas and associated infrastructure without the need for significant additional geotechnical remediation costs.

7.2 Medium Development Cost Areas

These areas incorporate:

- Moderate to steeper gradients in Helensville Conglomerate, Cornwallis Formation and around gully features in the Awhitu Group deposits,
- Low-lying, near-level recent (Holocene) alluvium areas having potential liquefaction/ lateral spread hazards or enhanced potential to contain organic and peat deposits subject to settlement hazards, although without further investigation and characterisation, it is difficult to quantify this hazard level.

Moderate earthworks involving cuts and fills and recontouring with associated subsoil drainage are expected to be required to remediate the principal slope stability issues in these areas. Areas of recent alluvium may require undercutting, installation of wick drains and pre-loading, depending on the type and extent of hazards present. Following these works as required, these areas are expected to be suitable for land development, residential development, school centres, employment areas and associated infrastructure.

7.3 High Development Cost Areas

These areas incorporate:

- Land that is constrained by steeper gradients with gullies,
- Areas that include or are adjacent to historic, deep-seated instability.
- Steeply graded land that exhibits shallow soil creep or shallow instability. This is predominantly steep land above the northern boundary that is expected to be difficult to develop due to overall gradients.
- The recent gully fill above the northern boundary.

It is anticipated in addition to earthworks normal cut and fill operations, significant geotechnical works such as over-excavations, deep subsoil drainage, in-ground walls and or/shear keys will be required to remediate the land to be suitable for residential type development.

Some specific areas have been nominated (labelled A, B, C, D, E and F) within this zone on Drawings 05 and 06. Each of these areas contain landslide features that are either contained entirely within the site or may be entirely contained within the site pending confirmation from geotechnical information. Subject to ecological considerations and geotechnical investigation, these areas could be considered for future development without the need to consider and address impacts on adjacent properties. In this respect, development of these specific features is a lower risk than the remaining land within this constraint zone. However, it should also be noted that these areas may require such substantial remediation to make the land developable.

8 MASTERPLAN COMMENTS

Based on the geohazards specified in Section 6 and the potential costs of development specified in Section 7 we have made the following comments on critical hazards which may affect the proposed masterplan:

Masterplan Comments			
Hazard	Description of Hazard on Development	Remediation Options	Photograph of Area
Deep-Seated Slope Instability	A large deep-seated landslide is inferred to be within the area shown by the red outline in the attached photograph.	It has been made aware to CMW that large cuts are proposed to the more elevated areas of the site which includes the southern half of this landslide. Head unloading through earthworks, along with construction of a shear key at the base of the landslide and reworking or removal of unsuitable material should be sufficient to reduce the risk for this area of the development to acceptable levels. Low to moderate height retaining walls are likely to be required between lots within this area.	
Deep-Seated Slope Instability	Multiple large deep-seated landslides are inferred to affect the development area shown by the red outline in the attached photograph.	It has been made aware to CMW that large cuts are proposed to the more elevated areas of the site which includes head scarps of the inferred landslides to the northwest of this development area. Head unloading through earthworks, along with construction of a shear key at the base of the landslide and reworking or removal of unsuitable material should be sufficient to reduce the	

Masterplan Comments			
Hazard	Description of Hazard on Development	Remediation Options	Photograph of Area
		risk for this area of the development to acceptable levels. Low to moderate height retaining walls are likely to be required between lots on steeper portions of this area.	
Deep-Seated Slope Instability	Multiple deep-seated landslides are inferred to affect the development area shown by the red outline in the attached photograph.	It has been made aware to CMW that large cuts are proposed to the more elevated areas of the site which includes head scarps of the inferred landslides to the northwest of this development area. Head unloading through earthworks, along with construction of a shear key at the base of the landslide should be sufficient to reduce the risk for this area of the development to acceptable levels. Low to moderate height retaining walls are likely to be required between lots in this area.	
Deep-Seated Slope Instability	Multiple deep-seated landslides are inferred to affect the development area shown by the red outline in the attached photograph.	Given the relatively small size of these landslides in comparison with other landslides referred to in the rows above, these landslides should be considered remediable through earthworks. These earthworks are likely to include construction of a shear key.	

Based on the geohazards specified in Section 6 and the potential costs of development specified in Section 7 we have made the following comments on general hazards which may affect the proposed masterplan:

- Deep-Seated Slope Instability – All other mapped deep-seated landslides known to CMW on the site appear to be fully contained within the site and/or are outside residential development areas. Remediation of these features to reduce the risk of potential slope instability to acceptable levels is expected to be achievable through earthworks.
- Shallow Slope Instability/Soil Creep – Earthworks comprising creation of cut/fill platforms to reduce slope angles to below 1(V):4(H) will be required to reduce soil creep hazard to acceptable levels. It is likely that low to moderate height retaining walls will be required between residential lots in these areas.
- Liquefaction – The majority of the previous identified areas which may be susceptible to liquefaction are outside proposed development areas. Within development areas potentially affected by liquefaction, undercuts of existing site soils and replacement with engineered fills with higher clay contents may be required to form a non-liquefiable crust. Specific design of foundations may also be used to reduce the risk of liquefaction to acceptable levels.

Pending the outcome of a full geotechnical investigation of the site, it is CMWs opinion that the majority of the hazards on site are remediable through a range of mitigation options, primarily comprising earthworks (including cutting, filling and shear key construction), construction of retaining walls and foundation design.

9 CONTEXTUAL CONSIDERATIONS

A relatively localised area of low-lying alluvial deposits is present in the northwest corner of the site and is considered medium risk development cost areas due to potentially liquefiable soils and/or soft and organic soils/peat. These units pose the same geotechnical risk as a large proportion of the land in Kumeu/Huapai and Riverhead that is already zoned as Future Urban.

However, in general, the majority of the subject site has extensive areas of readily developable land (low development cost areas) and land that can be developed provided moderate engineering solutions are employed to mitigate hazards (medium development cost areas). In this respect, it may be more favourable for providing enhanced and rapid development capability to this portion of the Auckland market than much of the nearby Future Urban zoned land.

In addition, the Awhitu Group dunes located within the southwestern portion of the site are generally low development cost and low risk areas. This Geological unit also extends southward from the southwestern boundary of the site. This land to the southwest should also be considered valuable for development potential versus development risk whereas large areas of more difficult to develop land having deep-seated instability features are present to the north.

10 FURTHER WORK

The following further work is recommended as the project progresses:

- Detailed geotechnical investigations to assess geotechnical hazards across the site in association with urban development proposals; including quantifying geotechnical risk these hazards present, and what remediation / engineering solutions are required to reduce these risks to tolerable/acceptable levels.
- Detailed design of any remedial engineering solutions in accordance with the Building Code B1.

11 CLOSURE

Additional important information regarding the use of your CMW report is provided in the '*Using your CMW Report*' document attached to this report.

This report has been prepared for use by Ian Humphrey and Barker & Associates in relation to the proposed referral application for Resource Consent under the Fast Track Approval Act 2024 at 1080 State Highway 16 project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Ian Humphrey and Barker & Associates seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental Matters Are Not Covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

Appendix A: Updated Masterplan

Urban Design Statement

Waimauku Masterplan - Fast Track Referral Application

12/11/2025

B&A
Urban & Environmental

B&A

Urban & Environmental

Prepared for

Halberd Holdings Limited

Prepared by

Cam Wallace, Partner / Urban Designer
(Registered Urban Designer - UDIA)

Document date

12 November 2025

Barker & Associates
Contacts

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Kerikeri Whangarei Warkworth **Auckland** Tauranga Hamilton Cambridge Havelock North Wellington Christchurch Wanaka

Contents

1.1 Purpose and Scope

The site is located north-west of the existing Waimauku township and is bounded to the south by State Highway 16 which provides access to Auckland CBD and Helensville.

This Urban Design Statement for Waimauku is one of a suite of technical reports which have been prepared in support of a Fast Track Referral Application on behalf of Halberd Holdings Ltd.

The purpose of this Urban Design Statement is to provide high-level design background and thinking to that supports the development of a masterplan that will form the basis of a referral applicaiton. This document identifies urban design considerations relevant to Waimauku and is informed by national and local urban design policy and guidance.

Specifically, this report seeks to provide the following:

- An understanding and high-level analysis of the site in the Waimauku context. In particular, to the existing and planned movement patterns and existing natural features;
- An analysis of the constraints that will impact the urban development of the site which seeks to integrate the other specialists' reports and key issues which they have identified which will have implications on the spatial outcomes within the site;
- An analysis of the spatial opportunities the site presents in terms of residential development; and
- A recommendation for a masterplan that illustrates the spatial form outcomes for residential development of the site that reflects the above analysis of the sites' context, constraints and opportunities.

Figure 1 - Location of Waimauku in Auckland Region

1.2 Site Location and Regional Context

The site is located directly north west of the Waimauku town centre. State Highway 16 (SH16) forms the extent of the southern boundary while the raiway corridor passes through its centre.

The site is well connected being located directly adjacent to SH16 which provides quick and convenient access to Auckland CBD to the south east via Huapai and Riverhead, and Helensville toward the north. The drive time from the site to Auckland CBD is approximately 33 minutes outside of peak traffic hours.

Waimauku Park and Ride is located 600m from the eastern portion of the site. This provides access of Bus 125 to Westgate and Helensville.

The Waimauku village centre is located approximately 400m from the eastern portion of the site.

The site is currently within a Rural Production Zone. The site is located close to a number of residential catchments to the south eastern portion of the site.

