Stantec

Memo

To:	Dunedin City Council	From:	Edward Guerreiro
		Review:	Lee Paterson
File:	2GP Rezoning sites_ March2022	Date:	March 31, 2022

SUMMARY

The purpose of this letter is to transmit our assessment the hazards at the requested sites:

- *RS220: 53, 64, 73, 74, 80, 85, 86, 92, 100, 103, 103A, 123, 127 Scroggs Hill Road*
- *RTZ2: 87 Selwyn Street*
- *RS170: Part 103, 105, 107 Hall Road, Sawyers Bay*
- *RS193: 177 Tomahawk Road*
- *RS204: 21, 43, 55, 65, 75, 79, and 111 Chain Hills Road*
- *RS153: 77 and 121 Chain Hills Road and 100 Irwin Logan Drive*
- *RS161: part 210 Signal Hill Road*
- *RS110: 23 Sretlaw Place*
- *RS206, RS206a, RS77: Part 35 and 43 Watts Road, Part 109 North Road*
- *RS200: 489 East Taieri-Allanton Road*
- *RS205: 761 Aramoana Road*
- *RS154: 91 and 103 Formby Street*
- *RS175: 85 Formby Street*

We have summarized our findings using a "traffic light" system.

"Green" indicates no significant hazards are present and that the site does not require any specific engineering for development (e.g. elevated areas with shallow slopes and competent underlying geology).

"Yellow" indicates that there are hazards identified on part or all of the site that will require some specific engineering design to mitigate and enable higher density development (e.g. within low risk flood and overland flow susceptible areas, liquefaction susceptible geology, moderately steep terrain, or potentially unstable geology).

"Red" indicates that there are significant hazards on part or all of the site that will require significant specific engineering design or further investigation to enable development (e.g. steep slopes, high risk flood hazards, low strength or known unstable geology, and existing known instability).

Table 1 summarizes our assessment of the requested sites.

Table 1 - Hazard Summary

Site	Current Zone	Proposed Zone	Hazards Category
RS220	RR1	LLR1	*Medium*
RTZ2	*RR2*	*GR2*	*High*
RS170	*RR1*	*GR*	*Low*
RS193	*R*	*GR1*	*High*
RS204	*RR1*	*RR1, GR1, LLR1*	*Medium*
RS153	*R*	*LDR, LLR1/2*	*Medium*
RS161	*R*	*LLR1/2, RR1*	*Low*
RS110	*R*	*GR1*	*Medium*
RS206, RS206a, RS77	*RR2*	*GR1/2*	*High*
RS200	*R*	*T&S, LLR1*	*Low*
RS205	*R*	*T&S*	*Low*
RS154	*R*	*GR1*	*Low*
RS175	*R*	*T&S*	*Low*

A detailed assessment of each site is presented below.

RS220: 53, 64, 73, 74, 80, 85, 86, 92, 100, 103, 103A, 123, 127 SCROGGS HILL ROAD

Site Summary

The proposed site is indicated in Figure 1.

