19 October 2020

Queenstown Commercial Limited

C/- J Carter Planning
By email

Attention: Jenny Carter

Dear Jenny,

466 Frankton-Ladies Mile Highway, Residential Subdivision Transport Assessment

The purpose of this letter is to provide a transport assessment for a proposed subdivision at 466 Frankton-Ladies Mile Highway (SH6) at Lake Hayes Estate. This assessment considers the access from the local road network and the onsite road network serving the proposed residential lots.

1 Introduction

1.1 Site Location

The site, 466 Frankton Ladies Mile Highway (SH6), is developed with a single residential dwelling. The site is identified in Figure 1 below.

Figure 1 – Proposed Location, image from QLDC Webmaps

The site is currently accessed from Howards Drive (as identified above). However, it is proposed to adjust the site boundaries to establish a new site access near to the south west corner of the site (refer RM200665).

PO Box 1383 | Queenstown | 9348
jason@bartlettconsulting.co.nz | 027 555 8824 | 03 442 3103

1.2 Site Use and Zoning

The site has been developed as a single residential house and the residential suburb of Lake Hayes Estate is to the south of the site.

The site and the surrounding land to the south and west has recently been zoned as Rural in the QLDC Proposed District Plan. The land to the north and east (516 Frankton-Ladies Mile Highway) is zoned as Rural Lifestyle.

1.3 Existing Transport Network

The site is accessed from Howards Drive which is classified as an Arterial Road under the QLDC Plan District Plan. Howards Drive provides access to Lake Hayes Estate and Queenstown Country Club areas as well as providing a secondary access to Shotover Country via Jones Avenue.

Howards Drive has a posted speed limit of 50km/hr[1] with a generally open driving environment. At the new site access, at the south west corner of the site, there is a curve with a curve advisory speed of 35km/hr. This curve advisory speed is likely to influence the operating speed at the site, it is likely that the operating speed at the site would be less than 50km/hr.

Traffic count data collected by QLDC in 2018 suggests an average traffic flow of 5,450[2] vehicles per day (vpd) with a peak (pm) traffic flow of 650 vehicles per hour (vph) which equates to approximately (12%). A more recent traffic flow estimate is that Howards Drive has a traffic flow of 6,000vpd at the site[3]. It is considered that the current (2020) traffic flow at the site will be approximately 6,000vpd with approximate 720vph during the peak hour.

The nearest footpath to the site, and cycle trails, are within the adjacent reserve area to the south. This footpath links to the footpath networks in Lake Hayes Estate and Shotover Country. This footpath also links with the surrounding off-road cycle network including the Queenstown Trails Network.

The nearest public transport route, Lake Hayes Estate to Queenstown passes close to the site with bus stops on Howards Drive (Lake Hayes Estate) and on Jones Road (Shotover Country). This bus service operates hourly between 06:00 to 22:00, during the am and pm peak periods (06:00 to 10:00 and 14:00 to 18:00) the service operates at a 30 minute frequency.

1.4 Network Changes

There are a number of significant consented development projects in the vicinity of the site, these include:

- SH160140 Queenstown Country Club, development of 137 retirement dwellings, clubhouse, dementia care and apartments. This will be accessed from Howards Drive.
- Queenstown Commercial, Southern Cross hospital with radiology and medical consultation with retail under construction. A Medical centre, pharmacy and childcare have been opened which is accessed from Jones Avenue.
- Queenstown Commercial, South development including 88 retirement villas approved under SH160140 and accessed from Jones Avenue.

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[1] It is noted that the speed limit of Shotover Country and Lake Hayes Estate will reduce as a result of the QLDC Speed Limit Bylaw (2019), this is expected to be implemented between the 26 and 27 October 2020, refer QLDC press release 13 October 2020.
[2] Based on two traffic counts: 5657vpd on 2/11/2018 and 5239vpd on 16/5/2018.
[3] From Mobile Road (mobileroad.org) estimate of 6002vpd dated 23/8/2019.

These developments will all add traffic to Howards Drive increasing the traffic flow above the current observed traffic flows.

SH160140 requires a number of upgrades are to be made on Howards Drive and at the intersection with SH6, this includes:

- Extension of the right turn bay on SH6 to increase capacity of the right turn from SH6 to Howards Drive,
- Improvements to the Howards Drive approach to include separate left and right turning lanes to increase the capacity of the Howards Drive intersection approach,
- Inclusion of a median strip on Howards Drive to separate opposing traffic to improve safety, and
- Provision of bus stops on Howards Drive to improve public connectivity in the area.

A number of these upgrades are currently on hold through discussion and agreement with NZ Transport Agency (NZTA) and QLDC. This is because NZTA have recently committed to upgrading the SH6 intersection with Howards Drive to a roundabout intersection. This will provide additional intersection capacity and improve road safety. This project is being funded as a safety improvement project and is anticipated to be constructed within the next 2 years.

1.5 Resource Consent Applications, Boundary Adjustment

The Applicant has recently applied to vary the site boundary, refer RM200665. This Application will remove the existing access corridor to the north and establish a new access at the south west corner of the site. The proposed new site access will serve the existing onsite dwelling and is identified in Figure 1 above.

2 Proposed Development

It is proposed to subdivide the site to create 12 residential lots one of which will include the existing house. This will be a net increase of 11 residential dwellings over what is currently consented for the site.

The subdivision is within the Rural zone of the Proposed District Plan, it is anticipated that each lot will support a single dwelling unit.

Details of the proposed onsite road network are shown in Appendix A.

2.1 Traffic Generation

The proposed development will allow for a further 11 residential lots onsite which will increase the traffic flow at the new access from Howards Drive and will also result in an overall, slight, increase in the traffic flows on the adjacent road network and at the nearby intersection of Howards Drive with SH6.

The potential traffic flow at the access will be approximately 98 (vpd) or 11(vph) during the peak period[4]. This is an increase of 90vpd or 10vph during the peak period.

2.2 Site Access

The site will be accessed from Howards drive with a new access intersection to be constructed at the south west corner of the site. This new access will be formed as a rural access serving the proposed 12 residential lots. This will have an overall traffic flow of less than 100vpd and

[4] Based on NZTA Research Report 453 (RR453) Trips and parking related to land use, Table 7.4 Summary of design trip rates and parking demand in NZ in 2010. Using data for a Dwelling (Outer Suburban) with a design traffic generation of 0.9vph/unit in the peak period and 8.2vpd/unit daily.

will include some of heavy vehicles. Heavy vehicle use will be for rubbish, recycling and general deliveries. There will be greater than 1 heavy vehicle movement at the access intersection per week suggesting an access design based on Diagram 10[5] from the Proposed District Plan.

The proposed access intersection is located near to the Lake Hayes Estate entry sign and road, the terminal end of the section of timber faced guardrail and a footpath within the adjacent reserve. The detailed design of the access intersection will need to consider any effect on these elements. For instance it is possible that the Lake Hayes Estate entry sign and rock can be relocated to within the current reserve area.

2.3 Onsite Road Network

It is proposed to develop an onsite private road network to serve the proposed residential lots. The onsite road network is based on the requirements of the QLDC Land Development and Subdivision Code of Practice[6] and will remain in private/shared ownership.

The onsite road network can be broken into a number of elements.

Access Road, a private access lane base on a Figure E11 type road serving less than 20 dwellings. This road provides access between Howards Drive and the central shared area of the subdivision. The road will serve all 12 residential lots although only 2 lots, Lots 1 & 2 will have an access directly from this road. This road will be constructed with a 5.5m movement lane (carriageway width) and will have an adjacent footpath (1.2m width) provided on 1 side only. This road is to be provided in a shared ownership road reserve with a minimum width of 6.7m as the road passes between Lots 2 & 3[7].

The private access lane will be located at the top of a significant slope dropping to Lake Hayes Estate below. It is possible that this road will need to consider the provision of guardrail at the top of this slope. This may be achieved by extending the existing Howards Drive Guardrail into the site adjacent to the new private access road.

Central Shared Area, the central area of the subdivision which will be a paved area to accommodate vehicle turning and to act as a cul-de-sac head. The overall dimensions of this area are 18m by 18m square which will not contain the full 9.5m radius standard turning head. Swept paths are Appended (refer Appendix A) to show the turning possible in this area.

Private Ways, there are two private ways; one serving 2 residential lots (Lots 3 & 4), and a second serving 6 residential lots (Lots 7-12). These accesses will be based on the requirements of a Figure E9 type road.

The private way serving Lots 3 & 4 is accessed from the onsite shared private access lane and will include a minimum 2.75m movement lane, the majority of which is considered to be the driveway to Lot 4.

The private way serving Lots 7-12 is accessed from the central shared area and will have a typical legal road reserve width of 4.5m. This access includes parking for 2 vehicles within the shared area and will require shared turning for a car at the end (at Lots 11 & 12). The tight curve at Lot 8 driveway will limit forward visibility for drivers. It is suggested that a passing bay is provided in this location to avoid conflict with oncoming vehicles.

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[5] Refer QLDC Proposed District Plan, Chapter 29 – Transport, Schedule 29.2, Diagram 10 – Access Design.

[6] Refer QLDC Land Development and Subdivision Code of Practice, Table 3.2 – Road Design Standards. Based on specific rural live and play local road road types Figure E9 & E11.

[7] Note, the QLDC Land Development and Subdivision Code of Practice, Road Type Figure E11 has a minimum legal width of 9m.

2.4 Onsite Parking

It is expected that development of the houses within each lot would include 2 onsite car park spaces. The outline house designs provided by the Applicant each have double garages. In addition the following on-street parking will be provided:

- 2 identified shared car parking spaces on the private way serving lots 7-12.
- Parking will be allowed in portions of the central shared area, parking is not to restrict access to the roads or access from this area.
- Parking will be allowed as on-street parking within the private access lane. It is suggested that some 'no parking' restrictions are applied at the tight curve in this road such that access is not restricted where forward sight distance may be reduced.

3 District Plan Requirements

The QLDC Proposed District Plan Transport Chapter (Chapter 29) provides a number of site standards to manage potential transport effects, refer Section 29.5. An assessment of the proposed onsite activity against the QLDC Proposed District Plan access site standards (Sections 29.5.14 to 29.5.24) has been undertaken, this assessment is provided in Appendix B. A number of breaches of the QLDC Proposed District Plan site standards have been identified these are:

- 29.5.7 Reverse Manoeuvring, (Part f.(iii)) the turning area provided at Lot 4 (a rear lot) means parked vehicle will require more than one reverse manoeuvre to enter, park, turn and exit the site.
- 29.5.14 Access and Road Design, the proposed new private access lane will have a minimum road reserve width of 6.7m (9m required) and at this stage a legally enforceable arrangement for road maintenance has not been provided for review.
- 29.5.16 Width and Design of Vehicle Crossings – Rural Zones, the detailed design details of the new vehicle crossings are not provided, suggest that these are based on; Diagram 10 for the new access intersection from Howards Drive and Diagram 6 for individual residential lots.
- 29.5.18 Minimum Sight Distances from Vehicle Access on all Roads other than State Highways, it is possible that the new residential lots will have less than the 45m minimum sight distance required for the 50km/hr speed limit[8].

The potential transport effects as a result of these breaches, along with appropriate consent conditions to manage and mitigate the breaches, is provided in the following Section.

4 Transport Effects

4.1 Off-site Transport Effects

The off-site transport effects of the proposed residential subdivision are likely to be a result of additional traffic within the local road network. This will include additional turning traffic at the access intersection and additional traffic at the nearby intersection of Howards Drive with SH6.

[8] It is noted that when the speed limit of Howards Drive reduces to 40km/hr this site standard will not be breached.

The Howards Drive approach to the intersection with SH6 currently has approximately 720vph during the peak hour. The proposed development may add a further 7vph to this traffic[9]. This equates to less than a 1% increase in the traffic on this approach. This will be reduced given the extent of consented development which will also travel through this intersection.

I consider that traffic increase as a result of the proposed subdivision will not have any noticeable effect on the traffic capacity, efficiency, or safety of Howards Drive or the Howards Drive intersection with SH6.

The increased traffic at the new access (from the boundary adjustment) will require that the site access intersection is upgraded. This assessment identifies that the appropriate access intersection design at the access would comply with Diagram 10 (Schedule 29.2) from the QLDC Proposed District Plan. At the proposed access location Howards Drive has less than 10,000vpd and the proposed access will have less than 100vpd although this will include at least 4 heavy vehicles per week when allowing for rubbish collection, recycling collection, domestic deliveries and construction during the initial stages of development. The suggested Diagram 10 is usually used in a rural environment where the speed limit is 70km/hr or greater. This access design can be modified for the lower speed limit at Howards Drive[10]. I suggest that the length of shoulder widening (dimension d from Diagram 10) is reduced to 30m[11]. This will mean that the seal width of Howards Drive will be locally widened at the subdivision access intersection to accommodate the additional turning traffic and to reduce any possible transport effects to a point which is acceptable.

It is noted that to establish the new access intersection this will affect the position of the Lake Hayes Estate sign and rock as well as existing stormwater infrastructure. These elements will need to be relocated/repositioned. The existing stormwater infrastructure can be realigned to accommodate the widened carriageway of Howards Drive. It is recommended that the design of any changes to this infrastructure is undertaken with QLDC during the engineering approvals stage when the extent of possible changes can be understood.

The Lake Hayes Estate sign and rock can be relocated, it is suggested that this is relocated to the south where it can be within the road reserve for Howards Drive or within the adjacent reserve area. This relocation can also be agreed with QLDC during the design process as there is no safety or operational critical element to this gateway sign.

The QLDC street lighting strategy, Southern Light, allows for flag lighting at rural intersections. Within the rural zone this need for flag lighting would be based on any identified safety concerns. It is noted that Howards Drive is becoming urbanised when considering roadside development such as the Queenstown Country Club opposite. Therefore the presence of pedestrians or cyclists (vulnerable road users) may also increase the need for street lighting in this part of the rural zone. If street lighting is deemed necessary this can be considered during the detailed design with flag lighting provided at the new intersection if necessary. To be prudent, it is recommended that street lighting is considered as a consent condition until such time it is considered not required.

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[9] Based on 70% of development traffic going through the SH6 intersection. The proposed development has a peak period traffic generation of a further 10vph. 70% x 10vph, 7vph new vehicles through the SH6 intersection.

[10] The current speed limit of Howards Drive is 50km/hr, This is expected to reduce to 40km/hr as a result of the QLDC Speed Limit Bylaw (2019).

[11] Based on a pro rata calculation from Diagram 10 where the value provided for d in metres being 10 less than the speed limit (S) value in km/hr, d = S – 10. For the future 40km/hr speed limit of Howards Drive d=30m.

As the design develops there are a number of elements which will need further consideration within the detailed design and engineering approvals process. To manage these and to minimise any off-site effects the following consent condition is suggested.

> *That prior to any onsite construction the design of any upgrade works within the existing local road network is to be provided to QLDC for review and approval. The design shall include:*
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> - *The upgrade of the access intersection from Howards Drive to meet the minimum requirements of QLDC Proposed District Plan, Schedule 29.9, Diagram 10. This new access intersection is to be designed for a speed limit of 50km/hr as per Howards Drive. For completeness the length of shoulder widening (dimensioned from Diagram 10) is to be 30m unless advised otherwise.*
> - *Intersection signage and road markings to meet the minimum requirements of NZTA Manual of Traffic Signs and Markings (MOTSAM) and the NZTA Traffic Control Devices (TCD) Manual. Unless determined otherwise the intersection design shall include a priority control (Give way or Stop) as appropriate.*
> - *Existing stormwater infrastructure including sumps, road crossings and swales will need to be realigned as part of the new access intersection construction. The detailed design of the intersection upgrades should provide details of any changes to the existing stormwater network in the vicinity.*
> - *To provide sufficient space for the new access intersection the existing Lake Hayes Estate gateway sign and rock may need to be relocated. The relocated position of the sign and rock will need approval of QLDC prior to any works being undertaken.*
> - *If deemed necessary by QLDC intersection lighting is to be provided at the new access intersection. The design of any street lighting at the intersection is to comply with the requirements of the Southern Light the QLDC lighting strategy and technical specifications.*

4.2 Onsite Road Network

The master plan for the site provides an onsite road network which has been conceptually developed by the designers. The plans provide a structure and context for the provision of an internal transport network although detail of this network has not yet been fully developed. It is expected that the onsite road network can be designed in accordance with the QLDC Land Development and Subdivision Code of Practice. The following Table 1 provides an overview of the proposed internal road network with comments regarding with its compliance with the QLDC Code of Practice and the District Plan.

Table 1 – Road Network, Compliance with QLDC District Plan and Code of Practice

Subdivision Road	Requirement	General Provision/Departures
Private Access Lane Private road providing access between Howards Drive and the central shared (turning) area. Provides access to all 12 residential lots, direct access is provided to Lots 1 & 2.	Access to houses serving up to 20 dwellings. Figure E11 road type.	Legal width of the road reduces to 6.7m (5.5m movement lane/carriageway and 1.2m footpath) as it passes between Lots 2 & 3. Includes a footpath along one side of the road only. Parking is shared within the movement lane although no stopping restriction required to allow 2 way traffic at the curve with limited forward visibility. Will achieve an operating speed of less than 25km/hr as a result of the curve limiting forward visibility, suggest 30km/hr speed limit. Need for guardrail and/or retaining to be assessed depending on shoulder treatment and gradient below the road (opposite Lot 1). Road is to remain in private/shared ownership, an appropriate agreement is required for the ongoing management and maintenance for the road.
Central Shared Area Extension of the private access lane providing a shared area and turning. Provides access roads and direct access to Lots 5 & 6.	Access to houses and turning area. Refer cul-de-sac tuning.	The shared area is 18m by 18m and provides turning for vehicles, swept paths provided for QLDC 8.8m medium rigid, refer PDP Schedule 29.2. This vehicle must be able to turn with only one reverse manoeuvre.
Private Way Minor lane providing access to Lots 7-12.	Access to houses serving 1 to 6 dwellings. Figure E9 road type.	Private way serving Lots 7-12 will have a minimum legal width of 4.5m with a 2.75 minimum movement lane width. This private way will provide 2 shared car parks adjacent to Lot 10. A passing bay of 5.5m width over 15m length is required, suggest passing is provided at the tight curve which will have limited forward sight distance. As this private way serves 3 or more dwellings turning is required, suggest that is provided at access to Lots 11 & 12. Road is to remain in private/shared ownership, an appropriate agreement is required for the ongoing management and maintenance for the road.

Subdivision Road	Requirement	General Provision/Departures
Private Way Minor lane providing access to Lots 3 & 4.	Access to houses serving 1 to 3 dwellings. Figure E9 road type.	Private way serving Lots 3 & 4 will have a minimum legal width of 3.6m with a 2.75m minimum movement lane width. The majority of this private way length is the driveway to Lot 4 only. Road is to remain in private/shared ownership, an appropriate agreement is required for the ongoing management and maintenance for the road.

The road designs will have a number of minor departures which will need to be considered during the detailed design and engineering approvals process. Of note are; the legal width of the private access lane between Howards Drive and the central shared area, and the turning area provided in the central shared area.

The legal width of the private access lane is 6.7m as this passes between Lots 2 & 3. This legal width will include the 5.5m movement lane (carriageway) width and an adjacent footpath of 1.2m. The QLDC Land Development and Subdivision Code of Practice requires that a public road within a suburban residential area (Figure E11) is to have a minimum 9m legal corridor width[12]. The reduced 6.7m legal width is acceptable for a private vehicular access within the residential zones[13], but this site standard does not apply in the rural zone. The proposed development will create a suburban residential subdivision akin to development expected in a residential zone and therefore any transport effects, of the reduced legal road width, are considered to be acceptable.

The private access lane will have an operating speed of less than 25km/hr[14] which is achieved through limiting the forward sight distance by the tight curve. In addition, this road provides a separate footpath for pedestrians. The QLDC Land Development and Subdivision Code of Practice requires that this road type (Figure E11) has a target operating speed of 20km/hr. With the additional footpath there will not be any effects of not meeting the target operating speed as there is a separate path for vulnerable road users (pedestrians). Retaining the 50km/hr speed limit is not necessary given the expected operational speed, it is suggested that a 30km/hr speed limit is placed over the onsite road network which can be posted at the subdivision entrance from Howards Drive.

The central share area is formed as a square of 18m by 18m. The QLDC Land Development and Subdivision Code of Practice provides a standard residential turning area with a radius of 9.5m[15] (19m diameter). This standard turning area will not fit within the square area provided. The design vehicle prescribed under the QLDC Proposed District Plan is the 8.8m medium rigid truck[16]. This Australian design vehicle has a minimum turning radius of 10m (20m diameter). This vehicle cannot turn as a single manoeuvre within a standard residential turning area and therefore is likely to need at least one reverse manoeuvre. It is therefore considered

[12] Refer QLDC Land Development and Subdivision Code of Practice, Table 3.2 – Road design standards.
[13] Refer QLDC Proposed District Plan, Chapter 29 Transport, Section 29.5.14 Access and Road Design, Part b.
[14] Refer QLDC Land Development and Subdivision Code of Practice, Section 3.3.5 Target Operating Speed and Figure 3.2 – Influence of road geometry on speed.
[15] Refer QLDC Land Development and Subdivision Code of Practice, Appendix B, Drawing B2-20 Dimensions of No-Exit Road Turning Areas.
[16] Refer QLDC Proposed District Plan, Chapter 29 Transport, Schedule 29.2.

equivalent transport effects wise if this vehicle is required to turn, with only one reverse manoeuvre, within the central shared area provided in this subdivision.

It is noted that the private access lane is located at the top of a steep bank which drops down to Lake Hayes Estate to the south. It is possible that this road may require additional retaining and/or safety barrier. These elements can be confirmed during the design process. At this stage it is appropriate to consider a consent condition to allow for a road design to incorporate these features should they become necessary. The QLDC Land Development and Subdivision Code of Practice provides guidance where a safety barrier is required[17] which can be reviewed as the design progresses. When considering the need for a safety barrier the operating speed, less than 25km/hr, and suggested speed limit of 30km/hr will be significant.

Because this is a rural subdivision street lighting is not proposed within any of the proposed road network. Under the QLDC lighting strategy, Southern Light, street lighting is only required in the rural zone where deemed necessary by Council. Given the urban nature of this subdivision and the nearby environments of Lake Hayes Estate, Shotover Country and the Queenstown Country Club it is likely that street lighting will be required at this location especially where pedestrians are required to share road space such as the central shared area and the private ways. To be prudent, it is recommended that street lighting is considered as a consent condition.

To manage the design and construction of the proposed onsite road network the following consent condition is suggested.

> *That prior to any onsite construction the design of the proposed road network is to be provided to QLDC for review and approval. The road network is to be design in accordance with QLDC Land Development and Subdivision Code of Practice and shall include:*
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> - *That the private road network shall include a 30km/hr speed limit which shall be posted at, or near, the entrance from Howards Drive. The speed limit signs and markings are to be installed to meet the requirements of the NZTA Manual of Traffic Signs and Markings (MOTSAM) and the NZTA Traffic Control Devices (TCD) Manual.*
> - *The design of the private access lane serving all lots between Howards Drive and the central shared area. This road shall be designed in accordance with a Figure E11 type road from the QLDC Land Development and Subdivision Code of Practice. The road design is to identify the overall legal width of the road with a minimum width of 6.7m.*
> - *The design of the private access lane serving all lots may require safety barrier at the top of a steep slope down to Lake Hayes Estate. The need for safety barrier is to be assessed against the requirements of the QLDC Land Development and Subdivision Code of Practice.*
> - *The design of the central shared area and turning area as a square paved area. The design is to accommodate the swept path of an 8.8m medium rigid truck (refer QLDC Proposed District Plan, Schedule 29.2) which must be able to turn with only one reverse manoeuvre.*
> - *The design of private way serving Lots 7-12 which shall include a turning area and a passing bay. The turning area is to allow for any*

[17] Refer QLDC Land Development and Subdivision Code of Practice, Section 3.3.4 Safety Barrier Provisions.

users to turn and exit and is to be located adjacent to Lots 11 & 12. A passing bay is to be provided at the tight curve where forward visibility is restricted. The passing bay is to have a minimum of 5.5m width over 15m length.

- *If deemed necessary by QLDC street lighting is to be provided on the private access lane and the central shared area. The design of street lighting is to comply with the requirements of the Southern Light the QLDC lighting strategy and technical specifications.*
- *The proposed agreement for the ongoing management and maintenance of any roads in private/shared ownership. This agreement may form part of an overall management and maintenance agreement to include other community infrastructure.*

It is considered that this consent condition will allow for an appropriate onsite road network for the proposed subdivision and manage potential transport effects to a point which is considered acceptable.

4.3 Property Access

This assessment assumes that each residential lot will be developed with compliant car parking. The proposed house designs each have 2 garaged car park spaces each accessed via the onsite driveways.

The proposed development will form vehicle crossings to individual residential lots. The rural zoning requires that each lot has a vehicle crossing formed to Diagram 8[18]. The proposed subdivision will create an urban residential subdivision and therefore it is recommended that vehicle crossings are to be formed to Diagram 6[19]. This is a technical breach of the vehicle crossing standards within the rural zone. The changed vehicle crossing detail provide the same outcome and will not result in any adverse transport effects.

Based on the suggested housing provided it is likely that all lots will reverse either to or from the frontage road. This is acceptable based on the QLDC Proposed District Plan. However, where users are utilising the narrow, 2.75m movement lane, private ways to turn with a reverse manoeuvre a swept path should be provided at the house design/building consent stage[20]. There are two lots, Lots 4 & 8, which are considered to be rear lots in that their frontage length is the vehicle crossing. These lots will be required to turn within their lots so that they are not required to reverse along their driveway length[21]. The current design for Lot 4 does not meet these minimum requirements as a result of a retaining wall. Further design is required to achieve minimum turning requirements for this lot which, a consent condition is suggested to allow compliance, of the detailed design, with the site standard of the Proposed District Plan.

The property accesses may not meet the minimum 45m sight distance requirement of the QLDC District Plan for the current 50km/hr speed limit on Howards Drive. This is a result of the road design which limits forward visibility through alignment to achieve a lower target operating speed of less than 25km/hr and the suggested speed limit of 30km/hr as identified in the suggested condition. To achieve appropriate sight distance at lot accesses it is recommended that access sight distance is based on the Land Transport Safety Authority (now NZTA) Guide to visibility at driveways (RTS 6). This document bases the minimum sight

[18] Refer QLDC Proposed District Plan, Chapter 29 Transport, Section 29.5.16 and Schedule 29.2 Diagram 8 – Access Design
[19] Refer QLDC Proposed District Plan, Chapter 29 Transport, Schedule 29.2 Diagram 6 – Residential Vehicle Crossing.
[20] Refer QLDC Proposed District Plan, Chapter 29 Transport, Section 29.5.7, part f.
[21] Refer QLDC Proposed District Plan, Chapter 29 Transport, Section 29.5.7, part f. (iii).

distance to any access on the operating speed of the adjacent (frontage) road. The sight distance required is approximately equivalent to the Austroads desirable minimum Stopping Sight Distance (SSD)[22] on the frontage road based on the assessed operating speed of that road. Based on the anticipated operating speed of less than 25km/hr the required sight distance would be 17m[23]. The sight line (approaching drivers' line of sight) shall be measured along the centre of the approaching lane as per RTS 6 refer Figure 1.

It is recommended that given the reduced operating speed of the subdivision roads that visibility sight distances is managed to maintain a safe driving environment at the property accesses. An operating speed and sight distance assessment can be undertaken for accesses during the design stage which allows consideration of the frontage roads horizontal and vertical alignments. This consent condition will mean that each residential lot will have an access with acceptable sight distance based on the designed road environment.

The following consent condition is suggested.

> *That prior to any onsite construction the designs for residential lot accesses is to be provided to QLDC for review and approval. The access designs shall include:*
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> - *Design details for each lot access, unless otherwise agreed these will comply with the QLDC Proposed District Plan, Chapter 29 Transport, Schedule 29.2 Diagram 6 – Residential Vehicle Crossing.*
> - *Where the lot access requires vehicles to enter or exit the site in a reverse direction the vehicle swept path, for a B85 car, shall be provided. This vehicle shall be able to turn with only 1 reverse manoeuvre.*
> - *For rear lots, Lots 4 & 8, a vehicle swept path, for a B85 car, shall be provided. This vehicle shall be able to turn within the lot with only 1 reverse manoeuvre.*
> - *The visibility sight distance at each property access shall be assessed based on LTSA (now NZTA) Guide to visibility at driveways (RTS 6). The minimum sight distance to any access is to be equivalent to the Austroads Stopping Sight Distance (SSD) on the frontage road based on the assessed operating speed of that road.*

5 Summary

It is proposed to undertake a residential subdivision and land use consent at 466 Frankton-Ladies Mile Highway (SH6) which will create a total of 12 residential lots. Each of the proposed lots will contain a residential dwelling. This is a net increase of 11 potential residential dwellings within the site.

The site is accessed from Howards Drive which is an arterial road within the Council's road network. It is proposed to upgrade the site access to accommodate the additional traffic generated by the development. A consent condition is suggested to manage the upgrade of the proposed access intersection.

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[22] Refer Austroads Guide to Road Design Part 3: Geometric Design, Section 5.3 Stopping Sight Distance (SSD), Table 5.5 Stopping sight distance for cars on sealed roads.

[23] Based on Refer Austroads Guide to Road Design Part 3: Geometric Design, Section 5.3 Stopping Sight Distance (SSD), Equation 1 where: reaction time R_T=1.5 seconds, operating speed V=25km/hr, coefficient of deceleration d=0.36 and longitudinal grade a=0.0 (flat ground).

The proposed subdivision will be a private subdivision where all access roads and transport infrastructure will remain in shared ownership. It is expected that the proposed road network can be designed and constructed to generally meet the requirements of the QLDC Land Development and Subdivision Code of Practice and the QLDC Proposed District Plan. A number of consent conditions are suggested to manage the design of the proposed road network and property accesses. This includes any minor departures from either the QLDC Land Development and Subdivision Code of Practice and/or the QLDC Proposed District Plan.

As a private road network an appropriate management and maintenance agreement will be required. A consent condition is suggested to manage the provision of an appropriate management and maintenance agreement.

I consider that with the suggested consent conditions the proposed subdivision can be appropriately designed and constructed. I consider that the subdivision will have minimal transport effects on the surrounding transport network, any transport impacts of which will not be noticeable.

Should you require any further information please contact me.

Yours sincerely,

Jason Bartlett

CEng MICE, MEngNZ
Transport Engineer

Appendix A Development Drawings

The following development drawing has been reviewed when undertaking this assessment:

- Queenstown Commercial, Proposed Site Plan, dated 16 October 2020.

In addition the following Bartlett Consulting figures have been provided to show swept paths.

- Figure 01, Vehicle Access Requirements, NZS B85 and B99 Car,
- Figure 02, Vehicle Access Requirements, NZS B85 Car, and
- Figure 03, Vehicle Access Requirements, RTS-18 and QLDC Medium Rigid Truck.

