

GeoSolve Ref: 210891
14 December 2021

Dani Nicolson
32 Gloucester Street
Dunedin

Preliminary Geotechnical Assessment 177 Tomahawk Road, Dunedin

Dear Dani,

In accordance with our Agreement dated 18 November 2021 we have undertaken a preliminary geotechnical assessment at the above property. Our investigation has comprised an engineering geological site inspection and desktop review of existing information, including Council hazard maps.

This report addresses potential geotechnical hazard conditions, general feasibility of residential development, constraints to residential development and recommendations for future subsurface investigations/reporting to assist with your eventual subdivision consent application.



Photo 1 – General view showing the upper part of the site, adjoining Gloucester St.

Potential Development

We understand that you are seeking to potentially re-zone the above property from its existing rural land use to residential land use, i.e. to general residential 1 zone or an alternative residential format. The current property boundaries are shown in Figure 1.

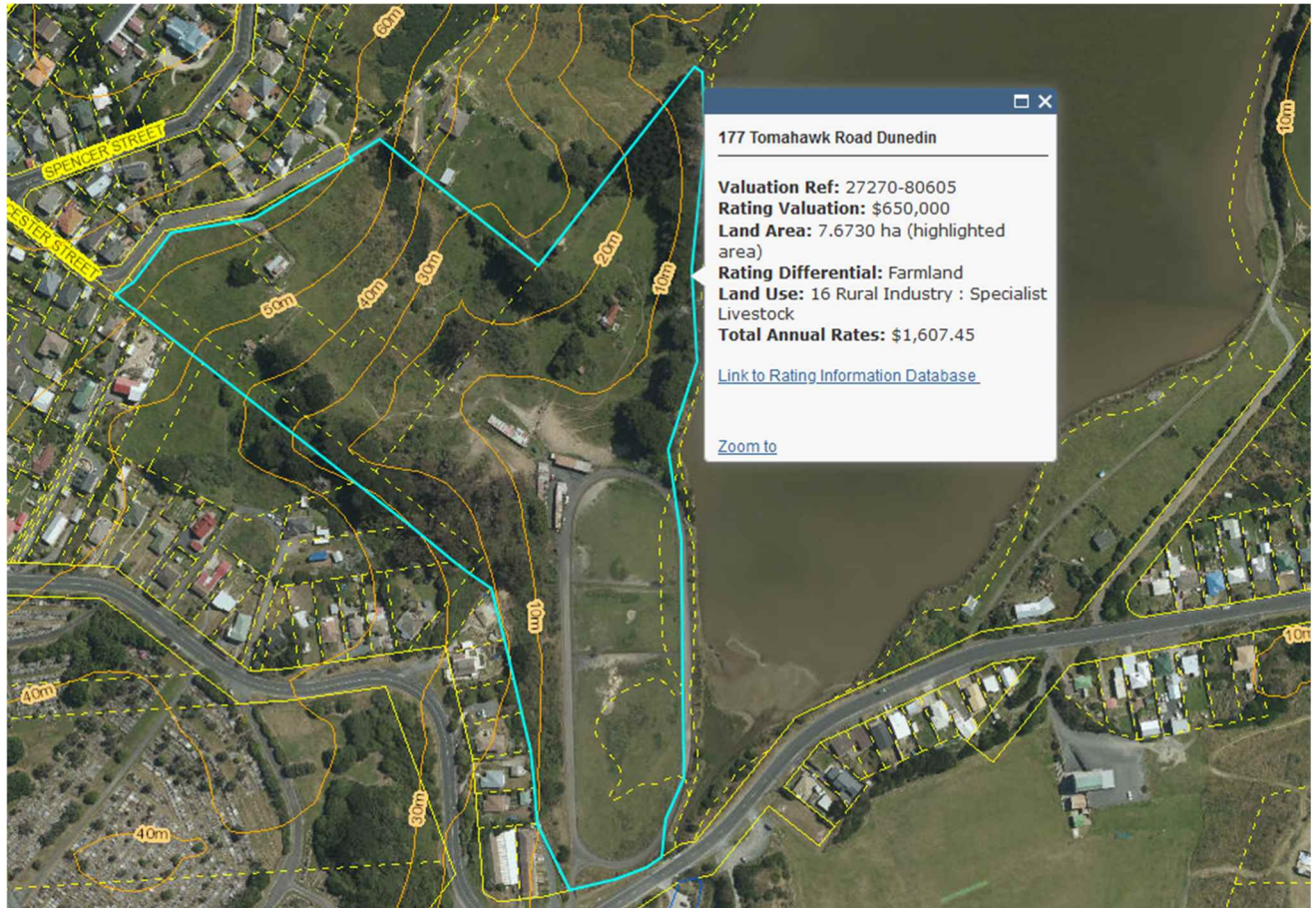


Figure 1 – Site location and basic topography.