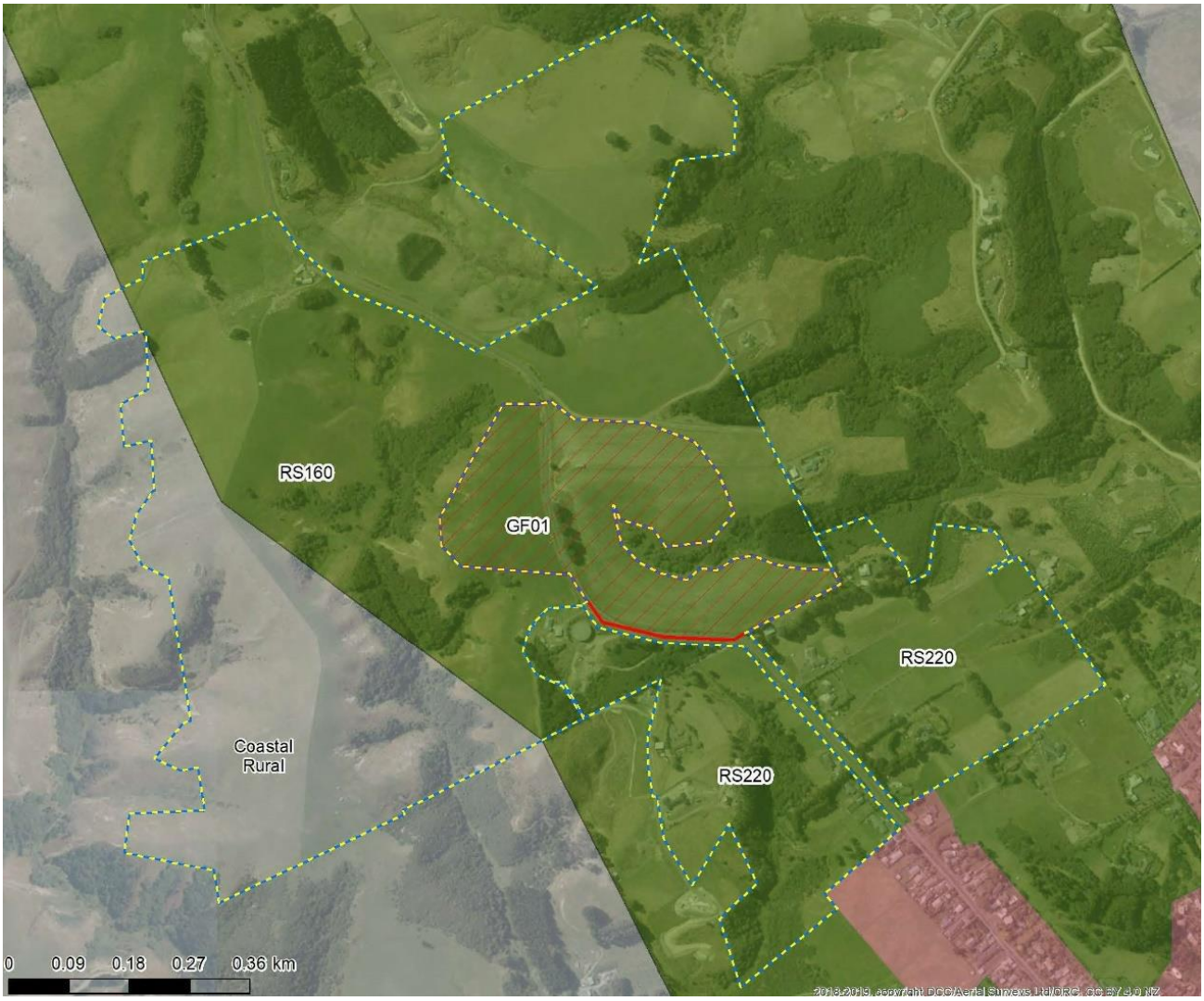

Figure 1 – RS220: 53, 64, 73, 74, 80, 85, 86, 92, 100, 103, 103A, 123, 127 SCROGGS HILL ROAD

Geology and Slopes

The geology of the site consists of Otago Schist and Taratu Coal Measures (Quartz conglomerate).

The site is typically sloping by less than 12 degrees along the flat tops and up to 35 degrees within numerous gullies within the area.

The underlying lithology is generally globally stable at steep slope angles (<26°), however is subject to weakness under certain conditions and slope angles. Excavation within lower schist slopes can destabilize uphill land. Though instability is generally limited to the overlying superficial deposits (loess). In this case, there is dense vegetation covering the steeper parts of the site.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10421: Land Stability – Land Movement (unknown)

  This hazard leads to a CST100 file for a lot within the proposed area. The consent conditions for the subdivision of this lot required any development to be 20m from the top of any escarpment, and that any earthworks not increase instability of the lot.

- Hazard ID 10116: Land Stability – Land Movement (Landslides from Forsyth)

  A large hazard polygon encompassing an area that has numerous land stability hazards.

The site consists of multiple landslide hazards relating to potential instability of the steep banks and gullies within the site area.

There have been historic landslips within similar geology and slope angles nearby this site. The trigger for these were related to stormwater.

These land stability hazards does not exclude this site from development, but engineering assessments of these steep areas is definitely required to permit development and confirm the extents of the proposed site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium level hazard**. This decision is based on the following summary of information:

- There are **medium level hazards** associated with slope instability on the site
  - Global stability of steeper parts of the site appears to be governed by stormwater management and steepness/aspect of the slopes.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability and ensure it will not affect any potential lots/structures. This may also identify any offsets that might be required from unstable areas.

Geotechnical assessment will be required to confirm the stability of proposed lots near steep portions of the site. Provided the site is found to be globally stable, some specific earthworks and stormwater management requirements would be applicable for lots on the site. It is likely that removal of trees from the gully areas will exacerbate instability.

The ridgelines and flatter areas appear to be readily suitable for building platforms.

RTZ2: 87 SELWYN STREET

Site Summary

The proposed site is indicated in Figure **2**.

Figure 2 – RTZ2: 87 SELWYN STREET

Geology and Slopes

The geology of the site consists of first main eruptive volcanics. The site slopes by 12 degrees towards the base of the valley and up to 26 degrees on the western slopes. There are some localized areas up to 35 degrees within the site.

The underlying lithology is well known for its sensitivity to over excavation and ground water. Instability is generally limited to the overlying superficial deposits (loess) for mellow slopes, however there has been known global instability within this geology.

Existing Hazards and Effects

There are no hazards identified within the hazards register for the proposed area, however there has been historic slips associated with rain events on nearby similar slopes.

The site is very steep and within a geology that is know for potential instability.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **high level hazard**. This decision is based on the following summary of information:

- There are **high level hazards** associated with slope instability on the site
    - The majority of the site consists of steep land over 15 degrees, and half the site is over 20 degrees
    - There is previous history of land instability nearby within similar geology and slope angles.
    - Some of the site is within typical stability limits, however there are significant areas of possible instability

Geotechnical assessment will be required to confirm the general stability of the site, especially for the steeper areas. Provided the site is found to be globally stable, requirements for earthworks consent would be normal for the lower lying land sloping by less than 12 degrees within this site.

If the site is assessed to be stable by a geotechnical engineer, it is likely that development on slopes greater than 15 degrees within this area will still have restrictions such as limitations to earthworks and control of stormwater runoff.

Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability in the steeper slopes and ensure it will not affect any development. This may also identify any offsets from unstable features that might be required.

RS170: PART 103, 105, 107 HALL ROAD, SAWYERS BAY

Site Summary

The proposed site is indicated in Figure **3**.

Figure 3 – RS170: PART 103, 105, 107 HALL ROAD, SAWYERS BAY

Geology and Slopes

The geology of the site is within the alluvial valley of upper Sawyers Bay. The site is all sloping by less than 12 degrees.

Although not directly a hazard, the underlying alluvial soils are relatively young, and as a result may be loose / lower strength

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10106: Land Stability – Land Movement (Alluival Fans – Active Floodwater Dominated)

  Possible transport of sediment from flooding within this area

- Hazard ID 10568: Land Stability – Land Movement (Unknown)
  Seems to not be related to any particular hazard

The land stability hazards above appear to be minor and related to alluvial deposition from flood events. This hazard affects the entire of Sawyers Bay. There are no other hazards on adjacent land that may affect this site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **no hazards** associated with slope instability
- There are no other listed natural hazards on the site which would affect development

The effects of stormwater will need to be controlled on this site, however mitigation measures are likely to be minor.

RS193: 177 TOMAHAWK ROAD

Site Summary

The proposed site is indicated in Figure **4**.