Legend

- Strategic Route
- Arterial Road
- Railway

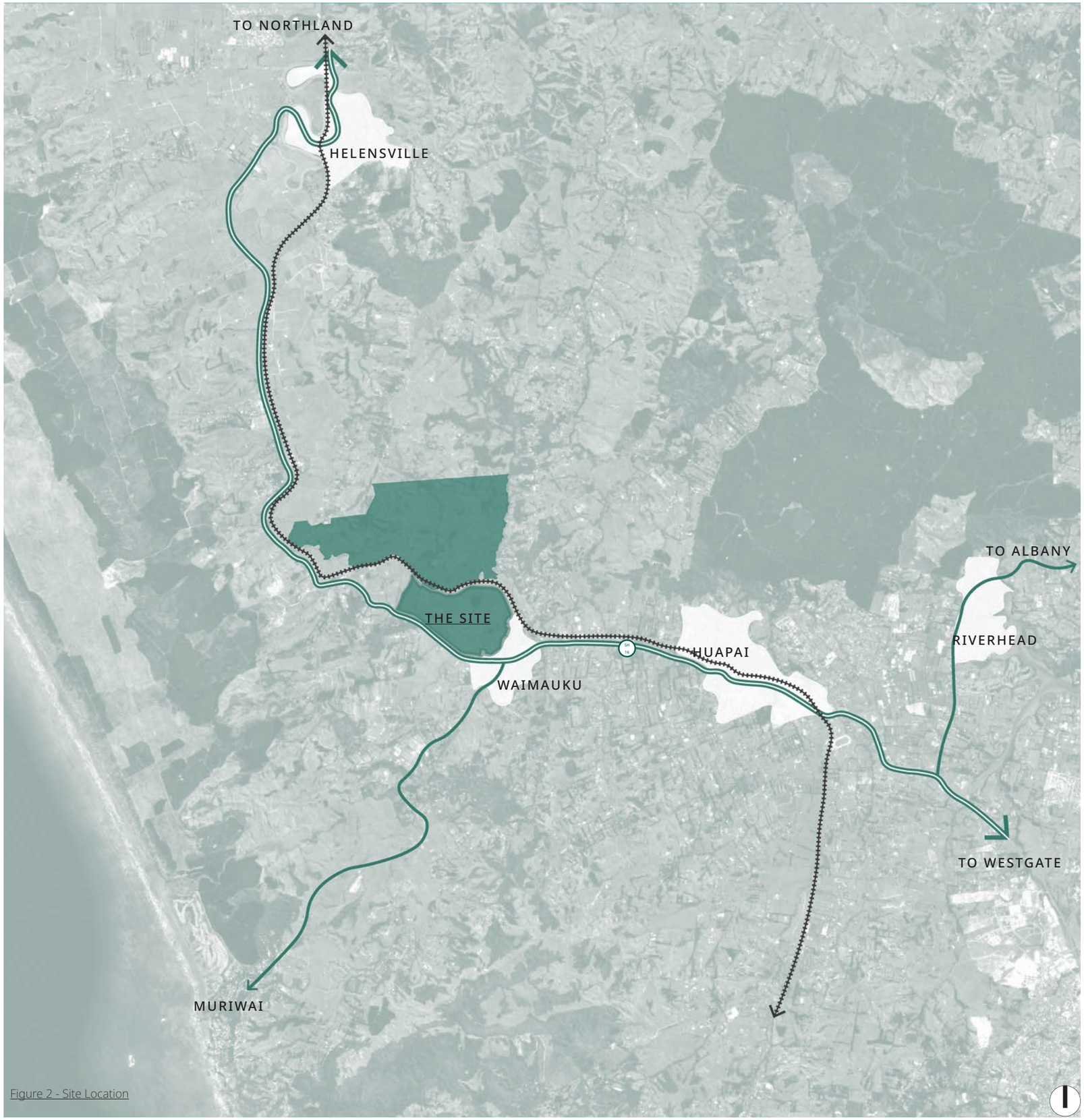


Figure 2 - Site Location

1.3 Site Overview

Halberd Holdings Limited have approximately 769Ha of land located immediately north-west of Waimauku, largely in use ofr pastoral farming.

Of this, 573Ha sits north of the railway corridor and can be accessed from an existing level crossing within the site or via Davidson Road. The balance of the site, south of the railway corridor, ecompassess approximately 196Ha and is accessed via multiple points along State Highway 16. The underlying title also includes a right-of-way easement providing potential access directly to Waimauku Station Road, over the Kaipara River.

For the purposes of this analysis, the southern portion of the site adjacent to the existing urban area is of most relevance when considering potential urban development.

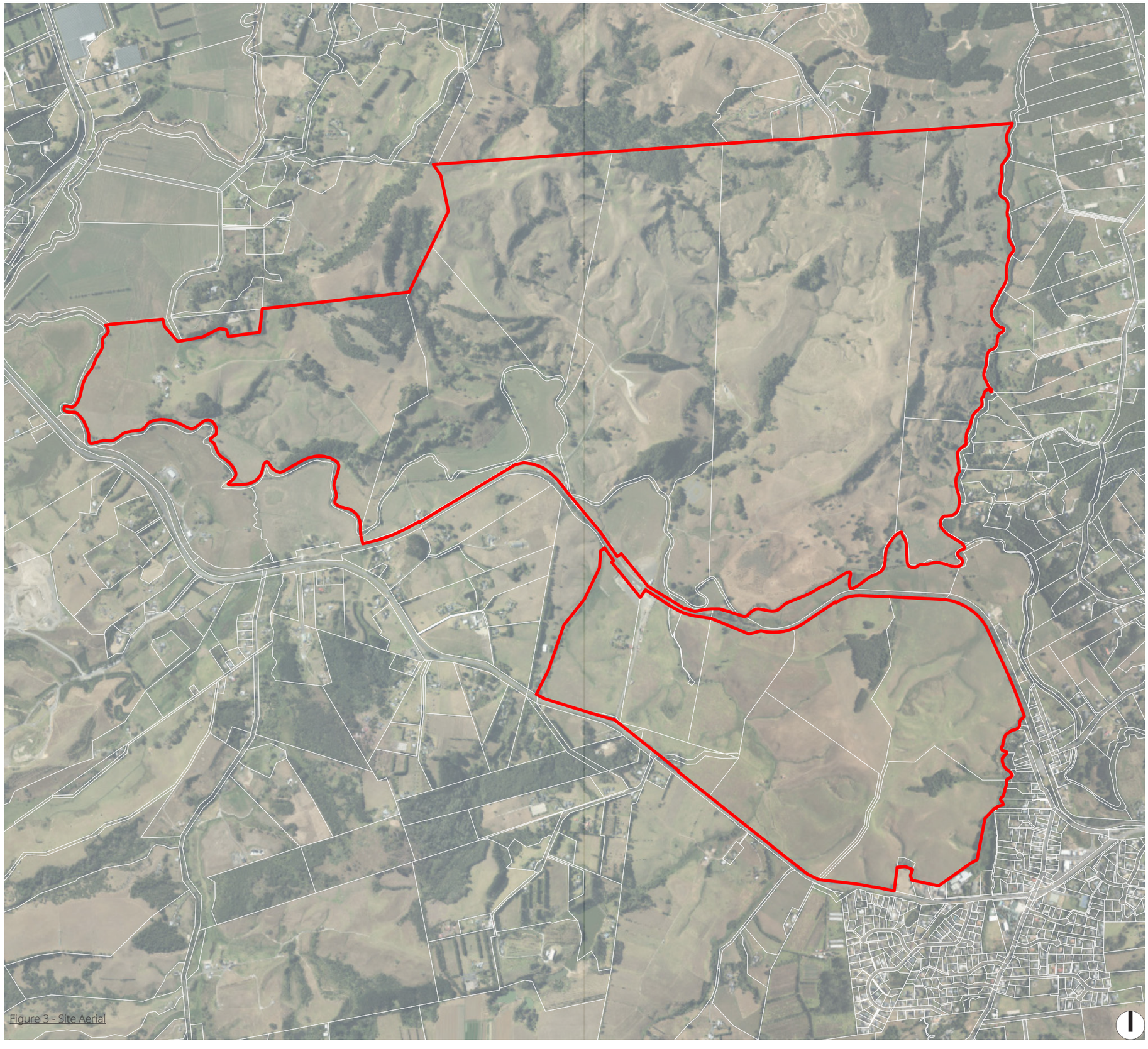


Figure 3 - Site Aerial

1.4 Planning Context

The site is located northeast of Waimauku Village Centre and zoned as 'Rural – Production Zone' under the AUP. The existing Waimauku urban area is largely zoned Residential - Single House with some additional Open Space zones, a small area of Business - Light Industry and Business - Local Centre. An area of Countryside Living currently extends north of Waimauku.

In addition to the underlying zones, the site also features several stands of native vegetation classed as Significant Natural Areas and a ridgeline protection overlay. A designation under the authority of Kiwirail also partially bisects the site and incorporates an underlying zone of Strategic Transport Corridor. The designation and zone boundary largely follows along a tributary of the Kaipara River.

Legend

- Residential - Single House Zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Open Space - Community Zone
- Business - Local Centre Zone
- Business - Light Industry Zone
- Rural - Rural Production Zone
- Rural - Countryside Living Zone
- Rural - Countryside Living Zone
- Strategic Transport Corridor Zone
- Water
- Significant Ecological Area
- Ridgeline Protection Overlay