Site Plan - Proposed

Rev ID	Ch ID	Change Name	Date
05	09	Road location altered - road moved further north	16/10/2020

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Proposed Site Plan

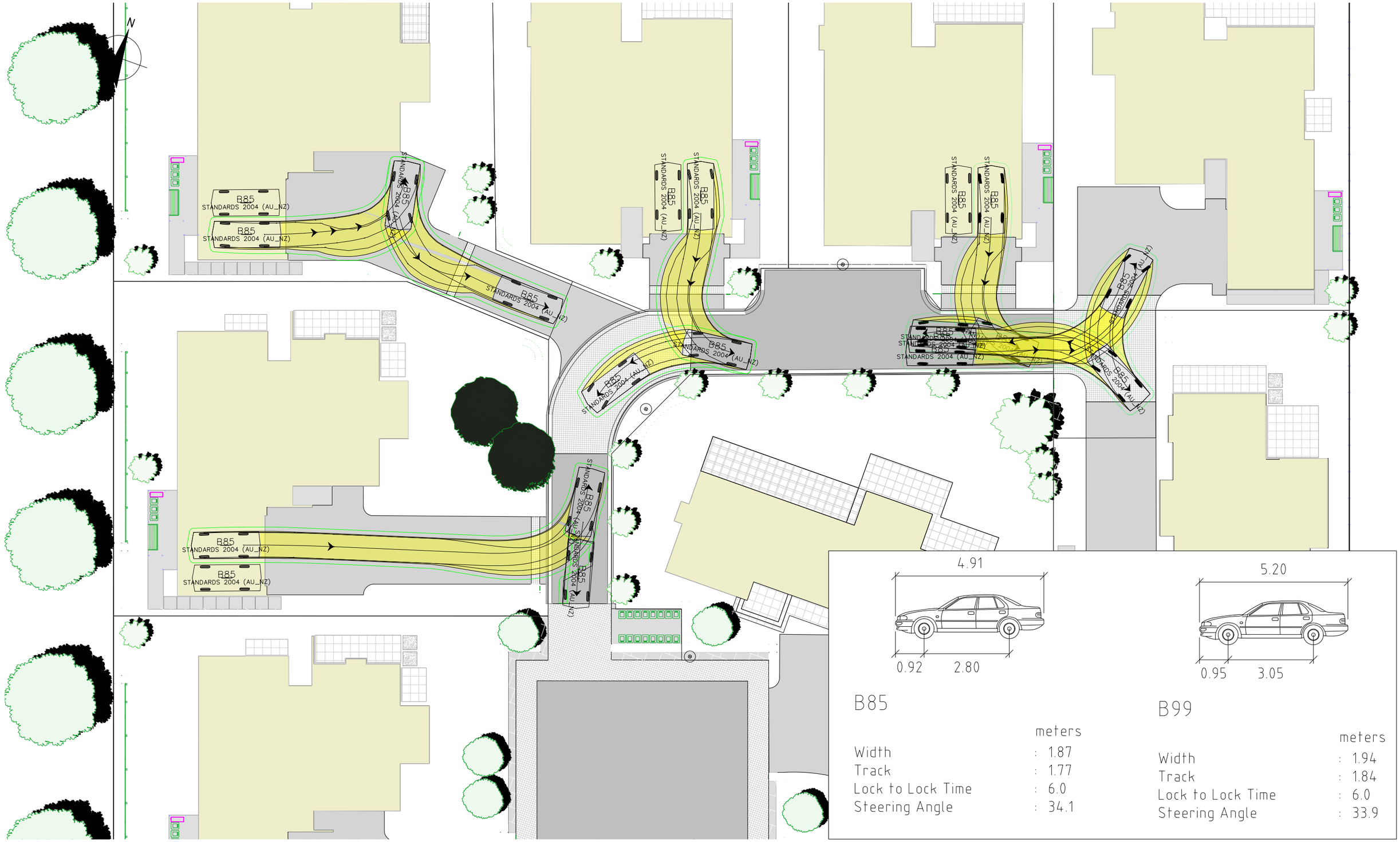
DRAWN BY: HA

1:750 @ A3

DATE: 16/10/2020

PHONE: 027 7743 762

REVISION NUMBER:
05



B85

	meters
Width	: 1.87
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.1

B99

	meters
Width	: 1.94
Track	: 1.84
Lock to Lock Time	: 6.0
Steering Angle	: 33.9

0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

Bartlett consulting

QUEENSTOWN COMMERCIAL
466 FRANKTON - LADIES MILE

VEHICLE ACCESS REQUIREMENTS NZS B85 AND B99 CAR

Job Number	QCO-001
Revision	C
Date	OCT 2020

Figure 01

Bartlett Consulting | PO Box 1383 | Queenstown, 9348 | +64 27 555 8824 | jason@bartlettconsulting.co.nz

Plot Date: 19 October 2020 - 7:16 PM Plotted by: Fraser Hocks
Cad File No: C:\Users\fhocks\Google Drive\Hocks Consulting Ltd\Jobs\Bartlett Consulting Ltd\466 Ladies Mile Highway\FIG01-FIG03.dwg

0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

Bartlett consulting

QUEENSTOWN COMMERCIAL
466 FRANKTON - LADIES MILE

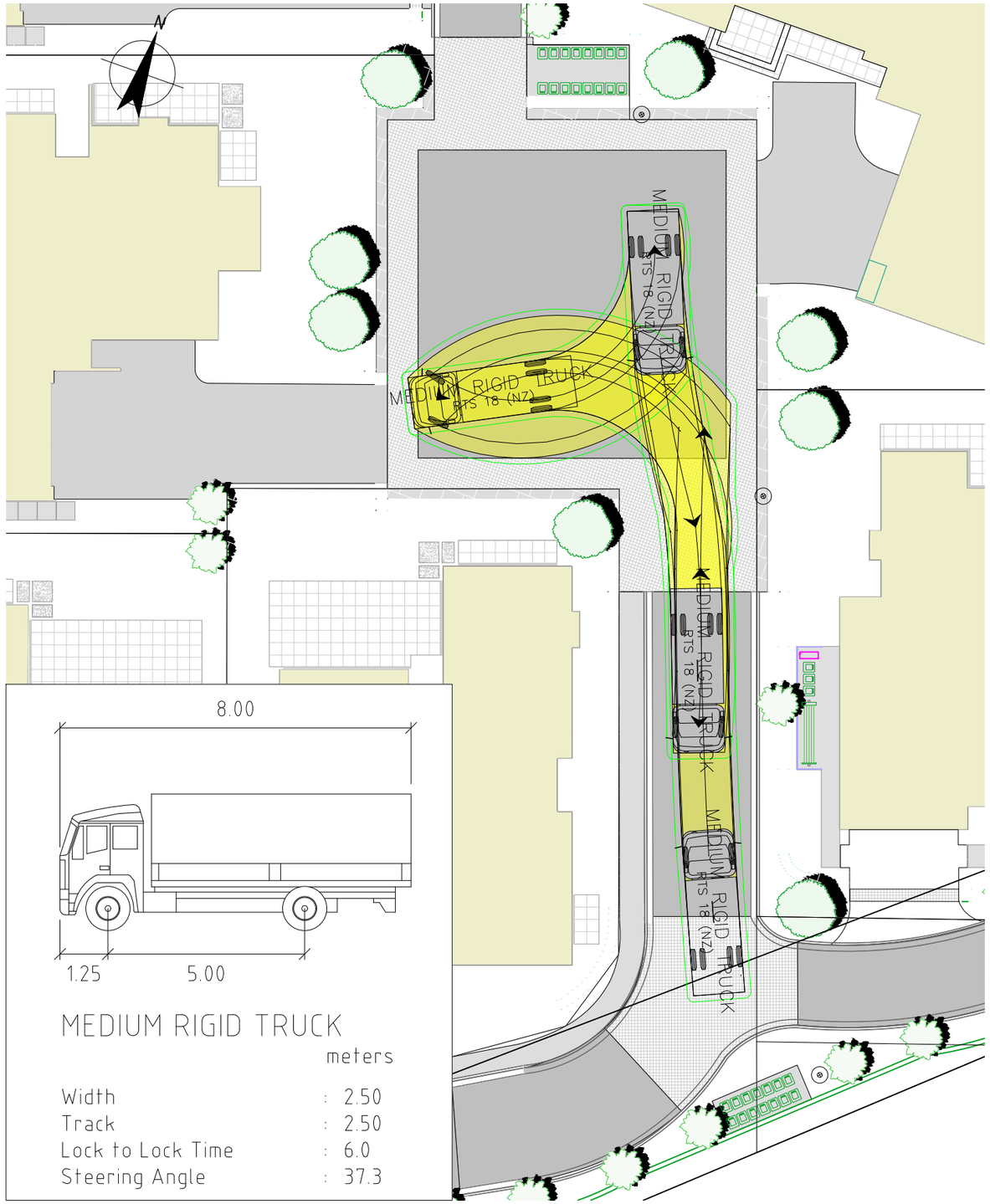
VEHICLE ACCESS REQUIREMENTS
NZS B85 CAR

Job Number | QCO-001
Revision | C
Date | OCT 2020

Figure 02

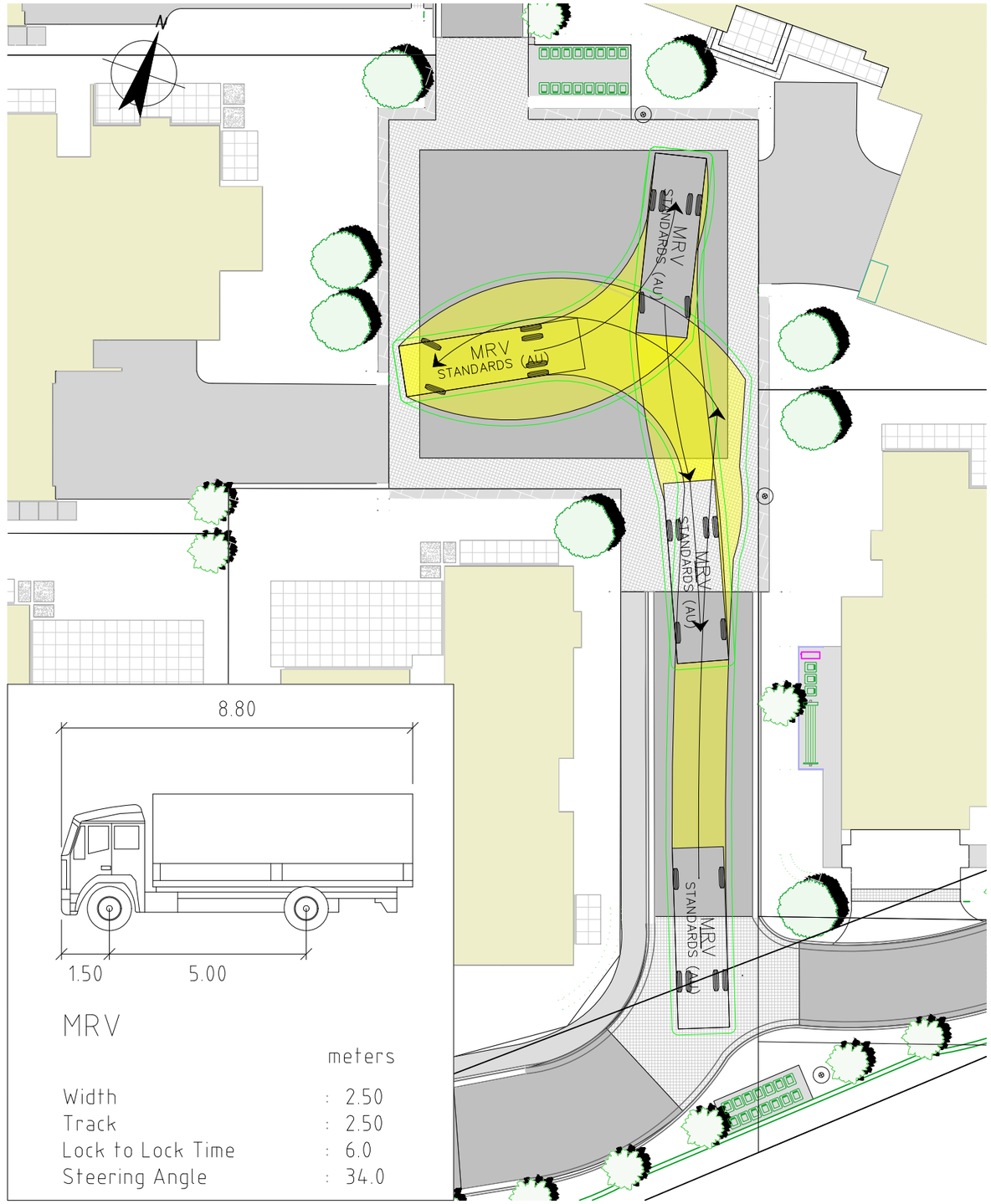
Bartlett Consulting | PO Box 1383 | Queenstown, 9348 | +64 27 555 8824 | jason@bartlettconsulting.co.nz

Plot Date: 19 October 2020 - 7:16 PM Plotted by: Fraser Hocks
Cad File No: C:\Users\fhocks\Google Drive\Hocks Consulting Ltd\Jobs\Bartlett Consulting Ltd\466 Ladies Mile Highway\FIG01-FIG03.dwg



MEDIUM RIGID TRUCK

	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 37.3



MRV

	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

Bartlett consulting

QUEENSTOWN COMMERCIAL
466 FRANKTON - LADIES MILE

VEHICLE ACCESS REQUIREMENTS
RTS-18 AND QLDC MEDIUM RIGID TRUCK

Job Number | QCO-001
Revision | C
Date | OCT 2020

Figure 03

Bartlett Consulting | PO Box 1383 | Queenstown, 9348 | +64 27 555 8824 | jason@bartlettconsulting.co.nz

Plot Date: 19 October 2020 - 7:16 PM Plotted by: Fraser Hocks Cad File No: C:\Users\fhocks\Google Drive\Hocks Consulting Ltd\Jobs\Bartlett Consulting Ltd\466 Ladies Mile Highway\FIG01-FIG03.dwg

Appendix B QLDC Proposed District Plan, Compliance Assessment

The table provided below outlines the proposed development's compliance against the access site standards (Sections 29.5.14 to 29.5.24) of the Transportation Site Standards for the Rural zone.

Table – Proposed QLDC District Plan Assessment

Rule	Requirement	Provided	Compliance
29.5.14	Access and Road Design a. Access to unit title shall be in accordance with QLDC Code of Practice. c. No private access shall serve a site with the potential to accommodate more than 12 units. d. Private shared vehicle accesses shall have legally enforceable arrangements for maintenance. e. All vehicle access design shall comply with Schedule 29.2.	The proposed private access lane will be designed in accordance with QLDC Code of Practice Figure E11 with the exception of legal road width being 6.7m. Other private shared access comply with Figure E9. The private road network will only serve 12 residential lots. This will require a legally enforceable arrangement for road maintenance. Access from Howards Drive and individual lot accesses to comply with Schedule 29.2.	No Private Access Lane with of 6.7m (requires 9m minimum). A legally enforceable arrangement for road maintenance to be provided.
29.5.15	Width and Design of Vehicle Crossings – Urban Zones	Not Urban Zone, Refer 29.5.16.	N/A
29.5.16	Width and Design of Vehicle Crossings – Rural Zones Based on traffic flows access to subdivision requires on Diagram 10. Access to residential lots from the internal access to be Diagram 8.	Based on the type of traffic the access intersection from Howards Drive is to be formed as a Diagram 10 access design, design details of the access design are to be provided. Each residential lot is expected to have an access design as per Diagram 8. As the onsite development is residential it is suggested that the access is designed based on Diagram 6 – Residential Vehicle Crossing.	No Detailed design of access intersection as per Diagram 10 required. Detailed design of residential vehicle crossings as per Diagram 6 required.
29.5.17	Maximum Gradient for Vehicle Access Maximum Access gradient is 1 in 6 and meets appropriate breakover angles.	The land is generally flat and the maximum access gradient will not be greater than 1 in 6.	Yes

Rule	Requirement	Provided	Compliance
29.5.18	Minimum Sight Distances from Vehicle Access on all Roads other than State Highways Howards Drive 50km/hr[24] speed limit requires 45m minimum sight distance for residential activities.	Access from Howards Drive sight distances are; • 320m to the north, and • 150m to the south/west. Possible residential lots will have less than the 45m minimum visibility requirements.	No Consent condition suggested for residential lots.
29.5.19	Minimum Sight Distances from Vehicle Access onto State Highways	No accesses from state highway.	N/A
29.5.20	Maximum Number of Vehicle Crossings 120m frontage length onto an arterial road allows 2 vehicle crossings.	The subdivision has a single vehicle crossing from Howards Drive. Each residential lot is to have a single vehicle crossing.	Yes
29.5.21	Minimum Distance Between Vehicle Crossings onto State Highways	No accesses from state highway.	N/A
29.5.22	Distances of Vehicle Crossings from Intersections Requires a minimum separation distance of 40m on Howards Drive. Or, 25m on the internal access to residential lots.	On Howards Drive the Separation distance is approximately 200m from the proposed access to Jones Rd to the south/west or 190m to First Avenue to the north. Lot 1 is the nearest lot access to the new access intersection with Howards Drive, the separation distance is approximately 30m.	Yes
29.5.23	Minimum distances of Vehicle Crossings from Intersections onto State Highways	No accesses from state highway.	N/A
29.5.24	Service Stations	Not a service station.	N/A

[24] The speed limit of Howards Drive is expected to reduce to 40km/hr as a result of the QLDC Speed Limit Bylaw (2019). There are no minimum sight distance requirements for a speed limit of 40km/hr.

Geotechnical Report for Resource Consent

466 Frankton-Ladies Mile Highway, Queenstown

Report prepared for:

Queenstown Commercial Ltd

Report prepared by:

GeoSolve Limited

Distribution:

Queenstown Commercial Ltd

GeoSolve Limited (File)

October 2020

GeoSolve Ref: 160041.08

Revision	Issue Date	Purpose	Author	Reviewed
1	July 2020	Client issue	MBS	PGF
2	Sept 2020	Client issue	MBS	PGF
3	Oct 2020	Client Issue	MBS	PGF
4	Oct 19 - 2020	Client Issue	MBS	PGF

GEOTECHNICAL WATER RESOURCES PAVEMENTS

Table of Contents

1 Introduction

1.1 General

This report presents the results of a geotechnical investigation and assessment undertaken by GeoSolve Ltd to determine the subsoil conditions and provide geotechnical inputs for a proposed subdivision at 466 Frankton-Ladies Mile Highway, Queenstown.

Photo 1 – Site photo looking west across the site.

The investigations were carried out for Queenstown Commercial Ltd in accordance with GeoSolve Ltd proposal 160041.08 dated 16 June 2020, which outlines the scope of work and conditions of engagement.

1.2 Development

Drawings provided indicate it is proposed to subdivide the site into 12 residential lots and construct 11 new residential buildings on the property, with 1 of the lots accommodating an existing dwelling. No significant excavations are expected with final levels being similar to the pre-development levels.

A new access road will be constructed along the southern boundary of the development, which is at the crest of an existing slope. In some locations the access road will extend out over the slope crest and structural retaining will be required to support the road shoulder.

Retained heights will vary up to approximately 2.6 m. Options to retain the road shoulder are discussed in Section 5.6.2. The proposed retaining is shown on the cross-sections provided by Queenstown Commercial Limited and included in Appendix A.

An existing residential dwelling is present on the site and we understand this is to remain.

The general development layout is shown on Figure 1, Appendix A.

2 Site Description

2.1 General

The subject property, legally described as Lot 2 DP 536321 is located south of Frankton Ladies Mile Highway, approximately 10 km from Queenstown township, as shown on Figure 2.1 below. The site is accessed from Howards Drive.

Figure 1 – Site location plan

The property is bounded by Howards Drive to the west, 516 Frankton-Ladies Mile Highway to the north and east and the existing Lake Hayes subdivision to the south. An existing residential dwelling with associated landscaping and outbuildings currently occupies the site.

2.2 Topography and Surface Drainage

The site is surface is generally sub-horizontal. Along the south-eastern boundary of the site the ground falls moderately to steeply (25-35°) to the south, approximately 13-18 m down a historic river terrace. Cross-sections A to C, Appendix A, show the topography of the slope along the south-eastern site boundary.

The site is naturally free draining and no seepages were evident within the site boundary. All surface drainage is expected to flow in a southerly and south-easterly direction.

3 Geotechnical Investigations

An engineering geological site appraisal has been undertaken with confirmatory subsurface investigations. Site investigations were undertaken on 25 June and 2 July 2020, undertaking geotechnical investigations comprising:

- Seven test pits (TP 1-7) which were advanced to a maximum depth of 3.3 m;
- Twenty-four Scala penetrometer tests which were advanced to a maximum depth of 1.9 m;
- Two Dynamic Probe (Heavy) tests (DPH 1-2) to a maximum depth of 10.9 m to assess the relative density of the subsoils.

Test pit, Scala Penetrometer and DPH locations and logs are contained in Appendix A and B respectively.

4 Subsurface Conditions

4.1 Geological Setting

4.1.1 Regional Geology

The site is in the Wakatipu basin, a feature formed predominantly by glacial advances. Published references indicate the last glacial event occurred in the region between 10,000 and 20,000 years ago. Glaciations have left deposits of glacial till and glacial outwash over ice–scoured bedrock. Post glacial times have been dominated by the erosion of the bedrock and glacial sediment, with deposition of alluvial gravel by local watercourses and lacustrine sediment during periods of high lake levels. The site is located on the historic Shotover River Delta.

Active fault traces were not observed at the site or in the immediate vicinity, and the closest major active fault is the Nevis-Cardrona Fault system. However, significant seismic risk exists in this region from potentially strong ground shaking, associated with the rupture of the Alpine Fault, located 80 km northwest of Queenstown along the west coast of the South Island. There is a high probability that an earthquake with an expected magnitude of over M8 will occur along the Alpine Fault in the next 50 years.

4.2 Stratigraphy

The subsurface soils observed during site investigation typically comprised:

- 0.1-0.3 m of topsoil, overlying;
- 0.35-0.6 m of loess, overlying;
- Deltaic sand and gravel.

Topsoil was observed at the surface to depths of between 0.15 and 0.3 m. The topsoil comprises firm, organic SILT with trace of rootlets and tree roots, and firm, gravelly organic SILT with minor sand and trace of rootlets.

Loess was observed to underlie the topsoil in all test pits to depths of between 0.6 and 0.9 m. The loess comprises stiff to very stiff, sandy SILT and loose to medium dense, silty SAND.

Deltaic sand and gravel were observed at the base all test pits from depths of between 0.6 and 0.9 m. The deltaic sand and gravel comprise loose to medium dense, SAND and GRAVEL deposits. The deltaic sand layers comprise sand with variable fractions of silt. Deep investigation data in nearby areas indicates these materials extend to depth beneath the site.

Full details of the observed subsurface stratigraphy can be found in the test pit logs and borehole logs contained in Appendix B.

An engineering geological model for specific sloping areas of the site is shown in Figure 2, Appendix A.

4.3 Groundwater

No groundwater seepage was observed in any of the test pits or bore holes during the investigations. Nearby Otago Regional Council (ORC) well data indicates the regional groundwater table is at depths of approximately 40 m below current ground levels in the general area. This complies with wider investigation data held on filed by Geosolve.

4.4 Natural Hazards

Seismic

A risk of seismic activity has been identified for the region as a whole and appropriate allowance should be made for seismic loading during detailed design of the proposed buildings, foundations and associated earthworks.

Liquefaction

The site is identified on the Queenstown Lakes District Council (QLDC) Hazard Maps as being 'possibly susceptible' to liquefaction. Our assessment indicates there is very low liquefaction risk for the proposed development due to the significant depth to the regional groundwater table (40 m+). No further assessment is considered necessary with respect to this hazard.

Slope Stability

No existing ground instability was identified during the site inspection and no mapped known instability is indicted on the QLDC hazard maps.

The potential for localised instability at the crest of the slope present on the south-eastern boundary of the site is discussed in Section 5.8.

Other

No other natural hazards have been identified at the site.

5 Engineering Considerations

5.1 General

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations are inferred and cannot be guaranteed.

5.2 Geotechnical Parameters

Table 5.1 provides a summary of the recommended geotechnical design parameters for the soil materials expected to be encountered during construction of the proposed development.

Table 5.1 – Recommended geotechnical design parameters

Unit	Thickness (m)	Bulk Density γ (kN/m^3)	Effective Cohesion c´ (kPa)	Effective Friction ϕ´ (deg)	Elastic Modulus **E** (kPa)	Poissons Ratio ν
Topsoil (firm, organic SILT and gravelly organic SILT with minor sand and trace of rootlets)	0.15 - 0.3	To be removed from development area				
Loess (stiff to very stiff, sandy SILT and loose to medium dense, silty SAND)	0.35 - 0.6	18	0	30	5,000	0.3
Deltaic sand & gravel (loose to medium dense SAND and GRAVEL deposits)	Unknown	19	0	32-34	20,000	0.3

5.3 Building Platform Preparation

During the earthworks operations all topsoil, organic matter, uncontrolled fill and other unsuitable materials should be removed from the construction areas in accordance with the recommendations of NZS 4431:1989.

Owing to the moderately erodible nature of some of the soils present across the site, sediment control measures should be instigated during earthworks construction.

Exposure to the elements should be limited for all soils. Excavations in soils should be left proud of the finished subgrade by 200 to 300 mm if a delay prior to construction is expected. The final footing excavations should be performed immediately prior to construction.

Water should not be allowed to pond or collect near or under a foundation slab. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

All fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification provided to that effect.

We recommend topsoil stripping and subsequent earthworks be undertaken only when a suitable interval of fair weather is expected, or during the earthworks construction season.

5.4 Excavations

No earthworks plans have been provided for the development, however, it is expected minor cut and fill earthworks will be required to establish level building platforms, services and roads.

Recommendations for temporary and permanent soil batter slope angles are described below in Table 5.2. Slopes that are required to be steeper than those described below should be structurally retained or subject to specific geotechnical design.

All slopes should be periodically monitored during construction for signs of instability and excessive erosion, and, where necessary, corrective measures should be implemented to the satisfaction of a geotechnical engineer or engineering geologist.

No groundwater seepage was encountered during test pitting, however, if encountered, a geotechnical practitioner should inspect any seepage.

Table 5.2 – Recommended batters for permanent cuts up to 3 m in height

Material Type	Recommended Maximum Batter Angles for Temporary Cuts Less than 3 m High (horizontal to vertical)		Recommended Maximum Batter for Permanent Cuts Less than 3 m High in Dry Ground (horizontal to vertical)
	Dry Ground	Wet Ground	
Topsoil and Loess	1.5H:1.0V	3.0H:1.0V	3.0H:1.0V
Deltaic sand and gravel	1.5H:1.0V	2.5H:1.0V	2.5H: 1.0V

5.5 Engineered Fill Slopes

All fill should be placed and compacted in accordance with the recommendations of NZS4431: 1989 and Queenstown Lakes District Council Standards. All cut and fill earthworks should be inspected and tested as appropriate during construction and certified by a Chartered Professional Engineer.

No fill slopes are currently proposed however, if required, all un-retained fill slopes which are ≤ 3.0 m high should be constructed with a maximum batter slope of 2.0H:1.0V (horizontal to vertical) or flatter and be benched into sloping ground. If a building platform is located at the crest of a slope then batters of 3.0H:1.0V are recommended in the first instance with an appropriate building set-back.

Fill slopes greater than 3.0 m in height, or that require to be steeper than 2.0H:1.0V, should be subject to geotechnical review.

5.6 Ground Retention

5.6.1 General

All retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 5.1 of this report. Due allowance should be made during the detailed design of all retaining walls for any additional loads upslope of the wall (i.e. surcharge due to backslope, traffic, buildings and seismic forces).

All temporary slopes for retaining wall construction should be battered in accordance with Table 5.2.

Groundwater was not identified in the test pits but has the potential to develop following completion of the earthworks, in particular as a result of heavy or prolonged rainfall. To ensure potential groundwater seeps and flows are properly controlled behind the retaining walls, the following recommendations are provided:

- A minimum 0.3 m width of durable free draining granular material should be placed behind all retaining structures;
- A heavy duty non-woven geotextile cloth, such as Bidim A14, should be installed between the natural ground surface and the free draining granular material to prevent siltation and blockage of the drainage media;
- A heavy-duty (TNZ F/2 Class 500) perforated pipe should be installed within the drainage material at the base of all retaining structures to minimise the risk of excessive groundwater pressures developing. This drainage pipe should be connected to the permanent piped storm water system;
- Comprehensive waterproofing measures should be provided to the back face of all basement retaining walls to minimise groundwater seepage into the finished buildings.

Horizontal drains should be installed to collect and control groundwater flows if excessive groundwater seepages are encountered during construction, but this is considered unlikely. The location and design of all horizontal drains should be confirmed on site by a Geotechnical Engineer or Engineering Geologist. The outlet of all sub-soil or horizontal drains should be connected to the permanent piped storm water system

5.6.2 Access Road Retaining

The proposed access road on the southern boundary of the site will extend out over the existing slope crest. Structural retaining will be required to support the fill placed to support the road, as indicated in the cross-sections provided in Appendix A.

Several options are available to retain the fill, the 2 most likely solutions are reinforced earth, see Figures 5.1, and a Universal Column (UC) and timber wall with tie-backs, see 5.2 below. Both options are considered technically feasible, with the final choice being decided by cost, constructability and aesthetics.

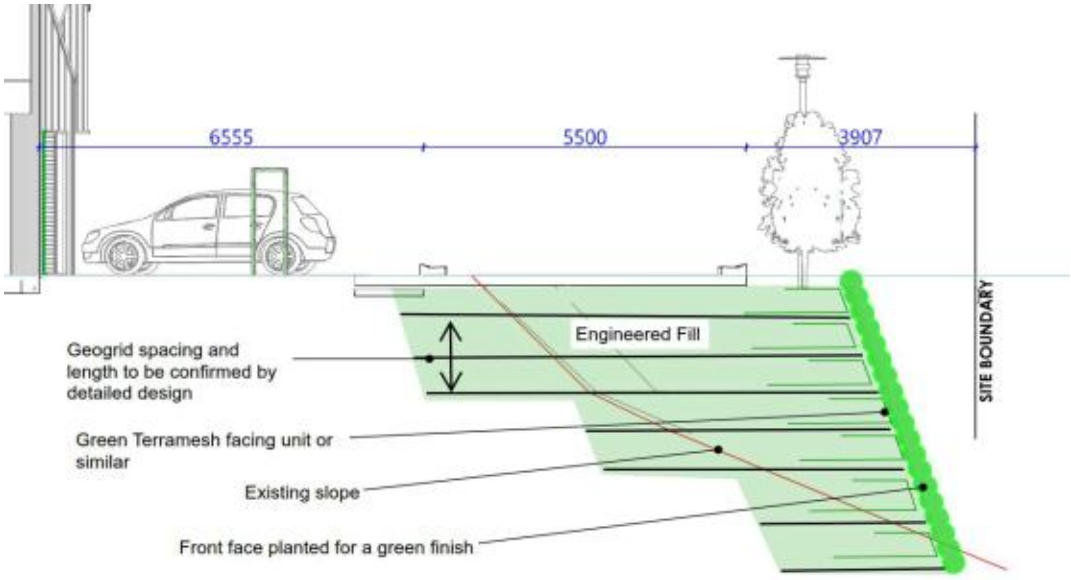


Figure 5.1 Concept for geogrid reinforced earth retaining along the southern boundary

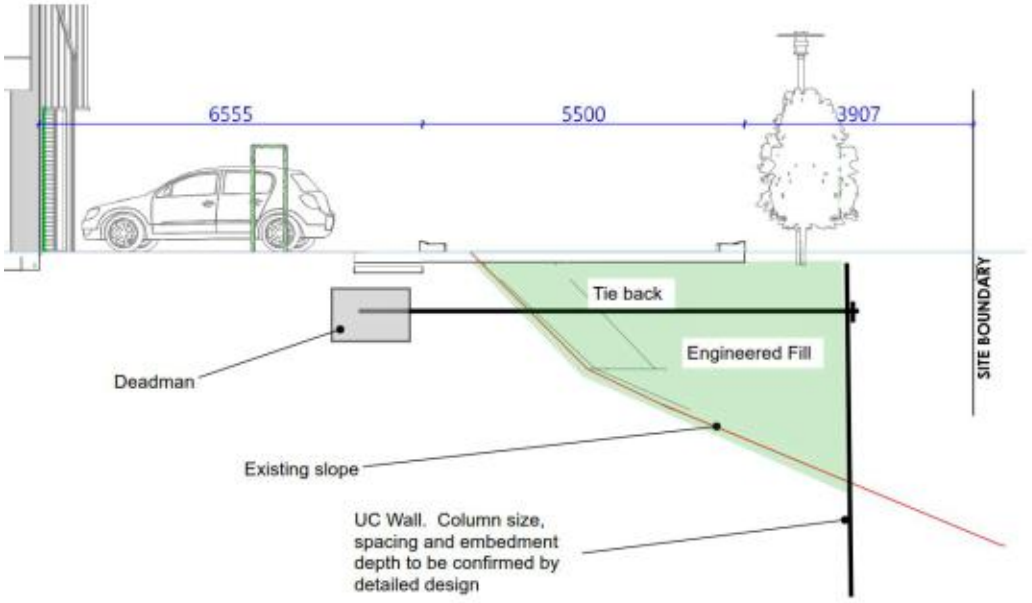


Figure 5.2 Concept for UC wall with tie back.

Other retaining options will also be suitable and can be considered at the detailed design phase, such as:

- Gabion faced reinforced earth, and;
- Timber pole

All designs will need to consider the slope stability discussed in Section 5.8 below, particularly for the section of wall adjacent to building 4.

5.7 Groundwater Issues

The water table is expected to lie well below earthworks and finished floor levels. Dewatering or other groundwater-related construction issues are therefore unlikely to be required. It is important that GeoSolve be contacted should there be any seepage, spring flow or under-runners encountered during construction.