We note that the preferred intention at this stage is to use the upper part of the site for higher density residential land use if possible, i.e. up to 8 new residential lots with access off Gloucester St. A possible preliminary lot layout is shown in the sketch that you have supplied (Figure 2).

We understand that the full residential potential of the site is dependent on planning considerations and consent, however wider areas of the site could also potentially be considered for development.

We understand that wastewater could be addressed by piping to existing infrastructure or other options such as pressure sewers and communal on-site detention tanks.

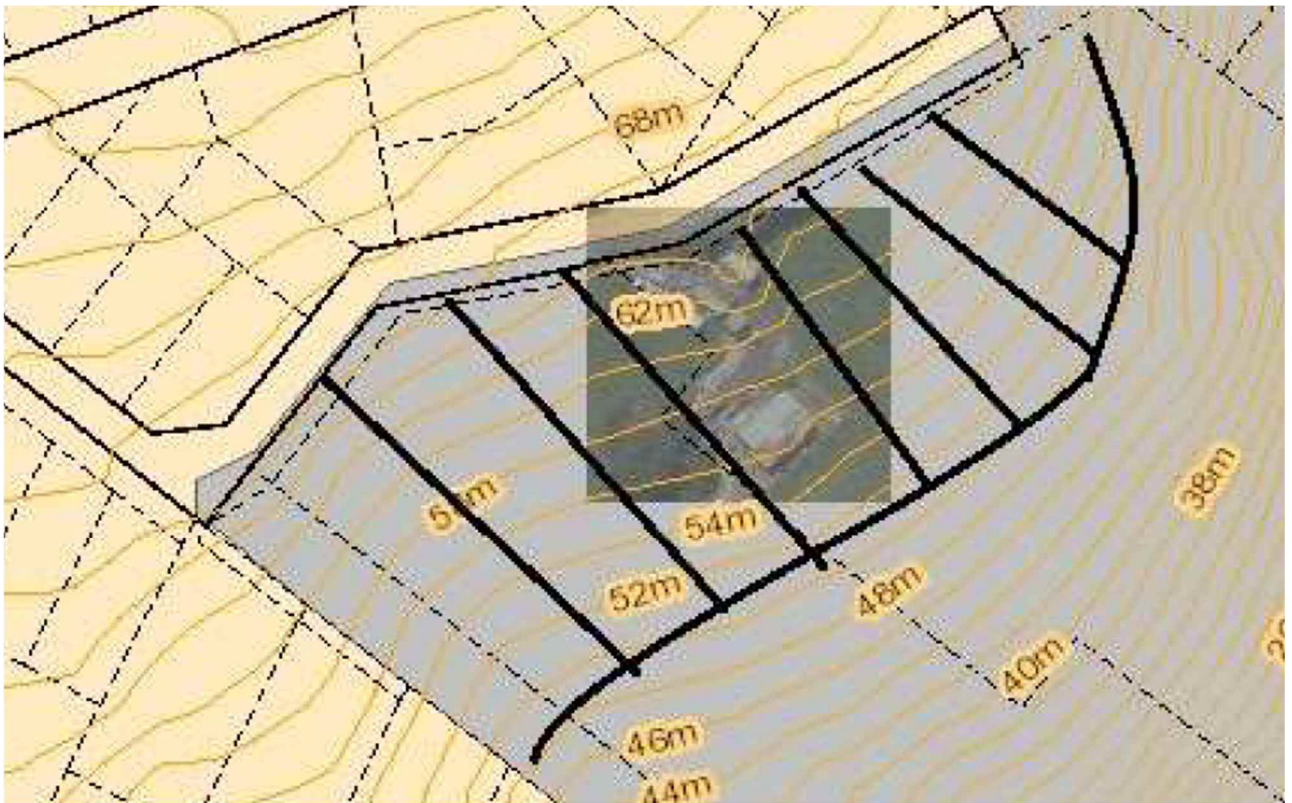


Figure 2 – Potential lot layout of upper part of site adjoining Gloucester St.