Figure 4 – RS193: 177 TOMAHAWK ROAD

Geology and Slopes

The geology of the site consists of alluvial flats adjacent to Tomahawk Lagoon, and a steeply rising second phase volcanic rock rise to the west. The site is flat adjacent to the lagoon and sloping by up to 35 degrees on the western slopes.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11407: Seismic – Liquefaction Domain C

  The ground is predominantly underlain by poorly consolidated marine or estuarine sediments with a shallow groundwater table. There is considered to be a moderate

to high likelihood of liquefaction-susceptible materials being present in areas classified as Domain C.

- Hazard ID 10945: Land Stability – Subsidence (Landfill)
  The flat portion of the site adjacent to Tomahawk Lagoon is comprised of a landfill hazard zone. It is unclear whether this is related to landfill or unengineered earth fill.

The liquefaction and landfill hazard zones cover the flat portion of the site adjacent to Tomahawk Lagoon.

Although not listed as a hazard, the slopes are very steep and are likely to present land stability risks with such a dense format such as GR1.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **high level hazard** site. This decision is based on the following summary of information:

- There are several **high level hazards** associated with slope instability in the steep portion of the site:
  - Much of the steeper slopes are sloping by over 20 degrees and global stability of the site could be affected by development, especially from earthworks and/or groundwater changes. Any global instabilities would affect multiple potential lots.
  - Geological investigations are required to determine the suitability of the site.
- There is a **high level hazard** associated with liquefaction and landfill on the flat portion of the site
  - The low lying land is unlikely to be suitable for development due to the low-lying nature of the land, potential for liquefaction/lateral spreading into the lagoon, and landfill.

Geotechnical assessments are required to substantiate the appropriateness of higher density development in this area. Specific assessment and design would be required to confirm the global stability of the site and implications of smaller lots. It is possible that much of this area is deemed unsuitable for dense residential development, though there are some flatter sections within the site that would be suitable for a structure.

RS204: 21, 43, 55, 65, 75, 79, AND 111 CHAIN HILLS ROAD

Site Summary

The proposed site is indicated in Figure **5**.

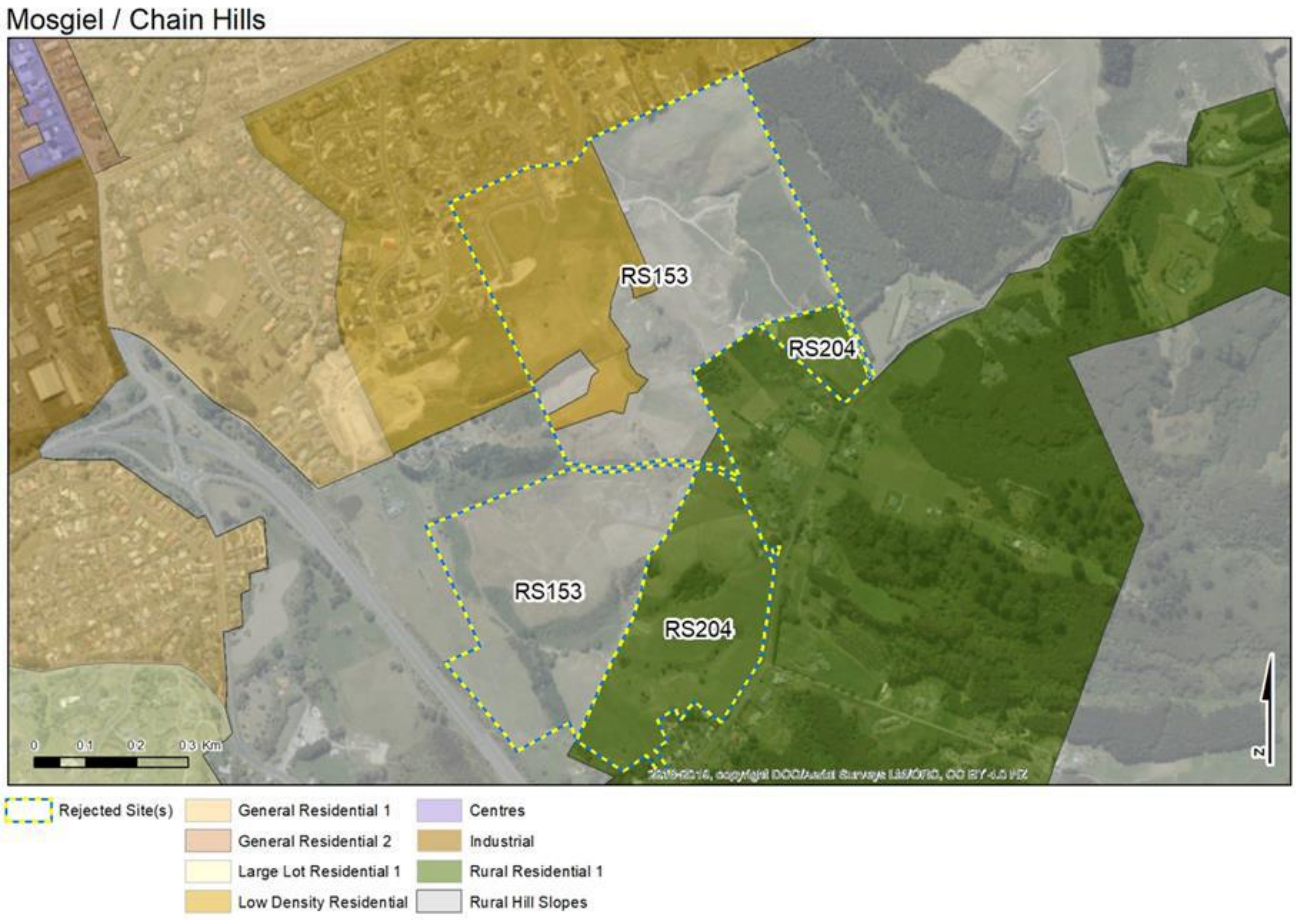

Figure 5 – RS204: 21, 43, 55, 65, 75, 79, AND 111 CHAIN HILLS ROAD

Geology and Slopes

The geology of the site consists of Otago Schist of East Taieri. The site is typically sloping by less than 12 degrees adjacent to Chain Hills Rd but locally up to 26 degrees throughout various gullies in the area.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10116: Land Stability - Land Movement (Landslides from Forsyth)