5.8 Slope Stability

Buildings will be located along the crest of the slope on the southern boundary of the site. A slope stability assessment of the existing contours has been undertaken using limit equilibrium slope stability software package Slope/W. The results indicate:

Buildings 1, 2 and 3 are approximately 8.5-12 m set back from the crest. The results of the analyses confirm the proposed building setbacks will meet typical factors of safety targets for static, SLS and ULS seismic loading scenarios. No special provisions therefore apply for the design of these buildings with respect to slope stability

Building 4 is nearer the existing slope crest, being set back approximately 2 m at its nearest point. However, proposed modifications of the slope will result in the building being approximately 6 m back from the crest once the access road and retaining have been constructed. For the pre-works slope profile target factors of safety are not met and ground displacement should be expected during a ULS event. Design of the retaining wall will provide an opportunity to improve the stability of the slope crest in the vicinity of building 4 to an appropriate level. The performance of the building should therefore be considered during the detailed design of the retaining wall in this location.

5.9 Shallow Foundations

5.9.1 General

The topsoil will not provide adequate support for the proposed development foundations and should be removed from the building footprints. Constructing foundations to bearing directly on the loess is not recommended.

All unsuitable materials identified in foundation excavations, particularly those softened by exposure to water, should be undercut and replaced with engineered fill during construction. Loess is susceptible to disturbance induced strength loss; therefore, care will need to be taken to minimise any disturbance of foundation footprints. Engineered fill is typically used to increase bearing capacity in this soil type.

The soil materials present at the site are not “good ground” as per NZS3604 , and specific engineering design will be required. Two options for shallow bearing foundations are provided as follows:

- Foundations should bear on a minimum thickness of engineered fill placed on the Loess, see section 5.9.2 below, or;
- Extend foundations down to bear directly on the underlying deltaic sand and gravel, see section 5.9.3 below.

Fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

To minimise the effects of freeze-thaw cycles, all shallow foundations in soils should be founded a minimum of 0.4 m below the adjacent finished ground surface.

It is recommended the foundation subgrade be inspected by a suitably qualified and experienced geotechnical practitioner to confirm the conditions are in accordance with the assumptions and recommendations provided in this report.

5.9.2 Shallow Foundations on Engineered Fill overlying Loess

Shallow foundations bearing on engineered fill overlying loess will be suitable for typical residential structures. The engineered fill should extend 1 m beyond the building footprint. The following minimum thickness of engineered fill are provided for 2 foundation scenarios:

- A minimum of 300 mm of engineered fill overlying loess will be required to provide 200 kPa ultimate bearing capacity.
- A minimum of 500 mm of engineered fill overlying loess will be required to provide 300 kPa ultimate bearing capacity.

A geotextile separation layer is recommended between granular engineered fill and loess.

Any engineered fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

5.9.3 Shallow Foundations on Alluvial Sand and Gravel

Foundations can be extended through the loess to bear on deltaic sand and gravel.

Figure 5.1 summarises the recommended working stresses for shallow footings, which bear upon deltaic sand and gravel. It should be noted the foundation working stresses presented on Figure 5.1 are governed by bearing capacity in the case of narrow footings and settlement in the case of wide footings.

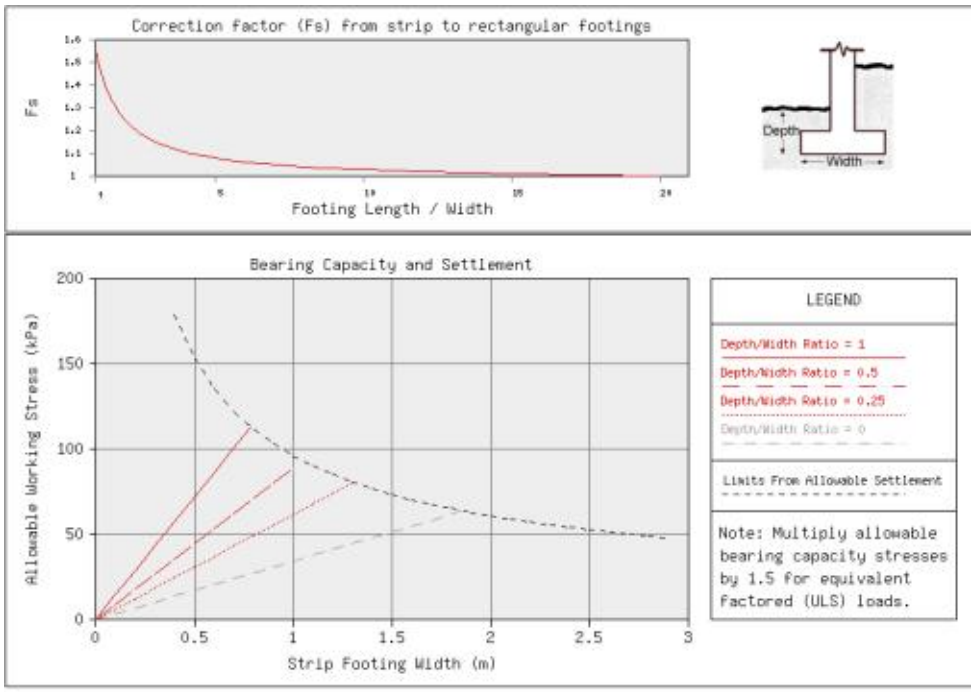


Figure 5.3: Recommended Bearing for Shallow Foundations bearing on Deltaic Sand and Gravel.

From Figure 5.3 above it can be seen an allowable working stress of approximately 60 kPa is recommended for a 400 mm wide by 400 mm deep (minimum) strip footing founded on deltaic sand and gravel. This corresponds to a factored (ULS) bearing capacity of approximately 90 kPa and an ultimate geotechnical bearing capacity of 180 kPa. Note, to bear on the deltaic sand and gravel excavating down approximately 1 m will be required in most areas.

It is recommended the foundation excavations be inspected by a suitably qualified and experienced geotechnical specialist to confirm the conditions are in accordance with the assumptions and recommendations provided in this report. After the foundations are inspected the bases of excavations should be tidily trimmed, compacted with a plate compactor and immediately covered with the 150 mm of compacted granular fill or 50 mm of site concrete.

5.9.4 Site Subsoil Category

For detailed design purposes, it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004.

The site is Class D (deep site) in accordance with NZS 1170.5:2004 seismic provisions. The soil parameters for static conditions given above require no downgrading for seismic bearing (The materials are not subject to liquefaction or other strength loss on cyclic loading).

5.10 Pavements

Several subdivision roads are included in the scheme. Following removal of topsoil, the pavement subgrade layer will predominantly comprise silty sand and sandy silt materials

(loess). Based on scala penetrometer results design CBR values (10th percentile) of 3.5% are recommended for pavement design. With rain saturation, ponding and machinery trafficking the CBR can and often does reduce to 2% or less.

Pavements in adjacent development areas used a CBR values of 2% and the works were generally completed without major redesigns during construction. A 3.5% CBR will provide a workable solution however careful construction methods, testing, staging due to weather and managing additional undercut as and when needed will be required.

Note the loess materials are very susceptible to a reduction in strength should they be subject to saturation or disturbance (trafficking). Care should be taken to stage all pavement construction to enable undisturbed loess materials to be protected as soon as practical following excavation to subgrade levels. A geotextile separation cloth between the loess subgrade and the overlying granular pavement layers is recommended as part of future detailed pavement design.

A higher CBR of 6% can be obtained on the underlying deltaic sand and gravels at depth.

5.11 QLDC Land Development and Subdivision Code of Practice

Section 2.4.4 of the QLDC Land Development and Subdivision Code of Practice (QLDC CoP) requires the developer of any subdivision to appoint a geo-professional to carry out the following functions from the planning to construction phases of the subdivision:

a) Check regional and district plans, records, and requirements prior to commencement of geotechnical assessment;

b) Prior to the detailed planning of any development, to undertake a site inspection and such investigations of subsurface conditions as may be required, and to identify geotechnical hazards affecting the land, including any special conditions that may affect the design of any pipelines, underground structures, or other utility services;

c) Before construction commences, to review the drawings and specifications defining any earthworks or other construction and to submit a written report to the TA on the foundation and stability aspects of the project (if required);

d) Before and during construction, to determine the extent of further geo-professional services required (including geological investigation);

e) Any work necessary to manage the risk of geotechnical instability during the construction process;

f) Before and during construction, to determine the methods, location, and frequency of construction control tests to be carried out, determine the reliability of the testing, and to evaluate the significance of test results and field inspection reports in assessing the quality of the finished work;

g) During construction, to undertake regular inspection consistent with the extent and geotechnical issues associated with the project;

h) On completion, to submit a written report (i.e. Geotechnical Completion Report) to the Territorial Authority (TA) attesting to the compliance of the earthworks with the specifications and to the suitability of the development for its proposed use including natural ground within the development area. Where NZS 4431 is applicable, the reporting requirements of that Standard shall be used as a minimum requirement.

This resource consent level report can be considered to have completed items a) and b) from the above list. Once resource consent for the subdivision has been granted a geo-professional will need to be appointed by the developer to review the earthworks drawings and specifications prior to finalising the documentation for tendering and/or construction, and to oversee the construction phase of the project including certification of fill and provide a Geotechnical Completion Report (GCR) and Schedule 2A in accordance with the QLDC CoP.

The GCR and Schedule 2A should detail the results of site observations, testing and monitoring during earthworks construction, confirm the stability of the finished earthworks, and identify any specific geotechnical design requirements that must be addressed in order to construct a building on site. Any identified specific design requirements will then be registered on the subject lots' 'certificate of title' and will need to be addressed during the building consent process.

The geo-professional completing the GCR and Schedule 2A which includes the certification of fill should in all cases be engaged by the developer not the contractor. It is also advisable that the geo-professional review the earthworks contract to assist in managing the developers risk and ensuring that the contract is clear with respect to geotechnical risks and responsibilities during construction.

The use of this report and any of its findings or recommendations as part of the GCR and Schedule 2A may only be used with our prior review and written agreement.

6 Neighbouring Structures

Distances to adjoining structures: The site is bounded by Howards Drive to the west, 516 Frankton-Ladies Mile Highway to the north and east and the existing Lake Hayes subdivision to the south. The nearest buildings are currently under construction within the Queenstown Country Club development, approximately 50 m to the west. No adverse geotechnical implications apply for neighbouring developments during construction provided appropriate measures are taken during the construction of the proposed development and the recommendations of this report are followed.

Aquifers: The regional ground water table is expected to lie at significant depth beneath the proposed foundation level and no aquifer resource is expected to be adversely affected by the proposed development. Note, the site is located above the Wakatipu aquifer and ORC consent will be required for any drilling/boring undertaken, e.g. for geothermal heating, or further geotechnical investigations.

Erosion and Sediment Control: The site presents some potential to generate silt runoff and this would naturally drain downslope. Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, hay bales, vegetation buffer strips and sediment ponds. Only the least amount of subsoil should be exposed at any stage and surfacing established as soon as practical. QLDC guidance on environmental management plans should be consulted.

Noise: Standard excavation and compaction plant will be required. QLDC requirements should be met regarding this issue.

Dust: The soil materials at the site have potential to generate dust. Regular dampening of soil materials with sprinklers should be effective if required.

Vibration: No vibration induced settlement is expected in these soils.

7 Conclusions and Recommendations

- The stratigraphy across the site typically comprises topsoil overlying loess and deltaic sand and gravel which extends to depth;
- No groundwater was observed during site investigations and is expected to lie at approximately 40 m beneath the site;
- The liquefaction risk at the site is very low to nil and no specific requirements are considered necessary with respect to development. ;
- Soil materials present at the site are not “Good Ground” as defined in NZS 3604. Recommendations for shallow foundations are provided in Section 5.9. It is recommended shallow foundations bear on engineered fill overlying loess or alternatively be extended down to bear on the underlying deltaic sand and gravel.
- Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect;
- A geotechnical practitioner should inspect all excavations and additionally any seepage that may be encountered during construction;
- For detailed design purposes, it is recommended the magnitude of seismic acceleration be estimated in accordance with recommendations of NZS 1170.5:2004 using Class D subsoil conditions;
- Retaining will be required along the southern boundary of the site to accommodate the access road. Retaining options are discussed in Section 5.6 and 5.6.2. Detailed design will be required to finalise the preferred retaining option.
- Slope stability analysis indicates the locations of buildings 1, 2, and 3 are sufficiently set back from the slope and no specific foundation design is required to cater for movement due to slope instability, or reduced factors of safety.
- For building 4, specific engineering design will be required to address slope stability. The detailed design of the proposed retaining wall along the southern boundary of the site will need to consider building 4 performance to ensure long terns stability is achieved.
- Pavement and access road subgrades are expected to comprise silty sand and sandy silt (loess). Design CBR value (10^{th} percentile) of 2% are recommended for pavement design. With rain saturation, ponding and machinery trafficking the CBR could reduce to 1 or 0. A higher CBR of 6% is given to the deltaic sand/gravel at depth.
- Geotechnical completion reporting should comply with QLDC requirements as per Section 5.13.

8 Applicability

This report has been prepared for the benefit of Queenstown Commercial Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

Report prepared by:

.....

Marte Stemland
Engineering Geologist

Reviewed for GeoSolve Ltd by:

.....

Paul Faulkner
Senior Engineering Geologist

Appendix A: Site Plan & Cross-Sections

GEOTECHNICAL WATER RESOURCES PAVEMENTS

Scale 1:750

0 10 20 30 40 50 (m)

Key

TP1 = Test Pit

SC1 = Scala Penetrometer

= Top of Slope

DPH1 = Dynamic Prove Heavy Test (DPH)

= Cross-section location and facing

Contour Interval 0.5 m

CADFILE:	Sketch 1.xar	DRAWN	MBS	09/2020
SCALE (AT A3 SIZE):	AS SHOWN	DRAFTING CHECKED	MBS	09/2020
PROJECT No:	160041.08	APPROVED	PGF	09/2020

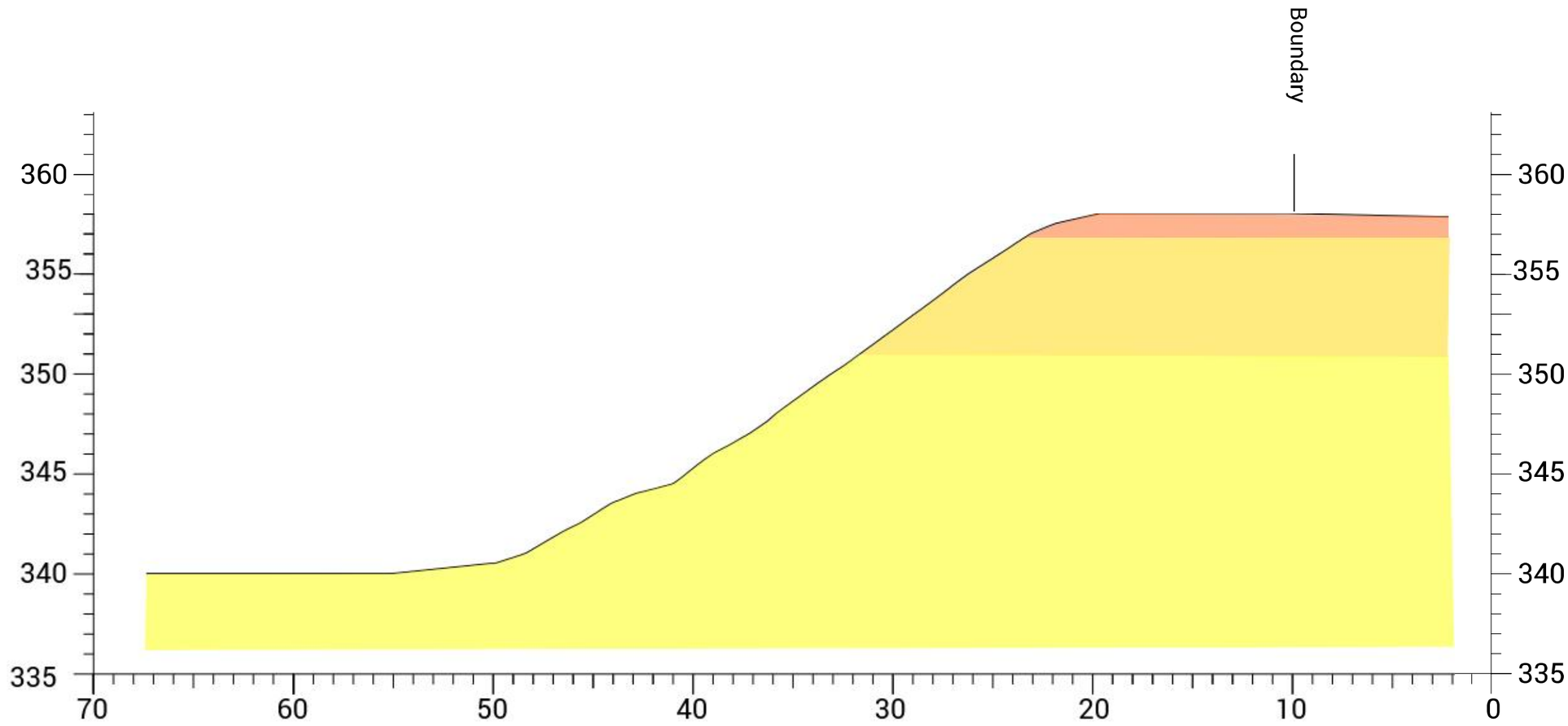
GEOSOLVE
ENGINEERING CONSULTANTS

GEOTECHNICAL
WATER RESOURCES
PAVEMENTS

Queenstown Commercial Ltd
Geotechnical Assessment
466 Frankton-Ladies Mile Higway
Site Investigation Plan

FIG No: FIGURE 1

REV. 1



Topsoil/Loess

Loose to medium dense alluvial sand and gravel

Medium dense to dense alluvial sand and gravel

Notes:
1. These drawings have been prepared for the benefit of Queenstown Commercial Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose with out our prior review and agreement.

SCALE 1:250
0 2.5 5 7.5 10 12.5 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

DRAWN	MBS	Jul.20
DRAFTING CHECKED	MBS	Jul. 20
APPROVED	PGF	Jul. 20
CADFILE: Cross Section.dwg		
SCALES (AT A3 SIZE): 1:250		
PROJECT No: 160041.08		

Queenstown Commercial Ltd
Geotechnical Assessment
466 Frankton-Ladies Mile Highway
Cross Section A

FIG No: FIG NO 2
REV. 0

Site Plan - Retaining Wall

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Proposed Retaining

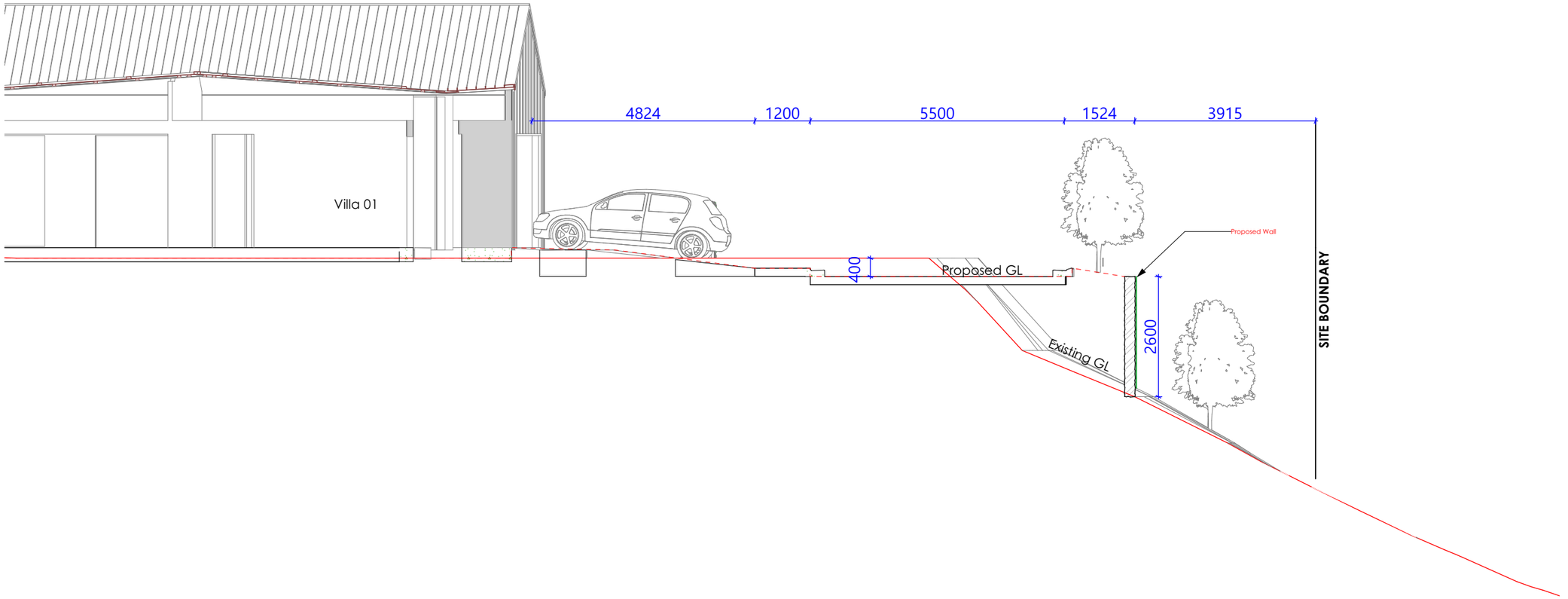
DRAWN BY: HA

1:375 @ A3

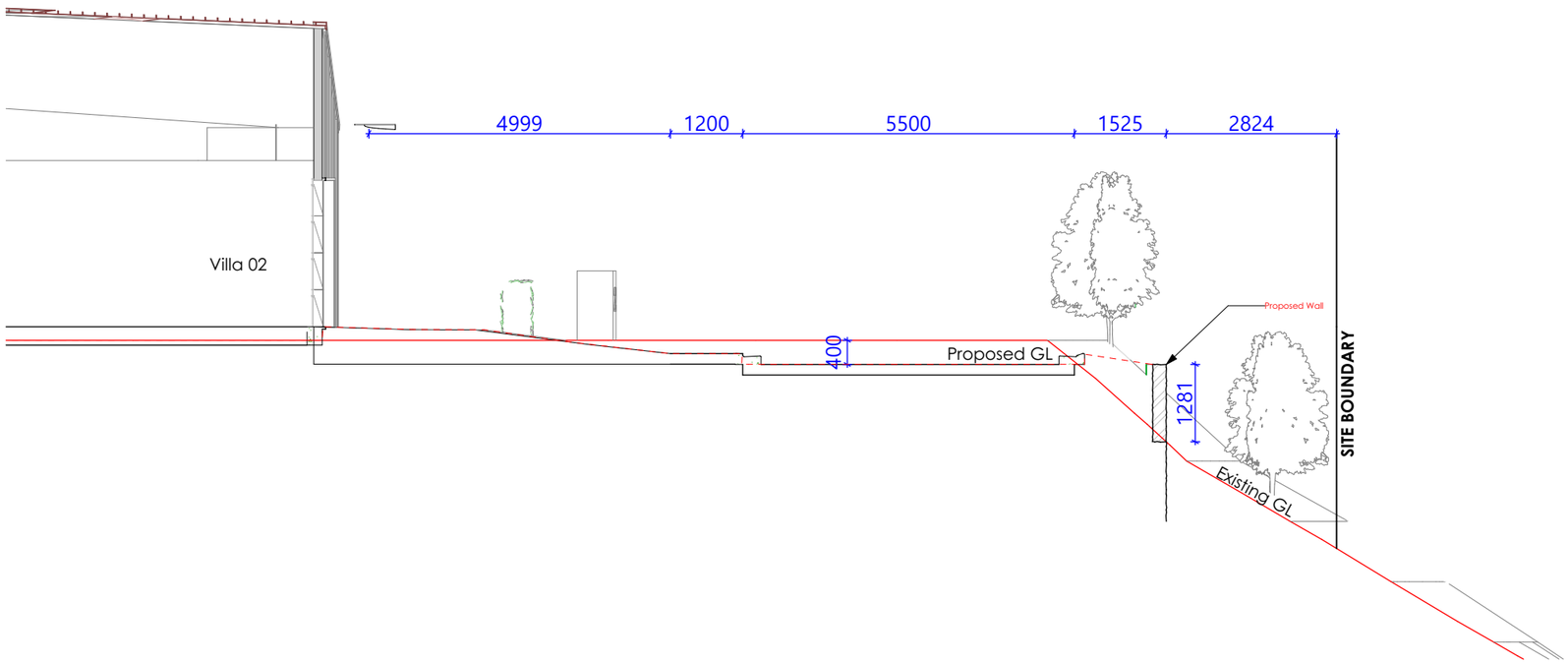
DATE: 16/10/2020

PHONE: 027 7743 762

REVISION NUMBER: **01**



Section 1



Section 2

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

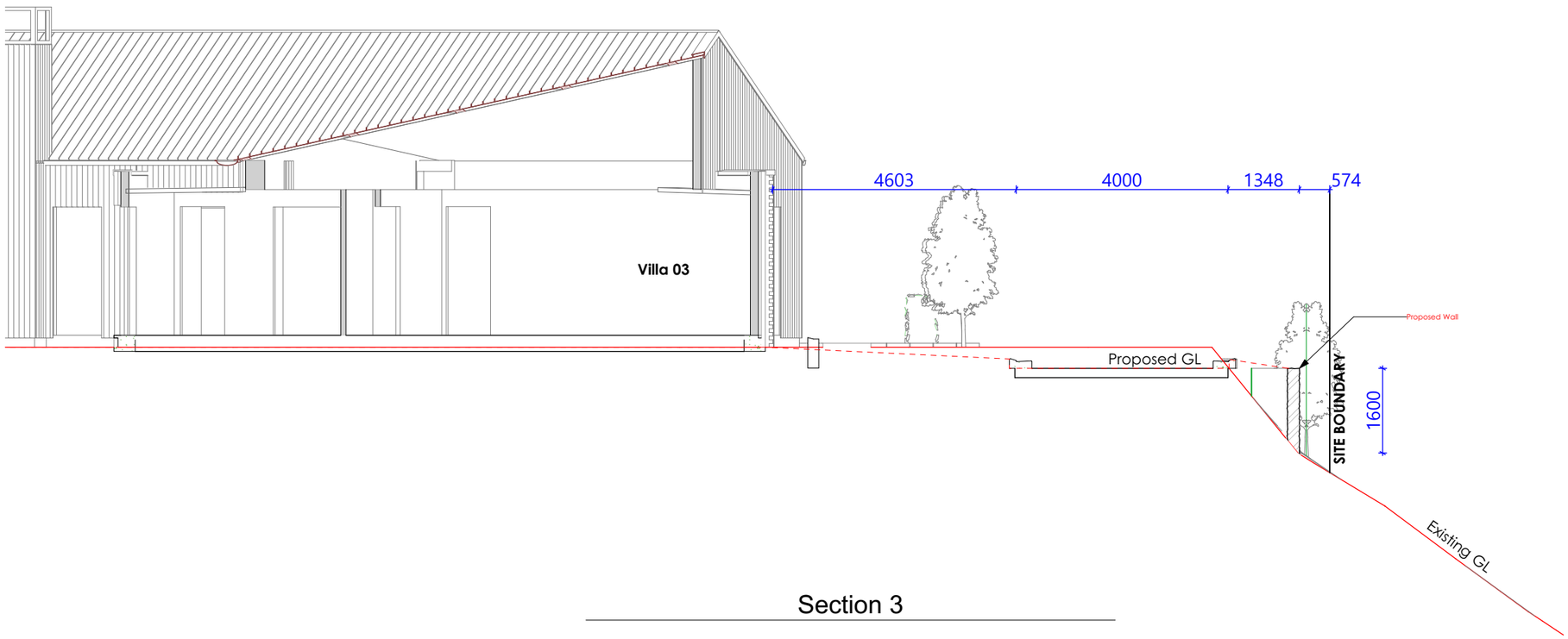
DRAWN BY: HA

1:100 @ A3

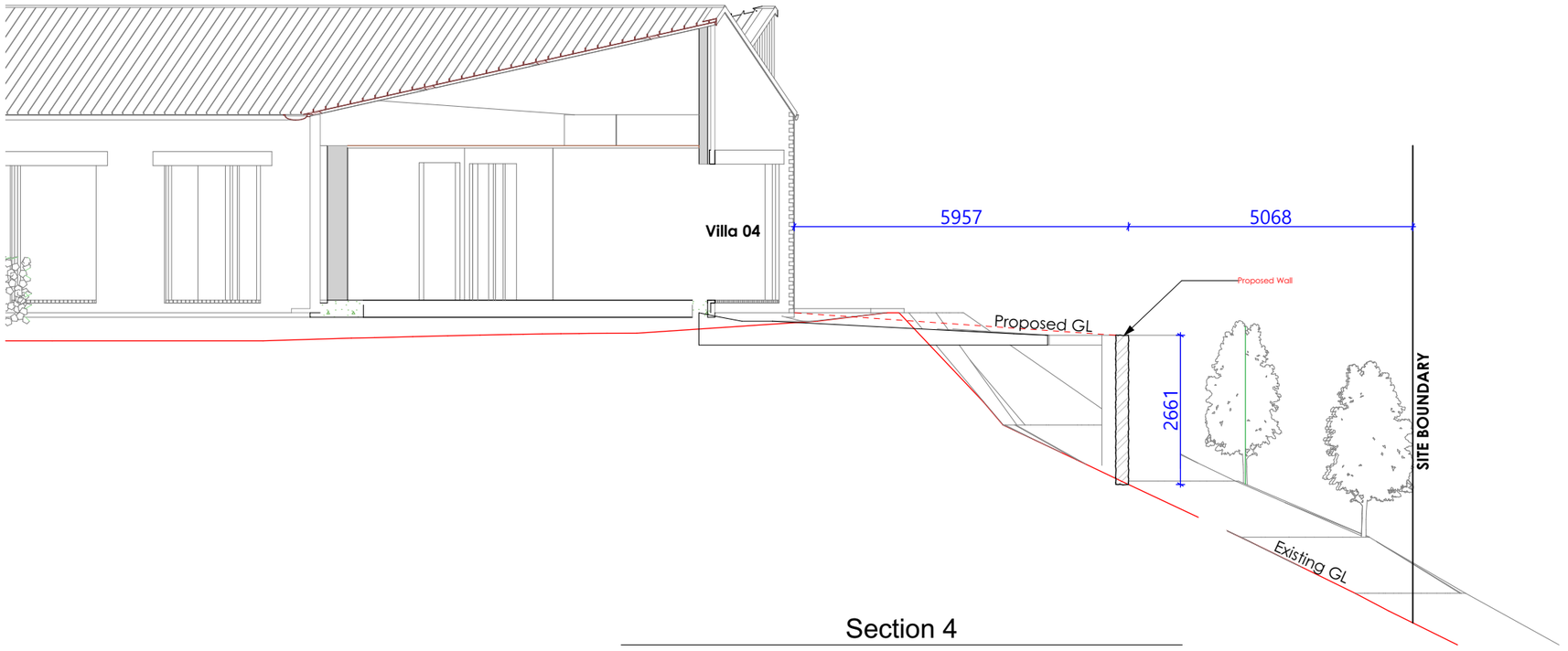
DATE: 16/10/2020

PHONE: 027 7743 762

REVISION NUMBER: **01**



Section 3



Section 4

Rev ID	Ch ID	Change Name	Date
04	08	Section provided at Villa 03 pinch point	23/09/2020

