Belmont Quarry Development – Part F

Substantive Application
Appendix F.1.B.12 – Land Exchange Application - Geotechnical Report
Winstone Aggregates

16 August 2026

Geotechnical Appraisal Report

Land Exchange Belmont Quarry Development Project

Wellington

Date: 1 December 2025

Job Reference: BGL000252 v1.0

Report prepared for: Winstone Aggregates

BASELINE GEOTECHNICAL

Document Control

Title:	Geotechnical Appraisal Report – Land Exchange Belmont Quarry Development Project			
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**
29/08/2025	0.1	First Draft	CJL	THL
05/09/2025	0.2	Second Draft – for consultation	CJL	THL
10/09/2025	0.3	Third Draft – for consultation	CJL	THL
27/11/2025	0.4	Fourth Draft - Addition of Southern Gully	CJL	THL
01/12/2025	1.0	First Issue	CJL	THL
Distribution				
Client: Winstone Aggregates				

Contents

1 Introduction 1

2 Land exchange locations 1

3 Regional geological setting 2

4 Dry Creek sites 3

4.1 General 3

4.2 Development of the site 4

4.3 Dry Creek – Northeastern and southwestern slopes 6

4.3.1 General 6

4.3.2 Slope instability hazard 6

4.4 Dry Creek – Northwestern slopes 7

4.4.1 General 7

4.4.2 Aerial photography 7

4.4.3 Site observations 7

4.4.4 Discussion 8

5 Firth Block exchange parcel 9

5.1 General 9

5.2 Aerial photographs & lidar 9

5.3 Site observations 10

5.4 Western boundary with Belmont Quarry 11

5.4.1 Area A 13

5.4.2 Area B 13

5.4.3 Area C 13

5.5 Discussion 15

6 Belmont Northern Gully land exchange parcel 17

6.1 General 17

6.2 Aerial photographs & lidar 17

6.3 Observations 17

6.4 Discussion 18

7 Belmont Southern Gully land exchange parcel 19

7.1 General 19

7.2 Aerial photographs & lidar 19

7.3 Discussion 20

8 Summary and Conclusions....20

9 Applicability....21

Appendices

Appendix A – Cameron Lines CV

Appendix B – Figures

1 Introduction

Winstone Aggregates (Winstone), a division of Fletcher Concrete and Infrastructure Limited (Fletcher), is undertaking a major development to expand its operations at Belmont Quarry, located in Lower Hutt in the Wellington Region. The expansion is critical to securing a reliable supply of high-quality aggregate for infrastructure and construction projects throughout the region.

A key component of the expansion is the creation of a new OBDA adjacent to the existing quarry footprint. To enable this, Winstone is proposing a land exchange involving approximately 34.1 hectares of Fletcher-owned land to be added to the conservation estate, in return for approximately 23.2 hectares of Crown-owned reserve land managed and controlled by Greater Wellington Regional Council as part of Belmont Regional Park.

Baseline Geotechnical Limited (BGL) has been engaged to undertake an assessment of the 34.1 hectares of Fletcher-owned land to be added to the conservation estate, specifically considering the stability of that land.

The scope of works was set out in our offer of service dated 24 June 2025.

The author of this report, Cameron Lines, confirms that, in his capacity as author of this report, he has read and agrees to abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. Cameron Lines' experience and expertise is set out in his CV at Appendix A.

2 Land exchange locations

The areas of Winstone land proposed as part of the land exchange are set out in Figure 2-1 and Appendix B, Figure 1.

These include:

- Dry Creek – Northeastern and southwestern slopes.
- Dry Creek – Northwestern slopes.
- Firth Block.
- Belmont Northwestern Gully.
- Belmont Southern Gully

Each of these sites is addressed in the following sections.

Figure 2-1: Illustration of the proposed Land Exchange parcels

3 Regional geological setting

The published geological map for the area (Figure 3-1) indicates that the proposed Winstone exchange land is underlain by undifferentiated Rakaia Terrane comprising sandstone and mudstone (Greywacke)[1]. Undifferentiated Pleistocene and Holocene river deposits are mapped within the surrounding area but outside of the property boundaries.

Numerous faults are present on the geological map including the Wellington Fault which is positioned immediately east of both the Belmont Quarry and Dry Creek sites. The Wellington Fault is designated as active by GNS.

[1] Retrieved from GNS (https://data.gns.cri.nz/geology/) on 25 August 2025.

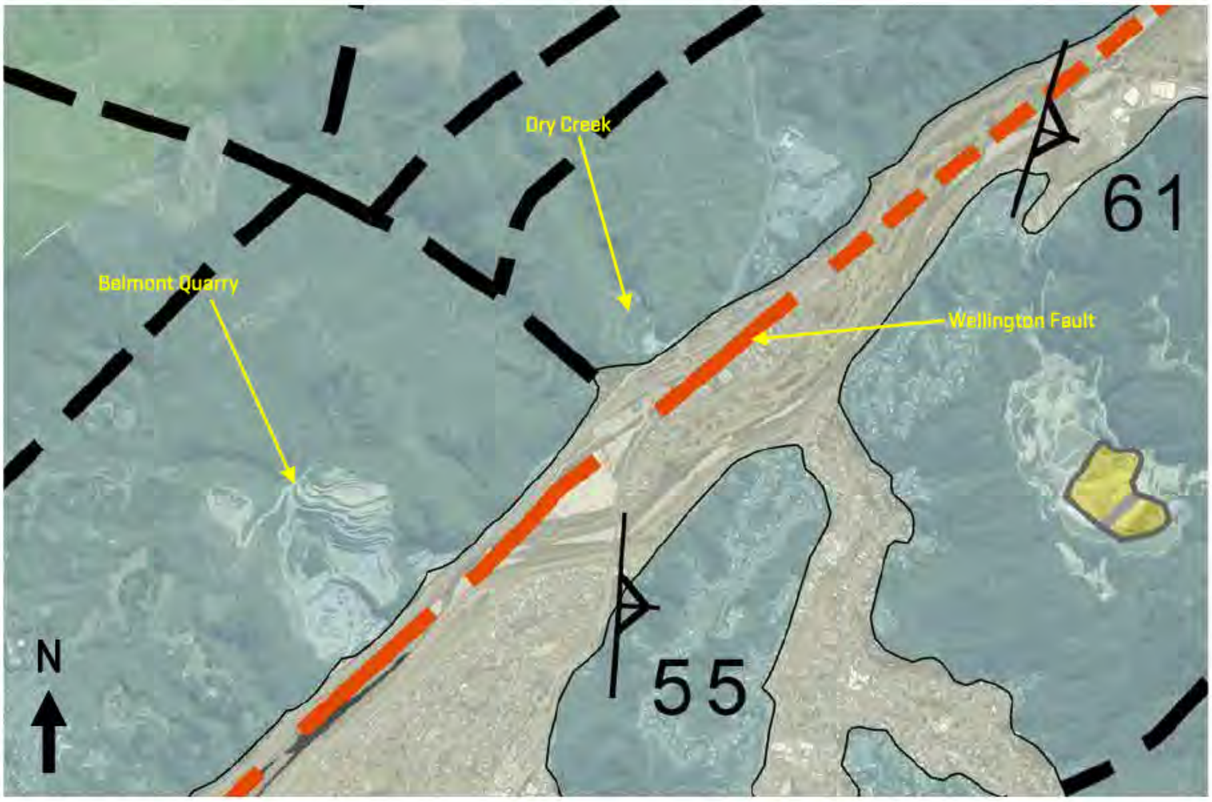


Figure 3-1: Regional geological setting (source GNS webmaps)

4 Dry Creek sites

4.1 General

The former Dry Creek Quarry and Cleanfill is located 22 km northeast of the Wellington CBD on Hebden Crescent. The site is positioned along the western Hutt Valley ranges that rise to an elevation of 380 m further to the west[2]. The surrounding topography is steep and vegetated with incised gully systems discharging to the southeast into the Hutt River. A concrete plant and site office is located on a flat area of land at the toe of the cleanfill (Appendix B, Figure 2).

The Haywards Interchange (SH2/58) and KiwiRail corridor are located approximately 170 m and 300 m respectively to the southeast when measured from the toe of the cleanfill slope.

The cleanfill has been developed within a northwest to southeast orientated gully with adjacent ridges extending to an elevation of approximately RL 180 m. The cleanfill extends across the gully mouth terminating against the western and eastern slopes. The base of the cleanfill slope, is at approximately RL 50 m, with the crest of the existing cleanfill at approximately RL 120 m (Figure 4-1).

[2] Retrieved from NZ Topo Map (www.topomap.co.nz) on 26 August 2025.

