02 September 2021 Reference No. 21490346_7407-002-LR-Rev1

Ray Mudgway
Westland Mineral Sands Company Limited
120 Medway Road
Hanmer Springs 7334

NINE MILE SAND MINING GEOTECHNICAL ADVICE TO SUPPORT RESOURCE CONSENT

Dear Ray

Introduction

WSP New Zealand Limited (WSP) has been asked by Westland Mineral Sands Company Limited (WMSC) to provide geotechnical advice to support a Resource Consent application for a proposed ilmenite sand processing operation at Nine Mile, south of Cape Foulwind, West Coast. WSP acquired Golder Associates (NZ) Limited (Golder) in May 2021 and the work described below has been undertaken by Golder for WSP under a variation to the existing WSP Consultant Engagement Agreement[1] with WMSC, dated 28 April 2021[2].

WMSC submitted the Resource Consent application to Buller District Council (BDC) and West Coast Regional Council (WCRC) in July 2021. Subsequently, WMSC was asked to provide the following information:

- Advise the setback of the mine site from the northern boundary. This links to the matter below.
- Given the proximity of two wetlands, Blind River and indigenous vegetation along the eastern boundary, a geotechnical assessment is requested to confirm that the activity will not give rise to any stability issues and hence effects beyond the boundary of the proposed activities. The geotechnical assessment should evaluate the mine design and identify any potential geotechnical issues, and if any are identified, recommend measures to address the issue/s.

This report summarises geotechnical advice that will assist in addressing the consenting authority's request.

Scope of Works

The scope of works for our assessment is as follows:

- Review geological and mine configuration data for the proposed mine site.
- Provide general geotechnical advice about the expected performance and suitability of the proposed cut slopes and mine closure configuration.

[1] Existing agreement project title: Westport barge export facility. WSP project reference 85.NZ. Variation title: Proposal for Nine Mile Sand Mining Geotechnical Advice to Support Resource Consent, dated 17 August 2021

[2] This letter report is provided subject to the attached Report Limitations.

- Advise on the expected geotechnical impact of excavation/backfilling on the adjacent wetlands and river, as per the BDC/WCRC request above.

No field investigation, sampling or laboratory testing has been undertaken as part of the Golder assessment and no site-specific geotechnical testing data is available for the site.

Assessed Information

We have been presented with various data from WMSC, with those relevant to our assessment listed below:

- WMSC, July 2021. Application for Resource Consent to Buller District Council and West Coast Regional Council – Mineral Sand Mining Activities at Nine Mile, Cape Foulwind.
- WMSC undated. Basic geological summary (informal). Includes geological plan, resource thickness and aerial site photographs.
- Mine Planning & Design Services Ltd, 17 August 2021. Technical Memorandum – Nine Mile Project Pit Slope Design (attached to this report).
- KSL, undated. Hydrological Impact Assessment for Westland Mineral Sands Quarry. Report No Z20019_01_R2.
- Geotech Consulting Ltd, 10 December 2019. Ruatapu Garnet Project – Geotechnical Interpretative Report. Ref 5506.

In addition, we have referred to the publicly available information listed below:

- Nathan, S.; Rattenbury, M.S.; Suggate, R.P. (compilers) 2002: Geology of the Greymouth area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 12.
- T. Marshall , R. P. Suggate & D. S. Nicholson (1958) A borehole survey of ilmenite-bearing beach sands at Cape Foulwind, Westport, New Zealand Journal of Geology and Geophysics, 1:2, 318-324, DOI: 10.1080/00288306.1958.10423186
- Christie, A.B.; Barker, R.G. and Brathwaite, R.L. 2010. Mineral resource assessment of the West Coast Region, New Zealand, GNS Science Report 2010/61. 235 p.

Various historical resource drilling records were also supplied, but these did not contain geotechnical information.

Site Description, Geology and Hydrogeology

The following summary has been prepared using the various assessed information sources described above.