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

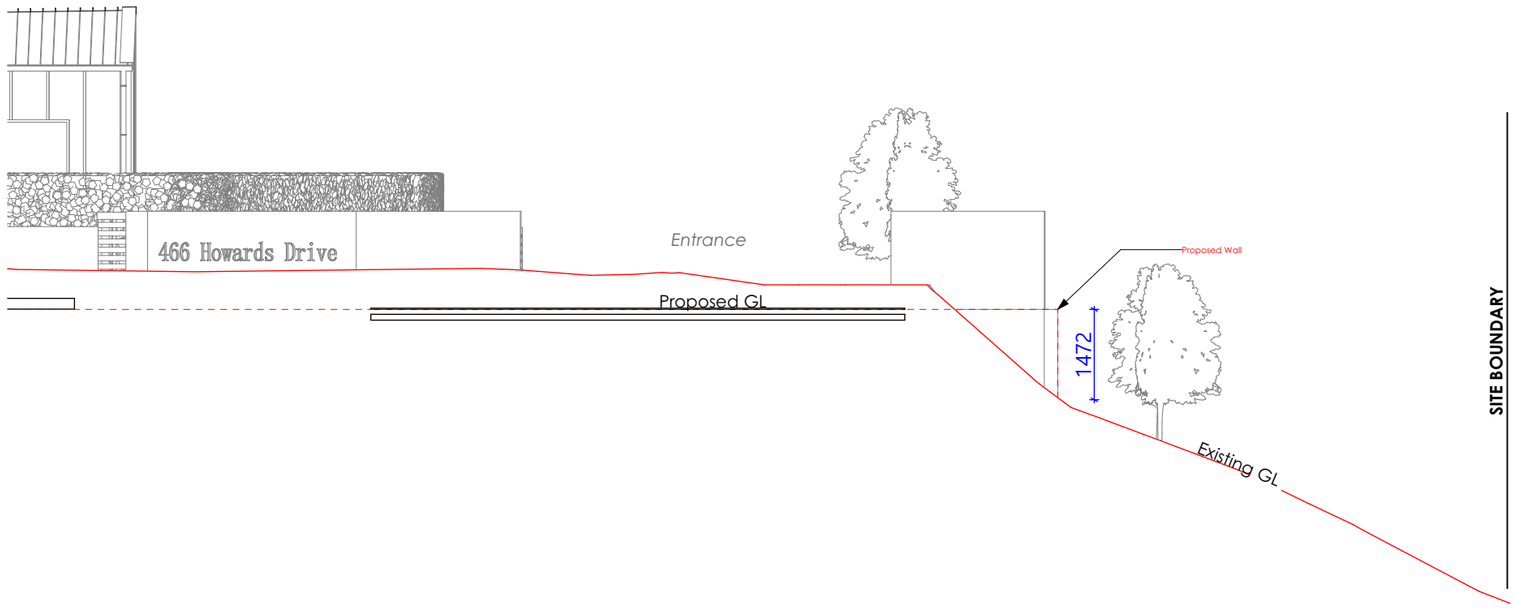
1:100 @ A3

DATE: 16/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

04



Section 5

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

1:100 @ A3

DATE: 16/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

01

Appendix B: Investigation Data

EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan — INCLINATION: Vertical		

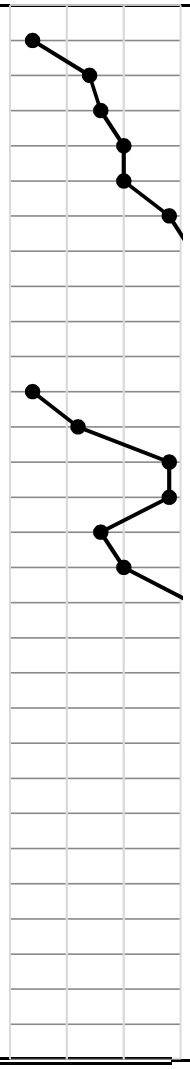
EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.1	TOPSOIL		Dark brown, gravelly organic SILT with minor sand and trace of rootlets. Firm. Dry.		
0.25	TOPSOIL		Dark brown, organic SILT with trace of rootlets. Firm. Dry.		
0.8	LOESS		Yellow brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff to very stiff. Massive. Dry.		
1.1	DELTAIC SAND		Light grey, SAND with some gravel and trace of silt. Sand is fine to medium with trace of coarse. Gravel is fine. Loose to medium dense. Bedded. Dry.		
3.0	DELTAIC GRAVEL		Light grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Dry.		NO SEEPAGE

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 3 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS

Checked Date: 3-Jul-19

Sheet: 1 of 1

GEOSOLVE

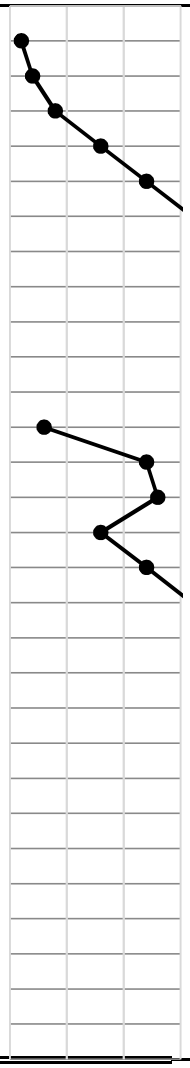
EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan — INCLINATION: Vertical		

EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.3	TOPSOIL		Dark brown, organic SILT with trace of rootlets and tree roots. Firm. Dry.			
0.9	LOESS		Yellow brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff to very stiff. Massive. Dry.			
1.2	DELTAIC SAND		Light grey, silty SAND. Sand is fine. Loose to medium dense. Massive. Dry.			
1.3	DELTAIC SAND		Light grey, SAND with some gravel and trace of silt. Medium dense. Bedded. Dry.			
1.4	DELTAIC SAND		Light grey, SAND with trace of gravel and silt. Medium dense. Bedded. Dry.			
2.4	DELTAIC SAND		Light grey, gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Dry.			
3.0	DELTAIC SAND		Light grey, SAND with minor gravel. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Dry.		NO SEEPAGE	



Total Depth = 3 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS
Checked Date: 3-Jul-19
Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan — INCLINATION: Vertical		

EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

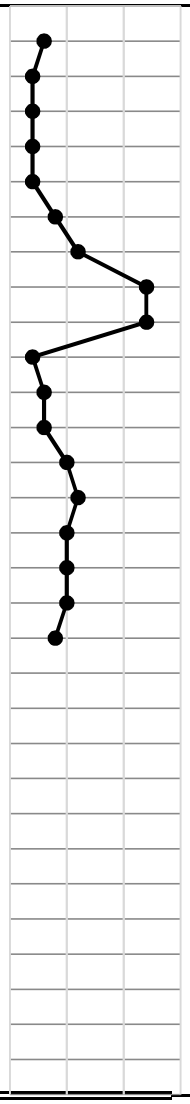
DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.3	TOPSOIL		Dark brown, organic SILT with trace of rootlets. Firm. Moist.		
0.6	LOESS		Light brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff. Massive. Moist.		
0.9	DELTAIC GRAVEL		Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Moist.		
2.4	DELTAIC SAND		Light grey, SAND with trace of silt. Sand is fine. Loose to medium dense. Massive. Moist.		
2.7	DELTAIC SAND		Grey, SAND with minor gravel and trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Moist.		
3.1	DELTAIC SAND		Grey, gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Moist.		NO SEEPAGE

Total Depth = 3.1 m

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS

Checked Date: 3-Jul-19

Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan — INCLINATION: Vertical		

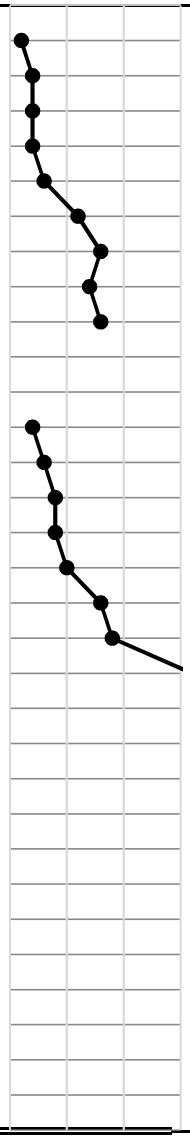
EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.3	TOPSOIL		Dark brown, organic SILT with trace of rootlets and tree roots. Firm. Moist.		
0.9	LOESS		Light yellow brown, silty SAND. Sand is fine. Silt is non-plastic. Loose to medium dense. Massive. Dry to moist.		
1.2	DELTAIC SAND		Light grey, sandy GRAVEL with trace of silt. Sand is fine. Medium dense. Massive. Dry to moist.		
1.7	DELTAIC SAND		Light grey, SAND with trace of silt. Sand is fine. Medium dense. Massive. Dry to moist.		
2.1	DELTAIC SAND		Grey, gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Dry to moist.		
3.2	DELTAIC SAND		Grey, SAND with trace of silt. Sand is fine. Medium dense. Massive. Dry to moist.		NO SEEPAGE

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 3.2 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS

Checked Date: 3-Jul-19

Sheet: 1 of 1

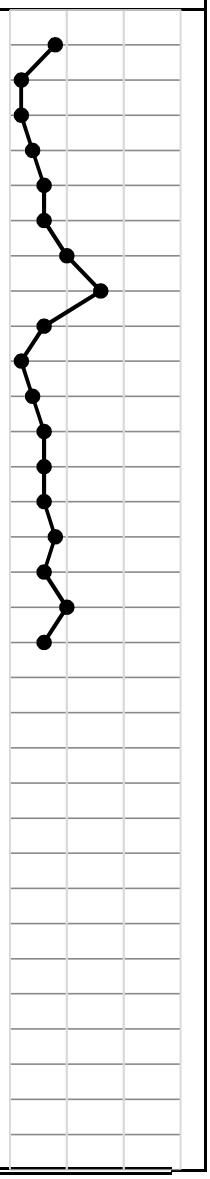
EXCAVATION LOG

EXCAVATION NUMBER: **TP 5**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan — INCLINATION: Vertical		

EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.25	TOPSOIL		Dark brown, organic SILT with trace of rootlets. Firm. Moist.			
0.6	LOESS		Light brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff. Massive. Moist.			
0.8	DELTAIC GRAVEL		Brown grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Massive. Moist.			
3.1	DELTAIC SAND		Light grey, SAND with trace of silt and gravel. Sand is fine. Gravel is fine to medium, subrounded to subangular. Loose to medium dense. Massive. Moist.			
3.3	DELTAIC SAND		Light grey, gravelly SAND with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Medium dense. Bedded. Moist.		NO SEEPAGE	



Total Depth = 3.3 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS
Checked Date: 3-Jul-19
Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan INCLINATION: Vertical		

EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.3	TOPSOIL		Dark brown, organic SILT with trace of rootlets and tree roots. Firm. Dry.			
0.9	LOESS		Yellow brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff to very stiff. Massive. Dry.			
3.2	DELTAIC GRAVEL		Light grey, sandy GRAVEL with trace of silt and gravel. Sand is fine. Gravel is fine, subrounded to subangular. Medium dense. Massive. Dry.		NO SEEPAGE	

Total Depth = 3.2 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS
Checked Date: 3-Jul-19
Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

PROJECT:	466 Frankton-Ladies Mile Highway	JOB NUMBER:	160041.08
LOCATION:	See Site Plan INCLINATION: Vertical		

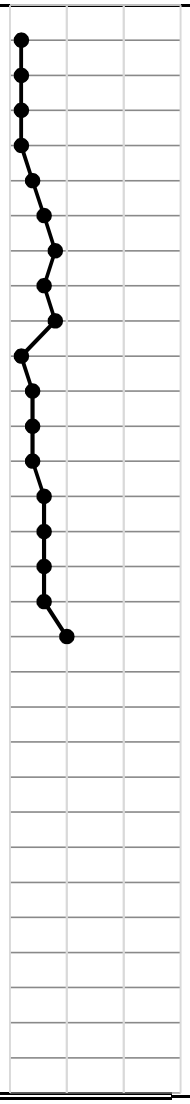
EASTING:		mE	EQUIPMENT:	5.5 T excavator	OPERATOR:	Nick
NORTHING:		mN	INFOMAP NO.		COMPANY:	Queenstown Comercial
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	25-Jun-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	25-Jun-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.3	TOPSOIL		Dark brown, organic SILT with trace of rootlets. Firm. Moist.		
0.8	LOESS		Light brown, sandy SILT. Sand is fine. Silt is non-plastic. Firm to stiff. Massive. Moist.		
0.9	DELTAIC GRAVEL		Light brown, sandy GRAVEL with trace of silt. Medium dense. Bedded. Moist.		
2.4	DELTAIC SAND		Grey, SAND with trace of silt. Sand is fine. Loose to medium dense. Massive. Moist.		
3.1	DELTAIC SAND		Light grey, SAND with trace of silt and gravel. Sand is fine to coarse. Gravel is fine, subrounded to subangular. Medium dense. Massive. Moist.		NO SEEPAGE

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 3.1 m

COMMENT: Test pit dry. Walls remained stable during excavation.

Logged By: MBS

Checked Date: 3-Jul-19

Sheet: 1 of 1

GeoSolve Ltd

SCALA PENETROMETER LOG

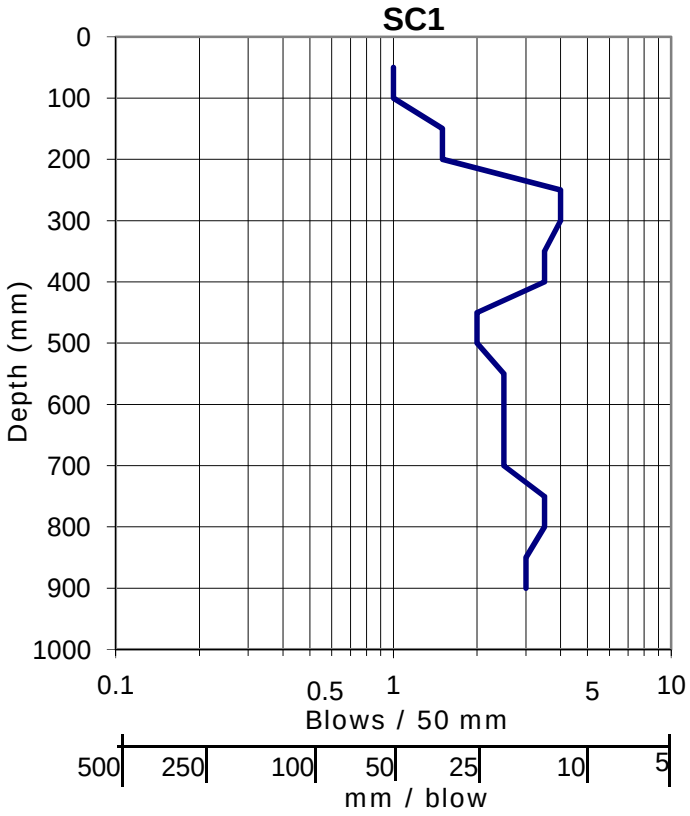
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

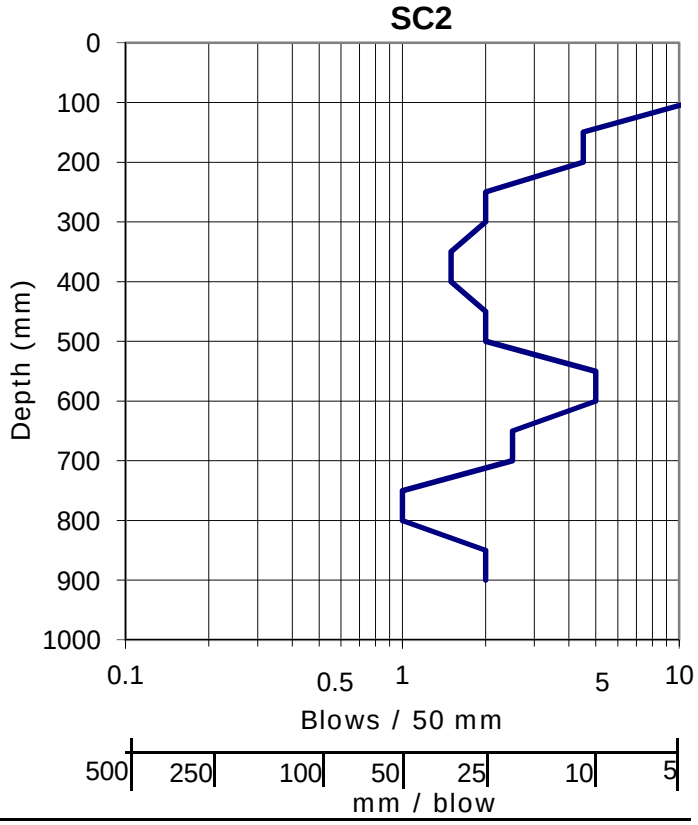
Test Number ***SC1 & SC2***

Sheet ***1***
of ***1***

SC1 Location: RL: 0 m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*1.5*
200	*1.5*
250	*4*
300	*4*
350	*3.5*
400	*3.5*
450	*2*
500	*2*
550	*2.5*
600	*2.5*
650	*2.5*
700	*2.5*
750	*3.5*
800	*3.5*
850	*3*
900	*3*
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC2 Location: RL: 0m	
mm Driven	No. of Blows
50	*11*
100	*11*
150	*4.5*
200	*4.5*
250	*2*
300	*2*
350	*1.5*
400	*1.5*
450	*2*
500	*2*
550	*5*
600	*5*
650	*2.5*
700	*2.5*
750	*1*
800	*1*
850	*2*
900	*2*
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

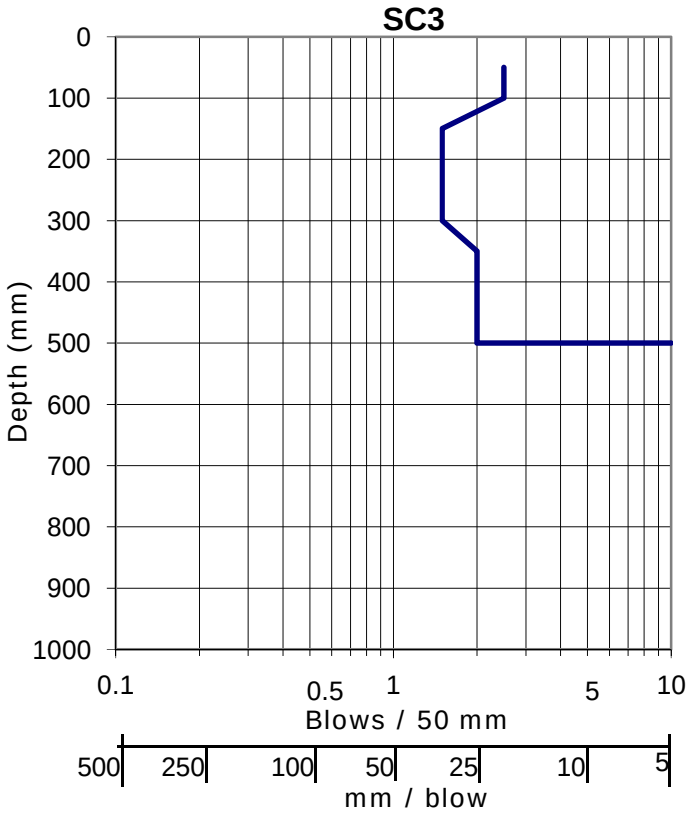
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

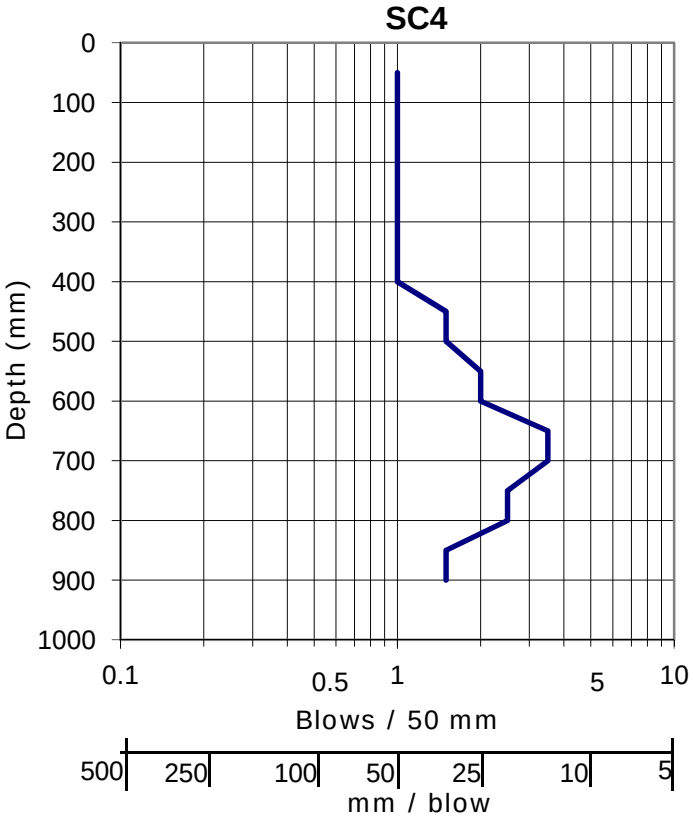
Test Number ***SC3 & SC4***

Sheet ***1***
of ***1***

SC3 Location: RL: 0 m	
mm Driven	No. of Blows
50	*2.5*
100	*2.5*
150	*1.5*
200	*1.5*
250	*1.5*
300	*1.5*
350	*2*
400	*2*
450	*2*
500	*2*
550	*refusal*
600	
650	
700	
750	
800	
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC4 Location: RL: 0m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*1*
200	*1*
250	*1*
300	*1*
350	*1*
400	*1*
450	*1.5*
500	*1.5*
550	*2*
600	*2*
650	*3.5*
700	*3.5*
750	*2.5*
800	*2.5*
850	*1.5*
900	*1.5*
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

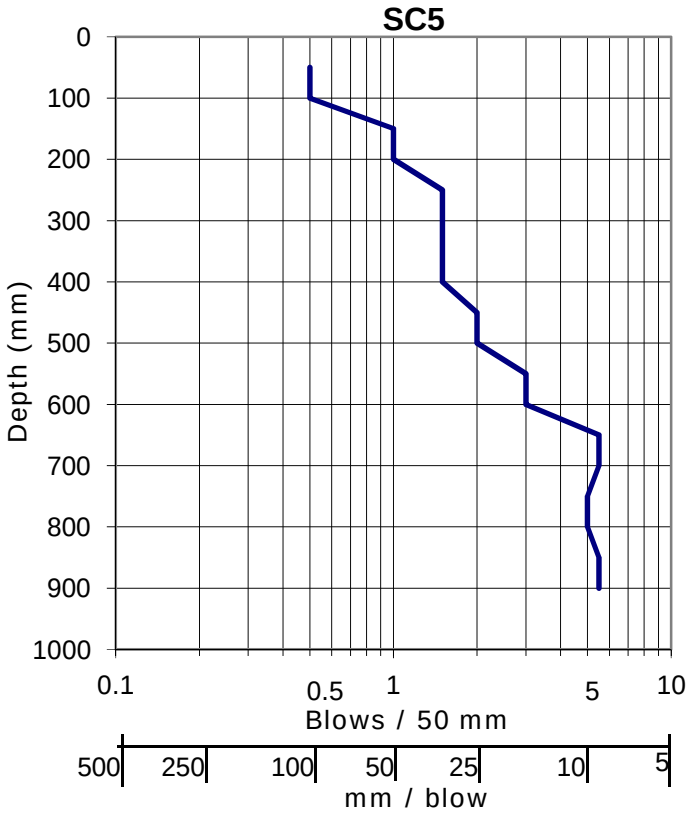
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

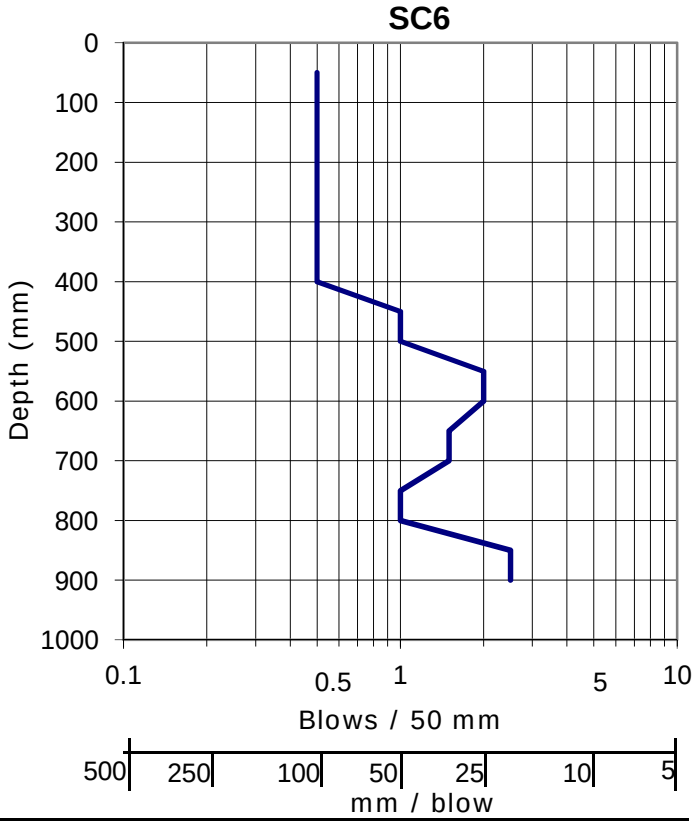
Test Number ***SC5 & SC6***

Sheet ***1***
of ***1***

SC5 Location: RL: 0 m	
mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1.5
300	1.5
350	1.5
400	1.5
450	2
500	2
550	3
600	3
650	5.5
700	5.5
750	5
800	5
850	5.5
900	5.5
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC6 Location: RL: 0m	
mm Driven	No. of Blows
50	0.5
100	0.5
150	0.5
200	0.5
250	0.5
300	0.5
350	0.5
400	0.5
450	1
500	1
550	2
600	2
650	1.5
700	1.5
750	1
800	1
850	2.5
900	2.5
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

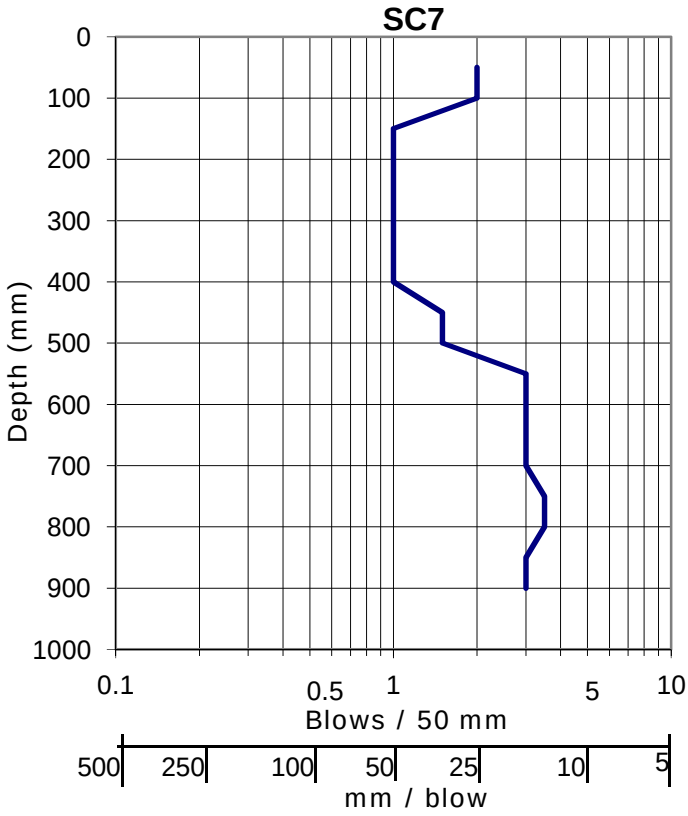
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

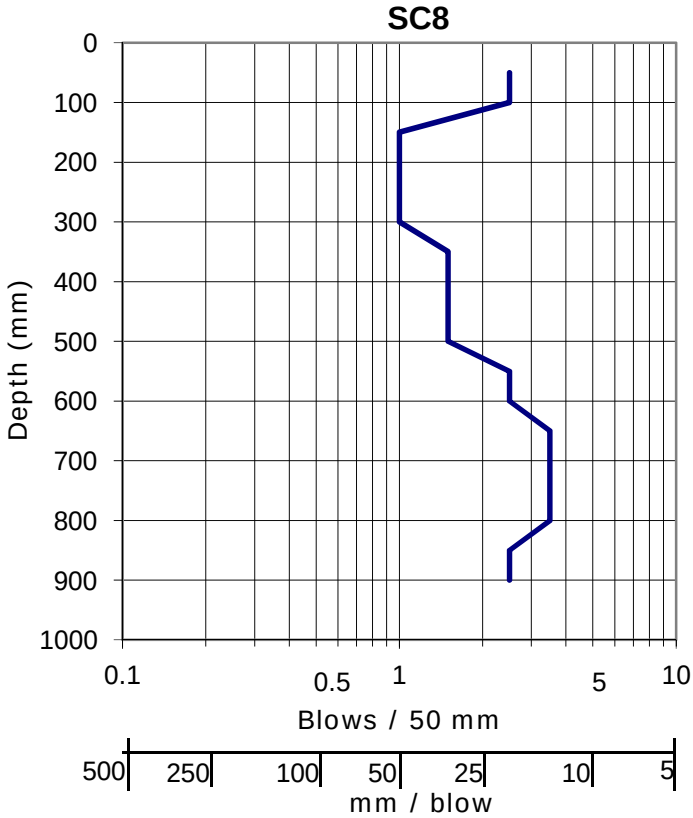
Test Number ***SC7 & SC8***

Sheet ***1***
of ***1***

SC7 Location: RL: 0 m	
mm Driven	No. of Blows
50	*2*
100	*2*
150	*1*
200	*1*
250	*1*
300	*1*
350	*1*
400	*1*
450	*1.5*
500	*1.5*
550	*3*
600	*3*
650	*3*
700	*3*
750	*3.5*
800	*3.5*
850	*3*
900	*3*
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC8 Location: RL: 0m	
mm Driven	No. of Blows
50	*2.5*
100	*2.5*
150	*1*
200	*1*
250	*1*
300	*1*
350	*1.5*
400	*1.5*
450	*1.5*
500	*1.5*
550	*2.5*
600	*2.5*
650	*3.5*
700	*3.5*
750	*3.5*
800	*3.5*
850	*2.5*
900	*2.5*
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

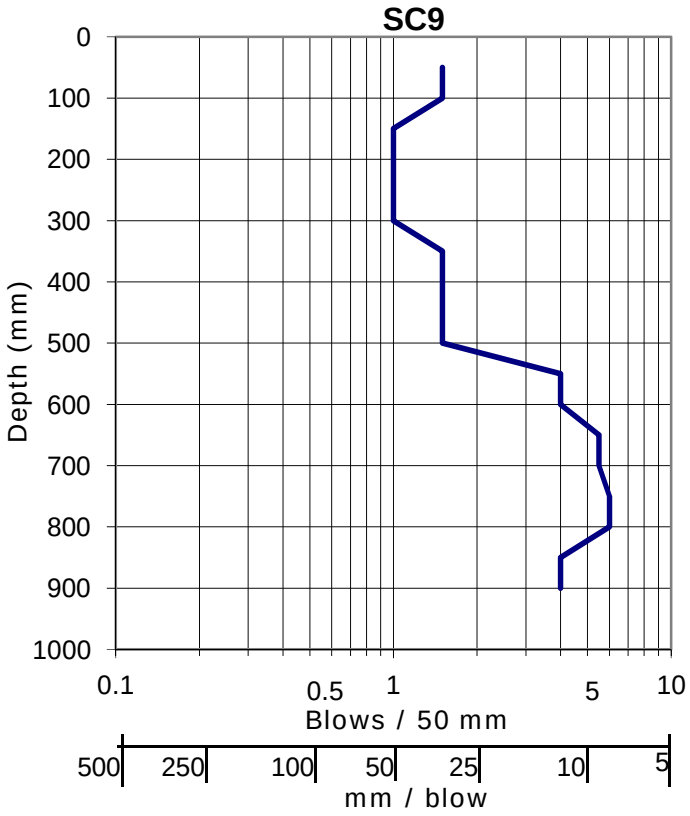
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

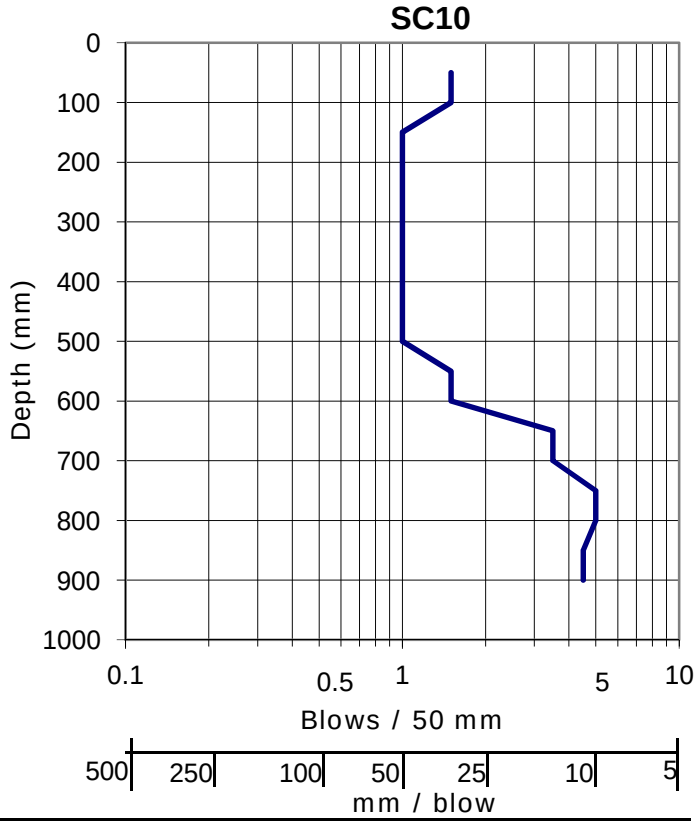
Test Number ***SC9 & SC10***

Sheet ***1***
of ***1***

SC9 Location: RL: 0 m	
mm Driven	No. of Blows
50	1.5
100	1.5
150	1
200	1
250	1
300	1
350	1.5
400	1.5
450	1.5
500	1.5
550	4
600	4
650	5.5
700	5.5
750	6
800	6
850	4
900	4
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC10 Location: RL: 0m	
mm Driven	No. of Blows
50	1.5
100	1.5
150	1
200	1
250	1
300	1
350	1
400	1
450	1
500	1
550	1.5
600	1.5
650	3.5
700	3.5
750	5
800	5
850	4.5
900	4.5
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