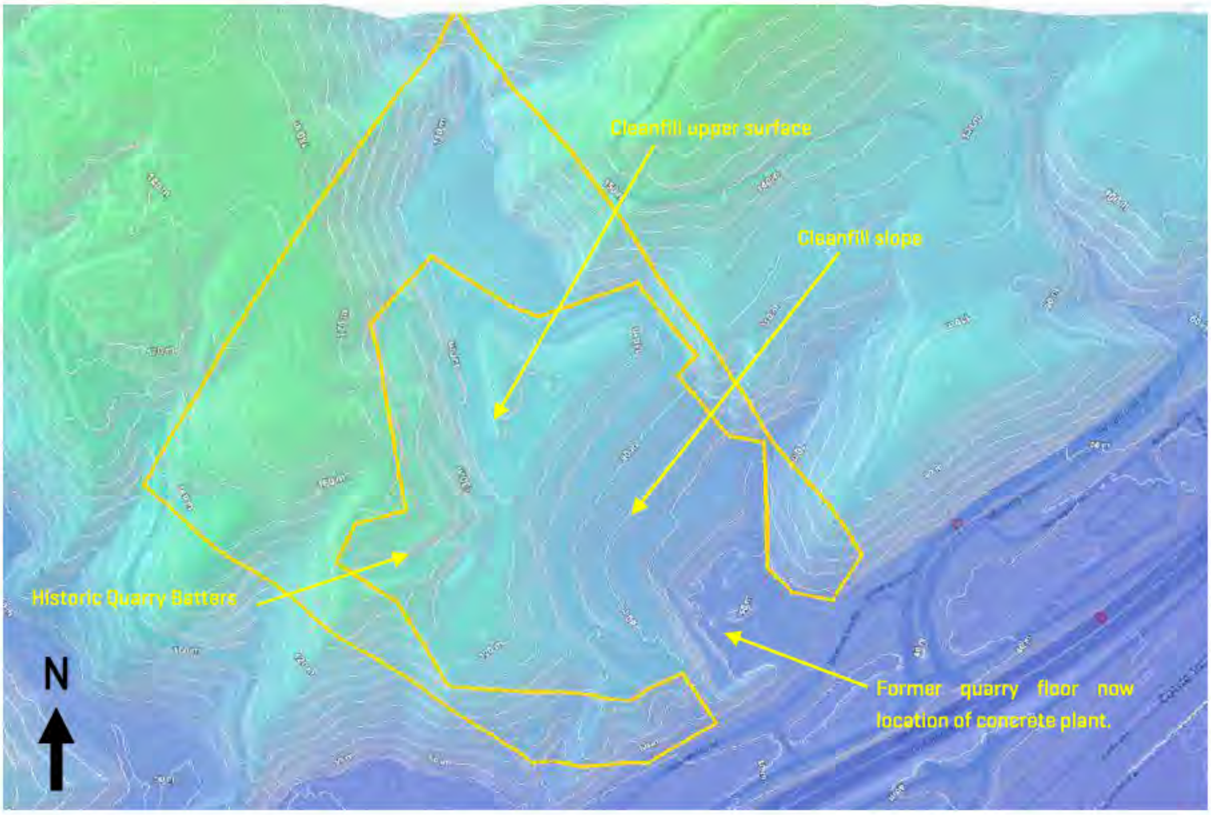


Figure 4-1: Lidar data for Dry Creek Site> and exchange boundary shown indicatively (source: Winstone Aggregates Propeller Site).

4.2 Development of the site

A quarry that potentially dates to the early 1940's previously occupied the site (Figure 4-2). Based on an oblique photograph from 1992 (Figure 4-3), the quarry extraction process over this 50 to 60 year period excavated into the western slopes of the gully forming a series of benches and batters. The quarry exposed unweathered rock in the lower slopes and weathered rock in the upper slopes.

We understand consent was granted in 1998 to transform the quarry into a cleanfill. The consent documents[3] indicate that the site was designed with a moderately sloped, benched front face supported by a series of front face bunds made up of weathered greywacke rock fill.

An unnamed creek is located at the base of the gully, flowing from northwest to southeast. As part of the development of the cleanfill, the creek has been diverted through a concrete culvert that extends under the cleanfill. The culvert inlet, located upslope of the clean fill, has an elevation of approximately RL 94 m. The culvert outlet, downslope of the cleanfill, has an elevation of approximately RL 44 m.

Land that Winstones are proposing to transfer is located outside of the areas of the site that have been subject to extensive quarrying or clean filling activities.

[3] Montgomery Watson (1998): Proposed Dry Creek Cleanfill SH58, Lower Hutt, Description and Assessment of Environmental Effects, Prepared for Winstone Aggregates.

Figure 4-2: 1941 aerial image of site (retrieved from retrolens on 26 March 2021).

Figure 4-3: 1992 oblique photograph (image supplied).

4.3 Dry Creek – Northeastern and southwestern slopes

4.3.1 General

The northeastern slopes of the Dry Creek site are steep with measured slope angles of up to 38° for a vertical distance of up to 50 m, before gradually becoming gentler towards the crest of the slope. The site is heavily vegetated with a variety of native vegetation.

Previous development of the site by way of quarrying fundamentally occurred on the northwestern side of the Dry Creek Gully (refer Appendix B, Figures 3 to 5). Other areas appear to have remained unmodified with the exception of:

- Localised historic access tracks that are apparent east of the Winstone property boundary.
- Local areas of cleanfill that have been placed against the northeastern slopes, but are not included in the proposed land exchange.

4.3.2 Slope instability hazard

Our review of historical aerial photographs (refer Appendix B – Figures 3 to 5) and our observations made during our site walkover on 20 August 2025 suggest no historical evidence of slope instability in this area of the site (Figure 4-4).

The steepness of the slopes suggests a thin, very stiff to hard soil layer underlain by weathered greywacke rock consistent with adjacent areas of the Belmont Regional Park.

Slope instability in future cannot be categorically ruled out, mainly due to the potential for a seismic event (rupture of the Wellington Fault). In a significant seismic event on the Wellington Fault many of the steep natural slopes in the adjacent Belmont Regional Park are expected to experience shallow instability of the soil regolith. The natural slopes within the proposed land exchange area is expected to demonstrate a similar level of performance.

Figure 4-4: Example of natural vegetated northeastern slopes at Dry Creek.

4.4 Dry Creek – Northwestern slopes

4.4.1 General

The northwestern slopes of the Dry Creek site above the existing cleanfill are steep with measured slope angles of up to 42° for a vertical distance of up to 100 m. Upper slopes of the Dry Creek site, above the cleanfill, are heavily vegetated and retain a number of old quarry batters, however these old quarry batters are located downslope, outside of the proposed area land transfer parcels (Appendix B, Figure 2).

4.4.2 Aerial photography

Aerial photographs of the site from 1979 and 1995 indicate that the upper part of the quarry earthworks extended into the area of the proposed land transfer (refer Appendix B, Figure 3 to 5).

The earthworks in this area appear to have included vegetation clearance and stripping of some overburden. However, since the 1995 aerial photograph, the crest of the slope has substantially revegetated with the only remaining evidence of quarrying activity being a remnant haul road identified on Figure 2, Appendix B.

Overall, there is no evidence of widespread instability in the aerial photographs and quarry operations in this area appear to have removed a significant proportion of the upper soils.

4.4.3 Site observations

We undertook a site visit to review the upper slopes at Dry Creek on 20 August 2025. While the cleanfill has largely covered and buttressed the larger part of the former quarry at the site, there are still at least three former quarry batters that can be observed at the site, separated by benches or ramps. These batters are located outside the proposed land exchange parcel.

The remnant quarry batters range from 7 m high to approximately 20 m high with a batter angle of 65 to 75 degrees. Remnant benches and ramps range from 6 m to 10 m wide. The former quarry topography is clearly evident in recent lidar survey of the site (Figure 4-1).

The overall slope geometry defined by the unsupported old quarry batters is typically 40-50 m high with an average slope angle of between 30° and 42°. This is comparable to the natural slope angles for the greywacke hills in the area which have slopes of up 100 m high at slope angles of 42°.

Batter performance is typical of old quarry faces with localised areas of spalling of rock from the jointed rock faces and localised instability evident in the upper 1-2 m of soil exposed in the uppermost quarry batter (Figure 4-5).

Figure 4-5: Examples of localised rock fall in former quarry batters

4.4.4 Discussion

Areas exposed to rockfall hazard from old quarry batters do not form part of the proposed land transfer parcel in the northwestern slopes of Dry Creek as illustrated in Appendix B - Figure 2. Additionally, large scale slope instability risk is expected to be similar to or better than equivalent natural slopes adjacent to the Dry Creek Site based on a comparison of slope heights and slope angles as set out in Section 4.4.3.

There is one area of the proposed land exchange parcel where a former quarry access road can still be identified in recent aerial photographs. This is largely inaccessible due to heavy vegetation regrowth, and we note that any remnant cuts in this area are not apparent in the most recent lidar. We anticipate that any localised remnant cuts for the access road would be of a limited height (less than 5 m) or they would be observable in the lidar data.

Localised small scale instability may still be possible in cut batters above the former quarry access road, but that scale of instability is considered to present little risk to persons and negligible risk to the conservation values of the proposed exchange parcel. We note that similar, or more significant hazard/risk exists for access roads that are already present in Belmont Regional Park (Figure 4-6).