The proposed Nine Mile mine is located east of Okari Road, south of Cape Foulwind and southwest of Westport. It is approximately 400 m from the present coastline and has a total mining consent area of 22 Ha, which includes an open pit and processing infrastructure (see Site Plan, attached).

The Nine Mile project geology consists of Holocene postglacial (less than 10 ka) coastal dune sand sediments deposited on a flat wavecut marine platform during shoreline progradation. The eastern boundary of the deposit is delineated by a post glacial Holocene shoreline/cliff, found throughout Westland and known as the Nine Mile shoreline. The sediments were deposited during westward progradation from the shoreline towards *the present shoreline. Two main mineralised paleo-dune formations exist in the project area; the eastern Ferry Member and western Shetland Member. These shoreline placer deposits contain accumulations of heavy minerals and are up to 30 m thick. The consent area is located on an area of the inland Ferry Member (dune).*

This comprises dunal sands that contain elevated heavy mineral content - notably garnet, ilmenite and critical minerals/rare earth elements. The average minable thickness of the sands is approximately 12.5 m and ranges between 3-28 m. The mining basement directly underlying the dunal sand is a blueish marine calcareous mudstone referred to locally as 'Papa'. In places a gravelly horizon sits on top of the mudstone basement. The sand, or ore component generally contains minor amounts of oversize material greater than 2 mm (i.e., 4%) and up to 10% of 'slimes' (very fine materials such as clays, particles less than 50 micron).

An informal summary of geology provided by WMSC is attached.

Groundwater is several metres below the present ground level at the proposed mine area and is at or near the surface in surrounding wetlands and streams, which are at lower elevations. The groundwater level slopes down towards the coastline (see Figure 1).