The landslide hazard zone is a large polygon covering most of the surrounding terrain with several indicative prehistoric land stability hazards

- Hazard ID 12094: Seismic – Fault Proximity (Titri Fault)

  The fault proximity hazard relates to a recent GNS science report which identifies the Titri Fault. This fault location is "mostly uncertain, and it is drawn in the best estimated position from sparse geological outcrop information". This fault is classed as a "potentially active fault" with a recurrence interval of 19,000 years (class V). It is not an inhibitive factor for rezoning.

There are land instability hazards within the site and mapped historic landslides within nearby slopes. These are typically within steeper slopes of the same geology. Although the risk of land stability hazard is not excluded from this site, it is likely to be localized to steep slopes around gullies.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low to medium level hazard**. This decision is based on the following summary of information:

- There are **low level hazards** associated with slope instability on the site in slopes less than 12 degrees adjacent to Chain Hills Road:
  - Much of the site itself is within typical stability limits.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability in the adjacent steeper slopes and ensure it will not affect any development. This may also identify any offsets that might be required from any gully features.
- There are **medium level hazards** associated with slope instability within gully features:
  - Stability of steeper parts of the area appears to be uncertain (on slopes greater than 15 degrees). In some areas, the site is steep and with prehistoric landslide features that require geotechnical assessment.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure they will not affect any adjacent lot. This may also identify any offsets that might be required from unstable slopes

Geotechnical assessment will be required to confirm the stability of the gullies across the site. Provided the site is found to be globally stable, requirements for earthworks consent would be normal for low angled lots (<15 degrees) within this area.

The geotechnical assessment may be required to help with the appropriate rezoning of the proposed area (i.e. to differentiate land that would be suitable for GR1 vs RR1).

RS153: 77 AND 121 CHAIN HILLS ROAD AND 100 IRWIN LOGAN DRIVE

Site Summary

The proposed site is indicated in Figure **6**.