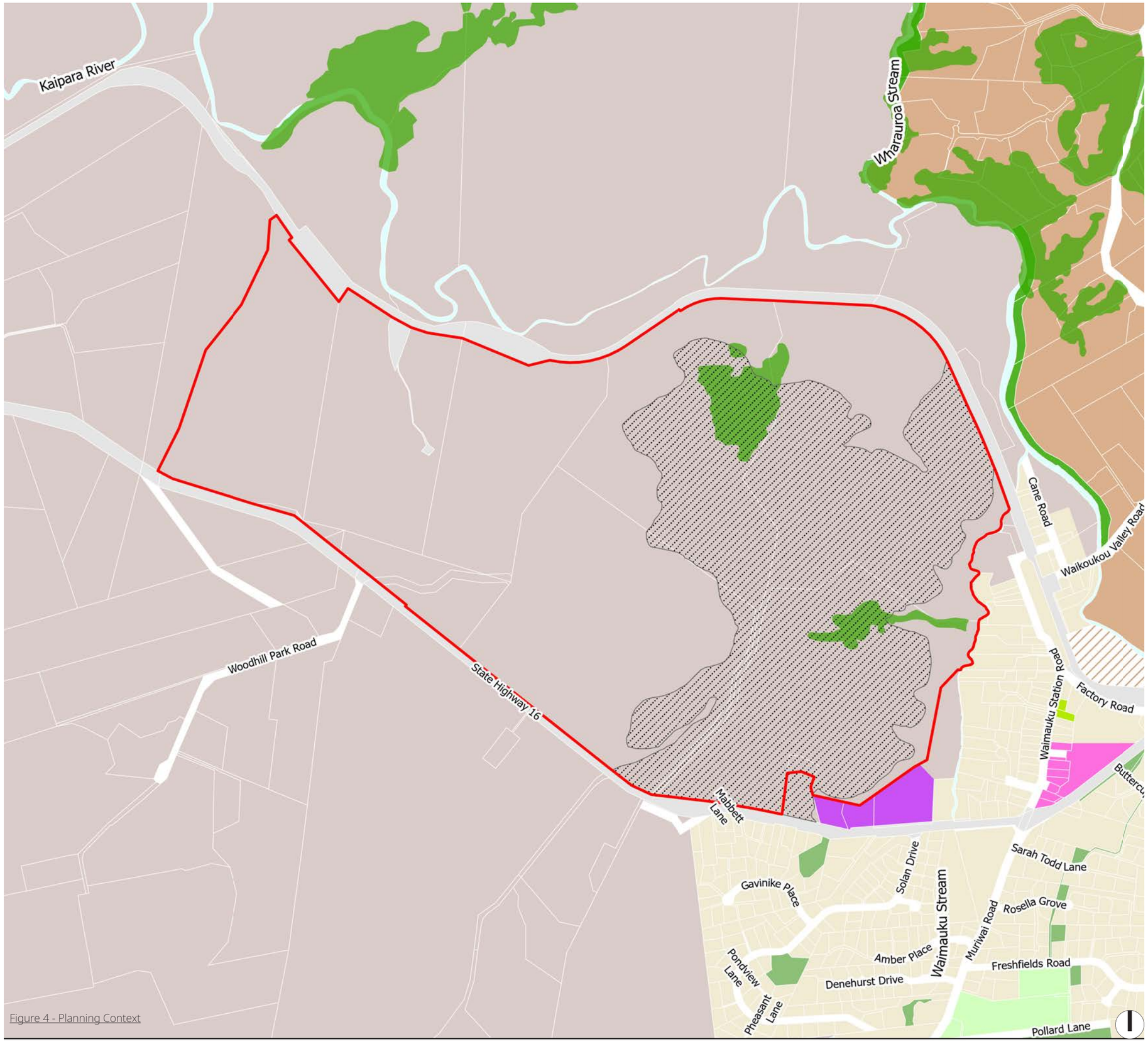
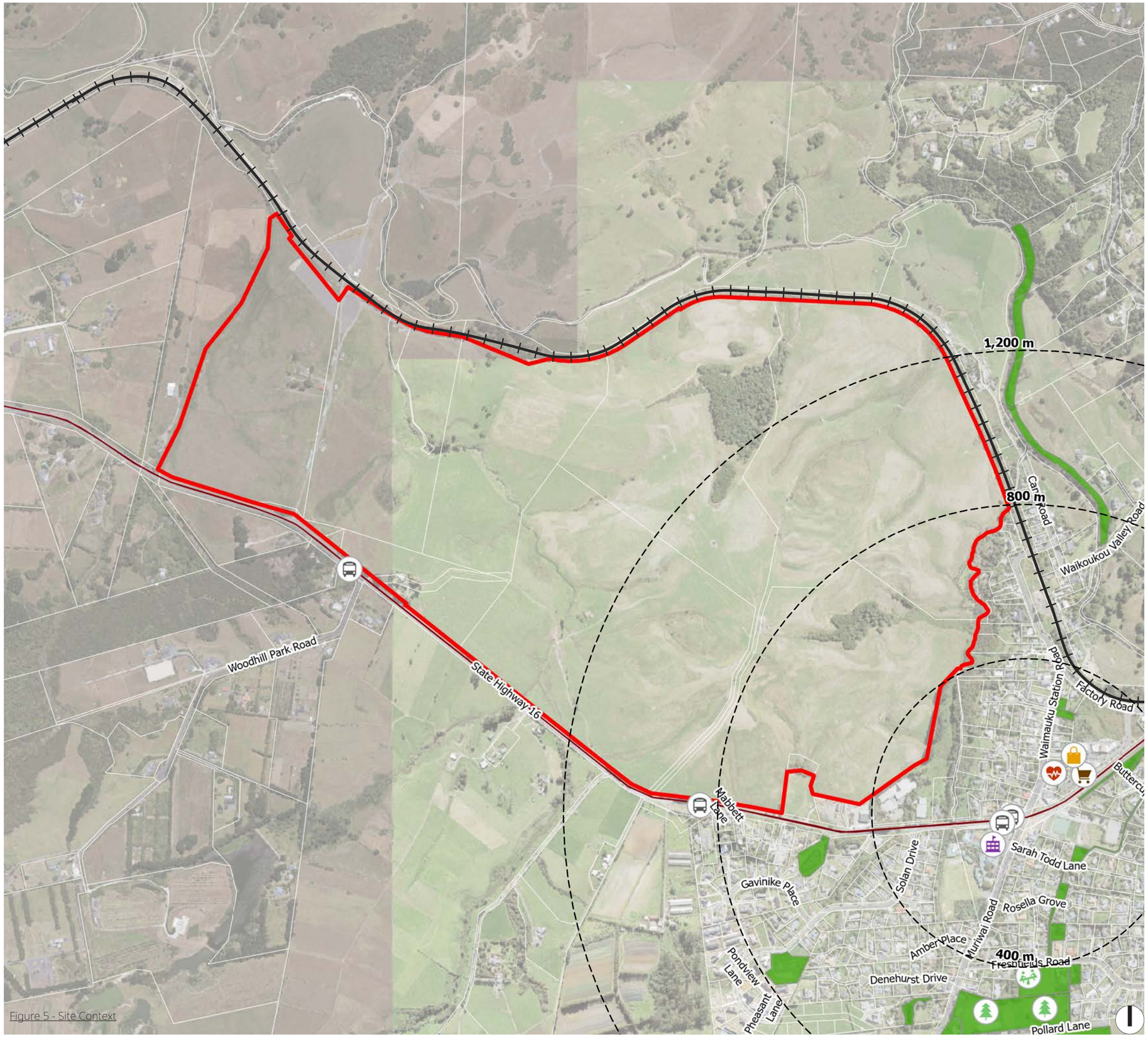


Figure 4 - Planning Context

1.5 Site Context

The southern portion of the site is approximately 196Ha in size comprising serveral land parcels and has road frontage to SH16 along the southern boundary. There are several access points off SH16 already in existence.

A number of existing amenities and social infrastructure are located in close proximity to the site. Waimauku village centre is located in around 400m south east of the site. This area comprises a number of amenities including Waimauku School, kindergarten, medical centre, supermarket, public open space, community facilities.



Legend

- Community Hall
- Medical Centre
- Playground
- Park
- School
- Supermarket
- Waimauku Village
- Bus Stop
- Bus 125 Route
- Railway Corridor
- Open Space

Figure 5 - Site Context

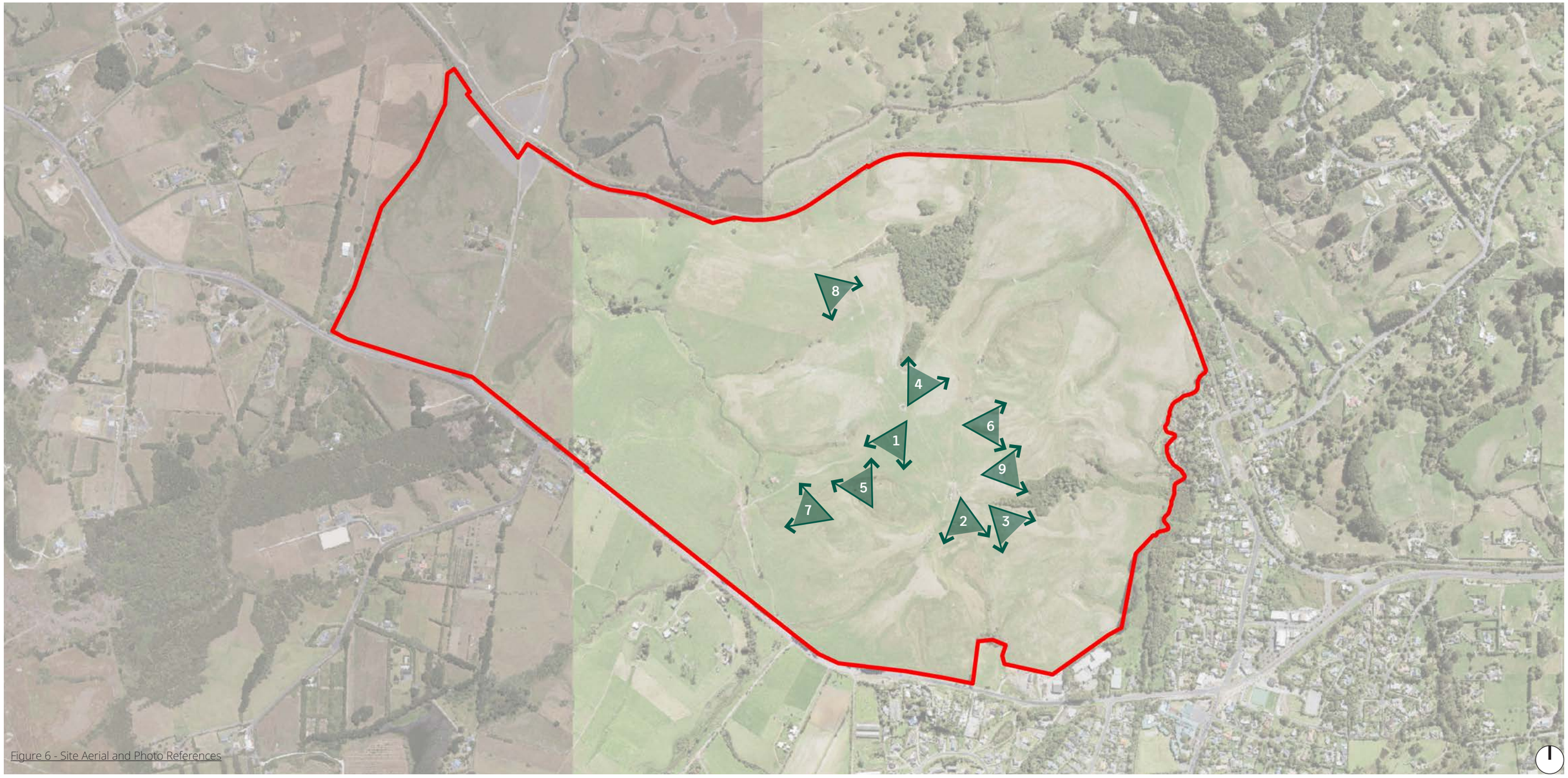


Figure 6 - Site Aerial and Photo References

1.6 Understanding the Site

The site is predominantly in pasture but also, includes a mix of native and exotic bush, streams, and potential wetlands. A main ridgeline runs through the east, along with a tributary of the Kaipara River. Small gullies shape natural drainage patterns, which, along with the existing vegetation, are key landscape features. As evidenced by the site photos on the following page, areas of steeper terrain give way to large areas of flat or gently sloping terrain which would be suitable for urban uses.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4


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1.7 Existing Contour and Elevation

The site's topography slopes away from the ridgeline in the eastern portion of the site.