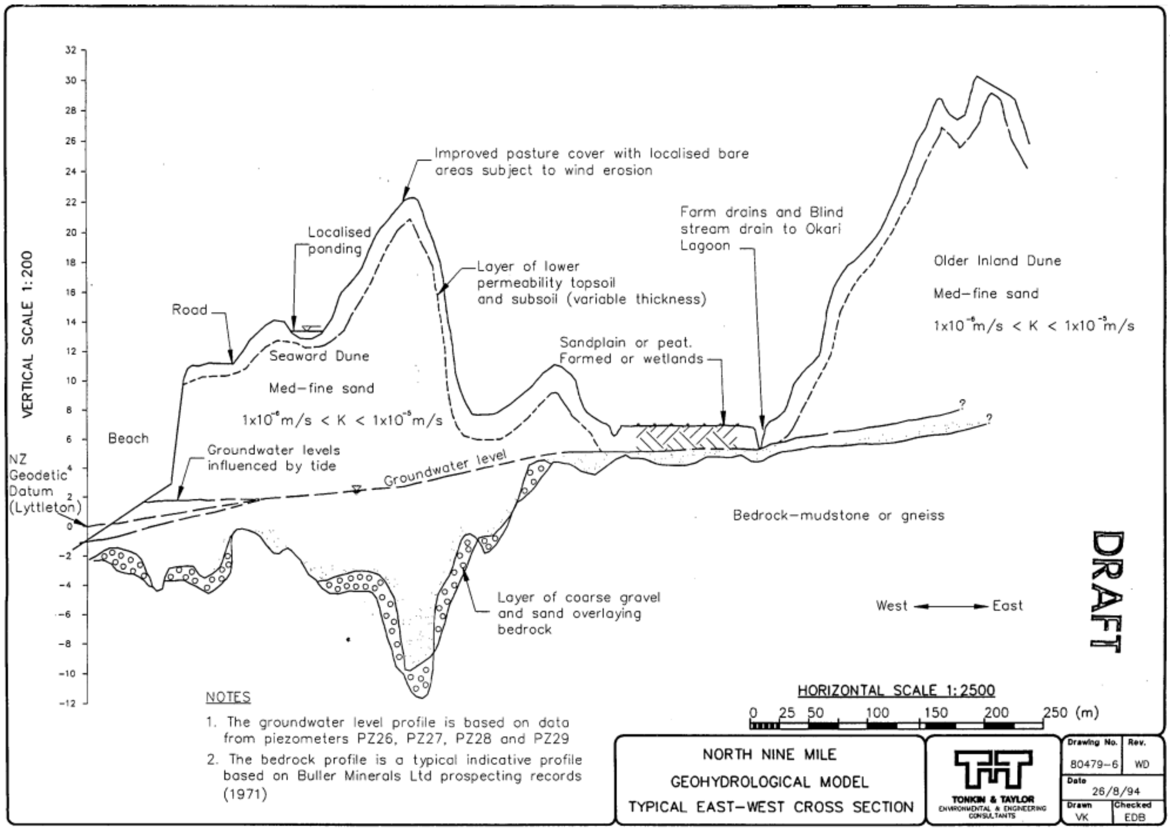


Figure 1: Conceptual hydrogeological section through the site (from Tonkin & Taylor, 1995, Westport Titanium Project - Assessment of environmental effects. Reproduced from KSL).

The four environmentally sensitive areas at the margins of the mine area are described below (see Site Plan):

- The Blind River to the southeast of the proposed mine. It has a buffer of 20 m horizontally from the river channel to the edge of the proposed mine pit.
- The Okari Road Wetland to the northwest of the proposed mine. It has a buffer of 40 m horizontally to the edge of the proposed mine pit.
- The Silverstream Wetland to the northeast of the proposed mine. It also has a buffer of 40 m horizontally to the edge of the proposed mine pit.
- The indigenous vegetation to the east of the proposed mine between Silverstream Wetland and Blind River. It has a buffer of 10 m horizontally to the edge of the proposed mine pit.

Mine Design and Operation

The proposed mining activity will involve the removal of topsoil, excavation of sands and transporting to an onsite processing plant by trucks. Excess material will be returned to the pit and the site will be progressively rehabilitated following mining. The mineral sands will be processed via the onsite plant with resulting HMC trucked off site for shipping.

The mine benches will be between 5 and 10 metres wide, no greater than 5 metres high with a slope batter between 37-45°. Bunds will be constructed along bench edges and the number of benches will vary depending on the thickness of the ore. All slopes will be temporary in nature, being exposed for approximately six months with a nominal angle of 45°. Mine Planning & Design Services Ltd has provided indicative cross sections (see attached Technical Memorandum). The proposed configuration overall is 27° based on experience from other iron sand mines in New Zealand.

It is expected that excavation will be below the water table in the bottom 2-3 m of the pit. KSL advises that if the rate of mineral sand excavation "from below the water table is limited to 100 m³/d, the excavation is very unlikely to have a significant hydrological impact".

The final landform at mine closure has not been defined, but remaining slopes will be contoured to a similar or flatter grade than at present, topsoiled and vegetated.

Design Pit Slope Performance

Geotechnical Characteristics of Ferry Dune Sand

To understand the likely performance of pit cut slopes, the geotechnical properties of the dunal sand must be characterised. In the absence of specific in situ testing, the internal friction angle can be conservatively estimated based on first principles and knowledge of similar material elsewhere.

A conservative estimate of internal friction angle corresponds with loose, dry free-flowing sand that has been dumped. The resting angle ('angle of repose') of the sand would be the lower bound for the internal friction angle and would correspond to a slope with a Factor of Safety equal to 1 (i.e., marginally stable). We estimate the angle of repose for loose dry sand to be about 32°.

Geotechnical testing at a similar West Coast sand deposit at Ruatapu (Geotech Consulting Ltd report, 2019) indicates that 38° may be reasonably adopted if the sand at Nine Mile is of similar nature. This would require the dune sand to be denser than free-flowing dumped sand, possibly with some apparent cohesion due to induration. This may be the case as the sand would have experienced induration since placement in the last 10,000 years, as well as the possibility of cementation. Photos of the Ferry Dune sand in the WMSC geological memo (attached) show partially indurated sand that stands in vertical slopes. We judge that the sand in the proposed mine is likely to have an average internal friction angle of about 38°. The surficial sand may be of lower internal friction angle (around 32° to 36°) due to less overlying mass.