Overall, it is our opinion that slope stability hazard in this proposed land exchange parcel is limited to very localised areas of old access roads and the risk to persons and conservation values is negligible.

Figure 4-6: Unsupported cut slopes within Belmont Regional Park

5 Firth Block exchange parcel

5.1 General

Located to the east of the quarry the Firth Block comprises a QEII-covenanted parcel with high ridgeline and steep south-facing slopes bordered to the west by the quarry boundary, to the north and northeast by Belmont Regional Park and to the south by the Firth Masonry Plant, which has been developed in the floor of an old quarry (Appendix B, Figure 6).

5.2 Aerial photographs & lidar

There is evidence of quarrying activity in the Firth Masonry Plant site in the 1957 aerial photographs, where site development and early quarry bench development is clearly in progress (Appendix B, Figure 7).

In the 1974 aerial photograph the quarry has extended to the north with a series of quarry batters developed into a north south trending spur ridge. Vehicle tracks have been developed to facilitate access onto the upper slopes above the quarry (Appendix B, Figure 8).

The 1984 aerial photograph indicate that the quarry has been pushed back only slightly further to the north into the spur ridge, but has been significantly deepened (Appendix B, Figure 9).

The 1995 aerial photograph illustrates the Firth Block Plant infrastructure broadly in its present location (Appendix B Figure 10). The lower slopes of the former quarry immediately above the Firth Plant area appear to have been regraded and a surface drain or catch ditch has been developed immediately downslope of the lowermost remnant quarry batter. Upper quarry batters have begun to re-vegetate, but quarry batter positions are still visible, the uppermost of which remains broadly in the same position as that identified in the 1984 aerial photograph.

We have georeferenced[4] these aerial photographs and compared with the proposed land exchange parcel. The land proposed for exchange clearly includes areas that have previously been quarried.

Lidar data for the site indicates that the remnant quarry slopes include 50-60° slopes between 15 and 45 m in height. Overall slope angles from the northernmost Firth site access road to the crest of the uppermost batter are 41-45° for slopes between 85-90 m in height (Figure 5-1).

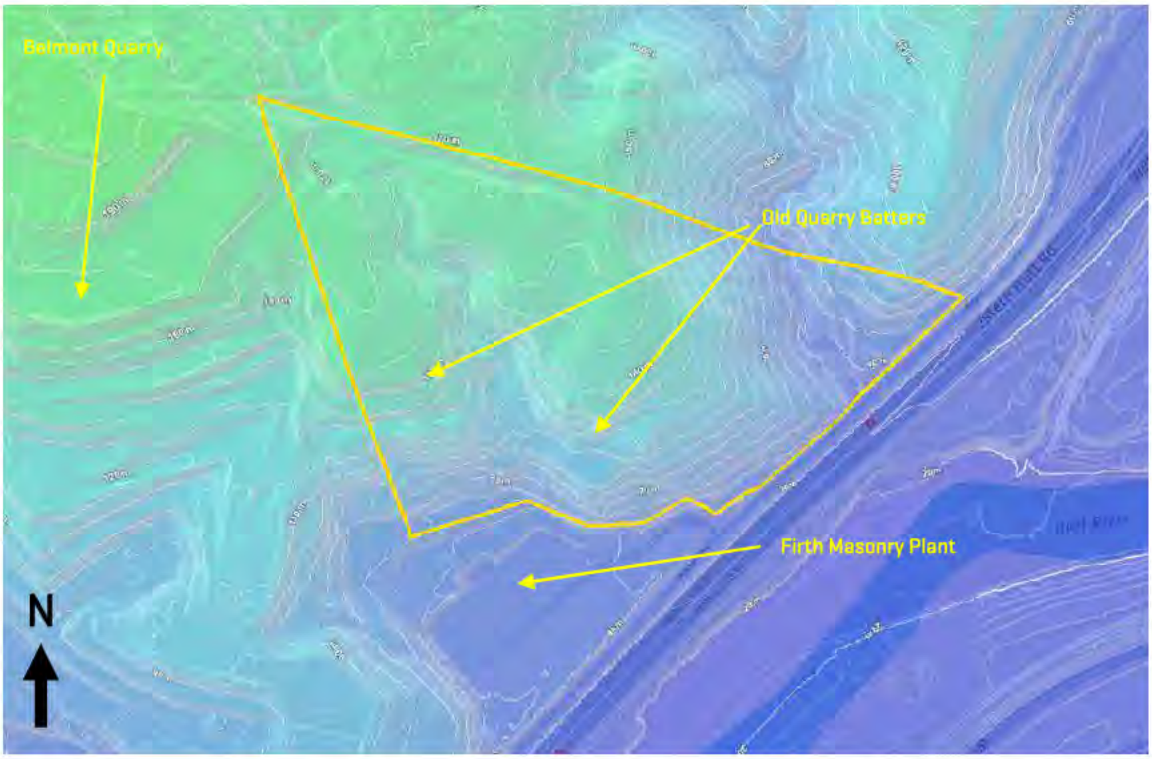


Figure 5-1: Lidar data for Firth Block, proposed exchange land illustrated indicatively (source Winstone Propeller site).

5.3 Site observations

We reviewed slopes from within the Firth Block on 20 August 2025. The lower quarry slopes of the former quarry immediately above the Firth Plant area could be accessed in places. In these areas a

[4] Georeferencing is estimated for old aerial photographs. The positioning of features within the land exchange boundaries should be considered indicative.

30° batter slope made up of what appear to be gravels and cobbles of processed, unweathered greywacke is present. The surface drain or catch ditch identified in the historic aerial photographs could be identified at its eastern extent, but the bench that accommodates it is largely impassable due to dense blackberry vegetation.

Upper quarry batters could be observed from the northernmost Firth accessway. These have generally revegetated, but it was apparent that some rockfall has occurred in localised areas over time (Figure 5-2).

A recent (2025) localised area of instability was observed in the northwest corner of the site, where failure of the upper soils above a remnant quarry batter has occurred over a width of slope of approximately 12 m. The soil material has evacuated down the quarry batter, clearing the batter downslope of vegetation with debris coming to rest on a lower remnant bench (Figure 5-2). Some localised sections of the remnant quarry batters were observed to be sub-vertical.

Figure 5-2: Remnant quarry batters Firth Block

5.4 Western boundary with Belmont Quarry

The western boundary with the Firth Block is formed by the upper slopes of Belmont Quarry. The cut slopes have been developed in close proximity to the boundary and consideration needs to be given to the long term performance of those slopes, which support the western boundary of the proposed Firth Block exchange land.

We understand that the most recent geotechnical design review document was prepared for the quarry slopes in 2010[5] by Tonkin & Taylor Limited. The design recommendations in that report included:

- 50° batter slopes up to 15 m high with 7 m wide benches in the resource.
- 37° batter slopes up to 15 m high, with 5 m wide benches in highly weathered greywacke (overburden).
- 27° batter slopes up to 15 m high, with 5 m wide benches in soils.

It is notable that the design recommendations at that time were based on a North Wall that trended more northwest to southeast and was sub-parallel to significant persistent rock structure that controlled batter performance. The current design for the North Wall has resulted in the wall being rotated to be almost east-west trending, which has improved pit wall performance, but also means that those 2010 specific design recommendations may not be relevant to the new wall orientation.

Additionally, in 2010 an east wall was not part of the pit development and T+T 2010 therefore does not consider appropriate bench/batter designs that might be applicable to the current East Wall.

There are three key areas adjacent to the boundary where cut batters have been developed, as set out in Figure 5-3.