Site Description

The existing property is largely in pasture with some larger trees over parts of the site. Some buildings are present including a dwelling with access off Gloucester St, old stables on the lower part of the site and several ruins elsewhere.

The upper part of the site adjacent to Gloucester St and the northern extent of the site above the lagoon slopes moderately, with some areas of steeply-sloping land in the central area of the site. Two gullies in the central part of the site are well incised with associated steep localised slopes.

The lowest extents adjacent to Tomahawk Lagoon are sub-horizontal and appear to have been used for equestrian training, with stables and a training track evident.

Geological Setting

The site is shown on published geological maps to be underlain predominantly by rock types of the Dunedin Volcanic Complex, mainly flows of basalt, andesite and phonolite.

These are generally all strong volcanic rocks in their unweathered state and have little susceptibility to major slope instability unless on very steep slopes.

Overburden soils on the hillslopes are likely to be a combination of colluvium, loess and possibly some wind-blown sand deposits, however these are not expected to be deep and

are likely to be in stiff condition at relatively shallow depth based on geomorphology. Such conditions are generally similar to many residential areas of suburban Dunedin.

The lower sub-horizontal part of the site is likely to contain deeper sandy soils with elevated groundwater and soil types with potential liquefaction risk. This area is mapped as dune deposits, alluvial deposits or raised beach deposits.

Landslide Hazard

The property contains no landslides mapped by GNS Science Ltd as part of their recent 2017 update of ORC hazard mapping (GNS Science Consultancy Report 2017/41, July 2017). In addition, no landslides are mapped on nearby hillsides.

No spring flows were obvious on site during our walkover inspection and we observed no evidence of major slope instability.

In general, the areas underlain by Dunedin Volcanic Group are likely to be straightforward for residential development (subject to test pitting investigations). We note that very few landslides are developed over these rock types in the general suburban areas near the site. In addition, the lower extents of the site are sub-horizontal or gently sloping and also likely to be at low risk of instability during static conditions. These observations generally mean that the site is at low risk of being affected by global slope instability.

Further investigation of slope instability hazard will however be required for any subdivision, in order to comment on soil types/depths, slope angles, and to enable comment on earthworks and retention. This is likely to be straightforward and simple test pitting is likely to be a suitable method of investigation.

Seismic and Liquefaction Hazard

No active faults have been mapped in the vicinity of the subject site, based on the ORC Natural Hazards database and recent fault mapping by GNS Science. Generally, the active faults in the wider Dunedin area are capable of producing strong ground shaking, however no specific fault-related constraints apply to residential development on this site. 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 development, but there are no site-specific constraints.

The hillslopes on the site have been mapped in a 2014 liquefaction hazard assessment¹ as belonging to Domain A, which is predominantly underlain by rock or firm sediments and in this domain there is little or no likelihood of damaging liquefaction occurring. These areas are shown by the yellow shading in Figure 3.

The lower area of the site adjacent to the Tomahawk Lagoon is mapped as Domain C which comprises ground predominantly underlain by poorly consolidated marine or estuarine sediments with shallow groundwater and moderate to high liquefaction potential. Lateral

¹Barrell, D.J.A., Glassey, P.J., Cox, S.C., Smith Lyttle, B. (2014). Assessment of liquefaction hazards in the Dunedin City district. GNS Science Consultancy Report 2014/068. 68p.

spreading could also be a potential risk. These areas include the equestrian training track and the lower stable buildings. We understand that this area of the site may not be considered for closer subdivision, however with sufficient engineering input, it is certainly possible to construct dwellings over Domain C land (provided that other potential hazards such as flood and coastal hazard are adequately mitigated). This option will likely require some deeper testing and specific liquefaction and lateral spreading analysis to inform design.