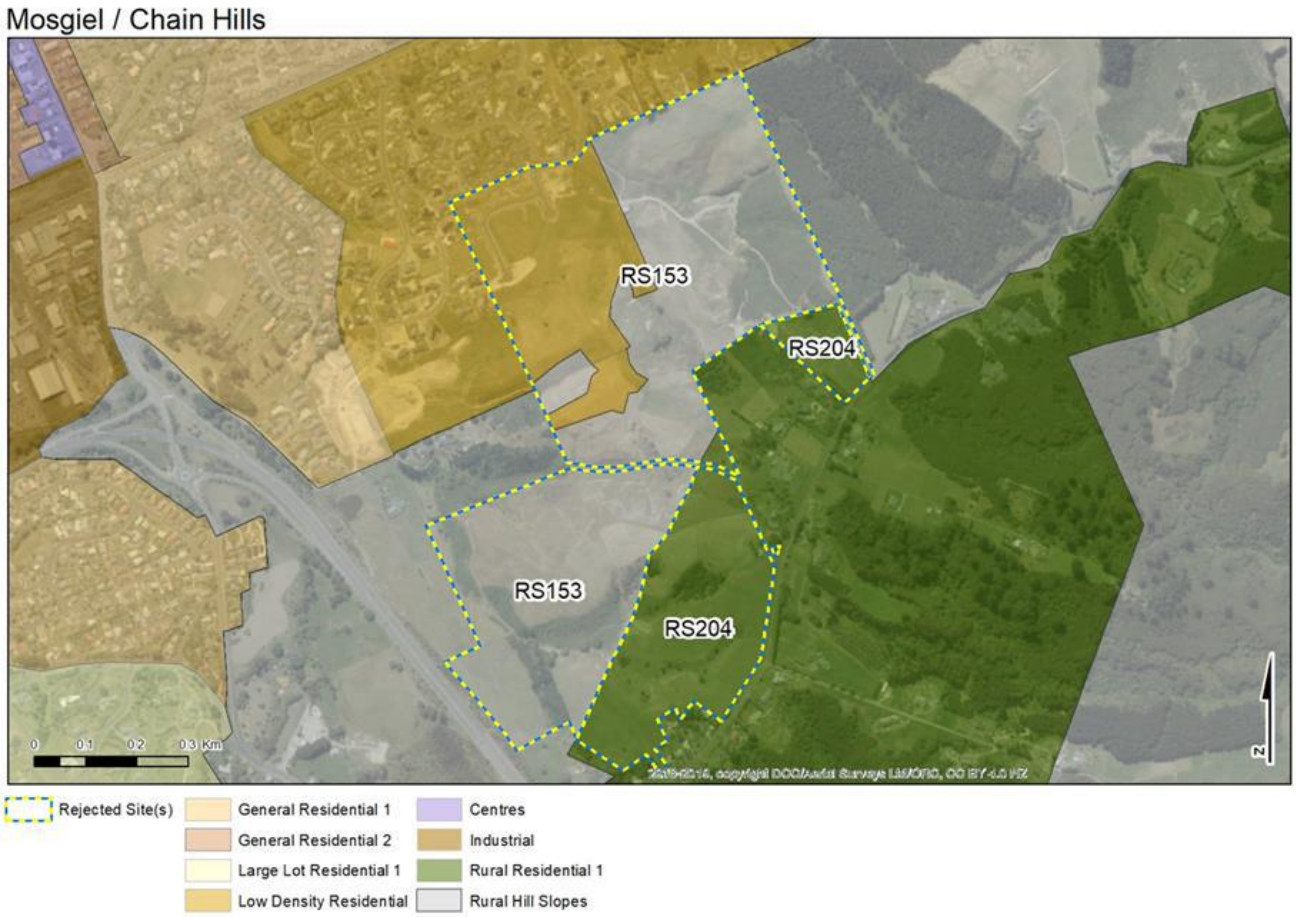

Figure 6 – RS153: 77 and 121 Chain Hills Road and 100 Irwin Logan Drive

Geology and Slopes

The geology of the site consists of Otago Schist of East Taieri. The site is undulating with slopes of less than 12 degrees and locally up to 35 degrees throughout various gullies in the area.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10116: Land Stability - Land Movement (Landslides from Forsyth)

The landslide hazard zone is a large polygon covering most of the surrounding terrain with several indicative prehistoric land stability hazards

- Hazard ID 12094: Seismic – Fault Proximity (Titri Fault)

  The fault proximity hazard relates to a recent GNS science report which identifies the Titri Fault. This fault location is "mostly uncertain, and it is drawn in the best estimated position from sparse geological outcrop information". This fault is classed as a "potentially active fault" with a recurrence interval of 19,000 years (class V). It is not an inhibitive factor for rezoning.

There are land instability hazards within the site and mapped historic landslides within nearby slopes. There are also obvious locations of localized surface movement/erosion evident in the aerial photographs. Some of these appear to have been planted out to prevent further erosion/land movement.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium level hazard**. This decision is based on the following summary of information:

- There are **medium level hazards** associated with slope instability:
  - Most of the site consists of undulating terrain with steep slopes over 15 degrees. In some areas, the site is steep and with prehistoric landslide features that require geotechnical assessment.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure the proposed subdivision layout will not limit the ability to address these hazards. This may also identify any offsets that might be required from unstable slopes

Geotechnical assessment will be required to confirm the stability of the gullies across the site. Provided the site is found to be globally stable, requirements for earthworks consent would be normal for low angled lots (<15 degrees) within this area.

We do not anticipate that this site will be generally unstable, though much of it will be unsuitable for structures. Geotechnical advice will need to identify building platforms and lot layouts/sizes that will work with the terrain features and not confuse the ability to address these hazards.

RS161: PART 210 SIGNAL HILL ROAD

Site Summary

The proposed site is indicated in Figure **7**.

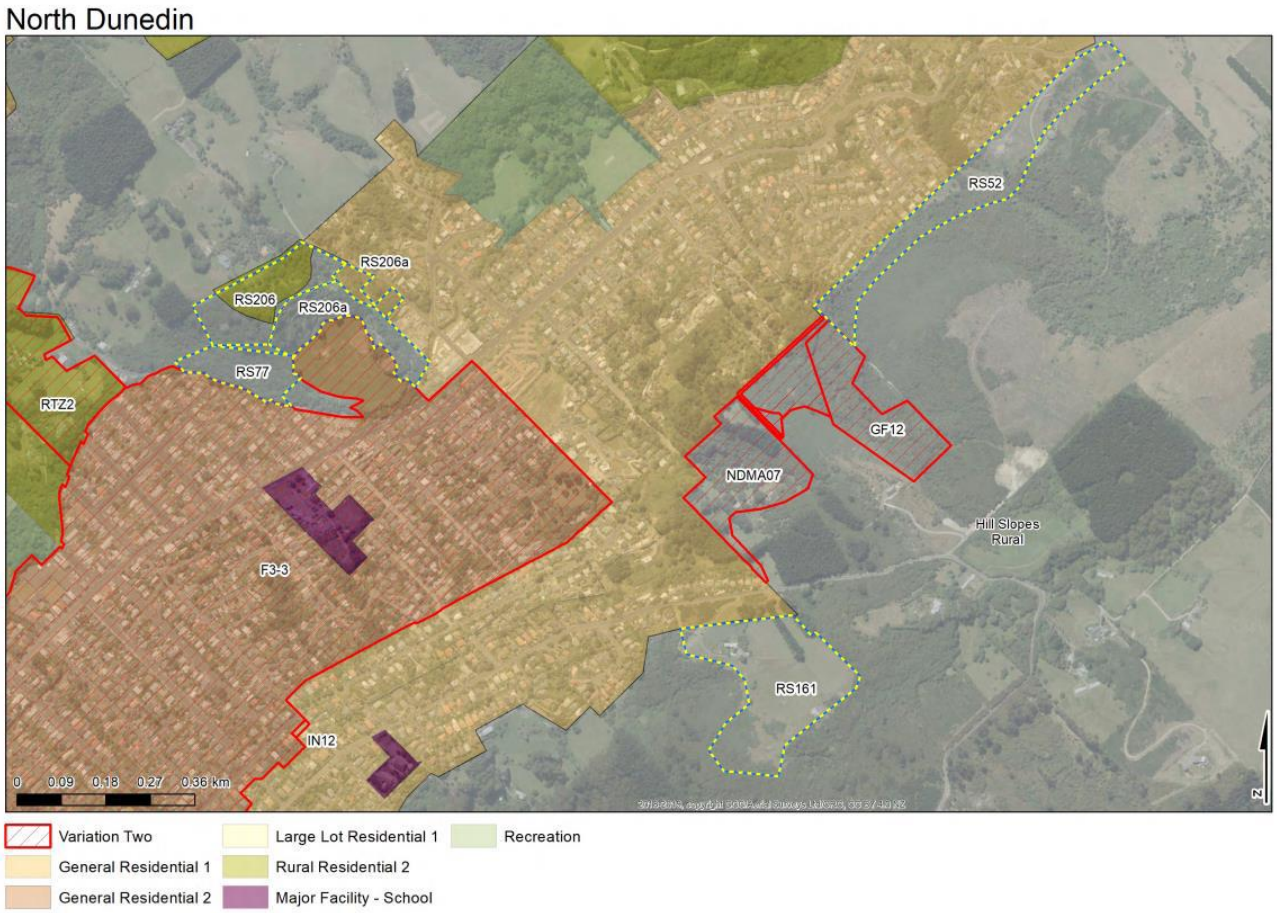

Figure 7 – RS161: PART 210 SIGNAL HILL ROAD

Geology and Slopes

The geology of the site consists of second main eruptive phase volcanics. The site is typically sloping by less than 12 degrees.