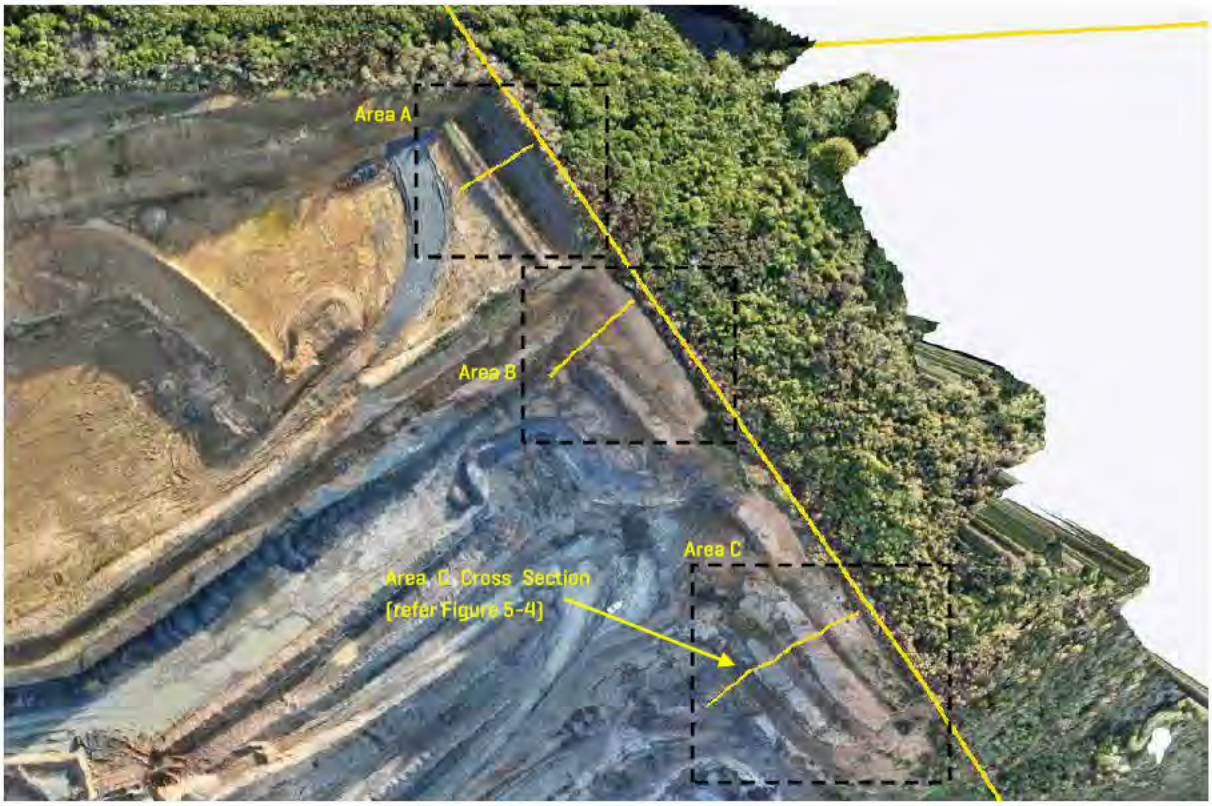


Figure 5-3: Belmont East wall abutting the Firth Block.

[5] T+T (2010). Belmont Quarry- pit slope stability review report, prepared for Winstone Aggregates, dated August 2010, ref: 83504.006 (in draft).

5.4.1 Area A

This area comprises a slope that is in the process of being developed. It has been cut at a slope angle of approximately 37° and has a slope height of approximately 5 m. It has been developed in residual soils and gravel rich colluvium and has been supported by a buttress of unweathered rock.

We consider that the combination of slope height and slope angles in this area should provide adequate levels of stability at the boundary with the Firth Block land exchange parcel. However, consideration will need to be given to the overall design for this area as the pit walls increase in height over time.

5.4.2 Area B

This area comprises an upper batter slope of 37° with a slope height of up to 5 m and a lower batter of approximately 50° with a batter height of 14 m. The two batters are separated by a 5 m wide bench.

The uppermost batter is within silt and gravel rich colluvium, and this material extends into the upper third of the lowermost batter as well. Highly weathered greywacke rock makes up the lower part of the lowermost batter, with slightly weathered greywacke apparent in the lower few metres of this batter.

The overall slope angle defined by the bench/batter geometry in this area is approximately 37°, which is expected to provide an acceptable level of multi-bench stability.

In terms of batter scale instability, the lowermost batter may be subject to localised dropouts within the gravel portion of the slope, however, this is not expected to affect the Firth Block land exchange area.

For the uppermost batter in this area, we consider that the combination of slope height and slope angle should provide adequate levels of stability at the boundary with the Firth Block land exchange parcel.

5.4.3 Area C

This area comprises a series of 10 m high batters, cut at approximately 50°, separated by a 3 m bench at RL 155 m, and 5 m wide batters at RL 145 m and RL 135 m. The bench batter geometry defines an overall slope (crest to toe) of approximately 40° for an overall slope height of 35 m (Figure 5-4).

The uppermost batter (above RL 155 m) is formed within completely to highly weathered greywacke, the second batter (between RL 145 m and RL 155 m) is formed within highly to moderately weathered greywacke, while the lower batters are formed within slightly to moderately weathered greywacke.

The key defects in the face are west to east striking bedding, which dips very steeply towards both the north and south. Bedding is defined by thin seams of dark grey argillite.

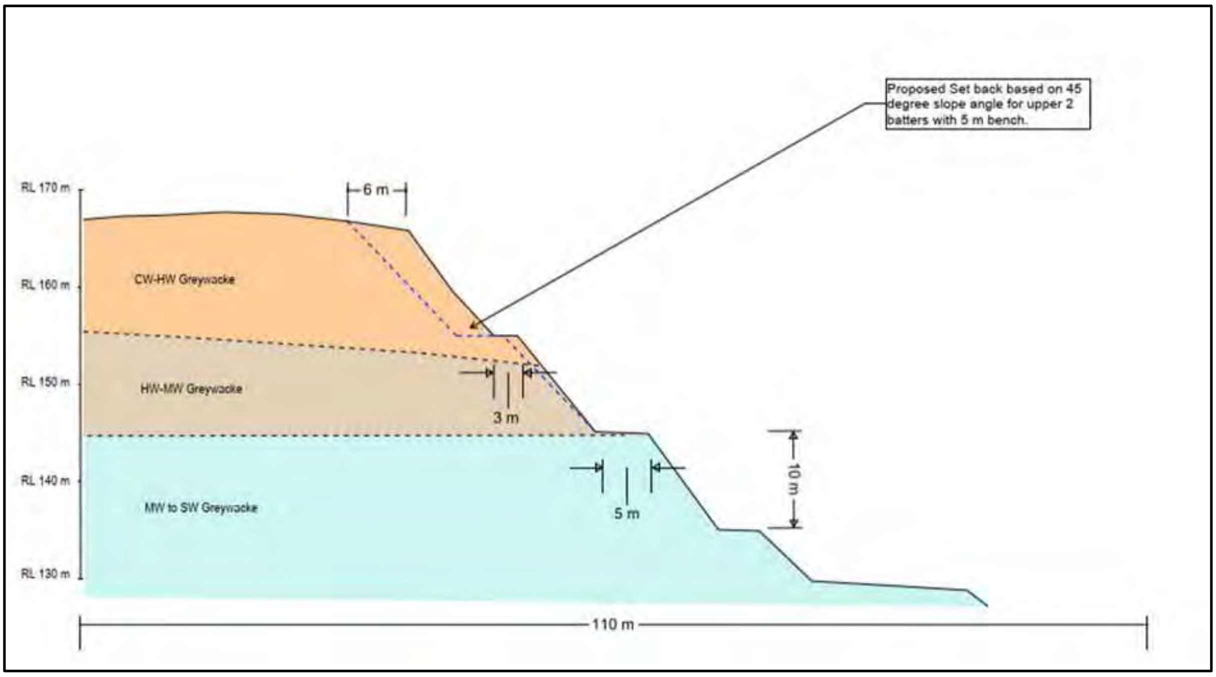


Figure 5-4: Cross Section through Area C

Below RL 155 m, the batter slopes are generally consistent with the advice provided in T+T 2010 and these batters appear to be performing acceptably. The exception to this is:

- The uppermost bench at RL 155 m which is narrower (at 3 m) than would typically be adopted[6].
- The slope angle of the uppermost batter (50°) is generally steeper than what would typically be adopted for completely to highly weathered greywacke and is inconsistent with previous design advice in T+T 2010.

Towards the southern end of the cut batters in this area highly weathered greywacke extends through the second batter (between RL 145 m and RL 155 m) as the excavation approaches the edge of the former ground surface.

A localised area of slope failure has occurred at the far southern end of the cut batters in this area. This appears to have occurred in an area of deeper weathering of the greywacke, but also where the batters were rotated around to become more northwest-southeast trending as a tie-in to the ground surface. This change in geometry has allowed failure to occur on steep bedding, orientated oblique to the slope with breakout through the highly weathered rock mass. The instability extends through the upper two batters, with debris spilling onto the benches below. It is not clear whether this instability extends into the proposed land exchange area.

[6] In typical design a bench width of half the height of the adjacent batter would be adopted in the absence of detailed geotechnical design.

Figure 5-5: Existing instability in Area C. Belmont East wall abutting the Firth Block.

Based on our observations in this area, we consider that a 6 m zone measured from the crest of the slope back into the proposed land exchange area presents a higher risk of instability than would normally be accepted for a final cut batter adjacent to a property boundary. The basis for this zone is a hypothetical bench batter geometry of 10 m high batter slopes at 45° separated by a 5 m wide bench, which could be expected to perform acceptably in the materials observed.

While instability could be expected to develop slowly in this area due to residual strengths on defects in the weathered zone, if this zone is included in the land exchange, it would be prudent to exclude people from this area. This could be achieved by erecting fencing positioned a minimum of 6 m from the crest of the quarry batters in this area.

5.5 Discussion

Remnant quarry batters make up a portion of the Firth Block land proposed to be used as part of the land exchange. These areas already have a QEII covenant applied to them.

There has been no sign of large scale slope instability at the site since the final development of the quarry batters were completed over 50 years ago. The overall slope angle and slope heights measured from lidar are consistent with natural slopes within the adjacent Belmont Regional Park.