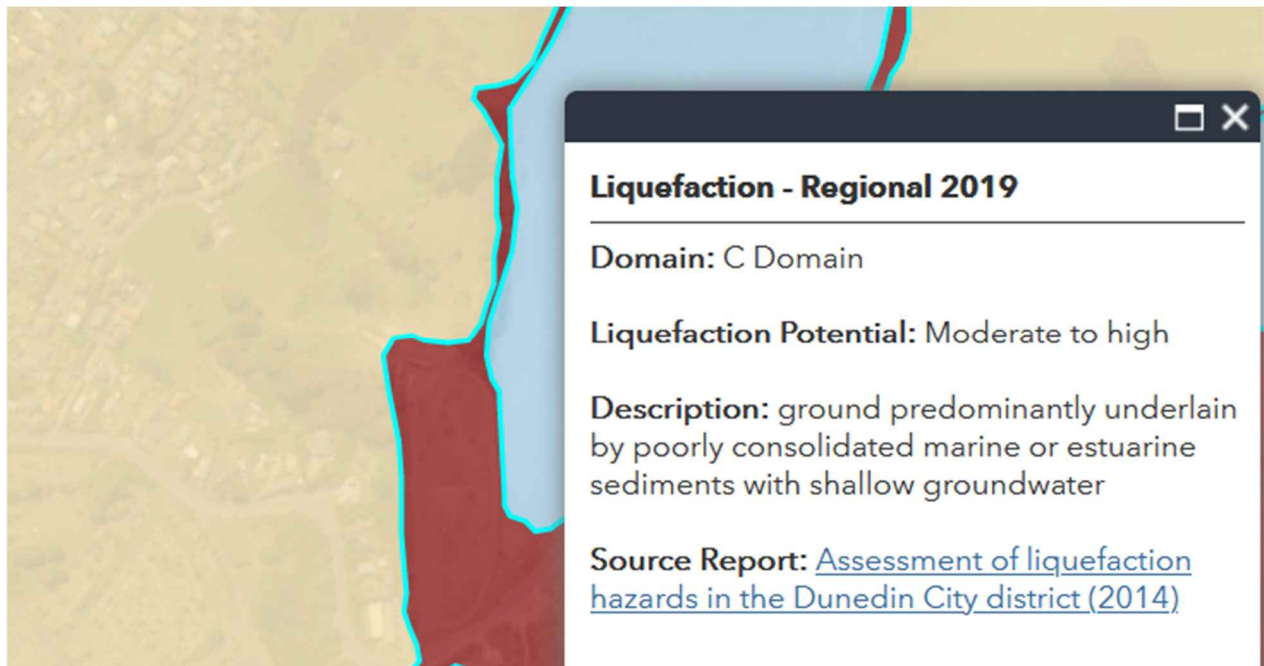


Figure 3 – Extent of Domain C liquefaction hazard (brown shading)

Flood and Coastal Hazard

Flood and coastal hazard assessments are beyond the scope of this report, however we note from the ORC Natural Hazards Database, that there may be some minor areas of coastal hazard associated with the lowest lying area of the site where the training track is situated.

Engineering Geological Appraisal and Summary of Geotechnical Considerations for Residential Land Use

The discussion above indicates that much of the area being considered for potential rezoning is likely to be appropriate for residential land use.

Our walkover appraisal of the site identified no significant evidence for major constraints to residential development, however this will need to be fully confirmed by subsurface investigations. The site appears to be generally suitable for the construction of dwellings, especially the upper areas adjacent to Gloucester St, as indicated on Figure 2.

Other areas of the site are either on steeper land or on land or low-lying land that could require specific engineering input during design, however widespread development could

be considered if planning considerations allow and if adequate engineering design is applied.

Standard subsurface investigations are recommended to confirm geotechnical requirements for any proposed subdivision and subsequent residential land use when plans become available. Such inputs are generally required in a staged manner, with subdivision-wide reporting initially (to assist with subdivision consent application), likely to comprise simple test pitting and reporting on general requirements for foundations, earthworks etc. If development on the Domain C land is proposed then we recommend CPT testing to obtain data for liquefaction analysis and advice. This phase would generally be followed by more detailed subsequent future investigations specific to each residential building site as part of the detailed design/building consent phase.

Soil contamination inputs are beyond the scope of this report, however certain historical land uses can result in contamination which could be further assessed by environmental engineer.

Applicability

This report has been prepared for the sole use of our client, Dani Nicolson, with respect to the particular brief and on the terms and conditions agreed with our client. It may not be used or relied on (in whole or part) by anyone else, or for any other purpose or in any other contexts, without our prior review and written agreement.

Yours faithfully,



Mark Walrond
Senior Engineering Geologist
GeoSolve Limited