The topography creates a unique sense of space and plays a strong role in determining a site's characteristics in terms of the alignment of streets, lot boundaries, building platforms and open space.

Whilst these areas are typically viewed as development and connectivity constraints, site planning considerations and opportunities include:

1. Utilise low lying areas typically associated with streams to identify an open space network for amenity, recreation and ecological enhancement.
2. Areas of higher elevation could be graded to a degree in order to fill some of the less sensitive gully areas to enable more efficient development outcomes.

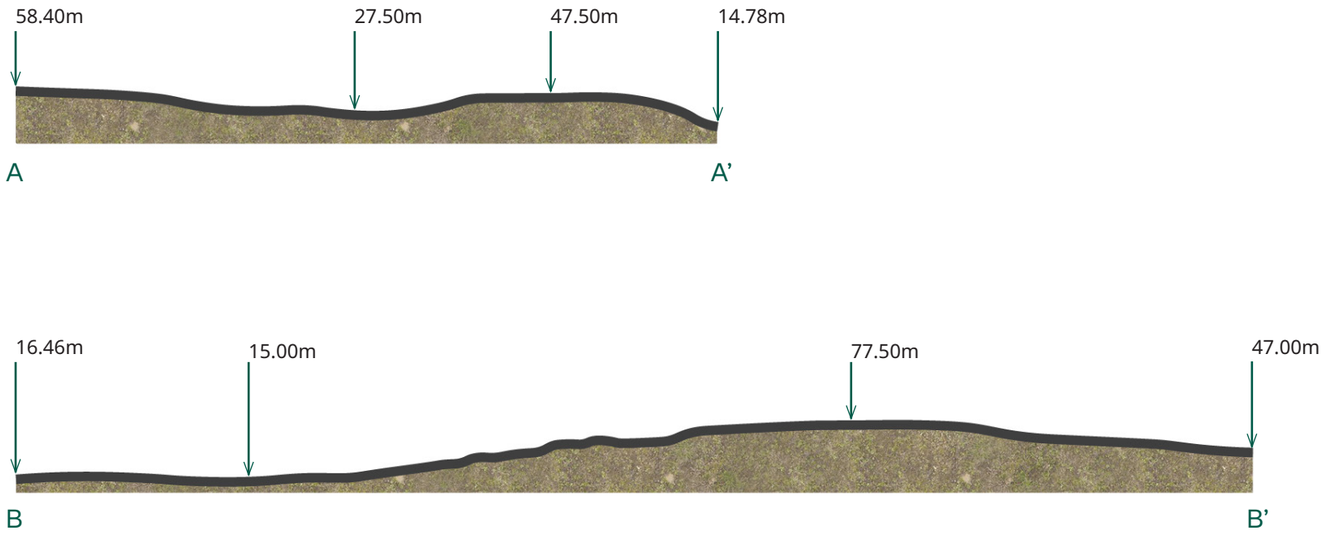


Figure 9 - Sections

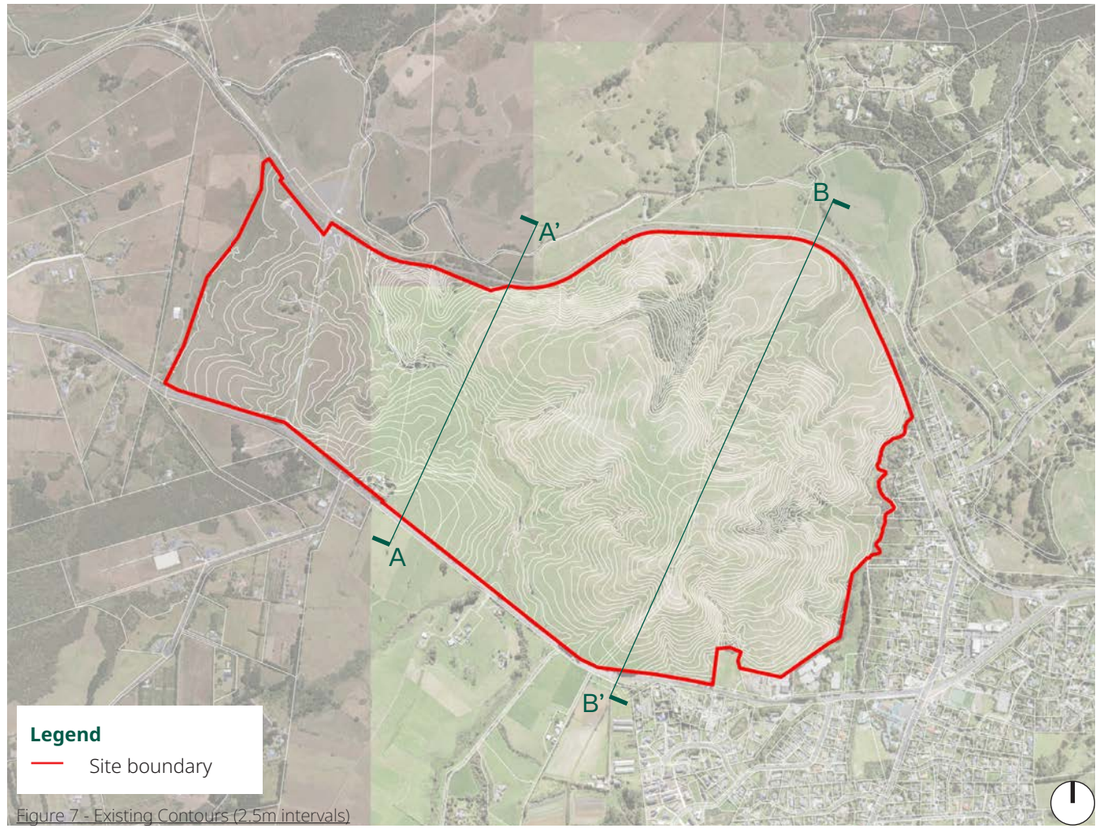


Figure 7 - Existing Contours (2.5m intervals)

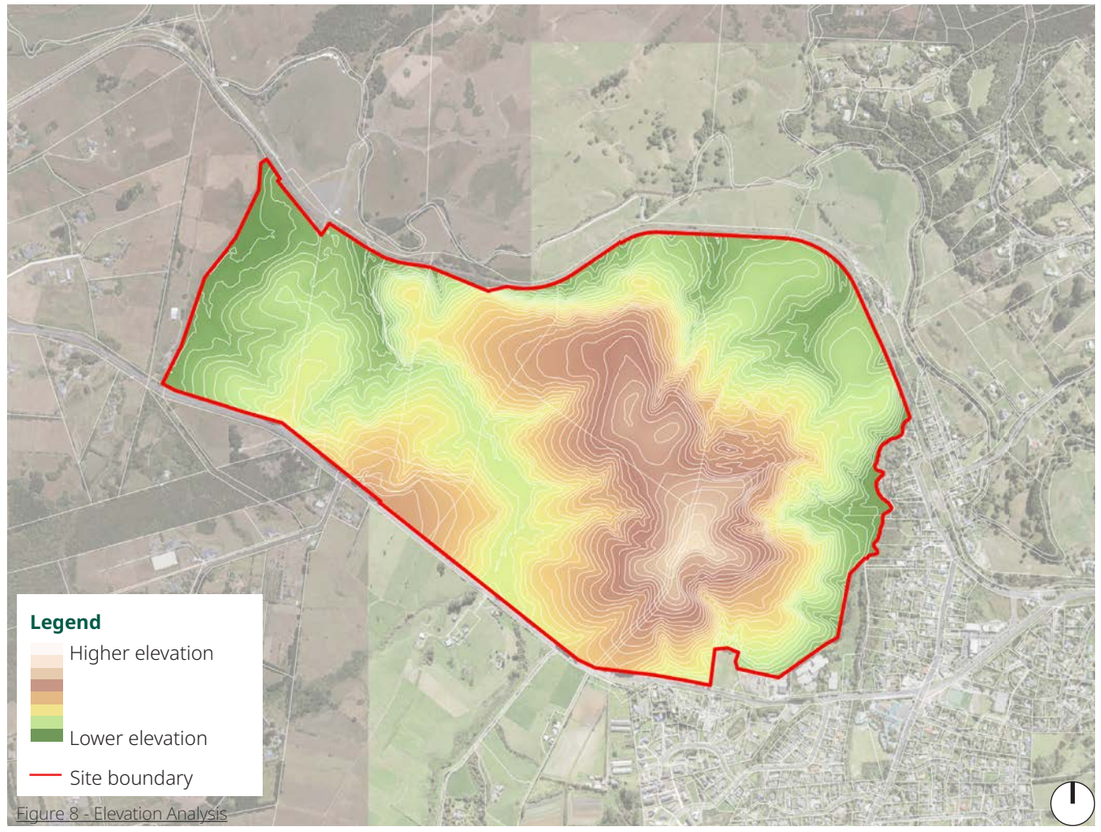


Figure 8 - Elevation Analysis

1.8 Slope and Aspect

The site's topography slopes away from the ridgeline in the eastern portion of the site. Some parts of the site slope steeply and will require carefull consideration in terms of land development / retaining to ensure an appropraite transition between any future streets, open spaces and residential lots.

The topography has the potential to create a unique sense of space and plays a strong role in determining a site's characteristics in the frame of alignment of streets, lot boundaries, building platforms and types of open space.

Whilst these areas are typically viewed as development and connectivity constraints, site planning considerations and opportunities associated with slope and aspect include:

1. Steep areas located in close proximity to sensitive ecological areas could be included within riparian margins to enhance ecological and amenity buffers;
2. Road and block layouts will need to take into consideration the ability to achieve appropriate grades without requiring overly circuitous routes and significant retaining (e.g. over 2m in height);
3. The aspect analysis demostrates the potential spatial arrangement for the future lots / dwellings that can maximise a northern orientation.