The performance of remnant quarry batters within the proposed land exchange area are consistent with what could be anticipated for a quarry, operational through the 1950's to 1980's, which has been closed for approximately 40-45 years and is now substantially heavily vegetated.

In terms of the remnant quarry batters, the recent localised instability observed at the Firth Block (Figure 5-2) lies within land that abuts Belmont Quarry and lies outside of the proposed land exchange parcel (refer Appendix B – Figure 6).

Other quarry batters are generally revegetated, and any remaining loose blocks of rock can be expected to have already fallen from the quarry batters since closure. However, over time continued intermittent spalling and localised areas of rock fall can be anticipated due to ongoing cycles of wetting and drying, root action from vegetation opening fractures in the rock mass or due to seismic events.

While there remains a localised slope instability hazard associated with these remnant batters, the area between the uppermost batter and the Firth Masonry plant site is heavily vegetated and largely inaccessible. Localised batter scale instability therefore is not expected to present a significant risk to persons.

Localised instability impacts on conservation values are expected to be negligible. It is notable that the area previously quarried has later had a QE2 covenant attached to it.

We note that the conservation estate in this area already incorporates an old quarry site on Hebden Crescent, located between the Firth Block and Dry Creek Sites, which was later incorporated into Belmont Regional Park. Excavation at that site appears to have been undertaken in the 1950's and 1960's (Figure 5-6), with the site closed and beginning to revegetate in the 1974 aerial photographs The remanent quarry batters at the Firth site are consistent with size and scale of those remnant batters that already exist within the Regional Park.

Figure 5-6: 1957 aerial photograph illustrating historic quarry faces incorporated in Belmont Regional Park.

Overall, it is our opinion that the Firth Block is not at risk of large scale slope instability and that localised rock fall from remnant quarry batters presents a negligible risk to persons (due to access difficulties) and to conservation values.

Provided the setback in Area C set out in Section 5.4.3 is adopted, then we consider that there is a low risk of instability in the adjacent Belmont Quarry slopes affecting persons accessing the Firth Block land exchange area.

We note that the long term stability of the Firth Block land exchange parcel is reliant on the final design of the adjacent Belmont Quarry slopes. We recommend geotechnical verification of the final design for the quarry walls.

6 Belmont Northern Gully land exchange parcel

6.1 General

The Northern Gully is located to the north-west of the quarry (Refer Appendix B - Figure 11). This parcel comprises south-facing hill slopes and deep gullies with forested stream margins.

The proposed land exchange parcel incorporates both land that has previously been unaffected by quarrying activities and land that has previously been subjected to overburden placement at the Cottle Overburden Disposal Area (OBDA).

Land to the north of the northern gully stream channel is heavily vegetated and rises from a stream level of approximately RL 145 m to RL195 m. To the south of the stream channel the land rises from RL 145 m to approximately RL 185 m.

6.2 Aerial photographs & lidar

Aerial photographs from 1957 through 1995 (Appendix B – Figures 12 and 13) indicate that with the exception of a small borrow pit observed in the 1957 photographs (accessed from an adjacent property) the area around the northern gully had not been modified by quarrying activity.

The first stages of the Cottle OBDA are visible in aerial photographs from 2000, this includes modification of land near the toe of the OBDA adjacent to the Northern Gully.

Recent aerial photographs for the site (2025) indicate that the area proposed as part of the exchange parcel includes rehabilitated parts of the lowermost slopes of the Cottle OBDA (Figure 6-1). There is no observable evidence of instability in the aerial photographs.

The remainder of the Northern Gully exchange parcel is made up of natural gully slopes, which also show no evidence of instability in the aerial photographs.

6.3 Observations

We traversed the gully floor of the Northern Gully on 26 June 2025. During that site visit we observed that the channel had been eroded down into the underlying greywacke rock in places, with other areas infilled with gravel rich alluvium. The natural slopes leading down to the gully floor are steep (26-30°) and heavily vegetated.

Part of the proposed exchange parcel incorporates the lower portions of the Cottle OBDA which we have previously observed over a decade or more of involvement with the site (Figure 6-1).

There has been no instability observed in final slopes within the Cottle OBDA since construction commenced in the mid 2000's. Rehabilitation has been progressive since construction commenced and the larger part of the Cottle OBDA that is included in the proposed exchange area has been rehabilitated and revegetating since 2015.

The Cottle OBDA is a designed landform, with the final stage of design completed by Tonkin & Taylor Limited (T+T) in 2019[7]. That document sets out that the final design for the OBDA was expected to have achieve acceptable levels of static and seismic stability (Damage Control Limit State), with calculated displacements in the Maximum Considered Earthquake of less than 170 mm.

Figure 6-1: Northern Gully exchange parcel (white outline) illustrating former Cottle OBDA placement (black outline).

6.4 Discussion

The proposed Northern Gully land exchange parcel comprises either:

- natural, unmodified slopes that show no evidence of significant instability, or
- rehabilitated OBDA slopes that are designed to achieve acceptable levels of stability.

Overall, we are satisfied that there is a limited slope instability hazard in the proposed exchange parcel and that there is a negligible risk to persons and to conservation values.

[7] T+T 2019. Belmont Quarry Cottle Overburden Disposal Area Geotechnical Assessment, Dated 19 April 2019. Ref: 1009697.

7 Belmont Southern Gully land exchange parcel

7.1 General

The Southern Gully is located within land owned by Fletcher Concrete and Infrastructure Limited (FCIL) to the west of the quarry (Refer Appendix B - Figure 1 & Figure 15). The proposed exchange area encompasses the upper-middle reach of a small catchment located to the southwest of the existing Cottle Block OBDA. It includes both sides of the gully as well as a small north-facing sidling gully that leads up to the existing road frontage with Liverton Road.

This catchment drains the upper section of Kaitangata Road and runs between Liverton Road and Belmont Quarry before discharging into the Hutt River (Te Awa Kairangi).

Similar to the Northern Gully, the proposed land exchange parcel incorporates both land that has previously been unaffected by quarrying activities and land that has previously been subjected to overburden placement at the Cottle Overburden Disposal Area (OBDA).

The main stem of the gully falls from approximately RL 130 m to RL 110 m from north to south through the parcel. Sidling gullies rise up to meet muted ridge crests at or around RL 150-160 m. Natural side slopes in the gully range between 1V:1.4H and 1V:2H.

In the northeast corner of the parcel, the toe of the Cottle OBDA extends into the parcel forming a 1V:2.2H slope and infilling a former sidling gully.

7.2 Aerial photographs & lidar

Aerial photographs from 1974 (Appendix B – Figure 16) indicate that the site and largely in pasture has historically been farmed. There is little vegetation apparent within the parcel at this time meaning that the geomorphology of the landform can be clearly observed. There is no evidence of significant slope instability in this aerial photograph.

The first evidence on the Cottle OBDA extending into this parcel is apparent in aerial photographs from 2015 where the toe of the OBDA is under construction (Figure 7-1). This part of the Cottle OBDA was substantially rehabilitated by 2017.

Figure 7-1: Southern Gully Parcel (yellow) illustrating extent of Cottle OBDA fill placement (black line)

7.3 Discussion

While BGL staff have not had the opportunity to walk over the Southern Gully parcel as part of this assessment, the historic aerial photographs indicate a natural landform that has not been subject to any significant episodes of slope instability.

As noted in Section 6.3, the Cottle OBDA is designed to achieve acceptable levels of static and seismic stability. Since construction of this section of the Cottle OBDA was completed in 2015, the site has been rehabilitated and revegetated. There has been no instability observed in final slopes within the Cottle OBDA since construction commenced in the mid 2000's.

Overall, we are satisfied that there is a limited slope instability hazard in this proposed exchange parcel and that there is a negligible risk to persons and to conservation values.

8 Summary and Conclusions

Baseline Geotechnical Limited has undertaken a review of land stability for four parcels of Winstone Aggregates land that are being proposed for land exchange with the conservation estate as part of the wider Belmont Quarry Development Project.

The land parcels that Winstone propose to offer in exchange for land in the existing Belmont Regional Park are the Northern and Southern Gullies adjacent to the Quarry, the Firth Block immediately upslope of the Firth Masonry Plant site and areas of land that surround the Dry Creek cleanfill.

We have identified that parts of both the Dry Creek site and the Firth Block have previously been affected by historical quarrying activities (refer Sections 4.4.4 and 5.5). Areas with more recent quarry batters and associated localised instability have been excluded from the proposed land exchange parcels at Dry Creek. Older quarry batters at the Firth Block and remnant quarry access tracks at Dry Creek remain in the exchange parcels. These areas are not considered to present a significant whole slope instability risk and the localised instability risk to persons accessing these areas and to conservation values is considered to be negligible. There is no evidence of instability in the natural unmodified slopes in these areas.