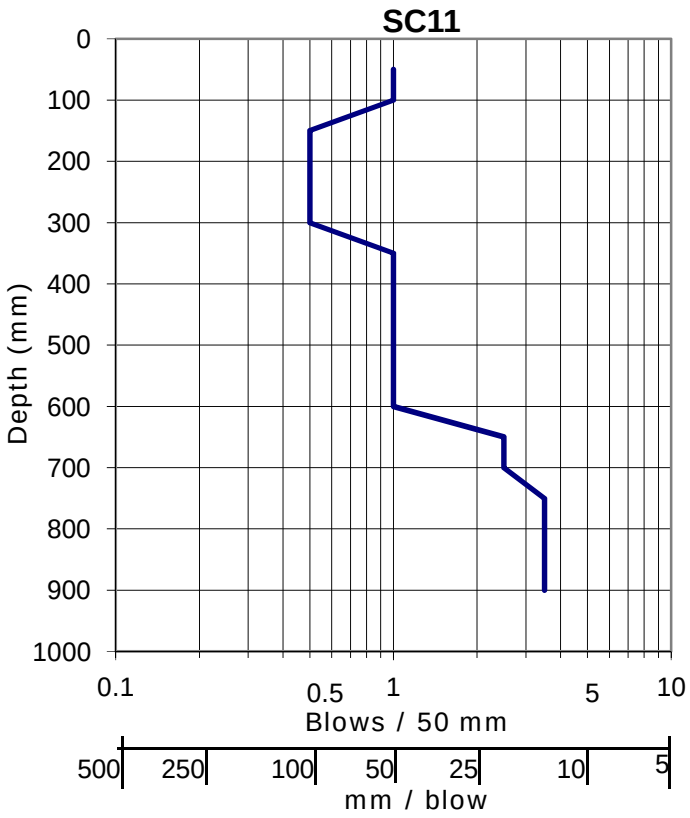
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

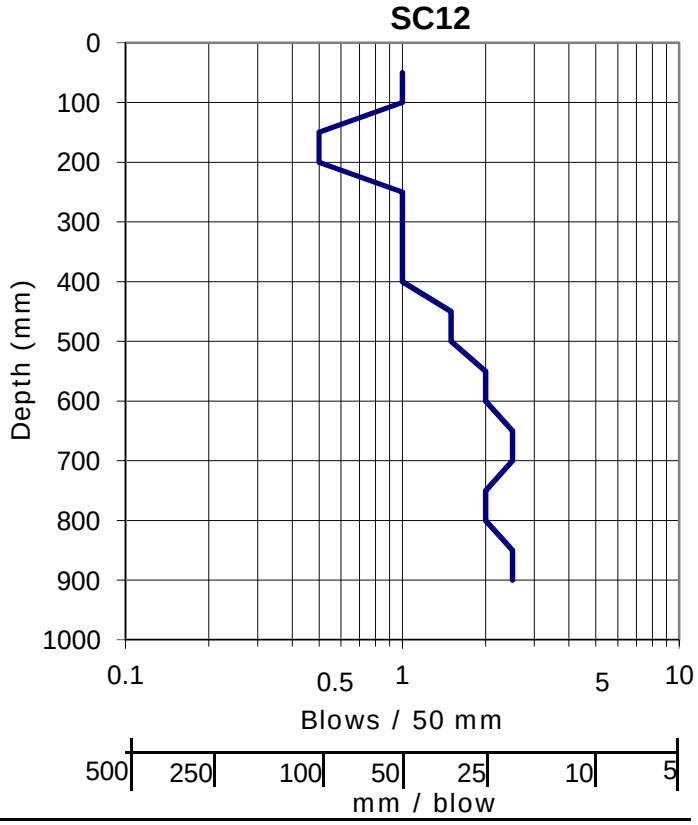
Test Number ***SC11 & SC12***

Sheet ***1***
of ***1***

SC11 Location: RL: 0 m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*0.5*
200	*0.5*
250	*0.5*
300	*0.5*
350	*1*
400	*1*
450	*1*
500	*1*
550	*1*
600	*1*
650	*2.5*
700	*2.5*
750	*3.5*
800	*3.5*
850	*3.5*
900	*3.5*
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC12 Location: RL: 0m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*0.5*
200	*0.5*
250	*1*
300	*1*
350	*1*
400	*1*
450	*1.5*
500	*1.5*
550	*2*
600	*2*
650	*2.5*
700	*2.5*
750	*2*
800	*2*
850	*2.5*
900	*2.5*
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

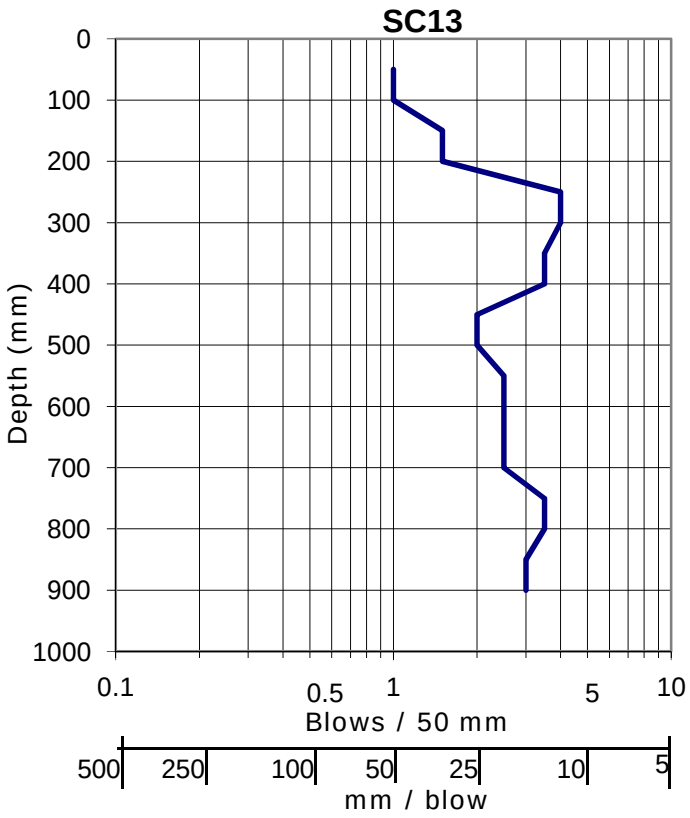
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

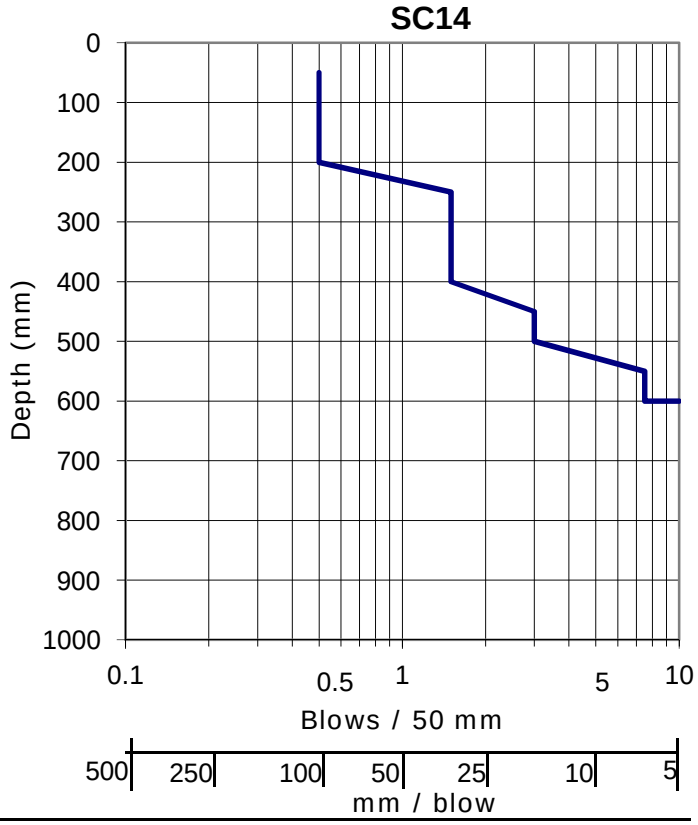
Test Number ***SC13 & SC14***

Sheet ***1***
of ***1***

SC13 Location: RL: 0 m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*1.5*
200	*1.5*
250	*4*
300	*4*
350	*3.5*
400	*3.5*
450	*2*
500	*2*
550	*2.5*
600	*2.5*
650	*2.5*
700	*2.5*
750	*3.5*
800	*3.5*
850	*3*
900	*3*
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC14 Location: RL: 0m	
mm Driven	No. of Blows
50	*0.5*
100	*0.5*
150	*0.5*
200	*0.5*
250	*1.5*
300	*1.5*
350	*1.5*
400	*1.5*
450	*3*
500	*3*
550	*7.5*
600	*7.5*
650	*refusal*
700	
750	
800	
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

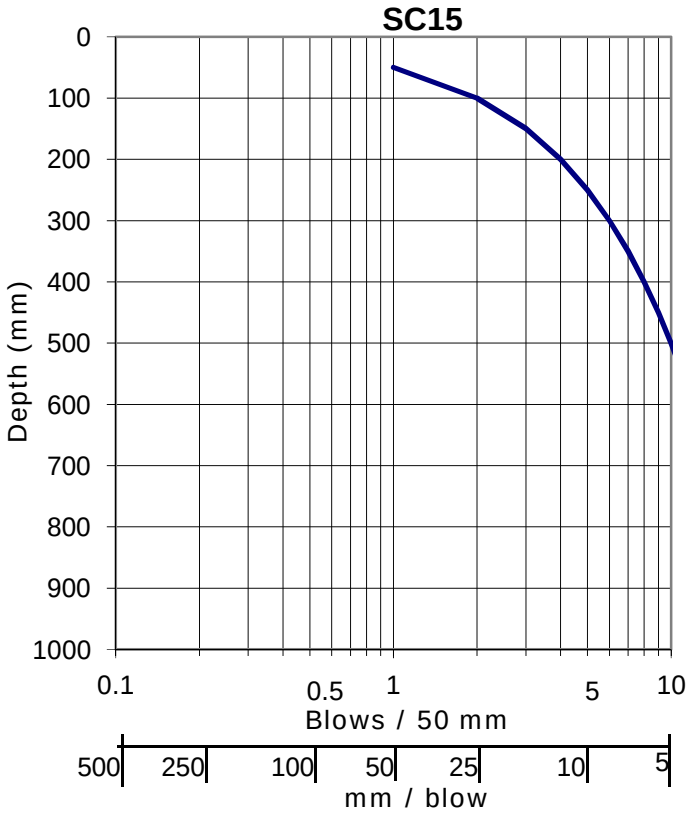
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

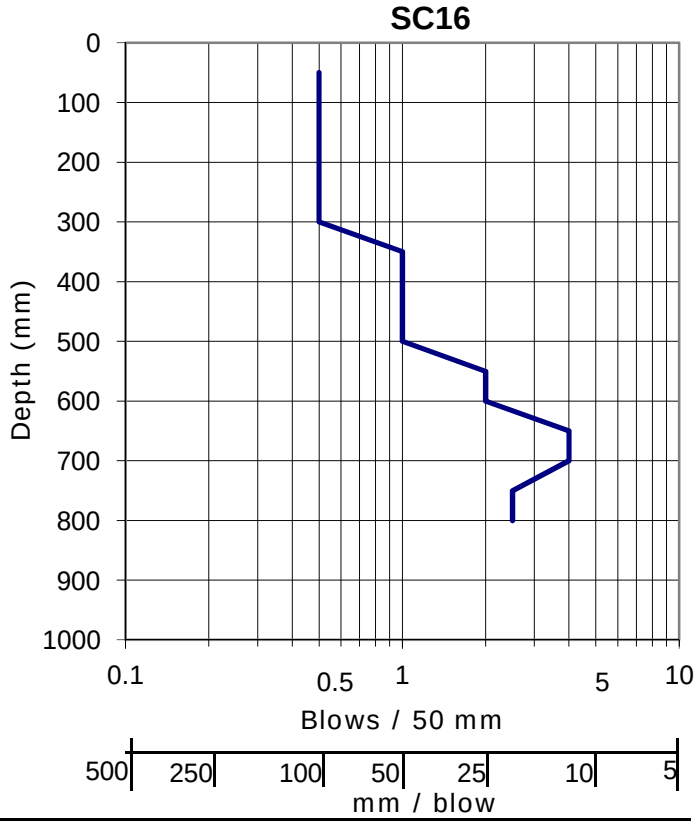
Test Number ***SC15 & SC16***

Sheet ***1***
of ***1***

SC15 Location: RL: 0 m	
mm Driven	No. of Blows
50	*1*
100	*1*
150	*1*
200	*1*
250	*1.5*
300	*1.5*
350	*1.5*
400	*1.5*
450	*2.5*
500	*2.5*
550	*6.5*
600	*6.5*
650	*refusak*
700	
750	
800	
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	

SC16 Location: RL: 0m	
mm Driven	No. of Blows
50	*0.5*
100	*0.5*
150	*0.5*
200	*0.5*
250	*0.5*
300	*0.5*
350	*1*
400	*1*
450	*1*
500	*1*
550	*2*
600	*2*
650	*4*
700	*4*
750	*2.5*
800	*2.5*
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

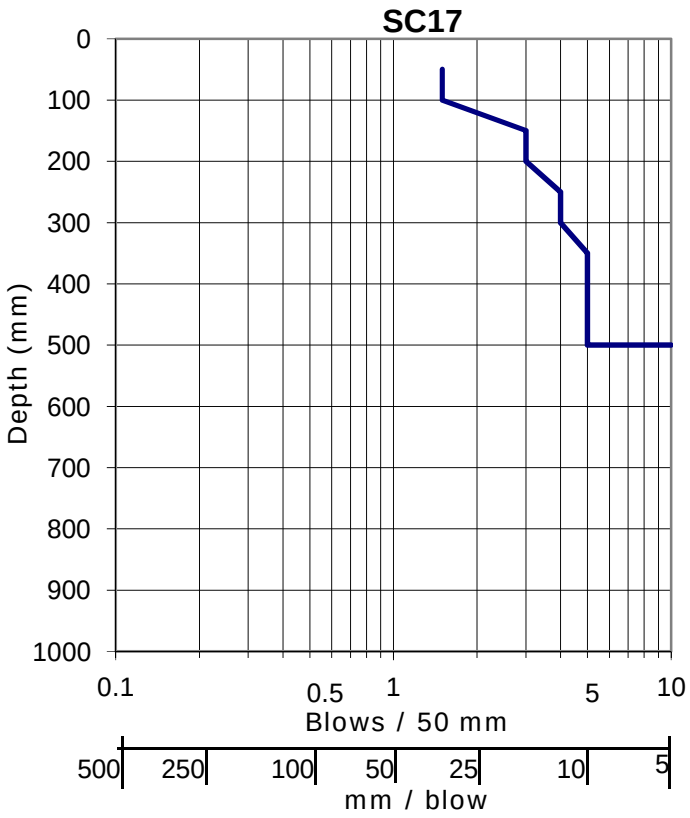
SCALA PENETROMETER LOG

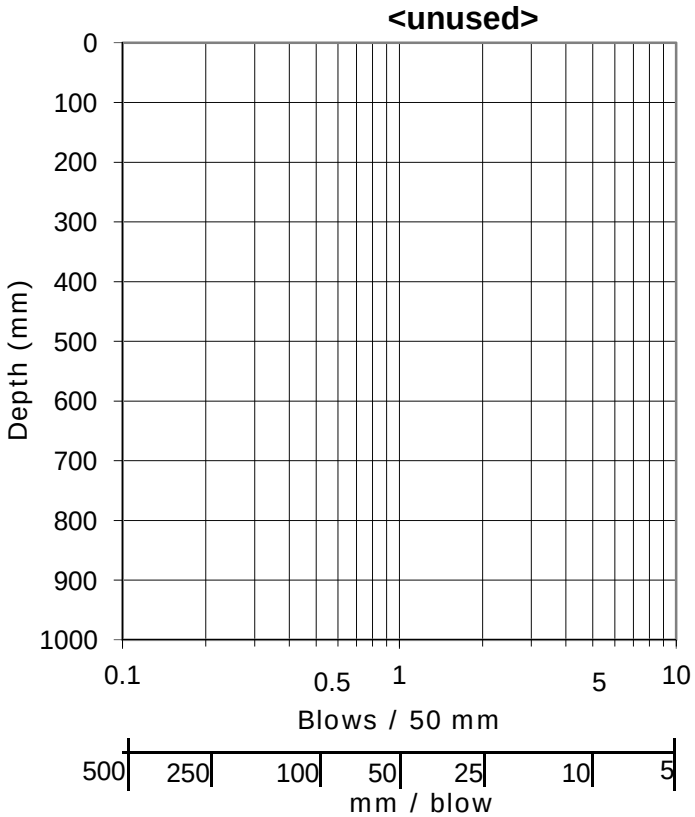
Job No: *160041.08* Date: *25/06/2020*
Project: *466 Frankton-Ladies Mile Higl* Operated by: *MBS*
Logged by: *MBS*

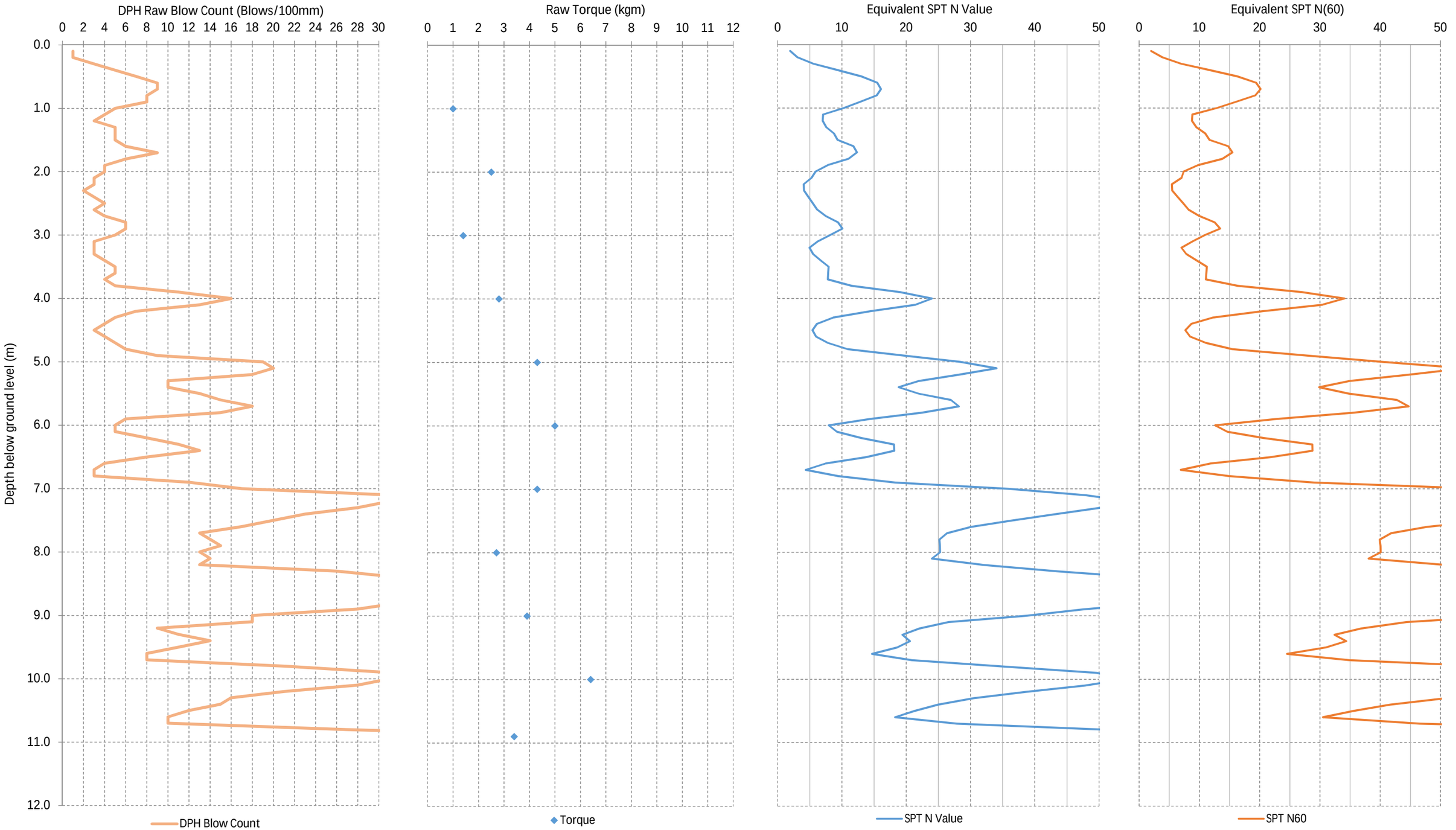
Test Number ***SC17***
Sheet ***1***
of ***1***

SC17 Location: RL: 0 m	
mm Driven	No. of Blows
50	*1.5*
100	*1.5*
150	*3*
200	*3*
250	*4*
300	*4*
350	*5*
400	*5*
450	*5*
500	*5*
550	*refusal*
600	
650	
700	
750	
800	
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	

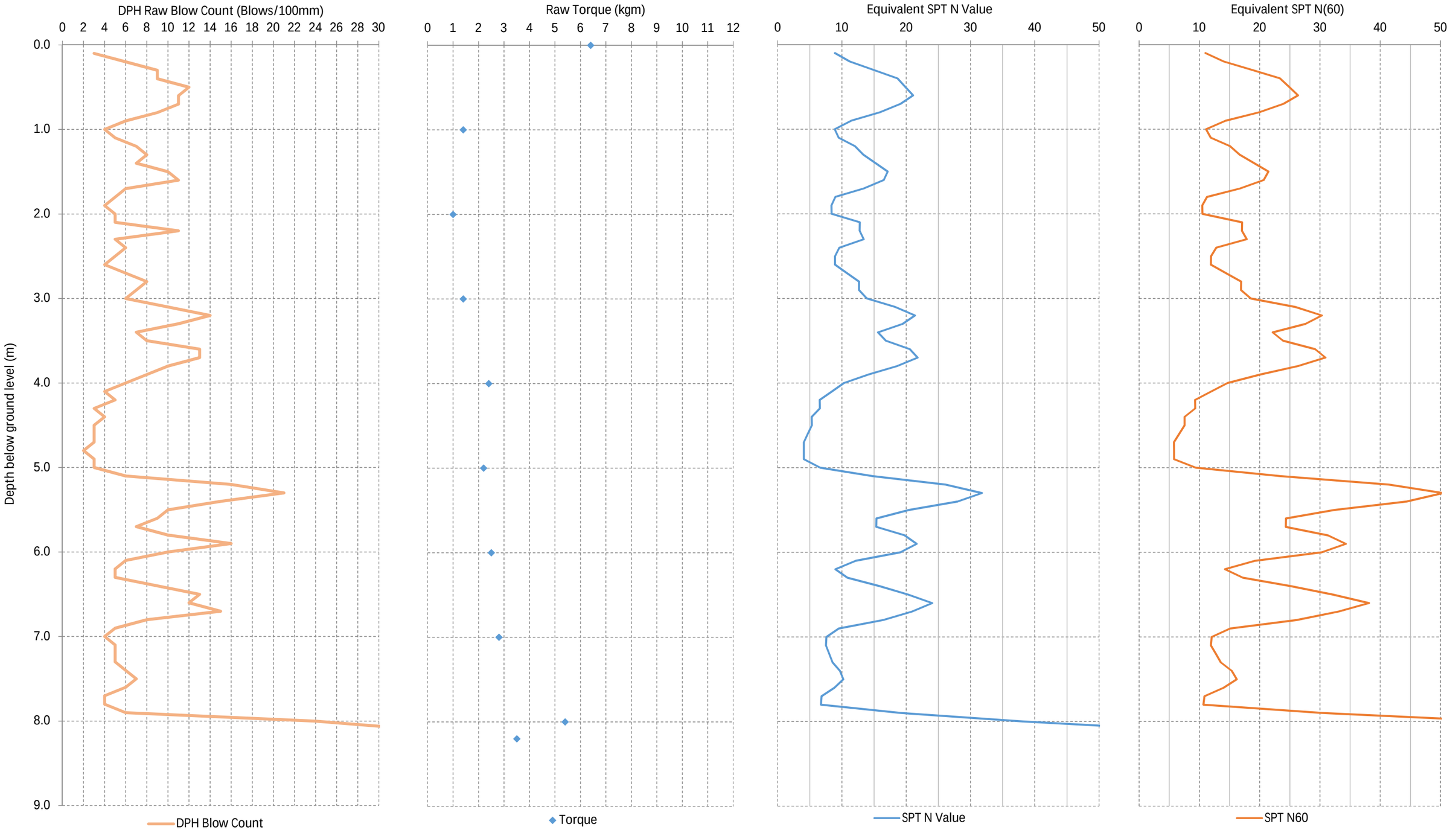
Location: RL: 0m	
mm Driven	No. of Blows
50	
100	
150	
200	
250	
300	
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
Inferred Soil Type	
Watertable Depth	







PROJECT	160041.08 - 466LadiesMile	CLIENT	Queenstown Commercial Ltd
DESCRIPTION	DPH testing	TEST NUMBER	DPH1
LOCATION	466 Frankton-Ladies Mile Highway	DATE	2/07/2020
		LOGGED BY	NT
		ANALYSED BY	MBS
		CHECKED BY	PGF

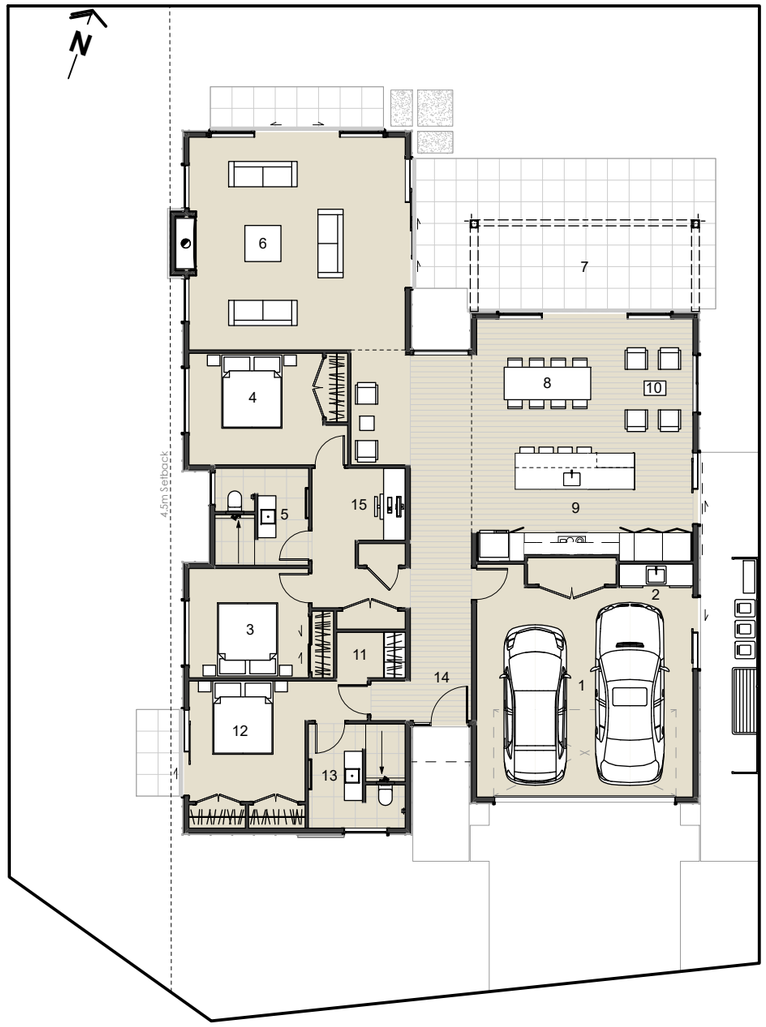


GEOSOLVE	PROJECT	160041.08 - 466LadiesMile	CLIENT	Queenstown Commercial Ltd	LOGGED BY NT
	DESCRIPTION	DPH testing	TEST NUMBER	DPH2	ANALYSED BY MBS
	LOCATION	466 Frankton-Ladies Mile Highway	DATE	2/07/2020	CHECKED BY PGF

QUEENSTOWN COMMERCIAL

3D Perspectives for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.



North Elevation 1:200

South Elevation 1:200

East Elevation 1:200

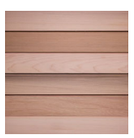
West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

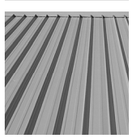
Villa ground floor = 222.97m²

MATERIALS:


Horizontal Cedar Board & Batten


Accent Steel Cladding

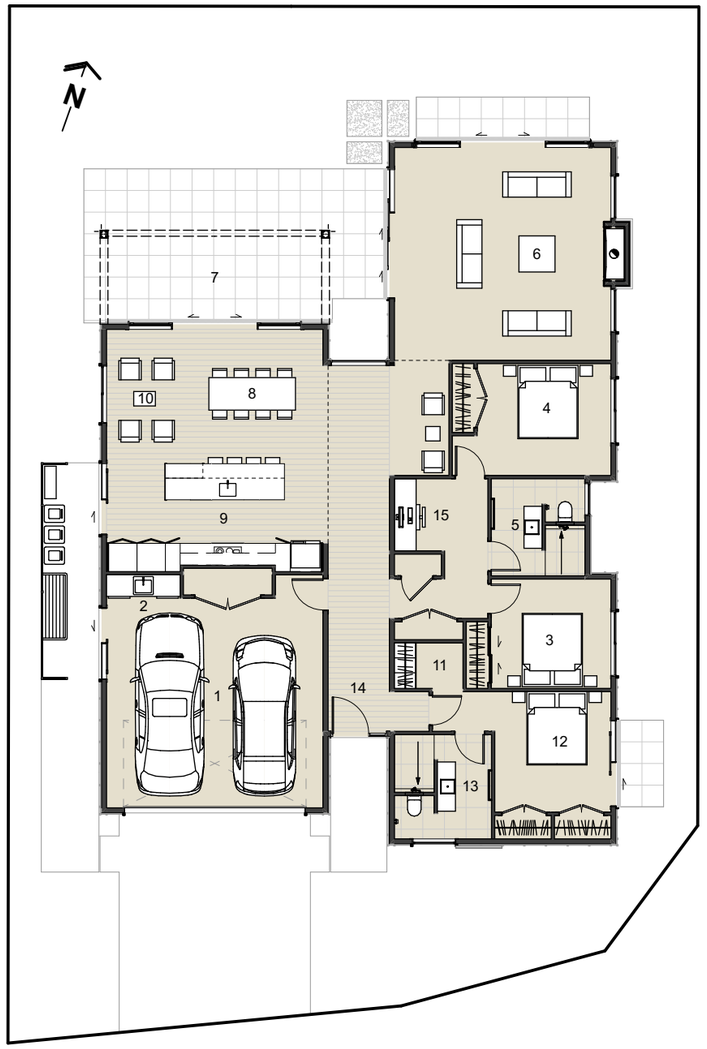

Accent Schist


Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 1
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.