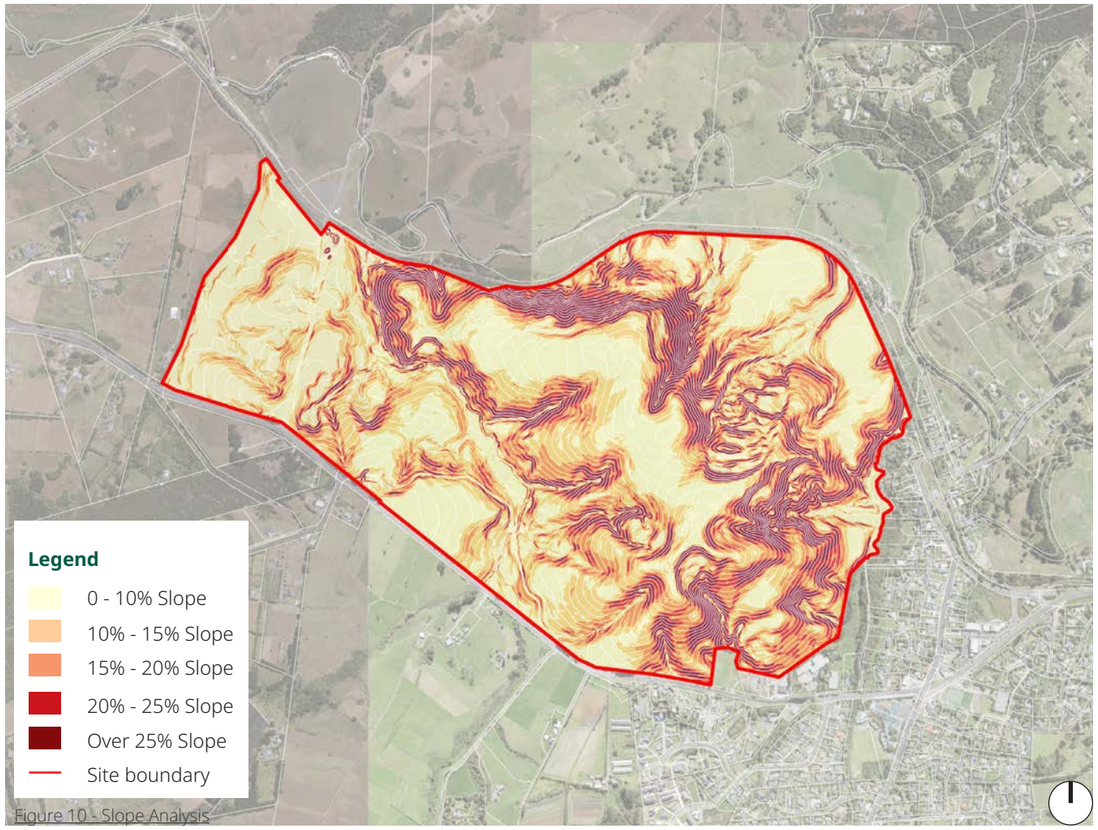


Figure 10 - Slope Analysis

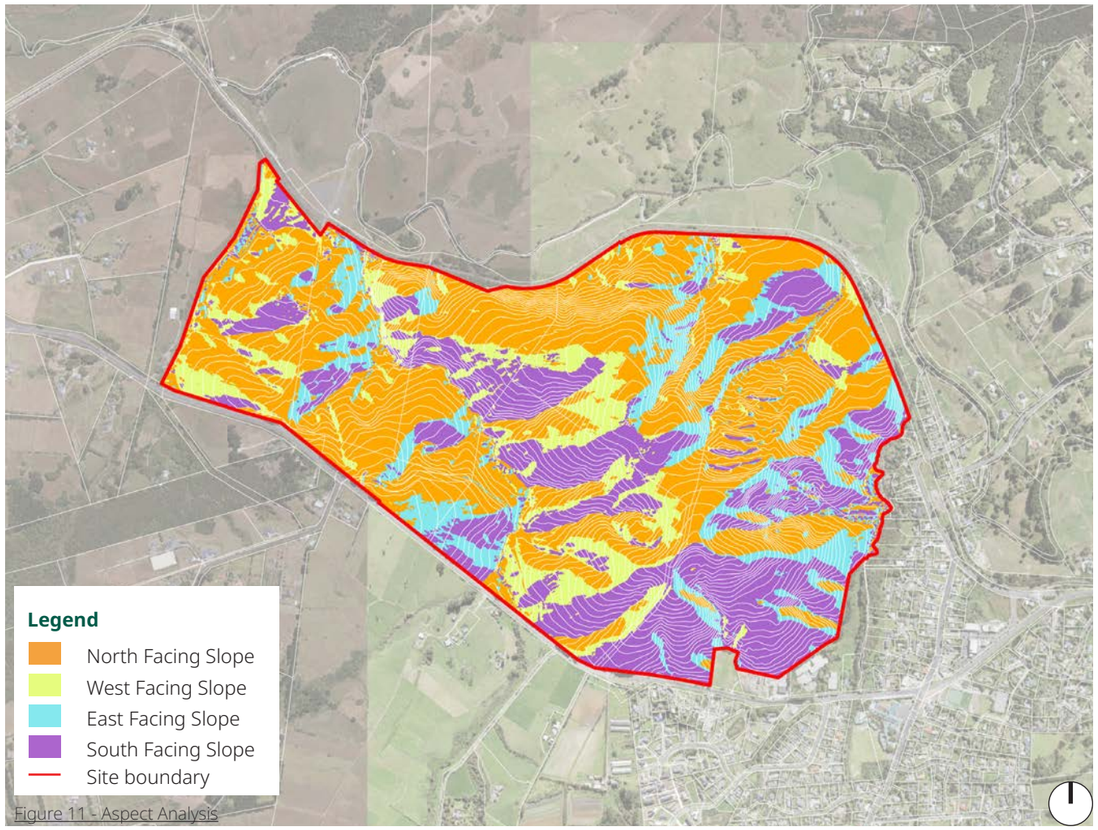


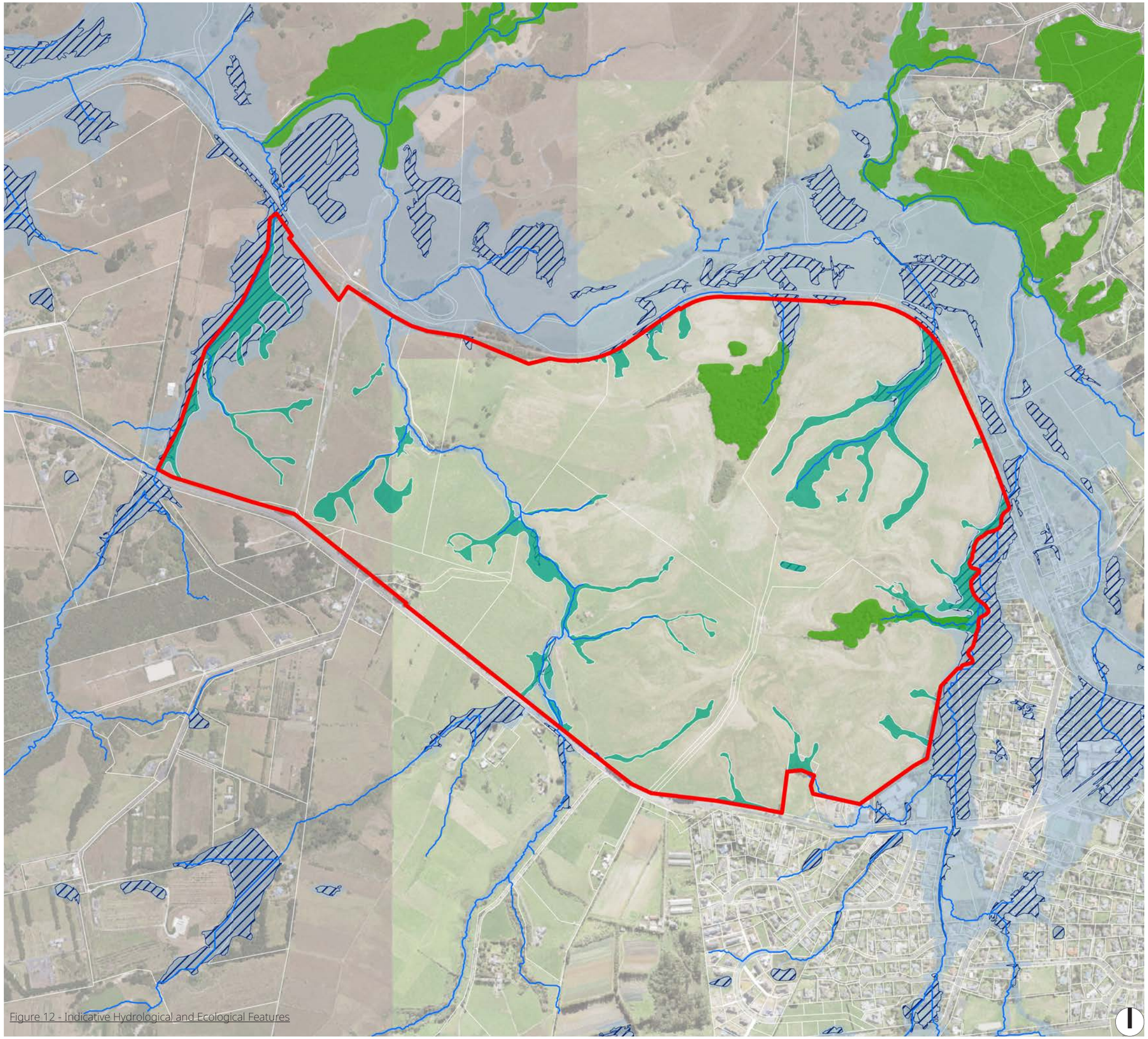
Figure 11 - Aspect Analysis

1.9 Hydrology & Ecology

The site has a rich underlying ecological layer based on its distinctive topography. The diagram is indicative only based on the desk top research and further investigation will be needed from professional ecologists. Existing waterways, wetlands and potential flood retention areas lead to development and connectivity constraints.

Site planning considerations and opportunities include:

1. Maintenance and enhancement of Significant Ecological Areas - this includes ensuring future landscaping responds to their particular ecological values;
2. Riparian setbacks from waterways and wetlands planted with eco-sourced native plants to improve ecological outcomes;
3. Public open spaces that provide for the treatment, drainage and in some cases retention of stormwater; and
4. A connected green network including a legible and safe pedestrian and cycle network providing future residents with access to nature and enhanced connectivity.



Legend

- Permanent Stream
- Flood Plain
- Flood Sensitive Area
- Potential Wetland (subject to future ecological assessment)
- Significant Ecological Area

Figure 12 - Indicative Hydrological and Ecological Features

1.10 Opportunities and Constraints

The site investigations and information gathering stage, including gaining feedback, advice and insights from the site analysis and desktop investigation, has helped to understand site constraints and to respond with a range of opportunities for conceptual site planning.