Provided the setback in Area C set out in Section 5.4.3 is adopted, then we consider that there is a low risk of instability in the adjacent Belmont Quarry slopes affecting persons in the Firth Block land exchange area. Long term pit slope design of the adjacent quarry will need to be considered when considering the long term stability of the western boundary of this Firth Block.

The Northern Gully and Southern Gully land exchange parcels incorporate both natural, unmodified slopes as well as portions of the rehabilitated toe of the Cottle overburden disposal area (OBDA). There has been no evidence of instability in the natural slopes nor in the Cottle OBDA since construction commenced. The Cottle OBDA is a designed landform, with the stability of the final land surface designed by Tonkin & Taylor Limited in 2019. Overall, these exchange parcels are not considered to present a significant whole slope instability risk and the instability risk to persons accessing this area and to conservation values is considered to be negligible.

9 Applicability

This report has been prepared for the exclusive use our client Winstone Aggregates and the Fast Track Expert Panel in their capacity as decision makers for Application FTA308 - Belmont Quarry Development. The recommendations and opinions in this report are limited to the purpose stated within the report. It may not be relied upon in other contexts or for any other purpose, or by any person other than those nominated above, without our prior written agreement.

We trust that this report meets your present requirements. If you have any queries or wish to discuss any aspect, please contact the undersigned.

Report prepared by:

[redacted]

Cameron Lines

Director

Reviewed by:

[redacted]

Tzin Hwa Lai

Senior Geotechnical Engineer

Appendix A: Cameron Lines CV

BASELINE GEOTECHNICAL

Cameron Lines - Principal Engineering Geologist

Cameron is an Engineering Geologist with 25 years of experience in mining/quarrying, large-scale infrastructure development and land development, specialising in slope instability, natural hazard assessment, materials assessment, cut slope design, overburden disposal and geotechnical risk assessment.

He continues to operate across the full spectrum of the geotechnical sector, from the gathering of field data through to development of engineering geological models, geotechnical design, provision of geotechnical support for construction, and peer review.

Cameron has worked extensively throughout New Zealand, with specific expertise in the geology of the Northland, Auckland, Waikato & Wellington regions. His career to date has also seen him work in Australia, Indonesia, Samoa, Fiji, Sri Lanka and England.

A good understanding of the New Zealand regulatory environment is one of Cameron's strengths including the ability to present often complex geotechnical issues within the framework of environmental effects. He has provided technical support to regulatory authorities when assessing consent applications and has developed and presented geotechnical evidence on behalf of both Applicants and Regional Authorities at consent hearings and at the Environment Court. He is certified as an Independent Resource Management Act hearing commissioner and has acted as an Expert Panel member under the Fast Track Approvals Act (2024).

Expertise

Core competencies include:

- Engineering geology
- Natural hazard assessment
- Slope stability assessment
- Cut and fill slope design
- Geotechnical materials performance and construction observations
- Assessment of geotechnical risk
- Peer review
- Evidence preparation and appearing as an expert witness
- Project management

Experience

Examples of relevant projects:

Waihi North Project – Fast Track Expert Panel

Appointed as a geotechnical and mining specialist to the Fast Track Approvals expert decision making panel for the Waihi North Project.

Belmont Quarry Pit Slope Redesign, Wellington

Rock mass defect mapping, kinematic analysis, slope stability assessment, development of alternative design options for actively deforming 150m high cut slope in greywacke rock.

Horokiwi Quarry – Resource and geotechnical assessment

Structural geology assessment of existing quarry cuts and proposed new areas for extraction to define volumes and quality of the greywacke resource.

Waotu Quarry – Mediation

Review of instability in pit wall affecting a neighbouring Pa site at Waotu Quarry. Review work completed for Waikato Regional Council & South Waikato Regional Council. Briefing Iwi representatives, evidence preparation & appearing as an expert witness at Environment Court mediation.

Plan Change 29 – Nelson City Council

Review of slope instability susceptibility assessments and Fault Hazard assessments prepared by Council's geotechnical consultants. Provision of expert evidence, attending expert witness conferencing and appearing as an Expert Witness at the Plan Change hearing.

Penlink (NZTA)- Geotechnical Peer Review

Engineering geological peer review of Geotechnical Interpretative Report prepared by GHD at pre-tender preliminary design stage.

WFT Finances Limited Appeal – Waikato District Plan Mediation
Review of geotechnical information on behalf of Waikato District Council related to a plan change appeal at Munro Road in Pokeno. Preparation of a position statement and appearing as an expert witness at Environment Court mediation.

Puhoi to Warkworth (NZTA) - Geotechnical Review
Engineering geological peer review related to post construction performance of cut slopes.

Mill Road Project (NZTA) - Geotechnical Review
Engineering geological peer review of Geotechnical Interpretative Report prepared by AECOM at pre-tender preliminary design stage.

Landslide assessments and remedial design for water infrastructure - Watercare
Engineering geological assessment and design of both temporary and permanent remedial solutions for landslides affecting Watercare assets following 2023 natural hazard events in Auckland.

Scenic Drive landslide assessments and remedial design – Auckland Transport
Engineering geological assessment and design of remedial solutions for landslides arising from 2023 natural hazard events in Auckland for Auckland Transport.

Northern Interceptor - Consenting Design
Lead geotechnical consultant for the consenting design for the Northern Interceptor project. Included desk studies, engineering geological models, geotechnical risk assessment, geotechnical guidance for construction feasibility for HDD crossing of the upper Waitemata Harbour, preparation of geotechnical baseline reports.

Remedial slope stability review, Kotata Rise Whangarei.
Engineering Geology assessment of deep-seated landslide mechanism on pre sheared bedding for a large-scale residential development.

Remedial Design Feisst Ridge Slope Instability, Maramarua
Assessment of large scale bi-wedge instability developed in old highwall of K2 Pit during dewatering of K2 lake. Updating of geological models, slope stability assessment and design of remedial toe buttress solution.

Resource Consent, Regulatory Reviews– Waikato Regional Council.
Geotechnical reviews to support Council review of AEE documentation for Quarry sites, clean fill sites and the Peacocke Strategic Wastewater Project.

Geotechnical Peer Review, Highlands Special Housing Area, Nelson.
Geotechnical review of preliminary geotechnical design for a residential sub-division on land subject to historical slope instability.

Mangatangi Mine, Peer Review, Waikato.
Mining, geology and geotechnical peer review of proposed opencast coal mine for regulatory authorities during Consent Application Process. Included liaison with Applicants Experts, review of preliminary design, Section 92 assessment and preparation of Evidence for Consent Hearing.

Technical Support– Wiri South Due Diligence
Assessment of geotechnical risks relating to transfer of ownership of a closed quarry. Included liaison with Iwi groups who had an associated Treaty settlement claim.

Puke Coal Landfill, Peer Review, Waikato.
Geology and geotechnical peer review for regulatory authorities of MSW landfill proposed to backfill an abandoned opencast coal mine. Included review of the AEE, liaison with Applicants Experts, review of preliminary design, and Section 92 assessment on behalf of Council.

Qualifications

MSc (Hons), Engineering Geology, 1999
BSc, Geology, Geography, 1996
Chartered Member of Engineering New Zealand - Registered Professional Engineering Geologist CMEngNZ (PEngGeol)
Qualified RMA Hearing Commissioner

Cameron Lines is currently a member of:
International Association for Engineering Geology,
New Zealand Geotechnical Society.
Australian Institute of Mining and Metallurgy.

Contact information

Tel: [redacted]
Email: [redacted]

Appendix B: Figures

Legend

- FCIL Land Exchange (version. 19/11/2025)
- Belmont Quarry Aerial (August 2025)
- Dry Creek Aerial (August 2025)
- LINZ Aerial (2021)

0 250 500 750 m

Notes:

Drawn	CLI	26/11/2025
Checked	CJL	26/11/2025

Project No. BGL000252

Scale: 1:10000 Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

WINSTONE AGGREGATES

Overview Plan

Winstone Aggregates

Land Exchange - Belmont Quarry Development Plan

Figure Number: Appendix A, Figure 1

Rev 0.4

Drawn		
Checked		
Project No.		
Scale:	Original Size:	A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Drawn		
Checked		

Project No.

Scale: Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Drawn		
Checked		

Project No.

Scale: Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Drawn		
Checked		

Project No.