Pit Slope Stability Assessment

For our assessment of pit slope stability, we have considered the profile E-EE presented in the Mine Planning & Design Services Ltd technical memorandum (17 August 2021), which has multiple benches that are 5 m-high, separated by 7 m-wide horizontal benches. There are two questions to be addressed for the Resource Consent application:

1) Is the pit design sufficiently stable so that slope failure is unlikely to extend beyond the buffer and into the two environmentally important wetlands and/or Blind River?

2) Is the pit design sufficiently stable for mining operation to take place according to plan?

The overall design of the pit slope is stated in the Resource Consent application as being 27°. This is expected to be a conservative (i.e., stable) geometry from a global, large-scale slope stability perspective, even when the water table is intercepted in the pit base. It is difficult to conceive of a failure of such proportions that would substantially intercept the designated environmental buffers. This conclusion applies even to the conservative sand internal friction angle of 32°. The overall pit slope design is likely to have a considerable factor of safety. A computer simulation of the proposed pit configuration using Slide2 software (by RocScience) is shown in Figure 3 to demonstrate the likely small-scale nature of expected instability.

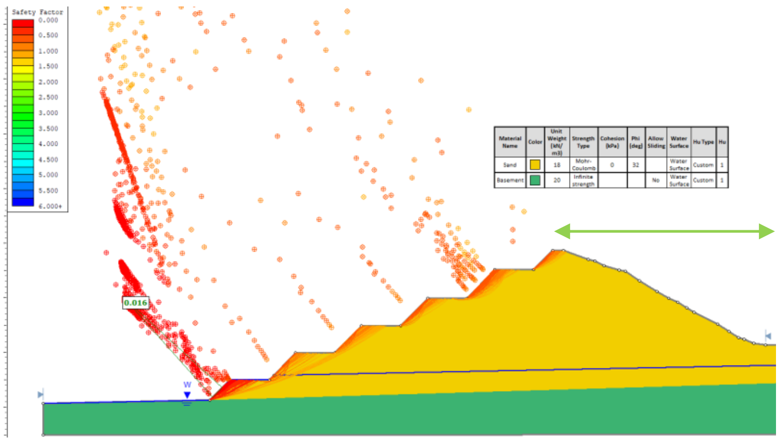


Figure 2: Slope stability analysis using Slide2 software showing failure planes for factor of safety of less than 1.2 for sand with an internal angle of friction of 32°showing failure likely on individual benches above the water table. Where the water table is intercepted failure may progress to benches above. Green arrow shows approximate location of 40 m-wide wetland buffer.

For point 2) we consider that individual benches could potentially fail during mining operation at assumed sand internal friction angle of 38°, as shown in Figure 3. It is likely that failure would involve relaxation and gradual subsidence of a bench in a localised area, rather than rapid failure. This type of failure is particularly expected for the benches within 10 m vertically of excavations below the water table, where the shear strength is reduced due to higher porewater pressures. Cut slope angles could be reduced to the estimated internal friction angle of 38° to mitigate against individual bench failure. A cut slope steeper than 38° may be justified, depending on the actual characteristics of the Ferry Dune sand (see following section).

If our geotechnical assumptions of Ferry Dune sand are accurate, a larger scale failure that would substantially encroach into the buffer of the two environmentally important wetlands and/or Blind River is not considered credible over the short-term duration of mining activity. The proposed buffer width to protect the two wetlands, Blind River and indigenous vegetation (i.e., native bush) along the mine boundary is therefore judged to be adequate.

Seepage erosion could potentially occur in cut slopes below the water table. This would occur where groundwater flows from the slope, possibly leading to bench failure. Seepage erosion is not expected where the water level in the actively mined pit is at the surrounding groundwater level.