Legend

- Existing Ridgeline Protection Overlay
- Permanent Streams
- Flood Plain
- Potential Wetland (subject to future ecological assessment)
- Significant Ecological Area
- Steep Land (over 20% slope) and geotechnical issues
- Potential Employment Land adajcent to State Highway and on the flatest land
- SH 16
- Existing Vehicle Access within the site
- Existing Access Point
- Limited opportunities to connect with the Village Centre
- Establish a Connection with Village Centre from the site
- Potential higher residential densities on the flatter areas
- Potential to use the balance of the farm to support on-site servicing (e.g. wastewater disposal)
- Viewshafts to wider landscape on the high point of the site and establishment of community node
- Potential noise and vibration impacts from SH16 and railway corridor
- Enhancement of riparian corridors to support stormwater management, ecology and connectivity outcomes
- Potential community / commercial node central to the site and linked with key ecological corridors to provide for residents day-to-day needs

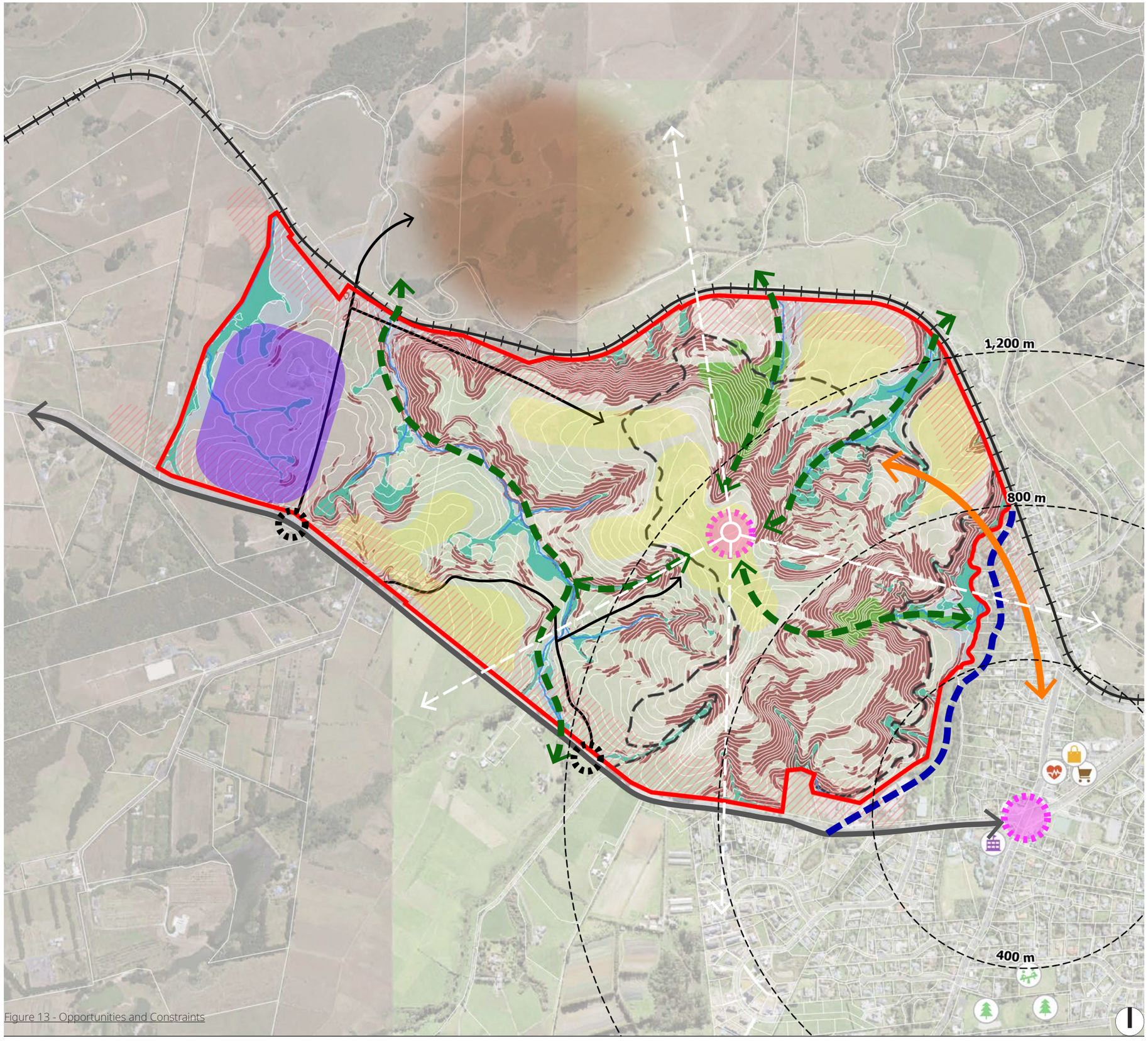
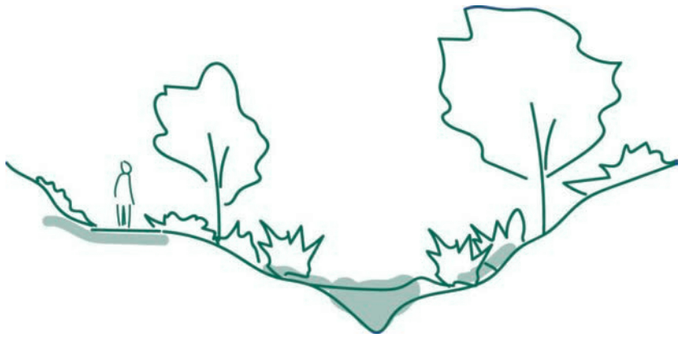


Figure 13 - Opportunities and Constraints

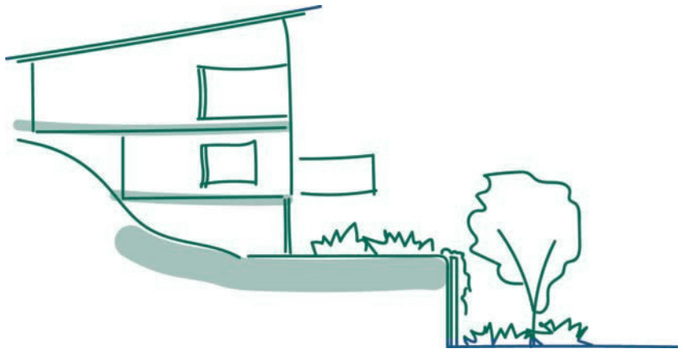
2.0 Design response

2.1 Design Principles

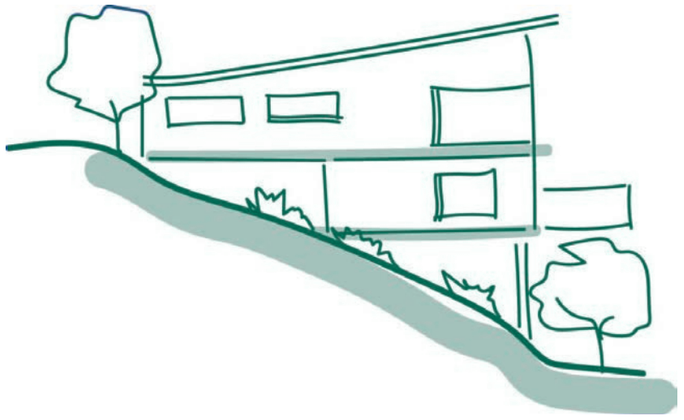
These design principles build off the opportunities and constraints and have been developed to help inform the detailed testing and layout of a block structure and lot layout across the site.



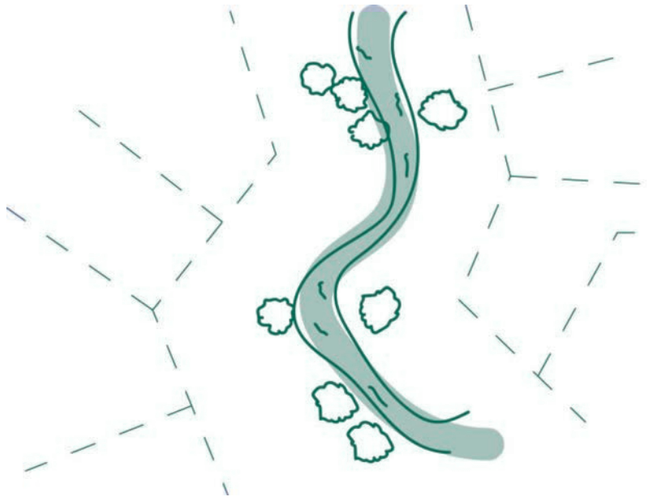
Re-vegetation and implementation of riparian planting along water courses



Street interfaces - fencing / retaining treatments

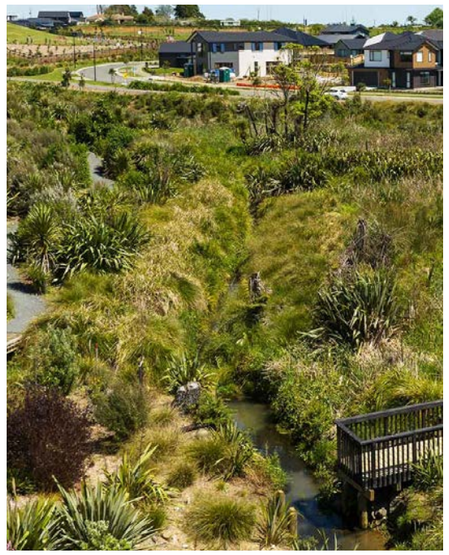


Specific lot and road design that respond to the contours of the site



Flexibility in lot sizes and arrangements to respond to natural environment - consideration of building platforms

2.2 Design Precedents



2.3 Slope Adaptive Housing

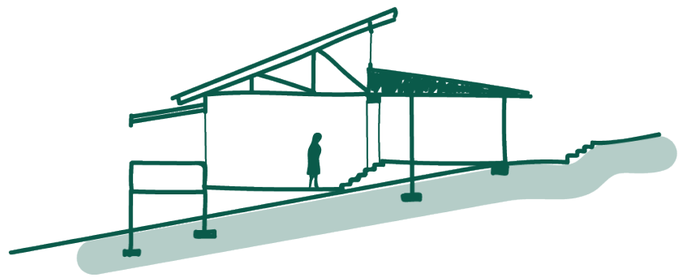
The Site has a large portion of sloping terrain, some of which is heavily vegetated and of ecological significance to the site while other steeply sloping areas function as key overland flow paths and watercourses.

Protection of these areas may require the development of some housing typologies which is adaptive across the site to preserve the ecological features through sympathetic housing.