North Elevation 1:200

South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

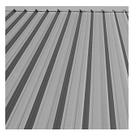
Villa ground floor = 222.97m²

MATERIALS:


Vertical Cedar


Accent Steel Cladding

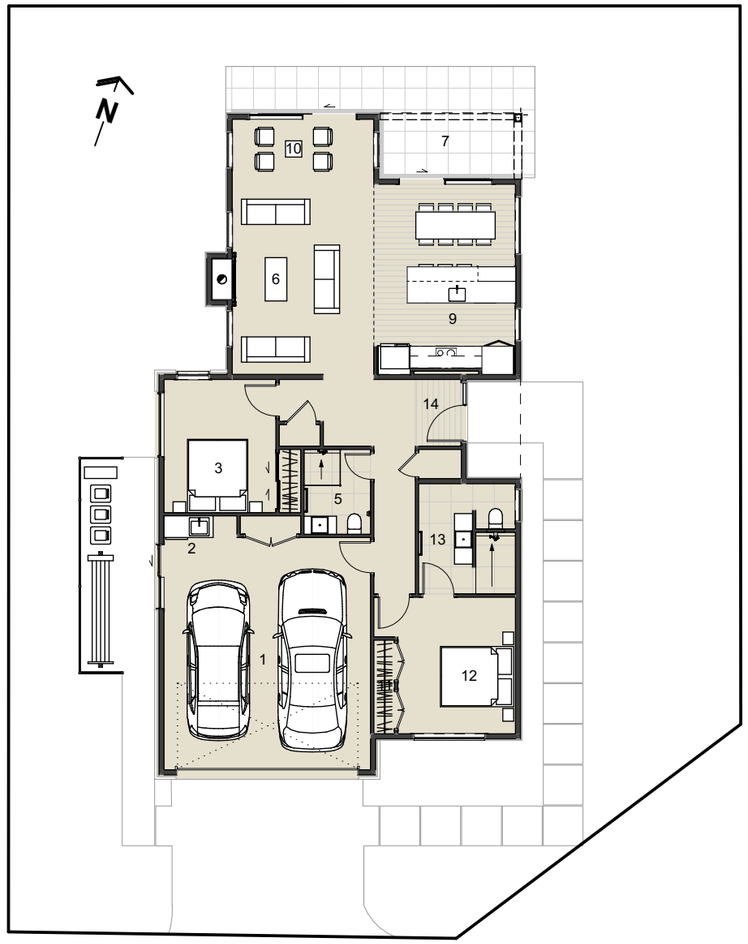

Plaster


Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 2
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.



North Elevation 1:200

South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Master Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry

Villa ground floor = 159.45m²

MATERIALS:


Vertical Cedar


Accent Steel Cladding


Rusticated Brick

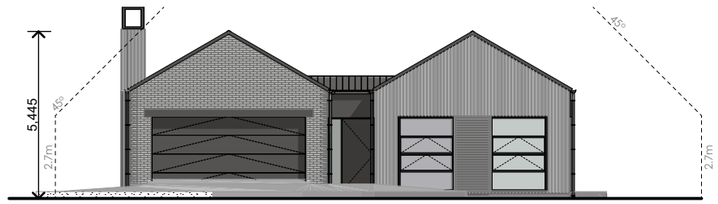

Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 3
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

North Elevation 1:200



South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

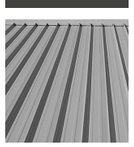
Villa ground floor = 231.66m²

MATERIALS:


Vertical Cedar


Accent Steel Cladding


Rusticated Brick

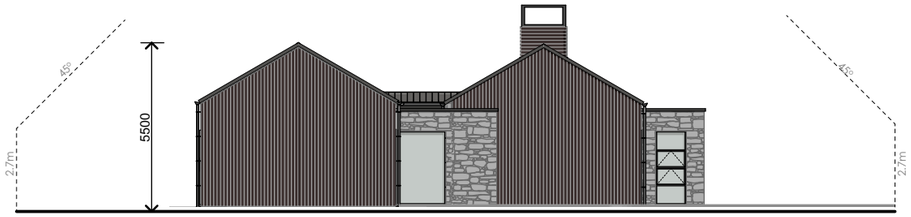

Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 4
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

North Elevation 1:200



South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

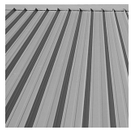
Villa ground floor = 215.27m²

MATERIALS:

Vertical Cedar

Accent Steel Cladding

Accent Schist

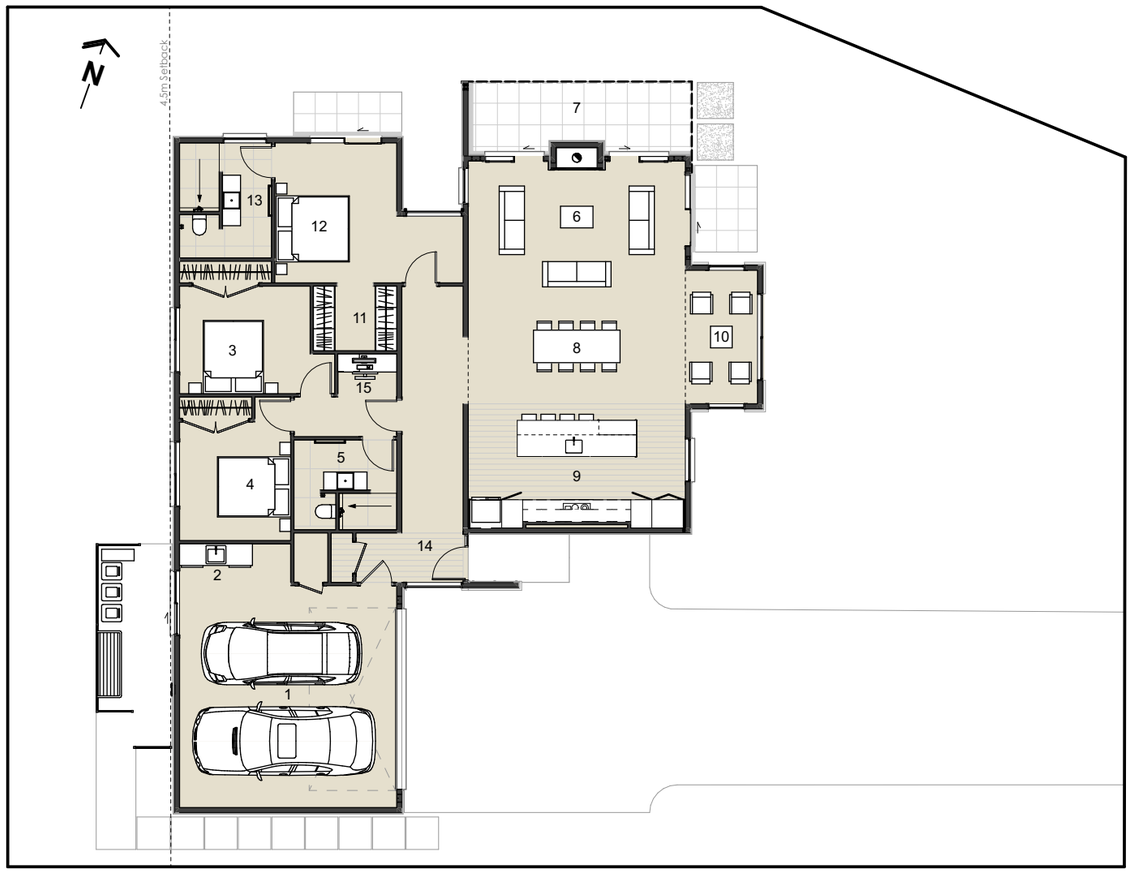


Half Eurotray Roofing

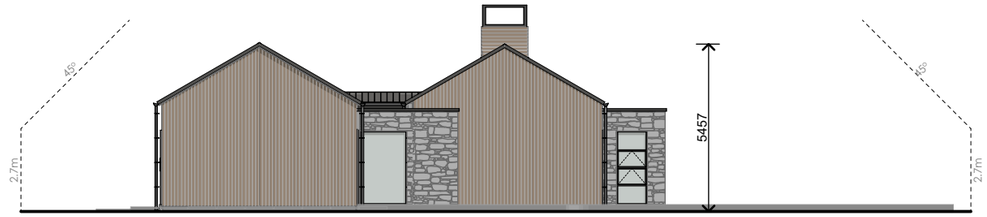
QUEENSTOWN COMMERCIAL

Lot 5 for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.



North Elevation 1:200



South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

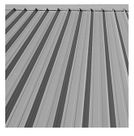
Villa ground floor = 215.27m²

MATERIALS:


Horizontal Cedar Board & Batten


Accent Steel Cladding


Accent Schist

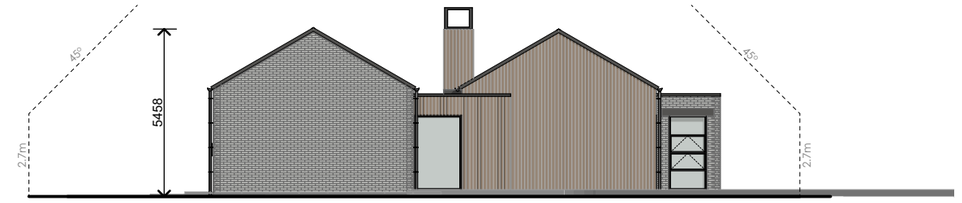

Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 7
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

North Elevation 1:200



South Elevation 1:200

East Elevation 1:200

West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

Villa ground floor = 222.75m²

MATERIALS:

Vertical Cedar

Accent Steel Cladding

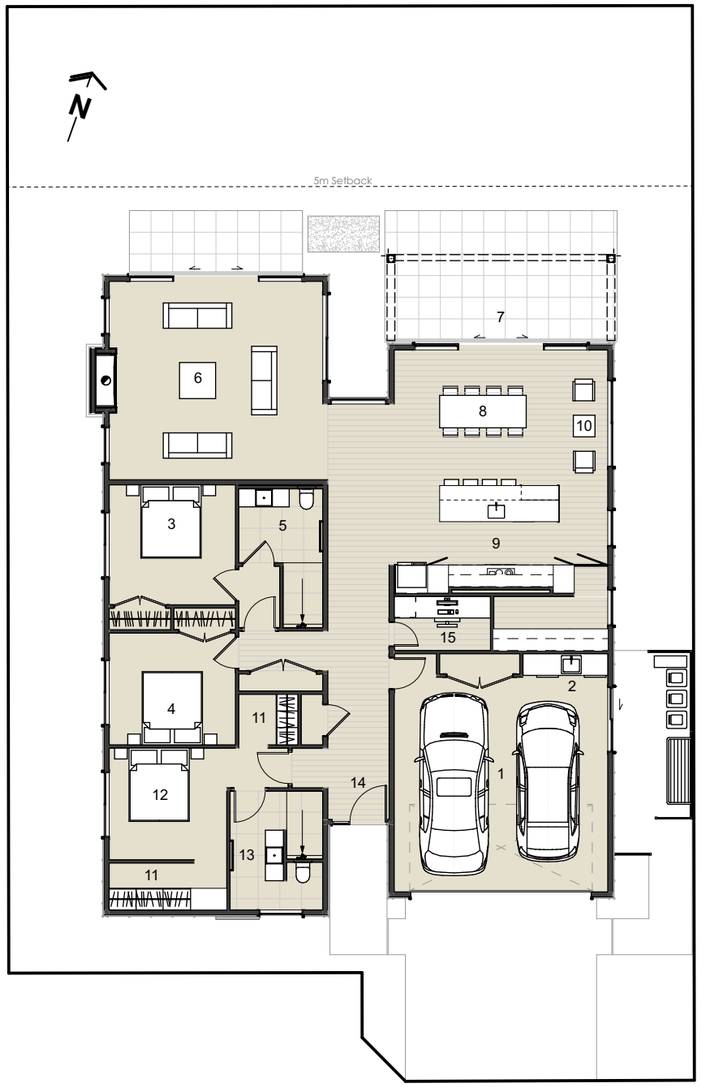
Rusticated Brick

Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 8
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.



North Elevation 1:200

South Elevation 1:200

East Elevation 1:200

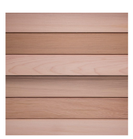
West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Study Nook

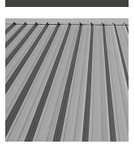
Villa ground floor = 224.22m²

MATERIALS:


Horizontal Cedar Board & Batten


Accent Steel Cladding

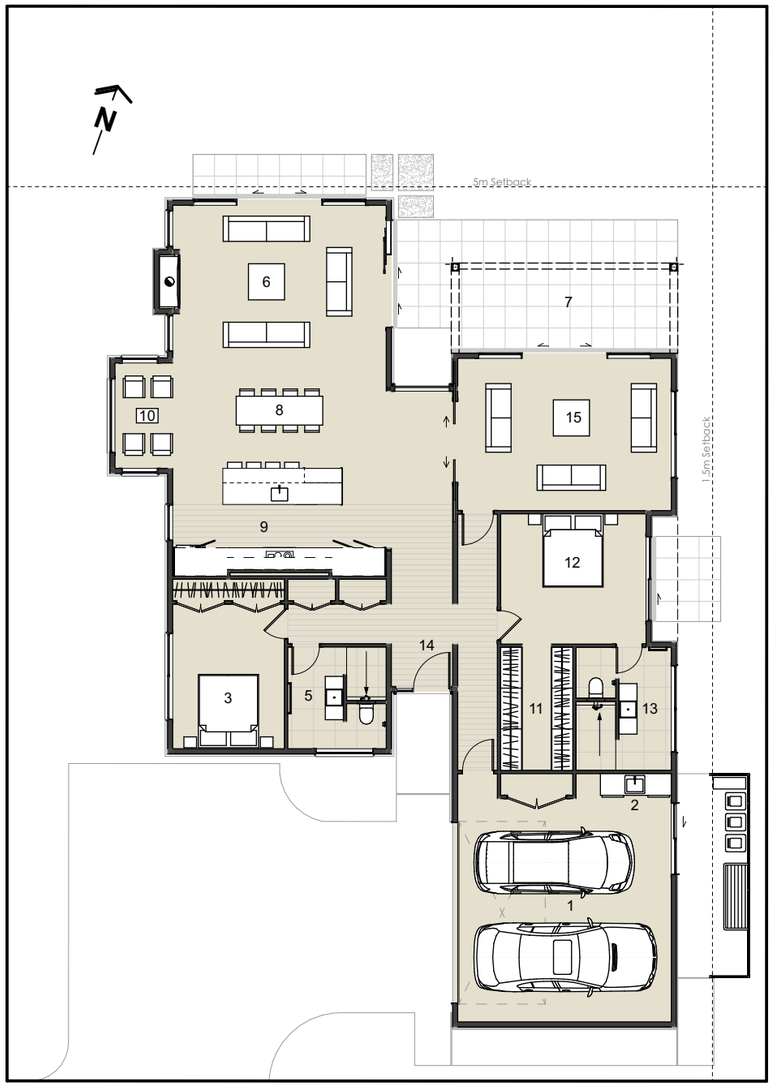

Rusticated Brick


Half Eurotray Roofing

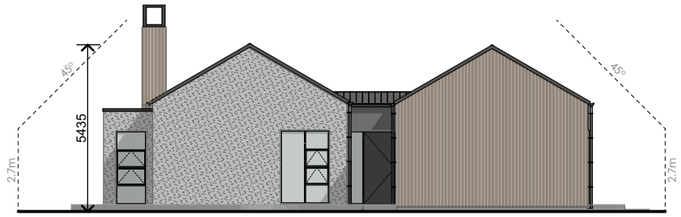
QUEENSTOWN COMMERCIAL

Lot 10 for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

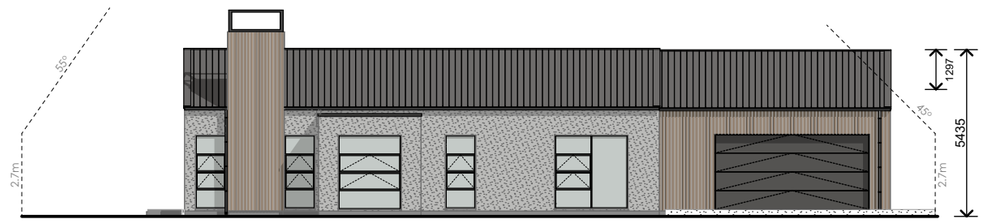


North Elevation 1:200



South Elevation 1:200

East Elevation 1:200



West Elevation 1:200

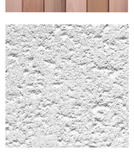
PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Sun Nook
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Media Room

Villa ground floor = 235.61m²

MATERIALS:


Vertical Cedar


Plaster

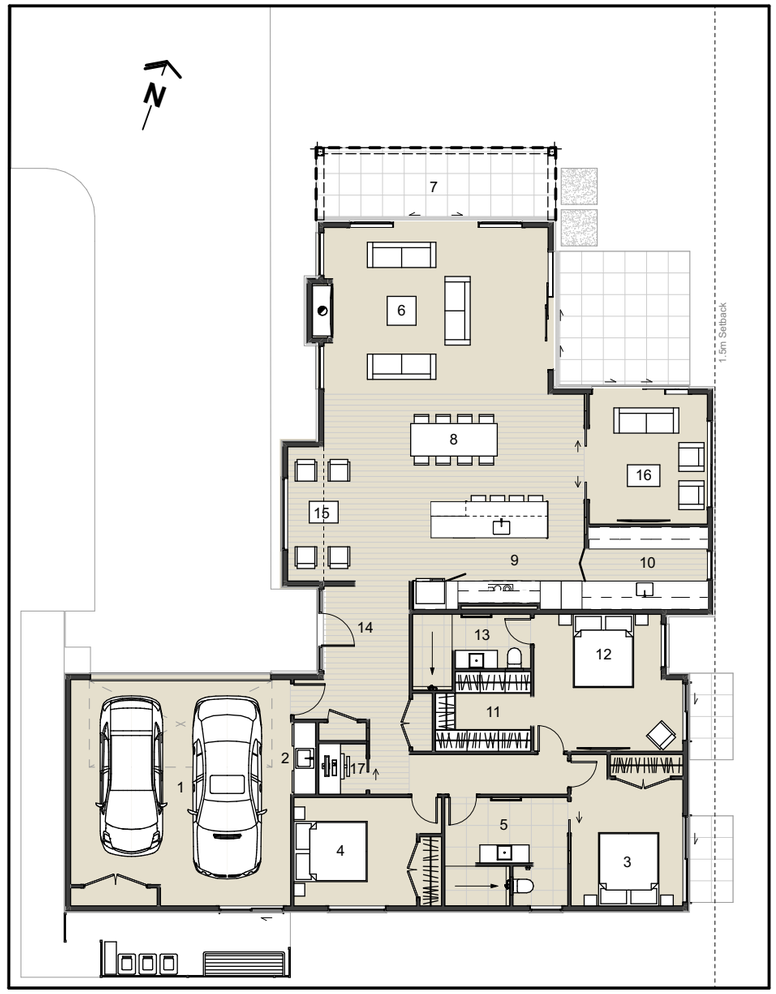

Accent Steel Cladding


Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

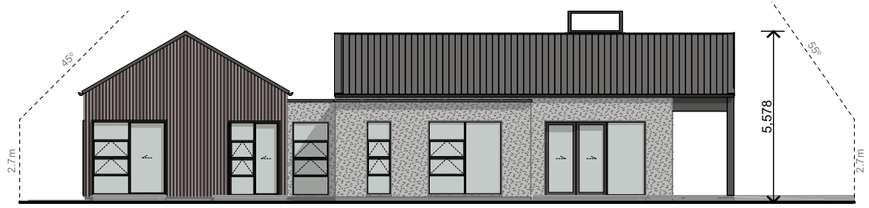
Lot 11 for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

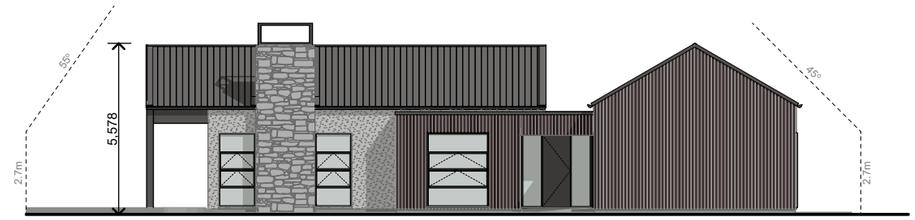


North Elevation 1:200

South Elevation 1:200



East Elevation 1:200



West Elevation 1:200

PLAN KEY

1 - Garage
2 - Laundry
3 - Bedroom 2
4 - Bedroom 3
5 - Bathroom
6 - Living Room
7 - Covered Patio
8 - Dining
9 - Kitchen
10 - Scullery
11 - Walk in Robe
12 - Master Bedroom
13 - EnSuite
14 - Entry
15 - Sun Nook
16 -Media Room
17 - Study Nook

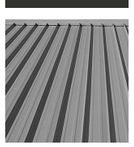
Villa ground floor = 228.44m²

MATERIALS:


Vertical Cedar


Plaster


Accent Steel Cladding


Half Eurotray Roofing

QUEENSTOWN COMMERCIAL

Lot 12
for Resource Consent

This plan is conceptual only to provide an indicative layout for the purpose of resource consent. Final plan layout may be altered from shown before being drawn for building consent.

Site Plan - Proposed

Rev ID	Ch ID	Change Name	Date
06	10	Retaining wall removed and contours updated	21/10/2020
	11	Retaining wall proposed to support turning area for Villa 04	

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Proposed Site Plan

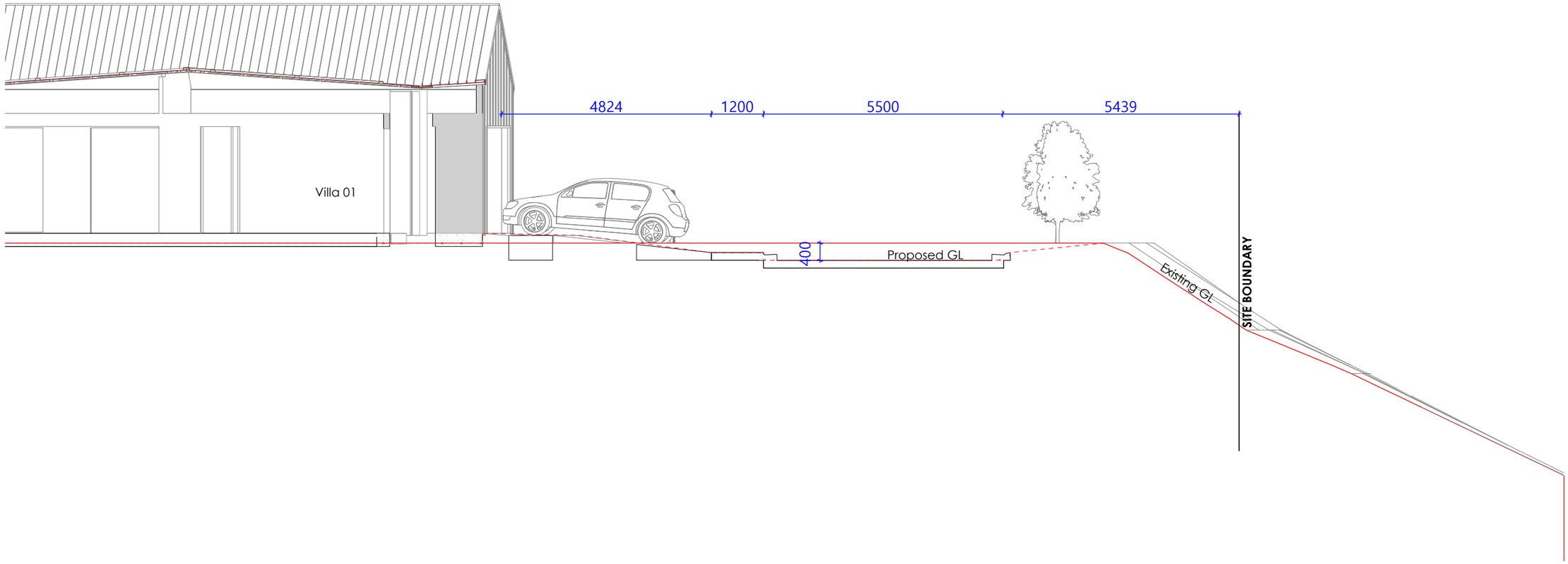
DRAWN BY: HA

1:750 @ A3

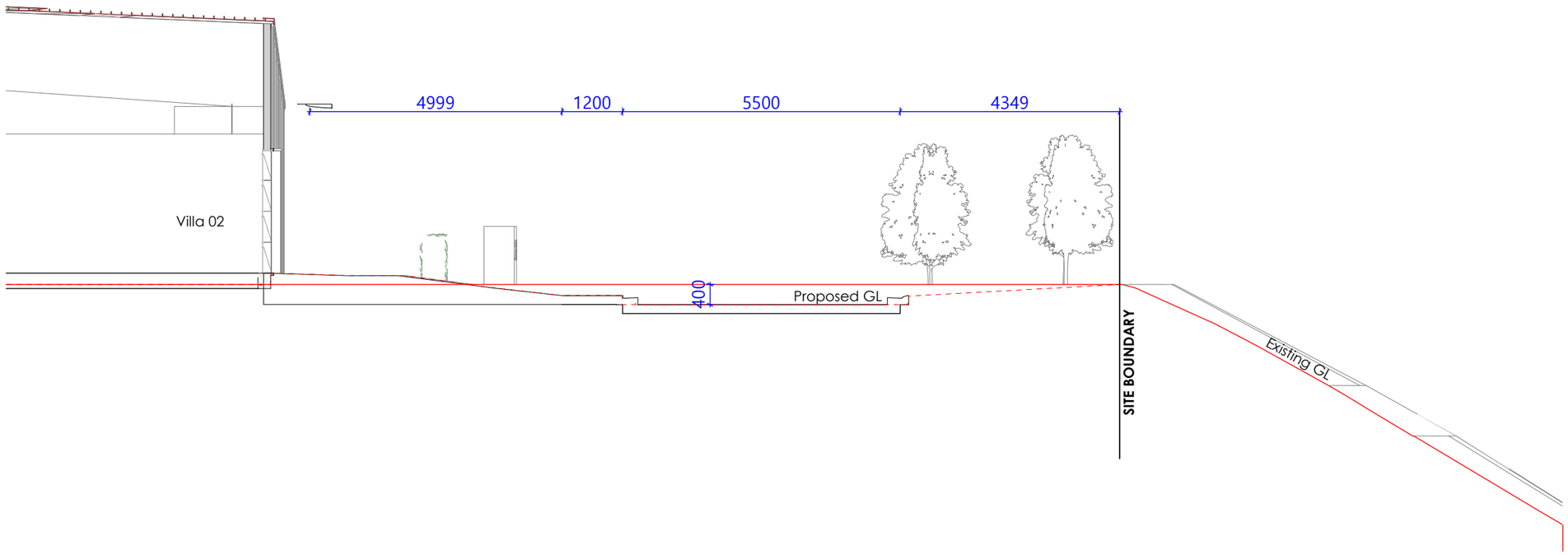
DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:
06



Section 1



Section 2

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

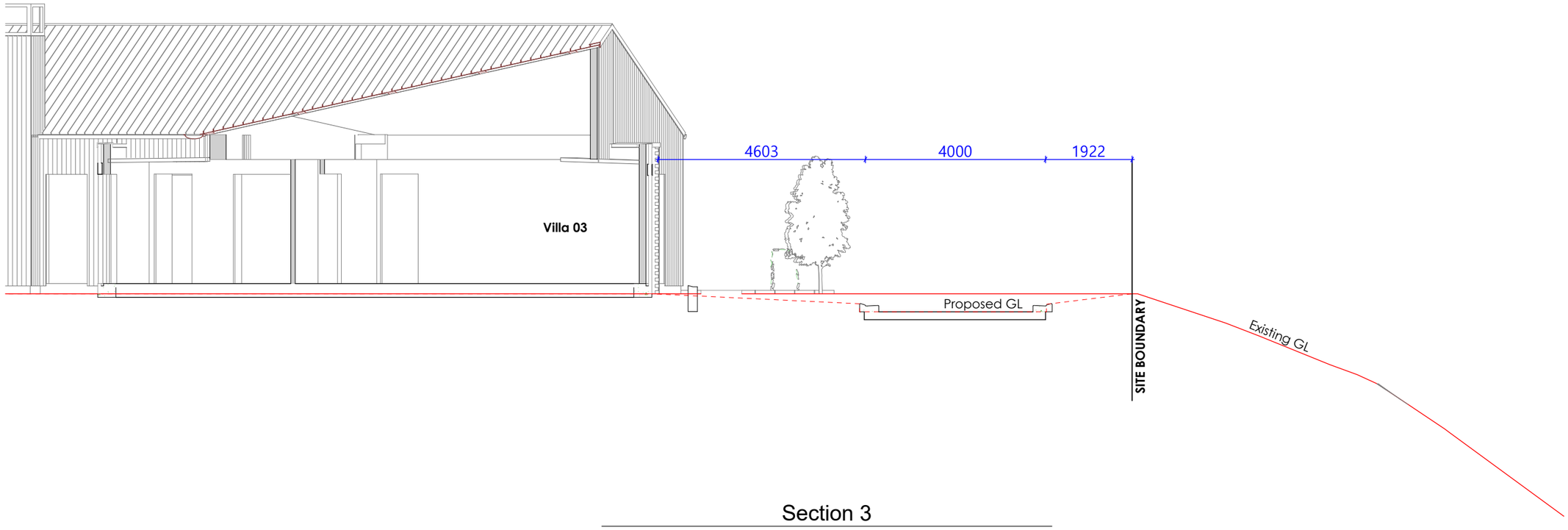
1:100 @ A3

DATE: 21/10/2020

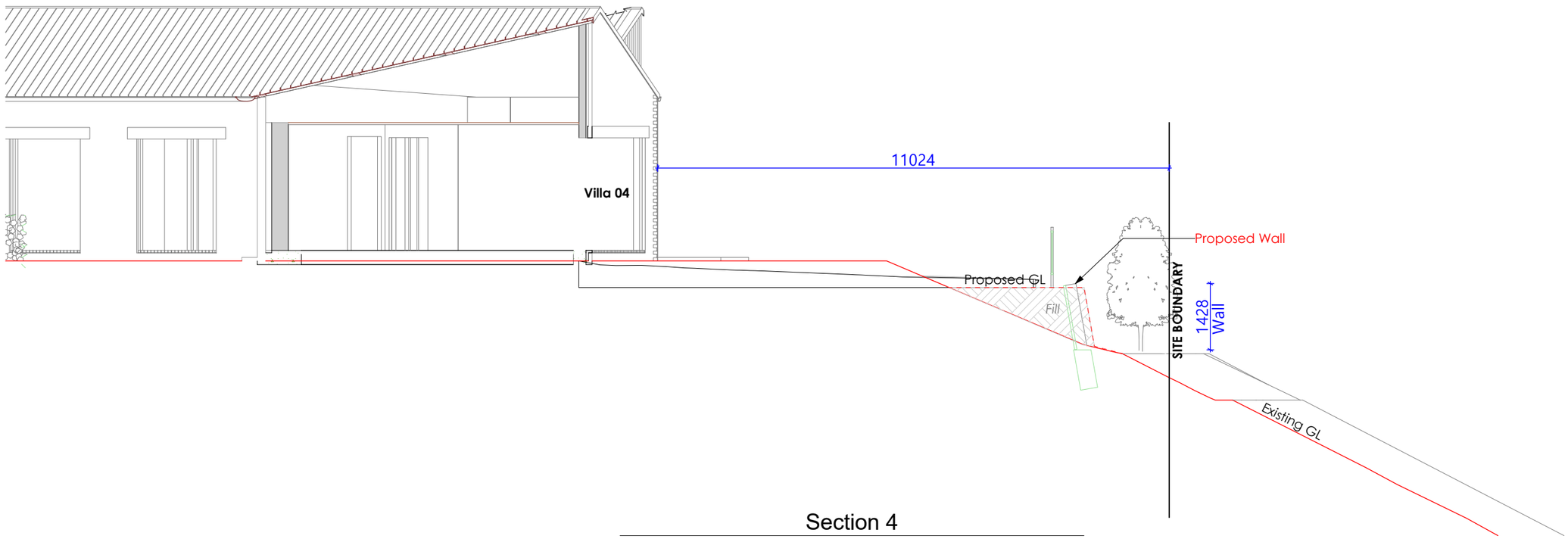
PHONE: 027 7743 762

REVISION NUMBER:

01



Section 3



Section 4

Rev ID	Ch ID	Change Name	Date
04	08	Section provided at Villa 03 pinch point	23/09/2020

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

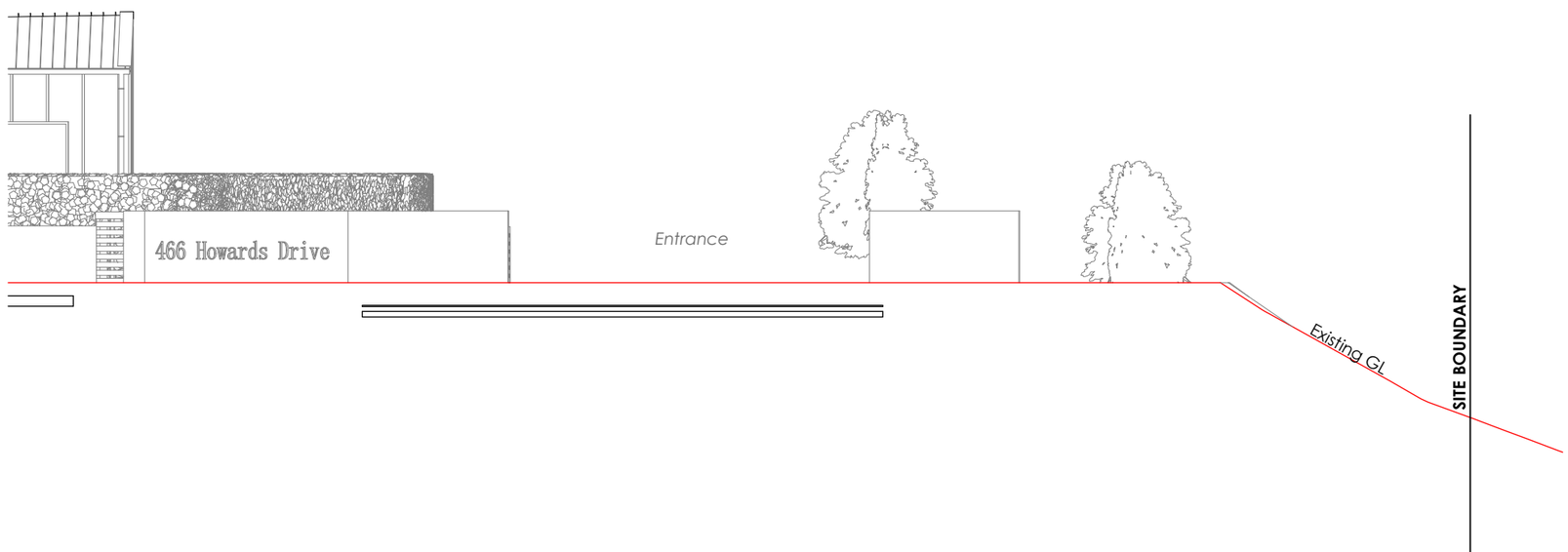
1:100 @ A3

DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

04



Section 5

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

1:100 @ A3

DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

01

Project Number: 6-XZ614.00

403 & 466 Frankton-Ladies Mile Highway, Queenstown

3 September 2020

Preliminary Site Investigation

Contact Details

Megan Baddiley

WSP
Tarbert Buildings
69 Tarbert Street
Alexandra 9320
+64 3 440 2400
+64 21 233 6761
megan.baddiley@wsp.com

Document Details:

Date: 03 September 2020
Reference: 6-XZ614.00
Status: Final

Prepared by:

Megan Baddiley CEnvP
Environmental Engineer

Reviewed by:

Lisa Bond SQEP
Senior Environmental Consultant

Approved for release by:

Rob Bond
Work Group Manager – Geotechnical and Environmental

Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
A	14 July 2020	M. Baddiley	L. Bond	R. Bond	Final
B	03/09/2020	MB	LAB	RB	Final RevB

Revision Details

Revision	Details
A	Issued for client comments.
B	Amendments as detailed by Planner

Report Checklist

Summary contaminated sites report checklist					
Report contained in this document	✓	☐	☐	☐	☐
Report sections and information to be presented	**PSI**	**DSI**	**RAP**	**SVR**	**MMP**
Executive summary	✓	☐	☐	☐	☐
Scope of work	✓	☐	☐	☐	☐
Site identification	✓	☐	☐	☐	☐
Site history	✓	S	S	S	S
Site condition and surrounding environment	✓	S	S	S	S
Geology and hydrology	A	☐	S	S	S
Sampling and analysis plan and sampling methodology	A	☐	X	☐	☐
Field quality assurance and quality control (QA/QC)	N	☐	X	☐	S
Laboratory QA/QC	N	☐	X	☐	X
QA/QC data evaluation	N	☐	X	☐	X
Basis for guideline values	✓	☐	☐	☐	☐
Results	A	☐	☐	☐	S
Site characterisation	✓	☐	☐	☐	☐
Remedial actions	X	X	☐	S	S
Validation	X	X	X	☐	S
Contaminated materials management plan (CMMP)	X	X	☐	S	S
Ongoing site monitoring	X	X	X	N	☐
Conclusions and recommendations	✓	☐	☐	☐	☐

Key:

PSI - preliminary site investigation report SIR detailed site investigation report
RAP - site remedial action plan
SVR - site validation report
MMP - ongoing monitoring and management plan
A - Readily available information should be included
S - A summary of this section's details will be adequate if detailed information has been included in an available referenced report
N - Include only if no further site investigation is to be undertaken
X - Not applicable and can be omitted.