Scale: Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Legend

FCIL exchange (24.08.2025)

LINZ Aerial (2021)

Belmont Quarry Aerial (August 2025)

0 100 200 m

Drawn		
Checked		
Project No.		
Scale:	Original Size:	A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:	Rev

Drawn			
Checked			
Project No.			
Scale:	Original Size: A3		

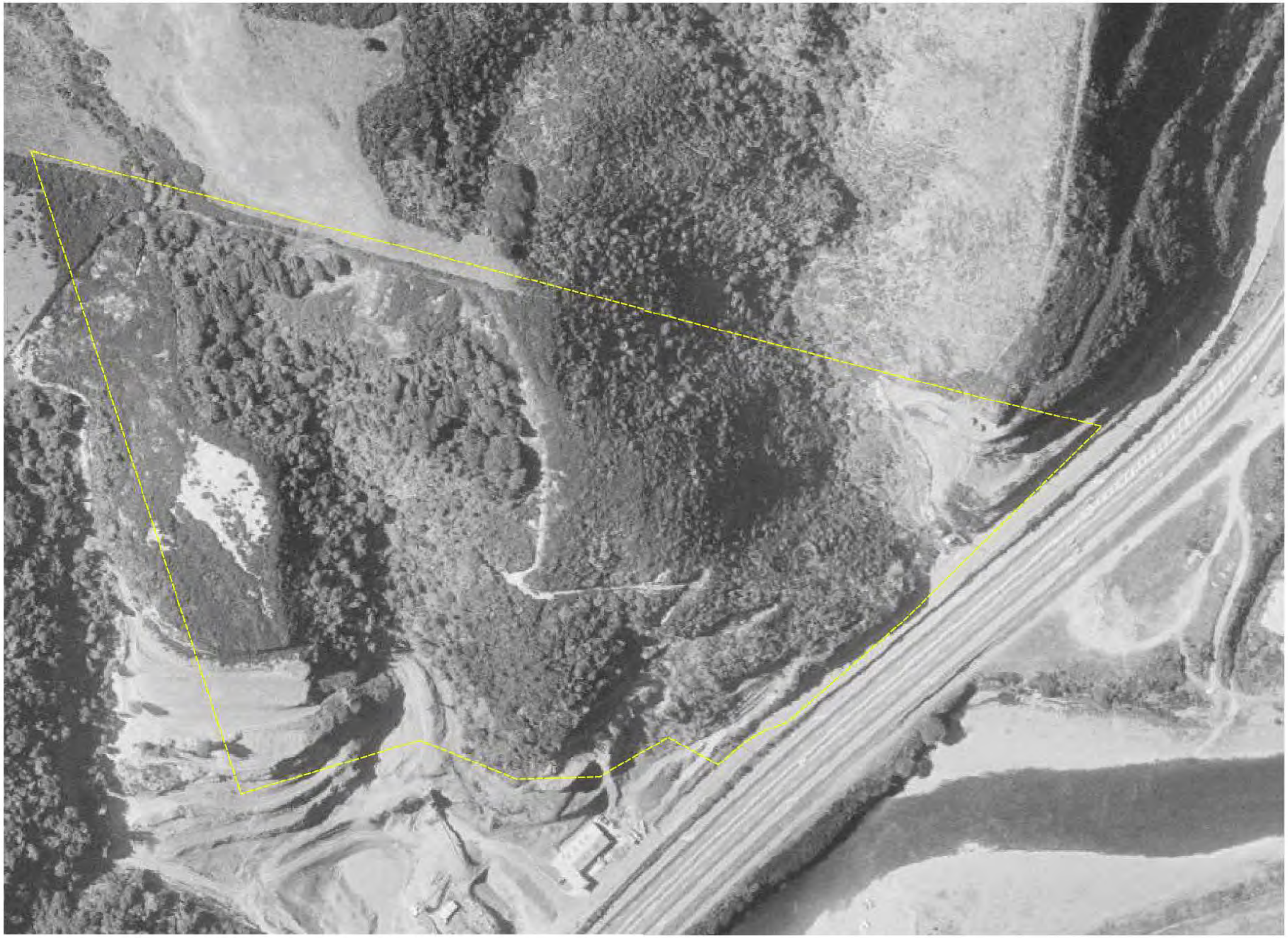
BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev



Legend

FCIL exchange (24.08.2025)

1974 Aerial (Retrolens)

0 100 200 m

Drawn		
Checked		
Project No.		
Scale:	Original Size:	A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Legend

FCIL exchange (24.08.2025)

1974 Aerial (Retrolens)

0 100 200 m

Drawn	
Checked	
Project No.	
Scale:	Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Legend

FCIL exchange (24.08.2025)

1995 Aerial (Retrolens)

Drawn		
Checked		

Project No.

Scale: Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Drawn		
Checked		
Project No.		
Scale:	Original Size:	A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

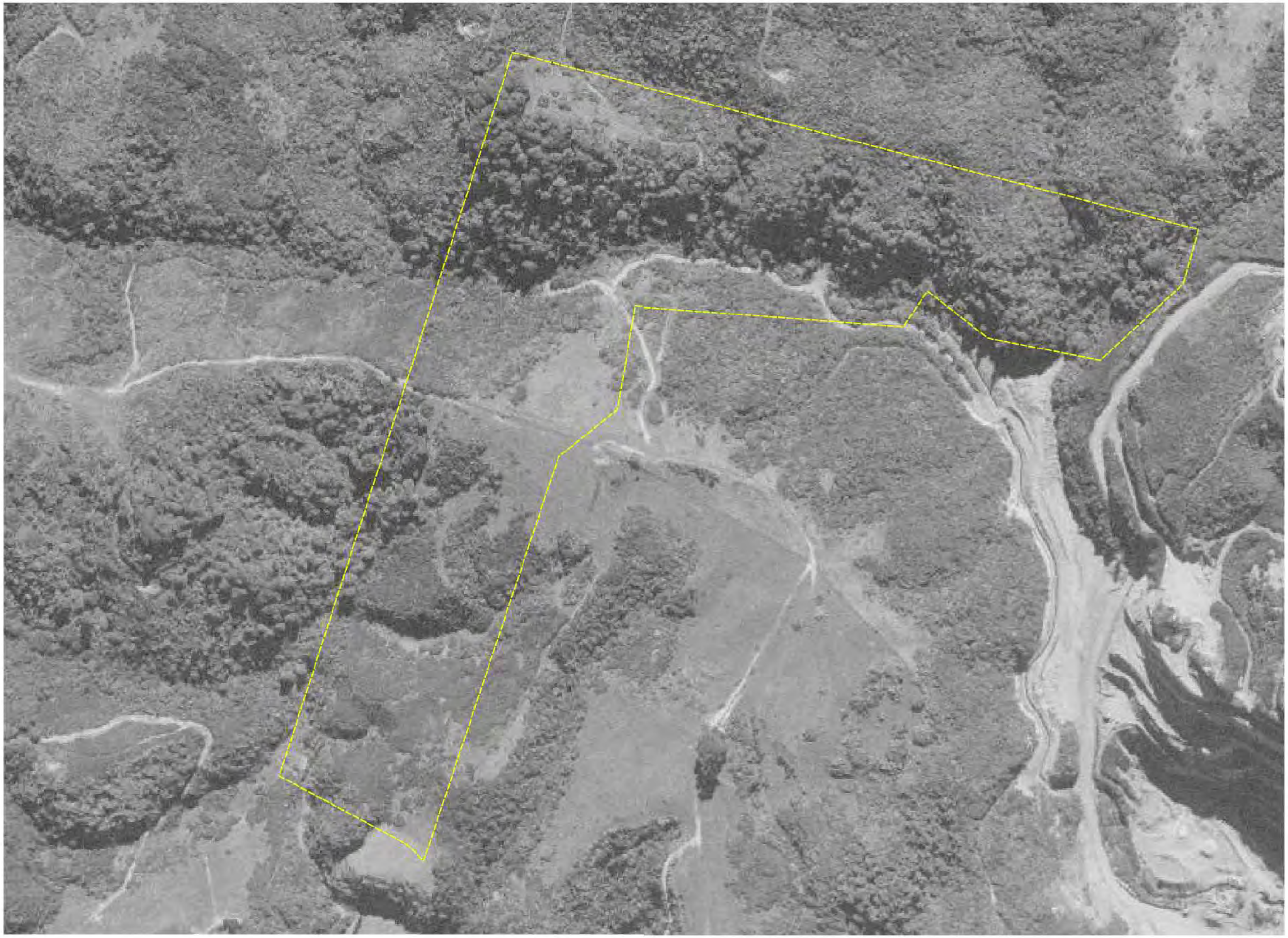
Legend

FCIL exchange (24.08.2025)

1957 Aerial (Retrolens)

0 200 400 m

	Drawn	BASELINE GEOTECHNICAL	Insert client logo	
	Checked			
	Project No.			Figure Number:
	Scale: Original Size: A3	www.baselinegeotechnical.co.nz		Rev



Legend

FCIL exchange (24.08.2025)

1995 Aerial (Retrolens)

0 200 400 m

Drawn		
Checked		
Project No.		
Scale:	Original Size:	A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

Insert client logo

Figure Number:

Rev

Legend

FCIL exchange (24.08.2025)

2000 Aerial (Retrolens)

0 200 400 m

	Drawn	BASELINE GEOTECHNICAL	Insert client logo	
	Checked			
	Project No.			Figure Number:	Rev
	Scale: Original Size: A3	www.baselinegeotechnical.co.nz			

Legend

FCIL Land Exchange (version. 19/11/2025)

1974 Aerial (Retrolens)

0 75 150 m

Notes:

Drawn	CLI	25/11/2025
Checked	CJL	25/11/2025

Project No. BGL000252

Scale: 1:2000 Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

WINSTONE AGGREGATES

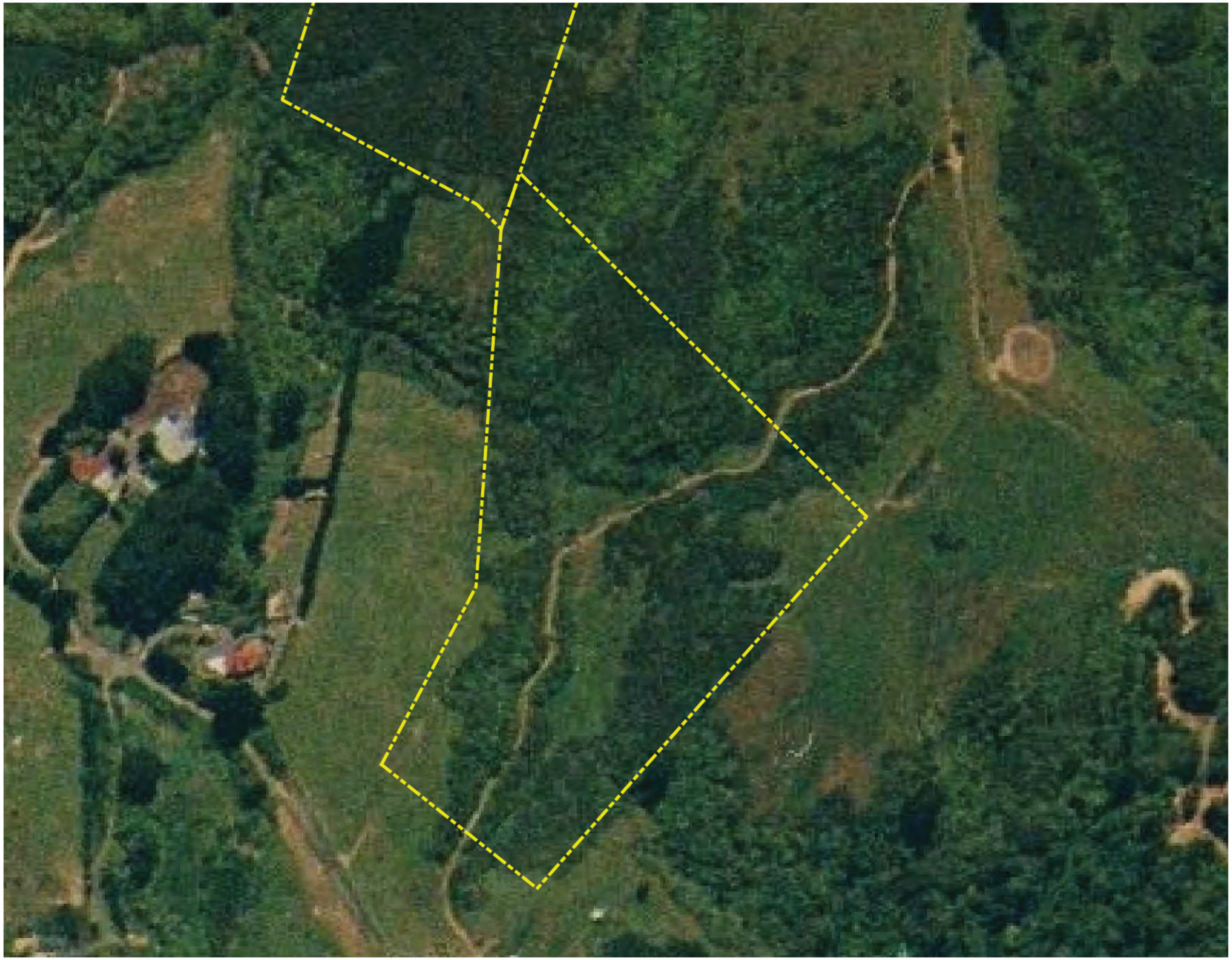
Belmont Southern Gully - 1974 Aerial

Winstone Aggregates

Land Exchange - Belmont Quarry Development Plan

Figure Number: Appendix A, Figure 15

Rev 0



Legend

FCIL Land Exchange (version. 19/11/2025)

2000 Aerial (Retrolens)

0 75 150 m

Notes:

Drawn	CLI	25/11/2025
Checked	CJL	25/11/2025

Project No. BGL000252

Scale: 1:2000 Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

WINSTONE AGGREGATES

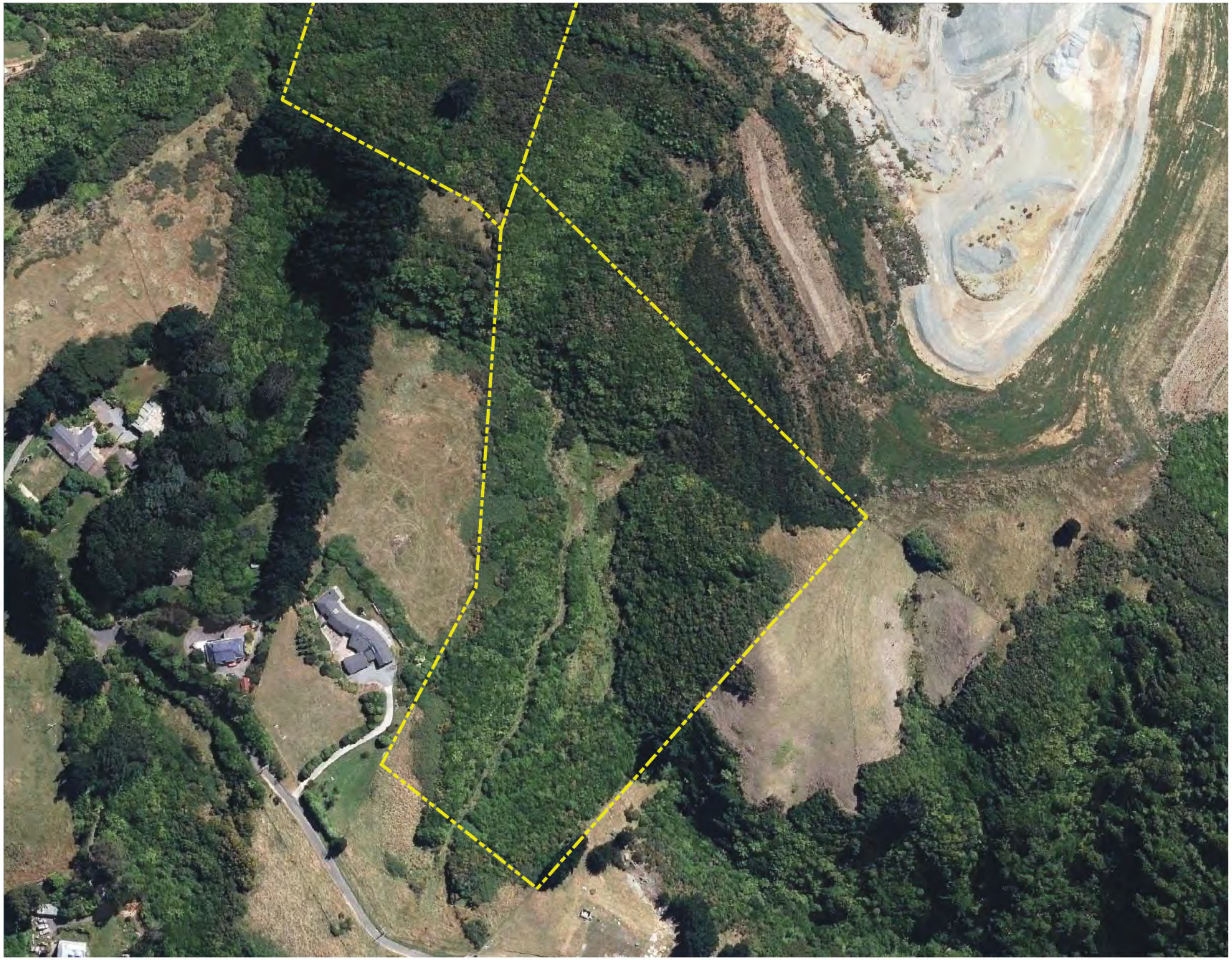
Belmont Southern Gully - 2000 Aerial

Winstone Aggregates

Land Exchange - Belmont Quarry Development Plan

Figure Number: Appendix A, Figure 16

Rev 0



Legend

FCIL Land Exchange (version. 19/11/2025)

LINZ Aerial (2021)

0 75 150 m

Notes:

Drawn	CLI	25/11/2025
Checked	CJL	25/11/2025

Project No. BGL000252

Scale: 1:2000 Original Size: A3

BASELINE GEOTECHNICAL

www.baselinegeotechnical.co.nz

WINSTONE AGGREGATES

Belmont Southern Gully - 2021 Aerial

Winstone Aggregates

Land Exchange - Belmont Quarry Development Plan

Figure Number: Appendix A, Figure 17

Rev 0