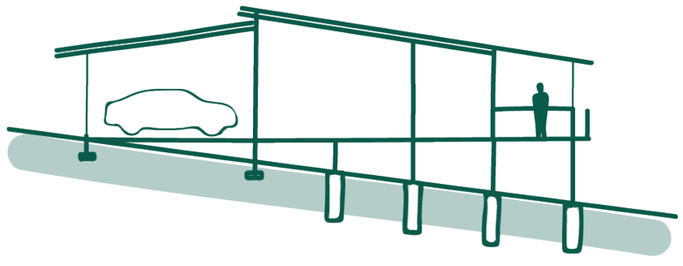
Slope Adaptive Housing could benefit development of the Site in a number of ways, including:

- Ensuring the layout of new development positively responds to the undulating topography
- Minimising disturbance to the natural topography through excessive earthworks and associated retaining structures
- Minimising cut and fill on sloping sites through site responsive house design
- Avoiding impacts from storm water run-off on neighbouring properties, streets and public spaces.

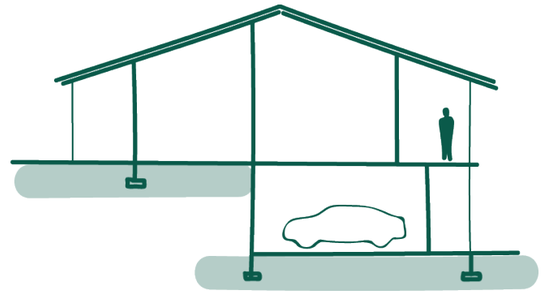
Stepped floor levels -
approximate 10% slope
(north facing slope)



Stepped floor levels -
approximate 15% slope
(south facing slope)



Down slope site -
approximate 20% slope
(driveway from above)



Up slope site -
approximate 20% slope
(driveway from below)

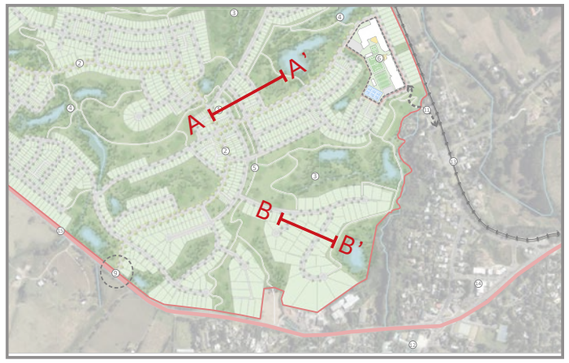
Figure 14 - Illustrative Masterplan

2.4 Illustrative Masterplan

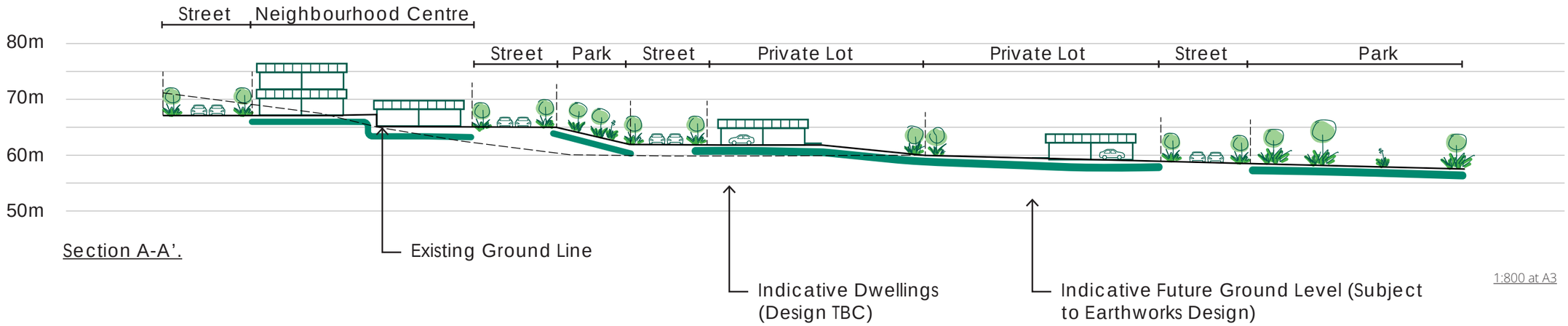
The Illustrative Masterplan presents a vision for urban development of the site. Key landscape and ecological features of the site are maintained whislt facilitating a vareity of residential typologies that respond to the market. Depending on detailed design it is estimated that the site could accommodate between 1,500 and 2,020 new residential dwellings.

Provision has also been made for two potential school sites (subject to further discussion with MoE), a neighbourhood centres and parks, land for business uses, stormwater management, and recreational trails.

2.5 Indicative Cross Sections

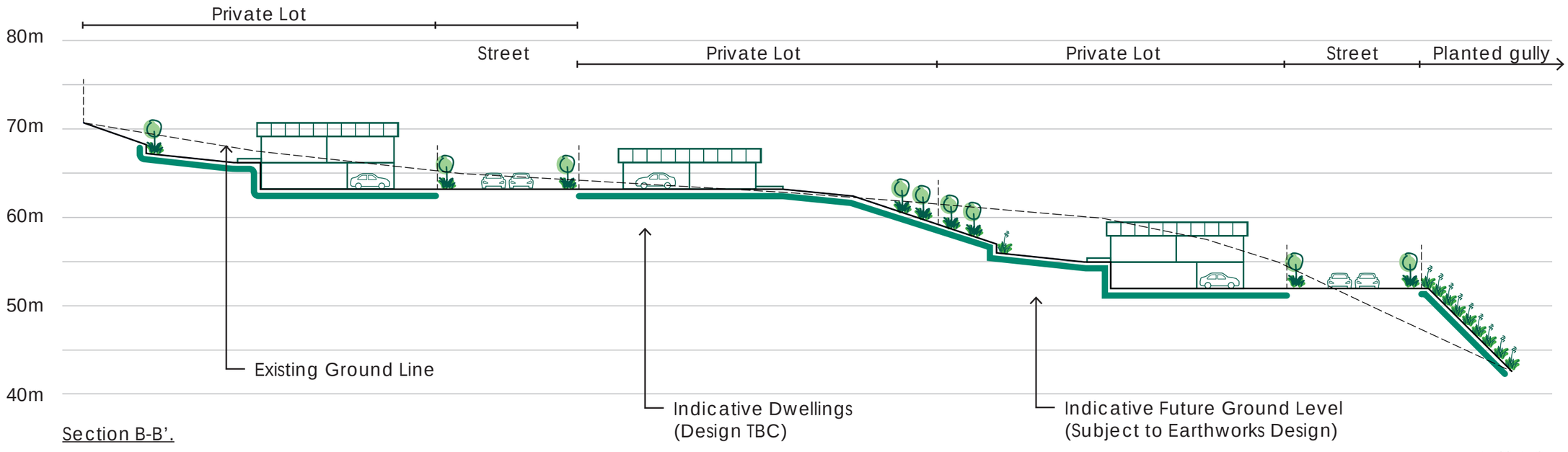


Key Plan (Not to Scale).



Section A-A'.

1:800 at A3



Section B-B'.

1:500 at A3

Figure 15 - Key Connections Plan

2.6 Connectivity

A central "Primary Collector Road" is proposed to run through the spine of the development and provide vehicular connection points to SH16. This route would be designed to support public transport routes to and from the site and provides a link to several key destinations within the site. The Masterplan also provides for two "Secondary Collector Roads" which may accommodate greater levels of vehicle movements and could benefit from segregated cycling provision. In addition to those key roads identified, there are several important off-road pedestrian and cycling connections proposed through the site along riparian corridors and to provide access to the existing Waimauku Village. These routes generally converge in the proposed location of the neighbourhood centre, located centrally within the site.

B&A

Urban & Environmental

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Kerikeri | Whangarei | Warkworth | Auckland | Tauranga | Hamilton | Cambridge | Havelock North | Wellington Christchurch | Wanaka

Appendix B: Geomorphology and Geology Plans

Title	Reference No.	Date	Revision
Geomorphology and Geology Plan (West)	01	13/02/25	0
Geomorphology and Geology Plan (East)	02	13/02/25	0

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA

LEGEND:

- SITE BOUNDARY
- BASE OF GULLY FORMATION
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- SWAMPY GROUND
- HUMMOCKY GROUND

GEOLOGY:

- HOLOCENE TAURANGA GROUP ALLUVIUM
- PLEISTOCENE TAURANGA GROUP ALLUVIUM
- AWHITU GROUP DUNE DEPOSITS
- HELENSVILLE CONGLOMERATE (WAITEMATA GROUP)
- CORNWALLIS FORMATION (WAITEMATA GROUP)

CMW Geosciences

CLIENT: HALBERD HOLDINGS LTD		DRAWN: TE	PROJECT No: AKL2025-0012
PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 01
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOMORPHOLOGY AND GEOLOGY PLAN**		DATE: 13/02/2025	SHEET: A3

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA

LEGEND:

- SITE BOUNDARY
- MAJOR HEAD SCARP
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- BASE OF GULLY FORMATION
- SWAMPY GROUND
- HUMMOCKY GROUND

GEOLOGY:

- HOLOCENE TAURANGA GROUP ALLUVIUM
- PLEISTOCENE TAURANGA GROUP ALLUVIUM
- AWHITU GROUP DUNE DEPOSITS
- HELENSVILLE CONGLOMERATE (WAITEMATA GROUP)
- CORNWALLIS FORMATION (WAITEMATA GROUP)

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PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 02
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOMORPHOLOGY AND GEOLOGY PLAN**		DATE: 13/02/2025	SHEET: A3

Appendix C: Geomorphology and Geotechnical Hazard Plans

Title	Reference No.	Date	Revision
Geomorphology and Geotechnical Hazards Plan (West)	03	13/02/25	0
Geomorphology and Geotechnical Hazards Plan (East)	04	13/02/25	0

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA

LEGEND:

- SITE BOUNDARY
- BASE OF GULLY FORMATION
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- SWAMPY GROUND
- HUMMOCKY GROUND
- UNCONTROLLED FILL HAZARD
- LIQUEFACTION POTENTIAL HAZARD
- SHALLOW SLOPE INSTABILITY / SOIL CREEP HAZARD
- DEEP-SEATED SLOPE INSTABILITY HAZARD

CMW Geosciences

CLIENT: HALBERD HOLDINGS LTD		DRAWN: TE	PROJECT No: AKL2025-0012
PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 03
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOMORPHOLOGY AND GEOTECHNICAL HAZARD PLAN**		DATE: 13/02/2025	SHEET: A3