(MfE. *Contaminated Land management guidelines No. 1*. 2011a)

Contents

List of Figures

List of Tables

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Queenstown Commercial Limited ('**Client**') in relation to undertaking a Preliminary Site Investigation (PSI) ('**Purpose**') and in accordance with the Short form Agreement (6-XZ588.00) with the Client dated 5 June 2020. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing the Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('**Client Data'**) provided by or on behalf of the Client. Except as otherwise stated in the Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable in relation to incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Executive Summary

A Preliminary Site Investigation (PSI) has been undertaken in order to assess the potential for contamination to be present at 403 & 466 Frankton-Ladies Mile, Queenstown (the Site). This PSI has been commissioned as part of the proposed subdivision and of the site.

The site is situated in an area historically dominated by agricultural activities but in recent years has been developed into low density residential. Initial development at the site occurred prior to 2001. The area for proposed subdivision and development is situated surrounding the existing homestead and is characterised by grass cover and garden. Records indicate that limited change has occurred historically in the areas earmarked for development.

Taking into consideration the information herein, it is considered more likely than not that the risk to human health associated with potential contamination derived from historic and ongoing activities across the site as a whole is considered to be **LOW.**

No HAIL activities were noted to have taken place within the area of proposed subdivision of the site. The Regulations within the NESCS are therefore **NOT** considered applicable to the proposed subdivisions.

1.1 Recommendations

Based on the results of this investigation, WSP recommends the following:

- This PSI should be submitted to the Queenstown Lakes District Council (QLDC) for inclusion on the property file; and
- This PSI should be submitted to Otago Regional Council (ORC) for updating of the HAIL database

Should any other ground conditions be encountered that are not covered herein a Suitably Qualified and Experience Practitioner (SQEP) specialising in contaminated land assessment should be consulted in order to assess the risks to human health and sensitive receptors.

2 Introduction

A Preliminary Site Investigation has been undertaken on behalf of Queenstown Commercial Limited for a piece of land located at 403 & 466 Frankton – Ladies Mile Highway, Queenstown (herein referred to as 'the site') in order to assess the potential for contamination to be present on the site.

Covering approximately 9,503m^2, the property is proposed to be subdivided into one of three concepts each with between eight and twelve medium density residential sections, refer to Figure 1. The existing residential building is to be retained within the centre of the site with ancillary structures removed to facilitate development.

Figure 1 Proposed development plans

2.1 Objective

This report has been prepared in order to assess the potential for ground contamination to be present across the site with respect to a resource consent application for subdivision with subsequent development of residential dwellings. This assessment will focus on determining whether Hazardous Activities and Industries List (HAIL) activities have been undertaken on the site as defined by the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

2.2 Scope of Work

In order to achieve the objective, set out above, the following scope of works was undertaken:

- A review of the site history including aerial photographs and anecdotal evidence,
- A site inspection and walkover,
- A review of documented data from Otago Regional Council (ORC) and Queenstown Lakes District Council (QLDC) with respect to the site,
- Assessment of the geological and hydrogeological conditions for the site and
- Characterisation of the site to determine the environmental and human health risks associated with the site along with recommendations for further work should it be deemed necessary.

3 Site Identification

The site is located at 403 & 466 Frankton – Ladies Mile Highway approximately 4.5km north east of Frankton Roundabout as shown on Figure 1 below. Site details are provided in Table 2.1.

Table 3-1 Site identification

Site Address	403 & 466 Frankton-Ladies Mile Highway, Lake Hayes 9371
Legal Description	Lot 2 DP 536321
Titles	CT- 889404
Owner	Neville & Deborah Kelly
Approximate total site area	9,503 m^2
Territorial Authority	Queenstown Lakes District Council (QLDC)

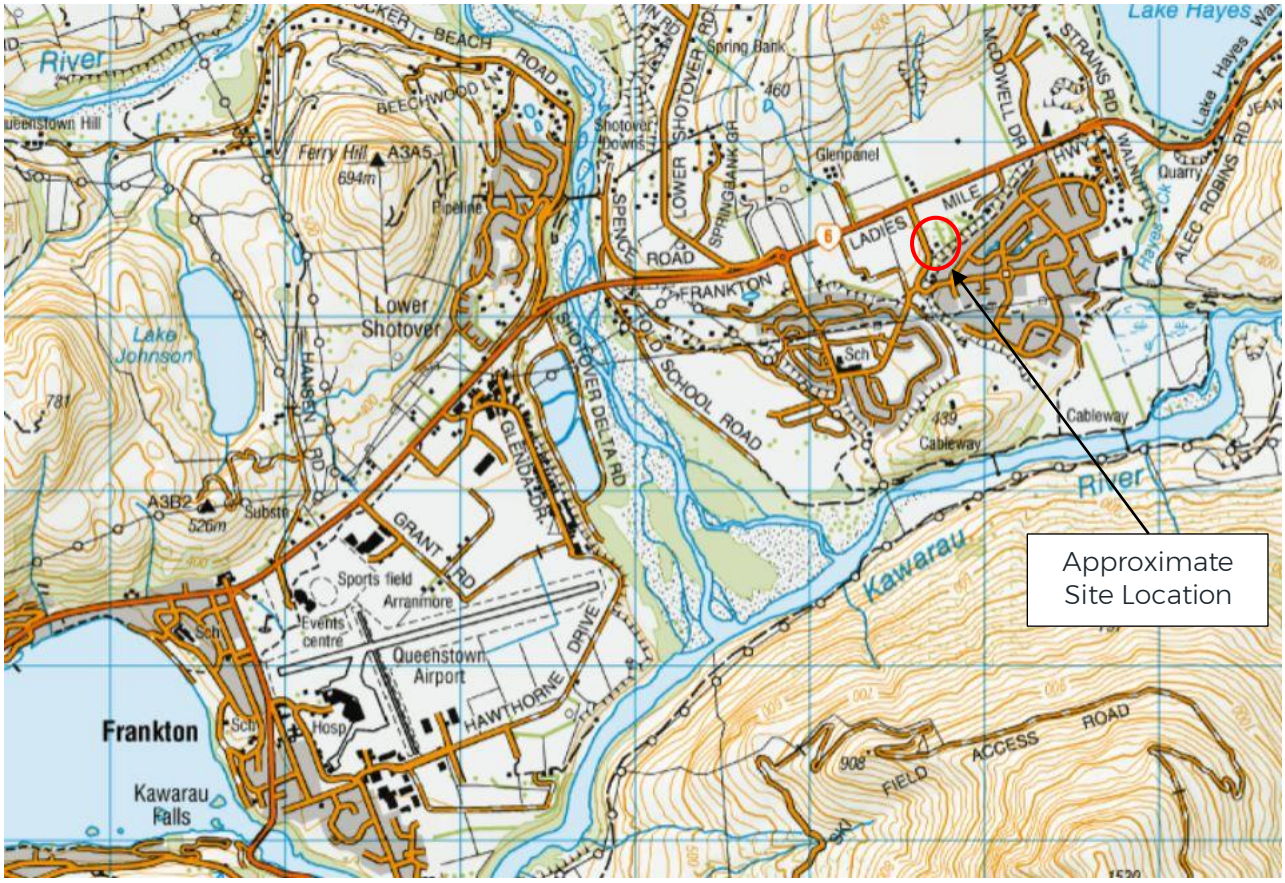


Figure 2 Site location plan (Base map sourced from NZTM 2019).

4 Site Description

4.1 Site History

Details of the site history have been gained from a review of multiple sources including historical aerial photographs obtained from Google Earth and Retrolens, historical topographical maps from Maps Past and a review of the QLDC and ORC databases. Historical information is presented in Appendix A.

4.1.1 Historical Aerial Photographs

Five historical aerials dating from 1956 were available to view on Retrolens, an additional four aerials were available from Google Earth (2004 – 2018). In addition, three historical maps (1929 – 1979) were available from Maps Past.

A summary of observations made following the review of historical aerials is presented in Table 3-1.

Table 4-1 Summary of historical aerial photographs

Year	Observations
1929 *Maps Past*	The map indicates that the present-day site forms the north western most part of a larger property designated 86 (34.2.33). Howards Drive is clearly marked on the map; however, settlement density is not clear.
1949 *Maps Past*	Howards Drive no longer visible on available map (possible mix up of dates online). Site is located in the middle of a large open area with no recorded access to it. Frankton - Ladies Mile (original layout of State Highway 6A is present) Limited detail is noted in this map.
1956 *Retrolens*	First available aerial photograph. Still no visible access to site from highway. The site is situated adjacent to a gentle slope. The site area is clear of vegetation and no buildings are present onsite.
1976 *Retrolens*	No discernible change to site. The large field in which the site is located has been divided down the middle by a fence. No visible access to site from State Highway.
1984 *Retrolens*	Soil disturbance visible in the south western corner of site, unclear if related to construction of buildings. Hedge row trees also visible along driveway. The surrounding area remains clear of vegetation and construction.
2001 *Retrolens*	First colour photo of site. The property has been developed at this time with the house and driveway visible. The pixilation of the aerial makes it difficult to determine if the existing shed has been constructed at this time. Surrounding farmland to the north and north east has been planted out as an orchard.
2005 *Google Earth*	Clear view of the property. One large 'L' shaped buildings in the centre of the site with a shed in the southern corner of the site. Residential properties have been built to the south east of the site and orchards are still present to the north.
2010 *Google Earth*	No discernible change to site since 2005. Increased residential development to the south east.
2013 *Google Earth*	No discernible change since 2010.
2018 *Google Earth*	No discernible change to site since 2013. Beginning of residential development to the west.

4.1.2 Council Records

A review of the GIS database held by QLDC has revealed that the site is located within a rural zone. Four resource consents were noted for the site area. Details of these consents are summarised in Table 3-2.

Table 4-2 QLDC consent details

Type of Consent	Date	Details
Resource	1993	Erection of Granny flat (cottage) on site
	1994	New Dwelling including garage (Withdrawn)
	2001	Lake Hayes subdivision
	2019	Boundary Adjustment with 516 Ladies Mile

4.1.3 HAIL Database Search

A review of the online HAIL database held by ORC has revealed that the site does not currently appear on the database.

It should be noted that the lack of detail on a property file or "no files of note" entry is not confirmation of no HAIL activities being present, or historically present on the site, it merely represents the council's knowledge of the site.

One HAIL site is noted to be present within 500m of the site and is associated with the Ladies Mile Pet Lodge located on the northern side of the Ladies Mile. The site is partially investigated as part of the removal of an underground petrol storage tanks in 2005, (HAIL A17 storage tanks or drums for fuel, chemicals or liquid waste).

4.1.4 Heritage

The Heritage New Zealand Pouhere Taonga Act 2014 makes it unlawful for any person to modify or destroy, or cause to be modified or destroyed, the whole or any part of an archaeological site without the prior authority of Heritage New Zealand.

In order to establish the heritage status of the site the Heritage New Zealand database was consulted. The site was not found on the database.

4.2 Geology and Hydrogeology

The geology of the site is shown on the 1:250,000 scale GNS Geology Web Map extract (accessed June 2020) as shown in Figure 2.

This map indicates the site to be underlain by Holocene Age fan deposits generally comprising loose, commonly angular boulders, gravel, sand and silt forming alluvial fans.

A review of the GNS Active Faults Database indicates that the nearest active fault is the Cardrona Fault (#8372) approximately 10km east of the site. The Cardrona fault is reverse with a recurrence interval of >5,000 to <=10,000 years (IV) and a low slip rate. There is no further information available relating to this fault line.

A review of the ORC Map-C series online indicates that the site is located within the Wakatipu Basin Aquifer and therefore groundwater beneath the site is considered to be sensitive.

A search of ORC online mapping resource database indicates that there are five boreholes within 500m of the site. The closest is located approximately 85m north west which is part of a small community supply of water from the Wakatipu Basin Aquifer. The depth to groundwater is indicated to be approximately 40m bgl within this borehole.

Figure 3 Site geology (Base map GNS web map, accessed 2020)

5 Site Inspection

5.1 Site Condition and Surrounding Environment

A site walkover was completed on 22 June 2020 by a WSP Engineer. A summary of the inspection is outlined below, and a selection of site photographs is presented in Appendix B.

The site was accessed off Howards Drive via a gravelled driveway. The driveway takes you past an orchard to the left before reaching a fork in at the end of the driveway leading to the homestead and shed respectively. The area around the homestead is relatively clear of vegetation with numerous trees dotted around the property. The grass cover shows signs of stress in places, but this is most likely due to the cold weather and frost experienced in the area. Frost is visible in multiple photos taken during the site visit.

The exterior of the homestead appears to be in a good condition and the roof looks to be a recent upgrade. The house is supplied by gas and water tanks.

The area immediately surrounding the shed has been gravelled and the floor of the shed is a painted concrete. The shed itself is of a hangar design constructed out of steel and wood beams and corrugated iron. The shed is currently being used for general private vehicle maintenance with multiple cars, utility trucks and boats stored onsite. Various lubricant, oil and cleaning product bottles were noted scattered around the shed. However, quantities observed suggest home use only.

Surrounding land uses include an orchard to the north and east which appears to have not been maintained in recent years. Large mature evergreen hedgerows and mature trees separate the site from the orchard area. To the south of the site is located open land beyond which lies relatively recent residential development of the Shotover Estate. Howards Drive delineates the western site boundary, beyond which lies the Queenstown Country Club retirement development.

6 Conceptual Site Model

This section of the report relates to the assessment of contamination arising from the previous and current land uses, both on and off the site that may impact on development proposals. This is achieved by detailing the nature and extent of contamination, the potential migration pathways and to identify potential receptors to the extent possible based on information gathered from the desk study and site visit. Data gaps and uncertainties are identified during the preparation of the conceptual model, which assists in designing a more detailed investigation.

The following conceptual site model been identified based on a conservative land use of rural lifestyle across the site. These may need to be amended in light of any further development proposals in the future:

Table 6-1 Conceptual site model

Likely sources of impact	Several potential current and historical sources were identified, including: • potential historical use of the site or adjacent properties for low intensity agricultural purposes. • Use of the shed as a domestic motor vehicle workshop • Use of adjacent properties for orchards
Potentially impacted media	Impacts are likely to be limited to shallow soils (the upper several metres).
Contaminants of concern	The potential contaminants of concern comprise: • heavy metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc) • organochloride pesticides (OCPs) • polycyclic aromatic hydrocarbons (PAHs) • benzene, toluene, ethylbenzene and xylenes (BTEX) • total petroleum hydrocarbons (TPHs) •
Migration pathways	Potential migration pathways for the contaminants of concern comprise: • airborne migration of dust, vapour or fibres • surface runoff containing impacted soil or dissolved contaminants • infiltration of contaminants in soil • groundwater transport through soil, including in preferential pathways (service trenches, through higher permeability soils).
Potential exposure pathways	Potential exposure pathways comprise: • inhalation of dust, vapours or fibres • ingestion or dermal contact with impacted soil, including surface soils including during excavation work • ingestion or dermal contact with impacted surface water or extracted groundwater.
Potential sensitive receptors	Identified sensitive receptors comprise: • workers and visitors at the site during the proposed site works • workers, visitors and animals following redevelopment of the site • users of neighbouring properties • surface water ecosystems.

6.1 Discussion

Site history, council records, historical aerial photography and a site inspection indicate no HAIL activities have been or are currently present at the site. The adjacent orchard may have been

subject to pesticide application in the past, however the presence of mature trees and hedgerows between the orchard and the site would likely prevented large amounts of spray drift from migrating on to the site.

Aerial photography indicates development has been limited onsite and has only occurred since the 1980's. No records exist indicating any historical use from agricultural activity however it is considered plausible given the site location and history of the area. This is likely to have included pasture or bailage planting rather than high intensity agricultural uses.

Domestic vehicle storage and maintenance was noted at the site however hydrocarbon storage was not observed in and around the buildings. Gravel ground cover appears to be clear of spills and no signs of an underground fuel storage tank were observed. Therefore, the risk of hydrocarbon contaminated soil to workers and site users is considered low.

Based on the age of the existing buildings the use of lead-based paint and asbestos containing materials (ACM) are not considered likely to have been used within the building fabric on site.

7 Basis for Guideline Values

For contaminated site assessments the hierarchy of reference documents containing guidelines for soils and waters, the MfE Contaminated Land Management Guidelines No 2 (November 2003) is referred to.

The site currently comprises rural residential and is currently zoned as a Rural Lifestyle Area according to the district plan.

The existing property is proposed to be subdivided into upwards of seven separate properties. As such, residential land use as defined in the NESCS is considered the most appropriate end use of the site as detailed within Table 6-1. The recommendations outlined in this report must therefore be considered when developing this land.

The primary human health receptors have been determined to be site workers, along with residential users and visitors following any development of sections on the site.

Table 7-1 Land use scenario

Scenario	Description
Rural / lifestyle block	Rural residential land use, including home-grown produce consumption (25 per cent). Applicable to the residential vicinity of farm houses for protection of farming families, but not the productive parts of agricultural land. Note: Consumption of eggs, milk and meat from animals raised on site is excluded. Produce consumption is limited to home-grown vegetables. Sites for which consumption of home-grown eggs, milk or meat is important will need to be evaluated on a site-specific basis.
Residential	Standard residential lot, for single dwelling sites with gardens, including home-grown produce consumption (10 per cent).
High-density residential	Urban residential with limited soil contact, including small ornamental gardens but no vegetable garden (no home-grown produce consumption); applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens, but not high-rise apartments.
Parks / recreational	Public and private green areas and reserves used for active sports and recreation. This scenario is intended to cover playing fields and suburban reserves where children play frequently. It can also reasonably cover secondary school playing fields but not primary school playing fields.
Commercial / industrial outdoor worker (unpaved)	Commercial / industrial site with varying degrees of exposed soil. Exposure of outdoor workers to near-surface soil during routine maintenance and gardening activities with occasional excavation as part of maintaining subsurface utilities (ie, a caretaker or site maintenance personnel). Also conservatively applicable to outdoor workers on a largely unpaved site.

8 Site Characterisation

The purpose of this preliminary site investigation was to provide an assessment of the historical land uses to determine whether the activities have, more likely than not, resulted in contamination of the soil that may be hazardous to human health.

On the basis of a review of information currently available, as well as observations made during the site inspection, and through the compilation of a conceptual site model our assessment of the site is as follows:

-
- Orchards located beyond the north and eastern boundaries are separated from the site by mature trees and hedgerows.
- The garage on site appears to be in use for private household vehicle maintenance only
- The underlying geology comprises alluvial fan deposits which have a mobile groundwater regime and are part of the Wakatipu Basin Aquifer and may therefore be considered sensitive.
- No obvious signs of vegetation dieback were noted in any location across the site.
- Adjacent land use may have resulted in the migration of contaminants, associated with horticultural processes, onto site.

Potential human health risks have been evaluated using the Likelihood and Consequence scales tabulated below, Table 7-1, to determine a risk level – low, moderate, high, very high or extreme. The assessed risk level allows prioritisation of investigations and assessment measures.

Table 8-1 Likelihood and consequence scale

	Consequence				
Likelihood	Insignificant	Minor	Medium	Major	Catastrophic
Almost certain	Moderate	Moderate	Very High	Extreme	Extreme
Likely	Low	Moderate	High	Very High	Extreme
Possible	Low	Moderate	Moderate	Very High	Very High
Unlikely	Low	Low	Moderate	High	Very High
Rare	Low	Low	Low	Moderate	High

The risks to human health have been assessed on the basis of the historical activities which may have occurred on specific areas of the site and can be split into the following activities:

- **Presence of Lead based paints:** Based on the age of the dwelling and visual observations on site, the risks associated with the potential presence of lead-based paint on existing buildings in a destressed state or in the soil is considered to be Low.
- **Use of site for agricultural purposes:** The risks associated with the use of the site for pasture or other agricultural purposes is considered to be Low.
- **Adjacent orchards:** Although an orchard is located to the north and east of the site, mature trees are noted along the boundary. In addition, the orchard trees do not appear to have been maintained for commercial growing for a number of years. The risk to site soils associated with spray drift from pesticides is therefore considered to be Low.

Taking into consideration the information herein, it is considered more likely than not that the risk to human health associated with potential contamination derived from historic and ongoing activities across the site as a whole is considered to be LOW..

Although HAIL activities are noted to have potentially occurred on an adjacent site (the orchard) no HAIL activities are identified to have occurred on the site itself.

9 Conclusions and Recommendations

The PSI has not identified HAIL activities to have occurred on the site, however adjacent land is considered to have potentially been subject to activities on the HAIL.

The conceptual site model and initial qualitative human health risk assessment presented herein are based upon information gained from a site inspection, council records, and other sources. The conceptual site model indicates that historical and current site activities have a Low potential risk of having contaminated the site.

It is considered highly unlikely that spray drift from the adjacent site would have impacted soils on site in sufficient quantity and as such it is highly unlikely that there is a risk to human health associated with any subdivision or land use change occurring on the site.

No HAIL activities were noted to have taken place within the area of proposed subdivision of the site. The Regulations within the NESCS are therefore NOT considered applicable to the proposed subdivisions.

9.1 Recommendations

Based on the results of this investigation, WSP recommends the following:

- This PSI should be submitted to the Queenstown Lakes District Council (QLDC) for inclusion on the property file; and
- This PSI should be submitted to Otago Regional Council (ORC) for updating of the HAIL database

Should any other ground conditions be encountered that are not covered herein a Suitably Qualified and Experience Practitioner (SQEP) specialising in contaminated land assessment should be consulted in order to assess the risks to human health and sensitive receptors.

10 References

Heritage New Zealand (accessed 2020). *http://www.heritage.org.nz/the-list*

Geological and Nuclear Sciences (accessed 2020). https://data.gns.cri.nz/geology/

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MfE (2012). *User Guide: National Environmental Assessment for Assessing and Managing Contaminants in Soil to Protect Human Health.* Ministry for the Environment.

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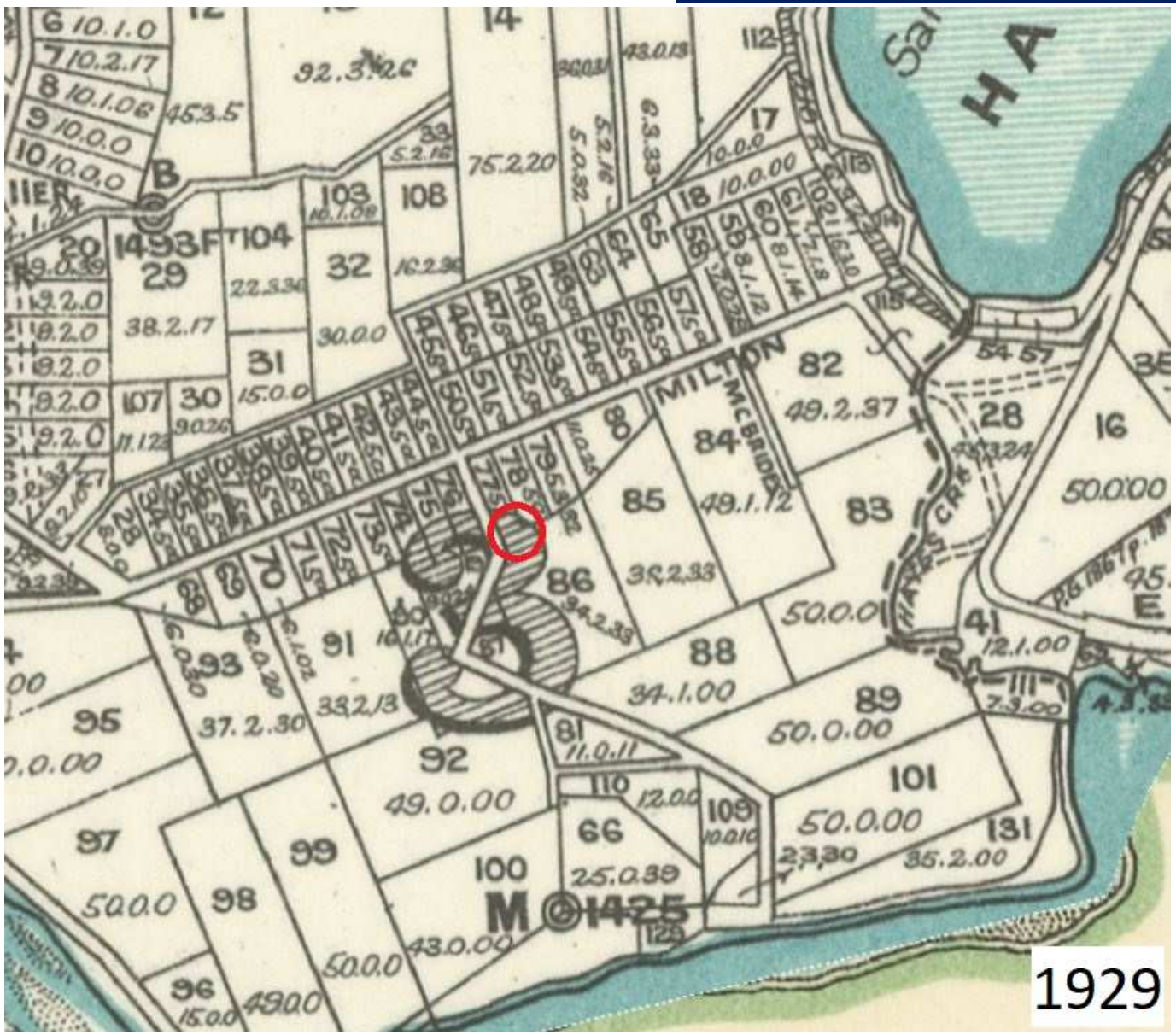
Appendix A
Historical Aerials

1929



N

Approximate Site Location

1949

N

Approximate Site Location

1956

N

Approximate Site Location

Approximate Site Location

Approximate Site Location

Approximate Site Location

2005

N

Approximate Site Location

Approximate Site Location

N

Approximate Site Location

Approximate Site Location

Appendix B
Site Photographs

PHOTOGRAPHIC LOG

Client Name	Site Location	Project No.
Queenstown Commercial Limited	466 Frankton-Ladies Mile, Queenstown	6-XZ614.00

Photo No.	Date
1	22 June 2020

Description

Driveway to site.

Photo taken facing south.

Photo No.	Date
2	22 June 2020

Description

Overview of backyard of homestead.

Photo taken facing south east.

	PHOTOGRAPHIC LOG	
Client Name Queenstown Commercial Limited	**Site Location** 466 Frankton-Ladies Mile, Queenstown	**Project No.** 6-XZ614.00

Photo No.	Date
3	22 June 2020

Description

Overview of shed.

Photo taken facing west.

Photo No.	Date
4	22 June 2020

Description

Storage area behind shed.

Photo taken facing north west.

	PHOTOGRAPHIC LOG	
Client Name Queenstown Commercial Limited	**Site Location** 466 Frankton-Ladies Mile, Queenstown	**Project No.** 6-XZ614.00

Photo No.	Date
5	22 June 2020

Description

Inside of the shed.

Photo taken facing south.

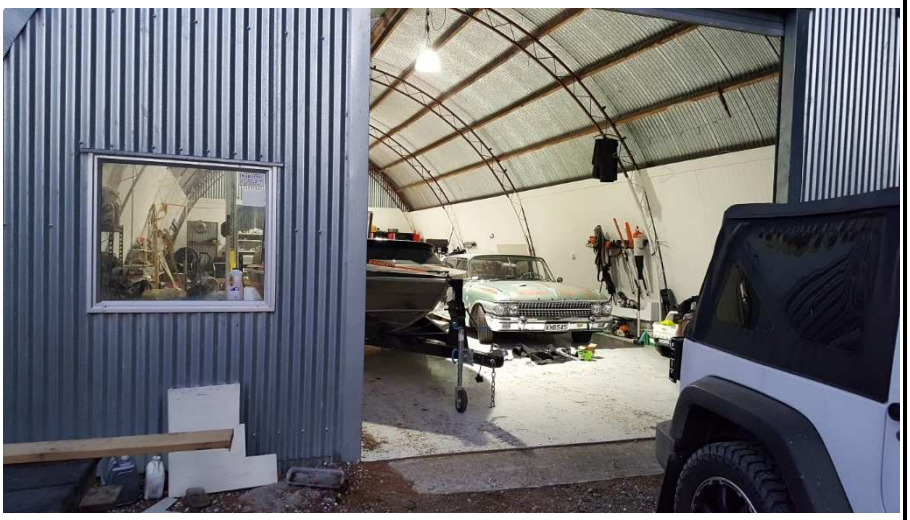


Photo No.	Date
6	22 June 2020

Description

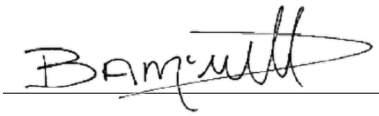
Orchard area to the north of the site.