The underlying lithology is generally globally stable at moderately steep slope angles (<20°), unless over-excavated or subject to weathering / ground water. Instability is generally limited to the overlying superficial deposits (loess).

Existing Hazards and Effects

There are no hazards on this site or adjacent land that may affect this site within the hazards register.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazard level**. This decision is based on the following summary of information:

- There are **low hazards** associated with slope instability within the proposed area. The area appears to have been explicitly chosen to avoid the steeper slopes surrounding the site.

There is readily developable land within the proposed area, however geotechnical investigation and assessments of the adjacent slopes may be pertinent to confirm the extents of the readily developable land.

RS110: 23 SRETLAW PLACE

Site Summary

The proposed site is indicated in Figure **8**.

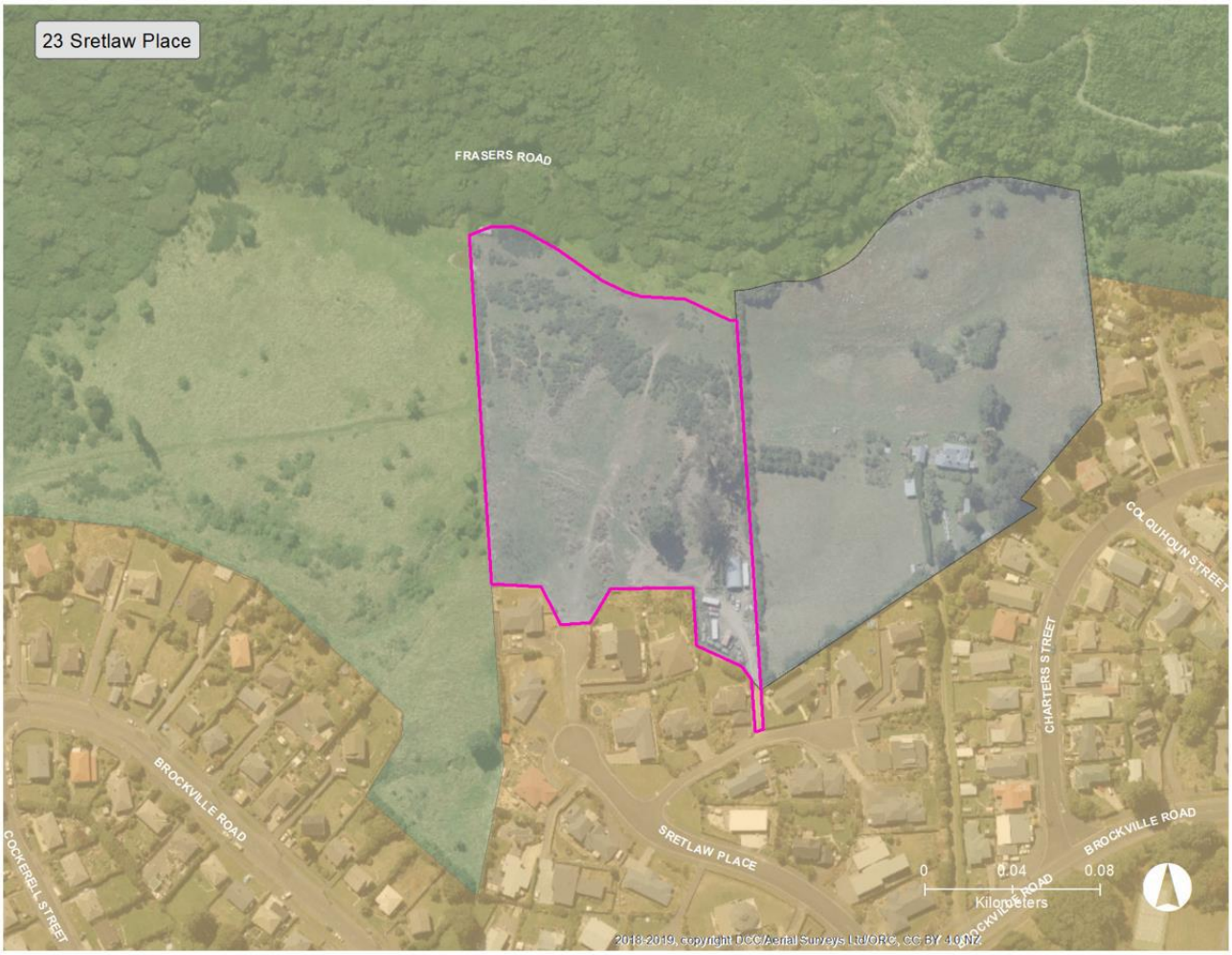

Figure 8 – RS110: 23 SRETLAW PLACE

Geology and Slopes

The geology of the site consists of Caversham Sandstone sloping down to alluvial outwash in the valley flats. The site is typically sloping by less than 12 degrees.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. This will affect foundation design.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10106: Land Stability - Land Movement (Alluvial Fans – active Floodwater Dominated)
- Hazard ID 11965: Land Stability – Land Movement (Unknown)
- Hazard ID 10111: Seismic – Intensified Shaking (Earthquake Possible Amplification

The above land stability hazards indicate that the site has some landslide debris from an ancient uphill landslide. There are also nearby slopes on adjacent lots with existing land instability. We found historical maps with land stability awareness zones that extend into the site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low to medium level hazard**. This decision is based on the following summary of information:

- The site slope angles are moderate, and there appears to be no significant landslides on the site. However,
- There are several sources of information to suggest the site has been inundated with landslide debris and affected by landslides from other lots. We consider the site to have **medium level hazards** associated with slope instability.
- Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure the proposed subdivision layout will not limit the ability to address these hazards. This may also identify any offsets that might be required from unstable slopes or landslide debris.