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA

LEGEND:

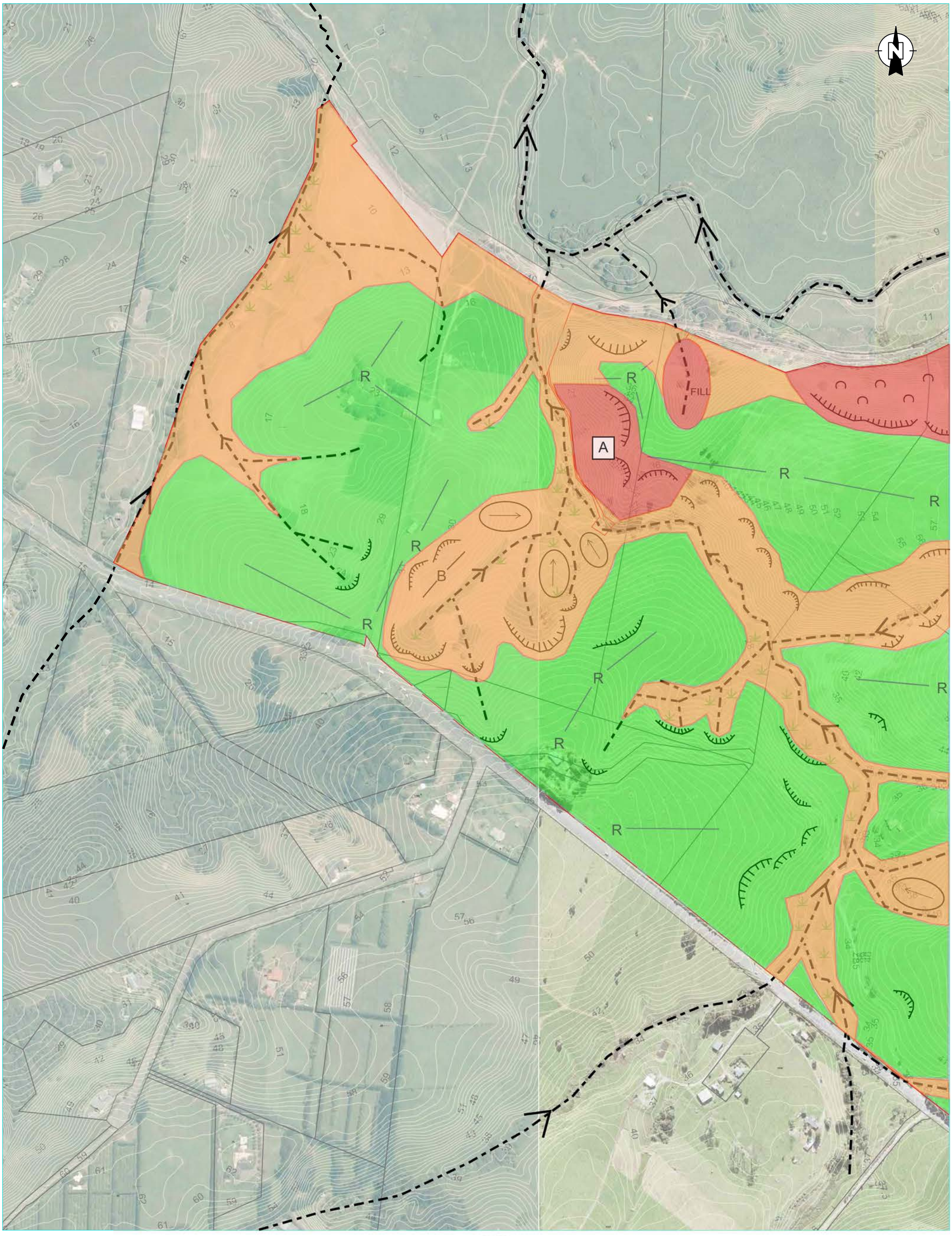
- SITE BOUNDARY
- MAJOR HEAD SCARP
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- BASE OF GULLY FORMATION
- SWAMPY GROUND
- HUMMOCKY GROUND
- LIQUEFACTION POTENTIAL HAZARD
- SHALLOW SLOPE INSTABILITY / SOIL CREEP HAZARD
- DEEP-SEATED SLOPE INSTABILITY HAZARD

CMW Geosciences

CLIENT: HALBERD HOLDINGS LTD		DRAWN: TE	PROJECT No: AKL2025-0012
PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 04
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOMORPHOLOGY AND GEOTECHNICAL HAZARD PLAN**		DATE: 13/02/2025	SHEET: A3

Appendix D: Geotechnical Zoning Plans

Title	Reference No.	Date	Revision
Geotechnical Zoning Plan (West)	05	13/02/25	0
Geotechnical Zoning Plan (East)	06	13/02/25	0



LEGEND:

- SITE BOUNDARY
- BASE OF GULLY FORMATION
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- SWAMPY GROUND
- HUMMOCKY GROUND
- LOW DEVELOPMENT PREMIUM (COST) AREAS
- MEDIUM DEVELOPMENT PREMIUM (COST) AREAS
- HIGH DEVELOPMENT PREMIUM (COST) AREAS

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA
2. DEFINITIONS OF DEVELOPMENT AREAS ARE OUTLINED IN OUR REPORT AKL2021-0058AB Rev 0

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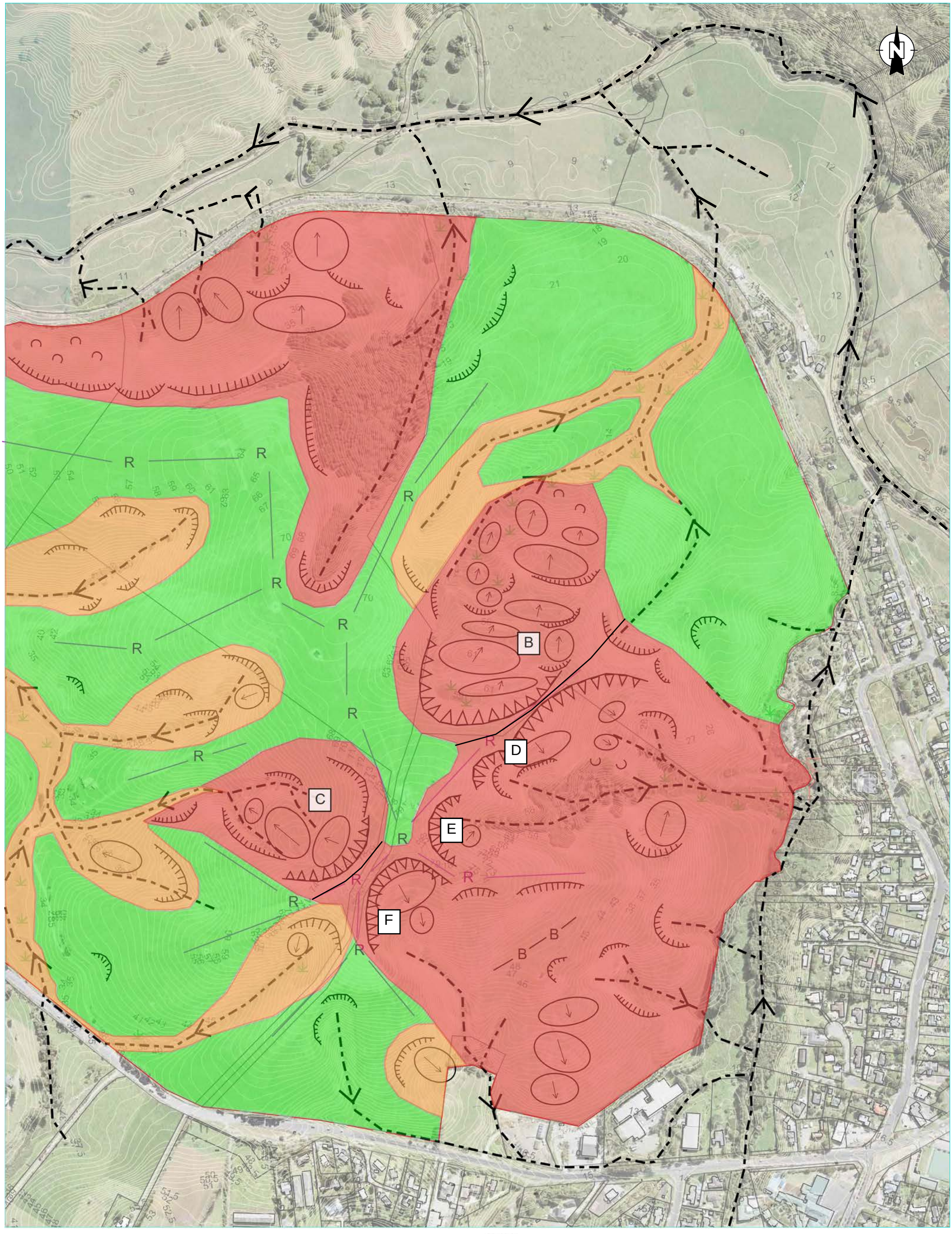
CLIENT: HALBERD HOLDINGS LTD		DRAWN: TE	PROJECT No: AKL2025-0012
PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 05
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOTECHNICAL ZONING PLAN**		DATE: 13/02/2025	SHEET: A3



LEGEND:

- SITE BOUNDARY
- MAJOR HEAD SCARP
- MINOR HEAD SCARP
- DEBRIS MOUND / ARROW IN DIRECTION OF SLOPE MOVEMENT
- B — BENCH FORMATION
- R — PROMINENT RIDGE
- BASE OF GULLY FORMATION
- SWAMPY GROUND
- HUMMOCKY GROUND
- LOW DEVELOPMENT PREMIUM (COST) AREAS
- MEDIUM DEVELOPMENT PREMIUM (COST) AREAS
- HIGH DEVELOPMENT PREMIUM (COST) AREAS

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS DATA
2. DEFINITIONS OF DEVELOPMENT AREAS ARE OUTLINED IN OUR REPORT AKL2021-0058AB Rev 0

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CLIENT: HALBERD HOLDINGS LTD		DRAWN: TE	PROJECT No: AKL2025-0012
PROJECT: **1080 STATE HIGHWAY 16, WAIMAUKU**		CHECKED: RK	DRAWING: 06
		REVISION: 0	SCALE: 1:5000
TITLE: **GEOTECHNICAL ZONING PLAN**		DATE: 13/02/2025	SHEET: A3