Photo taken facing north east.

wsp.com/nz

466 FRANKTON-LADIES MILE HIGHWAY

INFRASTRUCTURE REPORT

CLIENT	Queenstown Commercial Ltd.
JOB NUMBER	J000028
REVISION	E
DATE	22/10/2020
PREPARED BY	 Oliver Ewing, Civil Engineer
REVIEWED	 Bailey McNutt, Lead Surveyor

CONTENTS

1.0 INTRODUCTION

1.1 PROJECT

The purpose of this report is to provide an assessment of the existing infrastructure which may be used to serve 12 proposed lots, being a subdivision of Lot 403 DP 322452 and Lots 2 & 3 of RM 200665 at 466 Frankton-Ladies Mile Highway, Queenstown.

The engineering information provided herein relates to the capacity of the stormwater, wastewater, water supply, known services and their ability to service the proposed development.

The assessments included in this report are 'without prejudice' as a desktop analysis and are preliminary in nature based on information available at time of issue.

1.2 LEGAL DESCRIPTION

Street Address:	466 Frankton-Ladies Mile Highway
Legal Description:	Lot 403 DP 322452 and Lots 2 & 3 of RM 200665
Lot Area:	0.9503 Ha

1.3 SITE DESCRIPTION

The site is located off Howards Drive, set back off Frankton-Ladies Mile Highway by approximately 200m. The eastern and northern boundaries are surrounded by a Queenstown-Lakes District Council owned land currently occupied by a mature chestnut grove. The western boundary borders Howards Drive, with Queenstown Country Club beyond. At the south end of site, the ground begins falling away towards Lake Hayes Estates. This embankment, which separates the proposed development from Lake Hayes, is steep with an average slope of 1:1 and extends into the development site by approximately 2.0m. A single residential dwelling currently occupies the proposed development site. The existing building is to remain and form part of the re-development. The existing lot is flat, with a gentle fall gradually towards the north and east boundary. A site locality plan has been provided below.

FIGURE 1: SITE LOCALITY

QLDC GIS Webmaps

2.0 PROPOSAL

The client proposes to subdivide the site into 12 residential lots and a private Joint Ownership Access Lot (JOAL). The proposed lots are formed around the existing dwelling and range in size from 525m^2 to 873m^2. The following works are proposed as part of the subdivision.

- Earthworks - for the establishment of the JOAL, driveway access to Lots 3 and 4, general landscaping of the 12 lots to clear topsoil and create suitable building pads, as well as a retaining structure within lot 4 to support the laneway.
- Overland Flowpath Assessment – to set minimum floor level requirements for the proposed residential dwellings which is essential to maintain adequate freeboard throughout the subject site.
- Stormwater – treatment and discharge of stormwater taking into consideration the stormwater management flow zone rules. Individual connections will be provided to each lot.
- Wastewater – discharge of wastewater into the public wastewater network. Individual connections will be provided to each lot.
- Water Supply and Services – Provide individual water supply, telecom, and power to each lot.

Please refer to The Sanderson Group site layout and general concept plan attached as *Appendix A*.

3.0 ENGINEERING ASSESSMENT

3.1 ACCESS

The site is currently accessed off Howards Drive by a sealed vehicle crossing north of the site. A gravel laneway then leads to the existing dwelling. The client has entered into a land swap agreement with QLDC which involves exchanging ownership of two sections of land (refer to RM200665). Queenstown-Lakes District Council will gain ownership of the land that is currently used to access the site, totalling 527m^2, in exchange for 527m^2 of the land paralleling the northern boundary. Access to the proposed development will then be relocated to the southwest corner of the development site where Howards Drive begins bending towards Lake Hayes Estate. The new access will be provided as per the QLDC Proposed District Plan, Schedule 29.9, Diagram 10.

Asphaltic concrete will be used to seal the main section of the vehicle crossing and the merge slip lanes either side of the crossing. The remaining section closer to the property boundary will be concrete pavers or similar. The proposed private access lane is located at the top of a significant slope. Therefore, the existing guard rail along Howards Drive will be extended towards the development site to provide protection at the top of the existing bank. The existing Lake Hayes Estate gateway sign and rock may need to be relocated to make room for the proposed vehicle crossing. Approval from QLDC will need to be sought prior to relocating the sign.

Stormwater infrastructure in the vicinity of the existing and proposed vehicle crossings will be updated to suit the new layout. The side drain will be re-instated once the existing vehicle access is removed and a new culvert will be installed under the proposed vehicle crossing to maintain the side drain's continuity within Howards Drive's. The side drain is collected by a scruffy dome connected to the piped stormwater network.

A private access lane will be used to serve all 12 residential lots. The road will be constructed with a 5.5 metre carriageway width and will a have a single 1.2 metre adjacent footpath. Further detail supplied in the report *466 Frankton-Ladies Mile Highway, Residential Subdivision Transport Assessment* as prepared by Bartlett Consulting.

3.2 EARTHWORKS

The site has previously been worked during the development of the existing dwelling. This has resulted in a flat site that is considered suitable for future development. Earthworks will be required to strip topsoil, excavate, and backfill the new building pads, service trenches and roads. Depth of excavations for building pads will depend on foundation type. Excavations to a depth of 0.6m can be expected to reach good ground for building pads and paved areas. Other earthworks include the construction of a retaining structure within lot 4 to support the laneway and provide sufficient space for vehicle manoeuvres. It is expected that approximately 9m^3 of fill will be required to construct the retaining structure to a maximum height of 1.2m. Refer to *Appendix B, Cut Fill Plans* for the proposed cut/fill volumes and extent of work within the retaining structure area. Earthworks volumes required to form the building pads and roads have been excluded from this report.

Contaminated material and shallow ground water are not considered to be an issue. Efforts will be made to remove as little mature vegetation from site as possible.

3.3 STORMWATER

Council GIS does not show any stormwater reticulation adjacent to the proposed development site. However, the developments surrounding the subject site are still ongoing. Stormwater generated by The Queenstown Country Club and Lake Hayes Estates catchments are conveyed via gravity fed pipes

to multiple pump stations located throughout the greater development. It is eventually discharged through an open channel to the Kawarau River. The remaining work within the surrounding developments include extending the stormwater network up Howards Drive towards Frankton-Ladies Mile Road.

The proposed development will connect onto the newly constructed 1050mmØ concrete main within Howards Drive. This line has been laid at 0.7% resulting in a capacity of approximately 2500 L/s. It is understood the network extension has been designed to cater for the full development of the surrounding areas as per QLDC requirements. Therefore, capacity in the greater network is not considered an issue. Connections can be provided to the proposed development without requiring any upgrades.

Stormwater from impervious areas of the proposed development will be treated for debris and suspended hydrocarbons prior to discharging to the public network. Attenuation devices will be incorporated into the development's stormwater management plan where required.

3.4 WASTEWATER

Similar to stormwater, the wastewater network in the area is still being developed. Therefore, no sewer mains are shown on council's GIS. However, plans to construct new mains within Howards Drive form part of the outstanding work of the surrounding developments. The proposed development will connect onto the new gravity line within Howards Drive where it will eventually get pumped to Queenstown's wastewater treatment plant.

Existing wastewater lines have the capacity to meet this developments requirements. Property connections to the existing network can be made without the need for any upgrades to the existing infrastructure.

3.5 WATER SUPPLY

Both potable and fire water connections will also be provided from the new public main being constructed within Howards Drive as part of The Queenstown Country Club subdivision.

The development will not incorporate a sprinkler system into its fire protection system. Therefore, the proposed subdivision fire water supply will cater for a fire water classification of FW2. This requires a total flow rate of 25L/s provided by a maximum of 2 fire hydrants. Fire hydrants will be installed at regular intervals as per QLDC within the Queenstown Country Club and Lake Hayes Estate developments. Whether or not the newly constructed water supply network will satisfy the requirements set out in NZS4409 for fire hydrant spacing will have to be determined once the construction of the surrounding developments is near complete. It is assumed the new fire hydrants will satisfy the requirement for fire water being supplied by 2 fire hydrants located within 270m from the proposed development. If this is not the case, one new hydrant will have to be installed near the entrance to the proposed development or along Howards Drive adjacent to the eastern boundary of site.

The potable and fire water flow rate demands of the proposed subdivision can be met by the network extensions of the surrounding developments without the need for any upgrades given they have been designed in accordance with QLDC's requirement to consider the full development of surrounding areas.

3.6 OTHER SERVICES

Power and telecom networks will be made available following the completion of the adjacent developments. Connections to the proposed development will be provided from the newly constructed networks.

4.0 CONCLUSION

4.1 REPORT SUMMARY

Based on this engineering assessment and information available, we consider that the proposed subdivision can be serviced with existing and/or newly constructed public infrastructure without causing any adverse effects on neighbouring properties or requiring any upgrades to the existing public network.

4.2 LIMITATIONS

This report is for the use by Queenstown Commercial Ltd. and should not be used or relied upon by any other person or entity or for any other project. This report has been prepared for the project described to us and its extent is limited to the scope of work agreed between the client and Maven South Ltd. No responsibility is accepted by Maven South Ltd. or its directors, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

Appendix A - CONCEPT PLANS

Site Plan - Proposed

Rev ID	Ch ID	Change Name	Date
06	10	Retaining wall removed and contours updated	21/10/2020
	11	Retaining wall proposed to support turning area for Villa 04	

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Proposed Site Plan

DRAWN BY: HA

1:750 @ A3

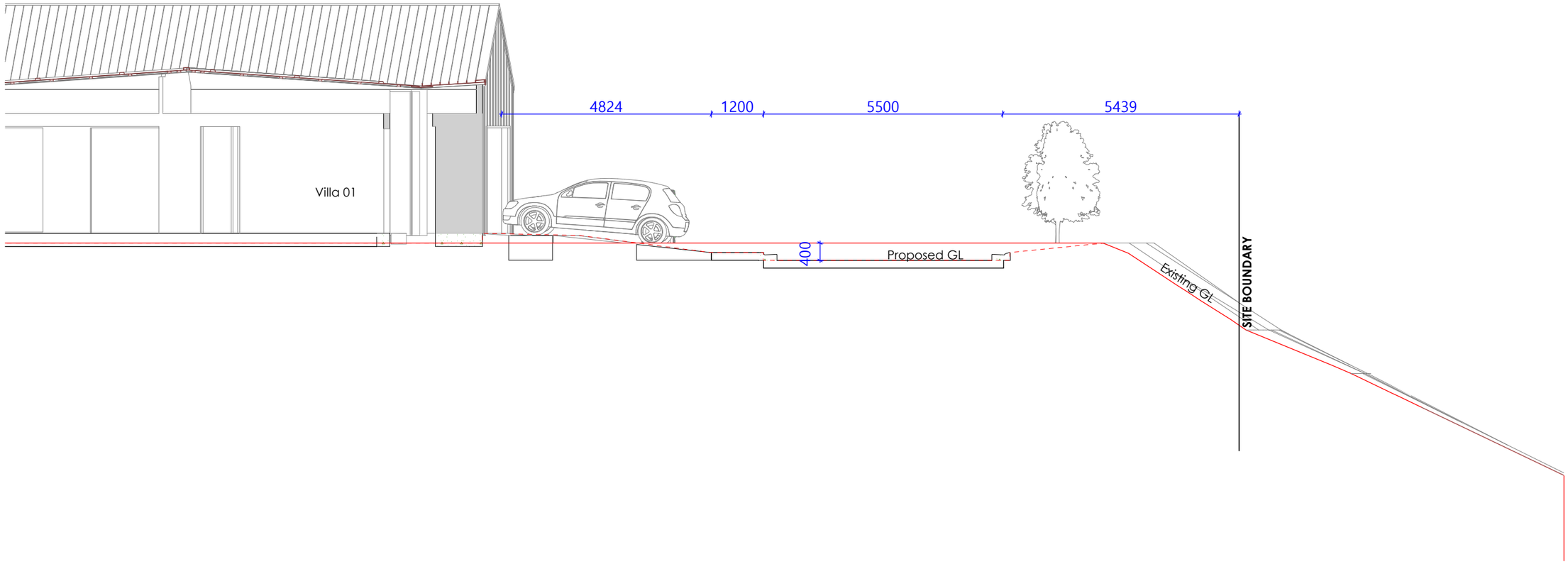
DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

06

Document Set ID: 6665420
Version: 1, Version Date: 29/10/2020



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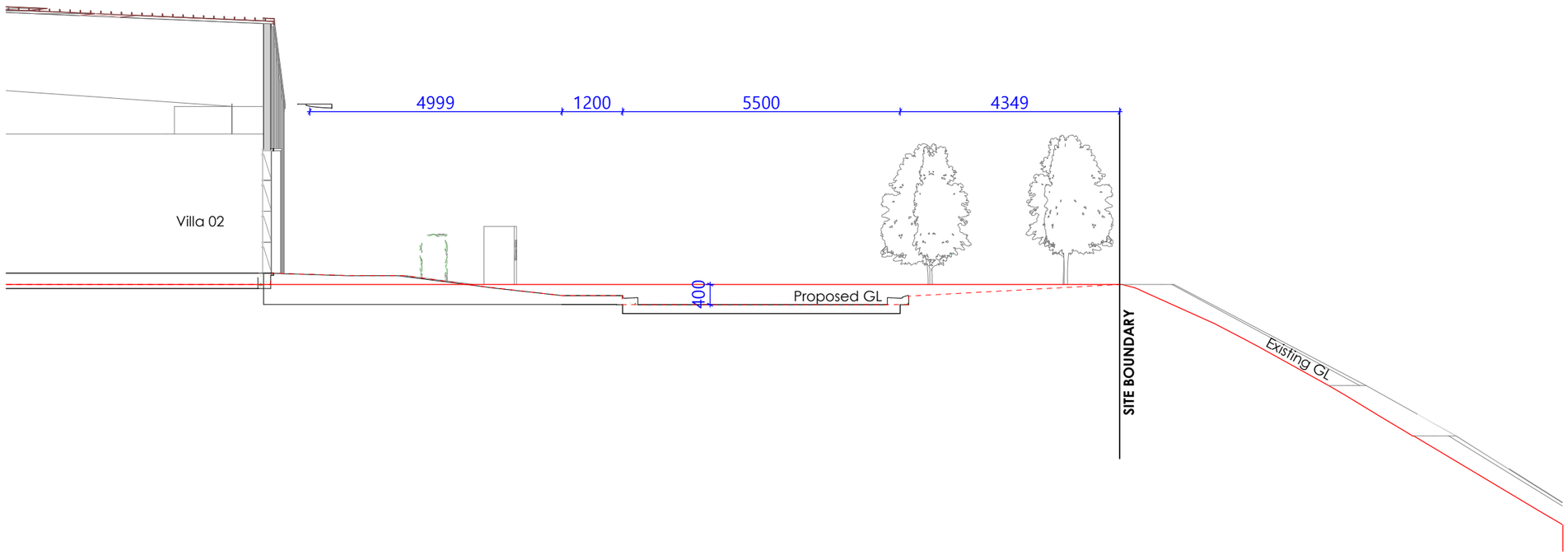


Section 2

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

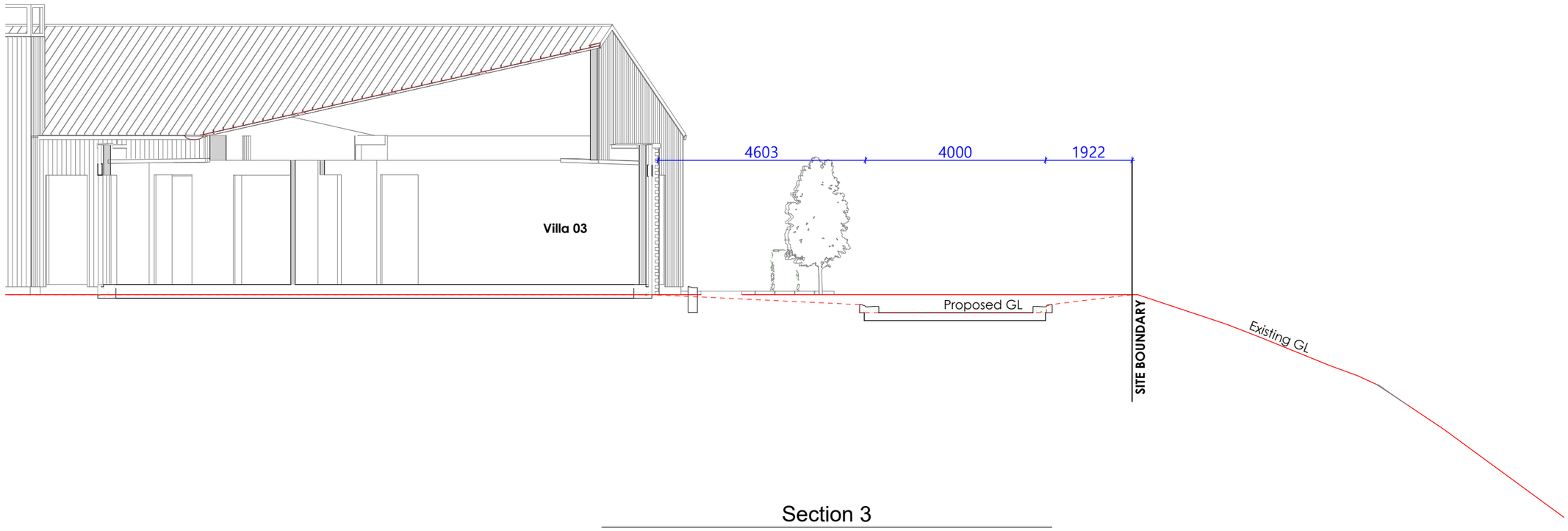
1:100 @ A3

DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

01



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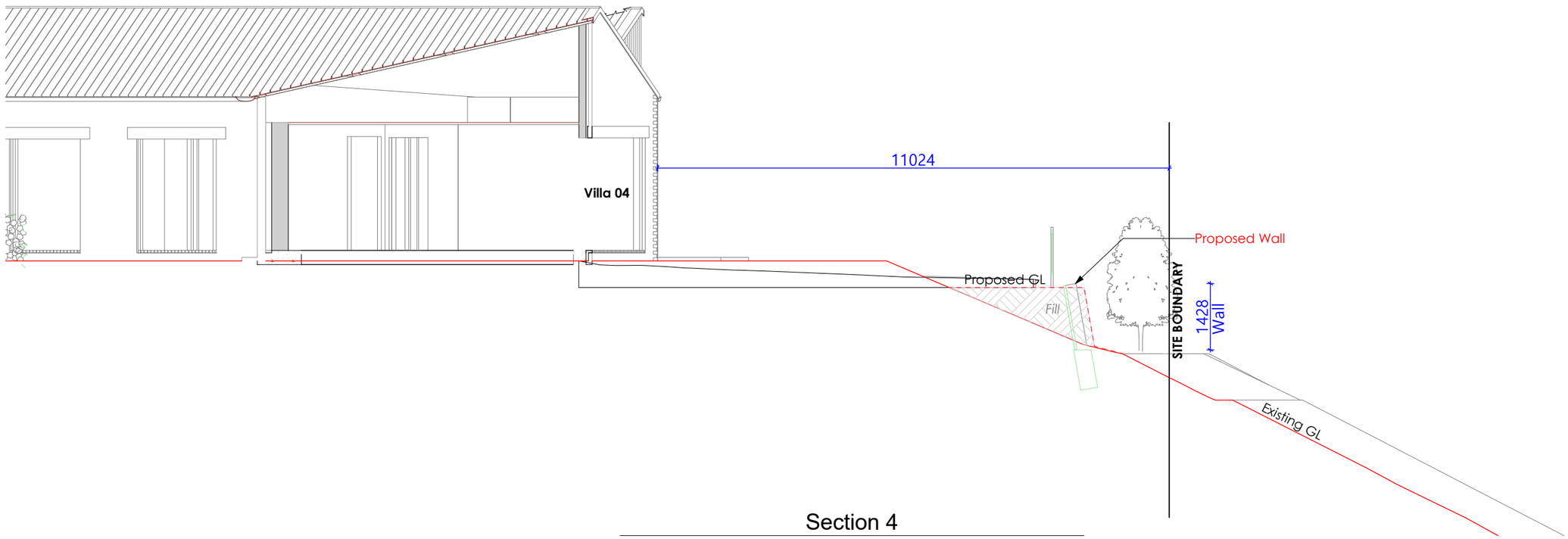


Section 4

Rev ID	Ch ID	Change Name	Date
04	08	Section provided at Villa 03 pinch point	23/09/2020

QUEENSTOWN COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

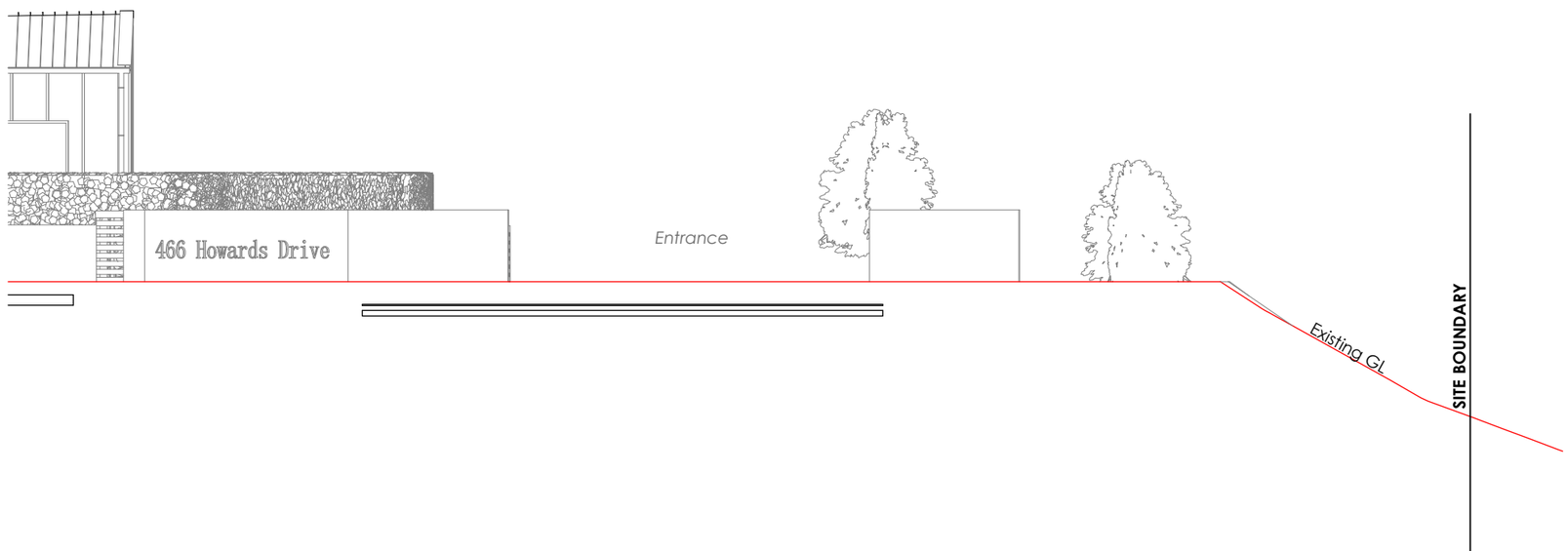
1:100 @ A3

DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:

04



Section 5

QUEENSTOWN
COMMERCIAL

466 Frankton-Ladies Mile Hwy
Queenstown

Site Sections

DRAWN BY: HA

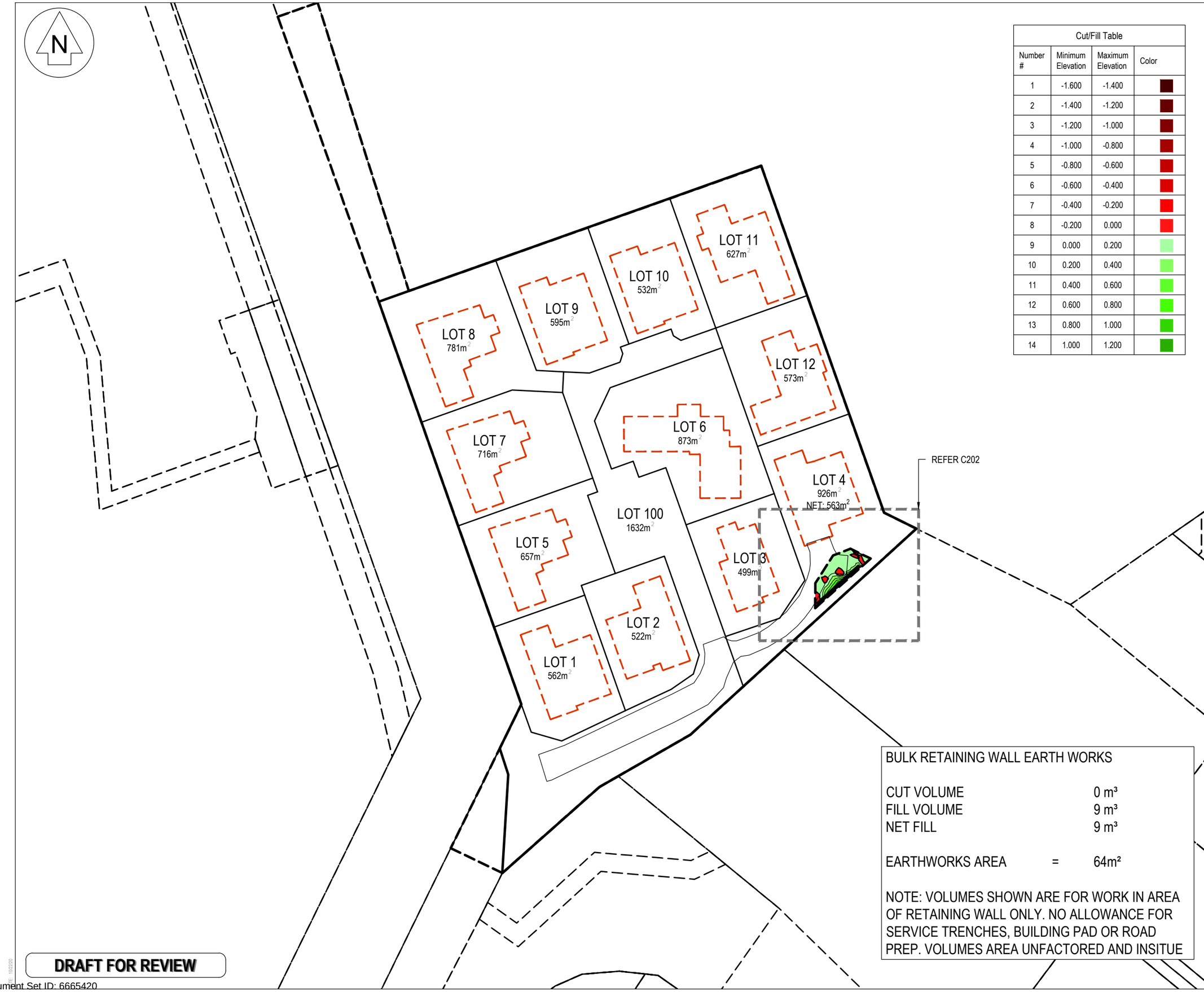
1:100 @ A3

DATE: 21/10/2020

PHONE: 027 7743 762

REVISION NUMBER:
01

Appendix B - CUT FILL PLANS



Cut/Fill Table			
Number #	Minimum Elevation	Maximum Elevation	Color
1	-1.600	-1.400	
2	-1.400	-1.200	
3	-1.200	-1.000	
4	-1.000	-0.800	
5	-0.800	-0.600	
6	-0.600	-0.400	
7	-0.400	-0.200	
8	-0.200	0.000	
9	0.000	0.200	
10	0.200	0.400	
11	0.400	0.600	
12	0.600	0.800	
13	0.800	1.000	
14	1.000	1.200	

BULK RETAINING WALL EARTH WORKS

CUT VOLUME		0 m³
FILL VOLUME		9 m³
NET FILL		9 m³
EARTHWORKS AREA	=	64m²

NOTE: VOLUMES SHOWN ARE FOR WORK IN AREA OF RETAINING WALL ONLY. NO ALLOWANCE FOR SERVICE TRENCHES, BUILDING PAD OR ROAD PREP. VOLUMES AREA UNFACTORED AND INSITUE

DRAFT FOR REVIEW

Notes
1. All works to be in accordance with Queenstown Lakes District Council Code of Practice 2018.
2. Co-ordinates in terms of NZ Geodetic Datum Mt. Nicholas 2000.
3. Levels in terms of the Dunedin Vertical Datum 1958.
4. Origin of Levels = SM XXXX SO XXXX(XXXX)
5. Published RL=XX.XX, sourced from The LINZ Digital Geodetic Database.
6. It is the contractors responsibility to locate all services that may be affected by his operations.
7. The contractor shall comply with all relevant OSH and Health and Safety requirements.
8. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
9. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
10. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend
- EX BDY
- PROP BDY
- PROP EXTENT WORK
- PROP BUILDING PAD

Rev	Description	By	Date
A	RESOURCE CONSENT	OE	09/2020
B	RETAINING UPDATES	OE	10/2020
C	EW EXTENTS	OE	10/2020

	By	Date
Survey	BY	DATE
Design	BY	DATE
Drawn	OE	09/2020
Checked	BM	09/2020

Maven South
03 777 4450
info@maven.co.nz
www.maven.co.nz
36 Shotover Street, Queenstown
Queenstown

Project
466 FRANKTON - LADIES MILE HWY DEVELOPMENT FOR QUEENSTOWN COMMERCIAL LTD

Title
PROPOSED CUT/FILL PLAN

Project no.	J000028		
Scale	1:750 @ A3		
Cad file	J000028_DESIGN.DWG		
Drawing no.	C201	Rev	C

Notes

1. All works to be in accordance with Queenstown Lakes District Council Code of Practice 2018.
2. Co-ordinates in terms of NZ Geodetic Datum Mt. Nicholas 2000.
3. Levels in terms of the Dunedin Vertical Datum 1958.
4. Origin of Levels = SM XXXX SO XXXX(XXXX)
5. Published RL=XX.XX, sourced from The LINZ Digital Geodetic Database.
6. It is the contractors responsibility to locate all services that may be affected by his operations.
7. The contractor shall comply with all relevant OSH and Health and Safety requirements.
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Legend

- EX BDY
- PROP BDY
- PROP EXTENT WORK
- PROP BUILDING PAD

Cut/Fill Table

Number #	Minimum Elevation	Maximum Elevation	Color
1	-1.600	-1.400	
2	-1.400	-1.200	
3	-1.200	-1.000	
4	-1.000	-0.800	
5	-0.800	-0.600	
6	-0.600	-0.400	
7	-0.400	-0.200	
8	-0.200	0.000	
9	0.000	0.200	
10	0.200	0.400	
11	0.400	0.600	
12	0.600	0.800	
13	0.800	1.000	
14	1.000	1.200	

BULK RETAINING WALL EARTH WORKS

CUT VOLUME		0 m³
FILL VOLUME		9 m³
NET FILL		9 m³
EARTHWORKS AREA	=	64m²

NOTE: VOLUMES SHOWN ARE FOR WORK IN AREA OF RETAINING WALL ONLY. NO ALLOWANCE FOR SERVICE TRENCHES, BUILDING PAD OR ROAD PREP. VOLUMES AREA UNFACTORED AND INSITUE

DRAFT FOR REVIEW

Rev	Description	By	Date
A	RETAINING DETAILS	OE	10/2020

	By	Date
Survey	BY	DATE
Design	BY	DATE
Drawn	OE	09/2020
Checked	BM	09/2020

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info@maven.co.nz
www.maven.co.nz
36 Shotover Street, Queenstown
Queenstown

Project

466 FRANKTON - LADIES MILE HWY DEVELOPMENT FOR QUEENSTOWN COMMERCIAL LTD

Title

PROPOSED CUT/FILL PLAN - RETAINING WALL

Project no.	J000028		
Scale	1:100 @ A3		
Cad file	J000028_DESIGN.DWG		
Drawing no.	C202	Rev	A