Geotechnical assessment will be required to confirm the stability of the site and address the landslide mapping concerns.

RS206, RS206A, RS77: PART 35 AND 43 WATTS ROAD, PART 109 NORTH ROAD

Site Summary

The proposed site is indicated in Figure **9**.

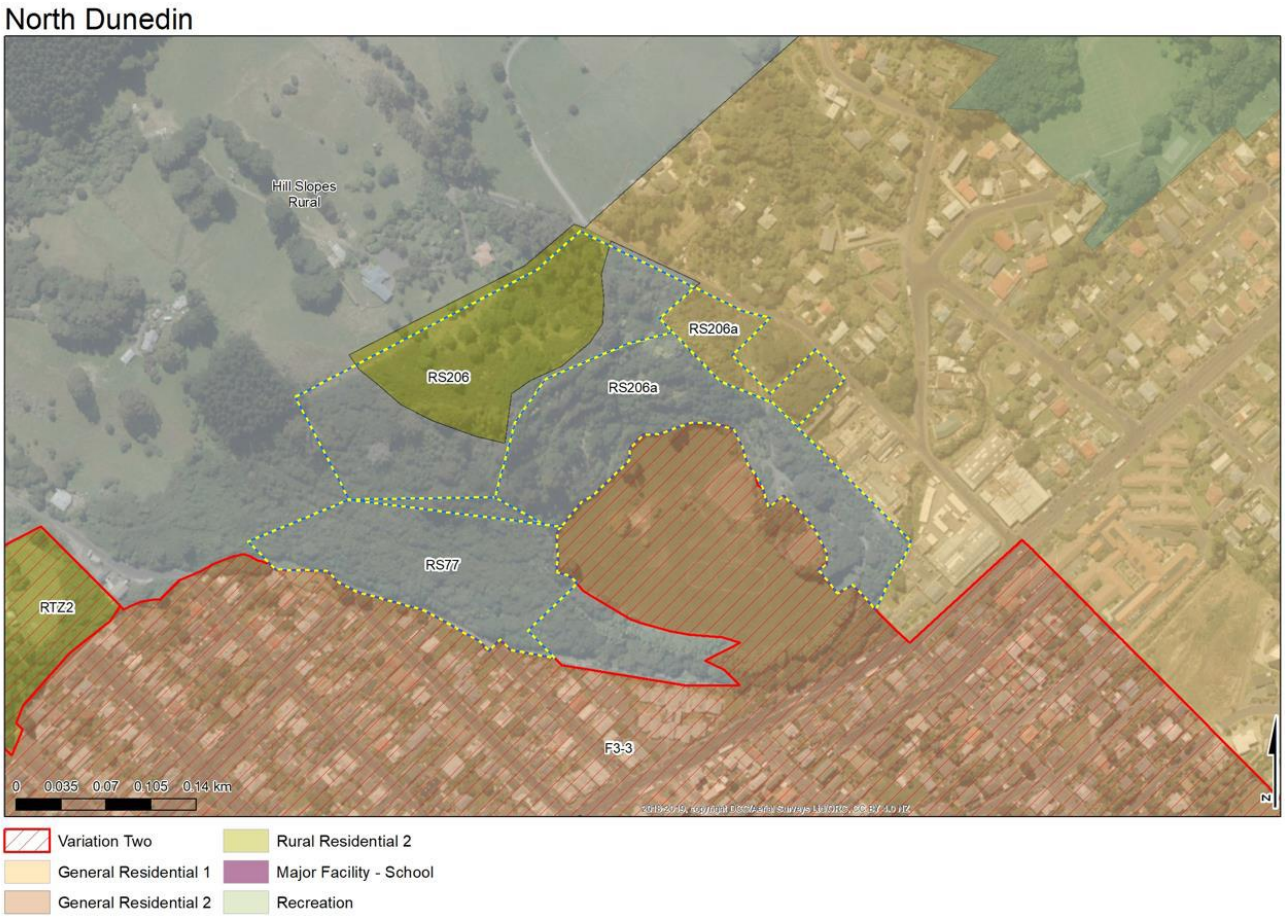

Figure 9 – RS206, RS206a, RS77: Part 35 and 43 Watts Road, Part 109 North Road

Geology and Slopes

The geology of the site consists of first main eruptive volcanics. The site slopes typically over 20 degrees. There are some localized areas up to 35 degrees or more within the site.

The underlying lithology is well known for its sensitivity to over excavation and ground water. Instability is generally limited to the overlying superficial deposits (loess) for mellow slopes, however there have been known global instability within this geology.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11706: Land Stability – Land Movement (landslide)

- Hazard ID 11965: Land Stability – Land Movement (Slip ID = 31)

Both hazards on the site are associated with the eastern boundary of the site to Watts Rd. There was a historic slip associated with a rain event on the bank of this site.

There is also a large hazard associated with the historic quarry activity in the middle of the sites.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **high level hazard**. This decision is based on the following summary of information:

- There are **high level hazards** associated with slope instability on the site
    - Most of the site consists of steep land over 20 degrees
    - There is previous history of noted land instability on the eastern slopes of the site
    - Some of the site is within typical stability limits (there is a small flat area on 43 Watts Rd), however the majority of the land has significant areas of possible instability

Geotechnical assessment will be required to confirm the general stability of the site, specifically for the steeper areas, and the appropriateness of allowing smaller lots in this area.

Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability in the steeper slopes and ensure it will not affect any development. This may also identify any offsets that might be required.

RS200: 489 EAST TAIERI-ALLANTON ROAD

Site Summary

The proposed site is indicated in Figure **10**.

Figure 10 – RS200: 489 EAST TAIERI-ALLANTON ROAD

Geology and Slopes

The geology of the site consists of alluvial deposits and rising Schist hills.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. The more elevated areas of the site are likely to have thinner layers of outwash deposits.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10106: Land Stability - Land Movement (Alluvial Fans – Inactive Floodwater Dominated)

- Hazard ID 12094: Seismic – Fault Proximity (Titri Fault)

  The fault proximity hazard relates to a recent GNS science report which identifies the Titri Fault. This fault location is "mostly uncertain, and it is drawn in the best estimated position from sparse geological outcrop information". This fault is classed as a "potentially active fault" with a recurrence interval of 19,000 years (class V). It is not an inhibitive factor for rezoning.

- Hazard ID 11582: Flood – Overland Flow Path (Flood Hazard Area 22)

All the hazards are relating to flood and liquefaction associated with weak floodplain alluvium on the lower lying portion of the site. This is no different than many other locations within Allanton and is controlled using engineering design for foundations and guidelines for minimum floor levels.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazard level**. This decision is based on the following summary of information:

- There are **low level hazards** associated with flood hazard on the site:
  - The site lies within flood hazard overlays that are typically mitigated through minimum floor levels implemented at the time of subdivision.
  - The site contains a important watercourse that are more than minor and affect neighboring land. It is unlikely that anyone will build on the lowest portion of the site, however, further assessments of stormwater management and offsets from the watercourse would be required to ensure any development does not have adverse effects.

Specific engineering design and assessment will be required to identify zones that are unsuitable for development near the ephemeral watercourse.

RS205: 761 ARAMOANA ROAD

Site Summary

The proposed site is indicated in Figure **11**.

Figure 11 – RS205: 761 Aramoana Road

Geology and Slopes

The geology of the site consists of beach/dune sands.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11407: Seismic – Liquefaction Domain C

  The ground is predominantly underlain by poorly consolidated marine or estuarine sediments with a shallow groundwater table. There is considered to be a moderate

to high likelihood of liquefaction-susceptible materials being present in areas classified as Domain C.

Whilst the only hazard identified for the lot is regarding liquefaction, there is significant hazards from rockfall from the erosional faces behind the site. Geolink has provided a report on this some 10+ years ago.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazard level** in the context of a T&S proposed zoning, considering the rest of the waterfront is also T&S zoned. However, we consider the site to have a **high hazard level** for future development.

There is a rockfall hazard from the slopes above and a Geotechnical assessment suggesting rockfall impaction in this area is possible. Further engineering assessment will be required to identify the safety of this area to be suited for further development with regards to rockfall and liquefaction.

RS154: 91 AND 103 FORMBY STREET

Site Summary

The proposed site is indicated in Figure **12**.

Figure 12 – RS154: 91 AND 103 FORMBY STREET

Geology and Slopes

The geology of the site consists of alluvial deposits. The site is relatively flat.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. This will affect foundation design.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11552: Contaminated Land (Persistent Pesticide Bulk Storage or Use)
- Hazard ID 11407: Seismic – Liquefaction (Domain C)

Domain B/C - The ground is predominantly underlain by poorly consolidated marine or estuarine sediments with a shallow groundwater table. There is considered to be a moderate to high likelihood of liquefaction-susceptible materials being present in some parts of the areas classified as Domain C.

- Hazard ID 11582: Flood – Overland Flow Path (Flood Hazard Area 1B)

All the hazards are relating to flooding and liquefaction associated with weak floodplain alluvium. This is no different than many other locations within Outram and is controlled using engineering design for foundations and guidelines for minimum floor levels.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **low level hazards** associated with flood hazard on the site:
    - The site lies within flood hazard overlays that are typically mitigated through minimum floor levels implemented at the time of subdivision

Minimum floor levels will be required to be set for any subdivision within the proposed area. A stormwater assessment may be required to confirm the flooding hazard of the adjacent stream and cumulative effects of filling large areas with respects to neighboring lots. The result of this assessment might be that development in this area will necessitate additional floor level requirements, floodbanks, or stormwater detention.

RS175: 85 FORMBY STREET

Site Summary

The proposed site is indicated in Figure **13**.

Figure 13 – RS175: 85 Formby Street

Geology and Slopes

The geology of the site consists of alluvial deposits. The site is relatively flat.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. This will affect foundation design.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11552: Contaminated Land (Persistent Pesticide Bulk Storage or Use)
- Hazard ID 11407: Seismic – Liquefaction (Domain C)

Domain B/C - The ground is predominantly underlain by poorly consolidated marine or estuarine sediments with a shallow groundwater table. There is considered to be a moderate to high likelihood of liquefaction-susceptible materials being present in some parts of the areas classified as Domain C.

- Hazard ID 11582: Flood – Overland Flow Path (Flood Hazard Area 1B)

All the hazards are relating to flooding and liquefaction associated with weak floodplain alluvium. This is no different than many other locations within Outram and is controlled using engineering design for foundations and guidelines for minimum floor levels.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **low level hazards** associated with flood hazard on the site:
    - The site lies within flood hazard overlays that are typically mitigated through minimum floor levels implemented at the time of subdivision

Minimum floor levels will be required to be set for any subdivision within the proposed area. A stormwater assessment may be required to confirm the flooding hazard of the adjacent stream and cumulative effects of filling large areas with respects to neighboring lots. The result of this assessment might be that development in this area will necessitate additional floor level requirements, floodbanks, or stormwater detention.