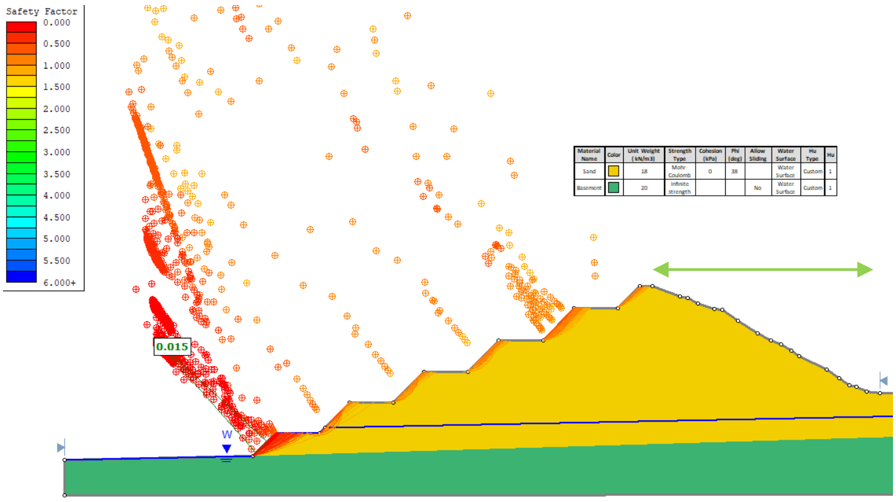


Figure 3: Slope stability analysis using Slide2 software showing factor of safety for less than 1.2 for sand with an internal angle of friction of 38°. Failure is shown to occur on the edge of individual benches above the water table. Green arrow shows approximate location of 40 m-wide wetland buffer.

A larger failure of Ferry Dune sand that intersects the ‘basement’ wave cut rock platform is not considered realistic due to the relatively high strength of the rock.

Pit Stability Risk Control Through Adaptive Mine Management

Commence excavation in low impact zones at proposed design and observe performance of the slopes. In the event of bench collapse do some/all of: flatten slope, reduce bench height, reduce time slopes are unsupported. There may need to be specific treatment below the water table. The risk associated with potential poor slope performance, particularly near to the water table, could be managed in advance and would likely take the form of CPTs to below pit floor.

To manage the risk of slope failure within the active pit WMSC may consider observing the performance of initially formed excavated slopes to guide the geometry of ongoing excavations. A trial bench may be cut at angles between 36° to 45° and incidents of instability observed. A stable cut slope angle may be adopted on this basis, provided the ground conditions are similar throughout the mine. It is recommended that the trial be undertaken at depths greater than 2 m below the present ground surface and be away from environmentally sensitive areas.

Should slope performance be less than expected during mining, the management of the pit may be adapted by some of the following methods:

- Make overall pit slopes flatter
- Reduce bench height to less than 5 m
- Reduce duration that slope is unsupported

Geometry of stable cut slopes above the water table are likely to be established reasonably quickly. When mining occurs below the water table, the assumptions of pit slope geometry will need to be reassessed due to the destabilising effect of excessive pore water pressure. It is recommended that cut slopes below the water table are backfilled as soon as practicable. In addition, pit slope surface should be monitored for erosion due to rainfall – it is likely that the exposed sand is highly erodible.

Mine Closure Stability

Tailings sand that is backfilled into the progressively mined pit is assumed to be subjected to minimal compaction, most likely in the form of track-rolling from site plant. The final ground profile is assumed to be at or below the present ground level due to the extraction of the ilmenite resource. We understand that the intention of WMSC is for the final pit walls to be backfilled and the land be recontoured to approximate the original form. In this scenario, the final mine closure landform is likely to be of a similar stability to the present natural ground. The successful establishment of vegetation on the mine site is expected to mitigate the potential for surface erosion.

Closing

We trust that the above advice meets your requirements. Please contact either of the undersigned if you have any questions.

Yours sincerely

GOLDER ASSOCIATES (NZ) LIMITED

Matt Howard
Principal Engineering Geologist

Tim McMorran
Principal Engineering Geologist
CMENGNZ (PENGGEOL) 176867

CC: Heather McKay (heather.mckay@tprl.co.nz)
Tom Ritchie (tom@hardiepacific.com)

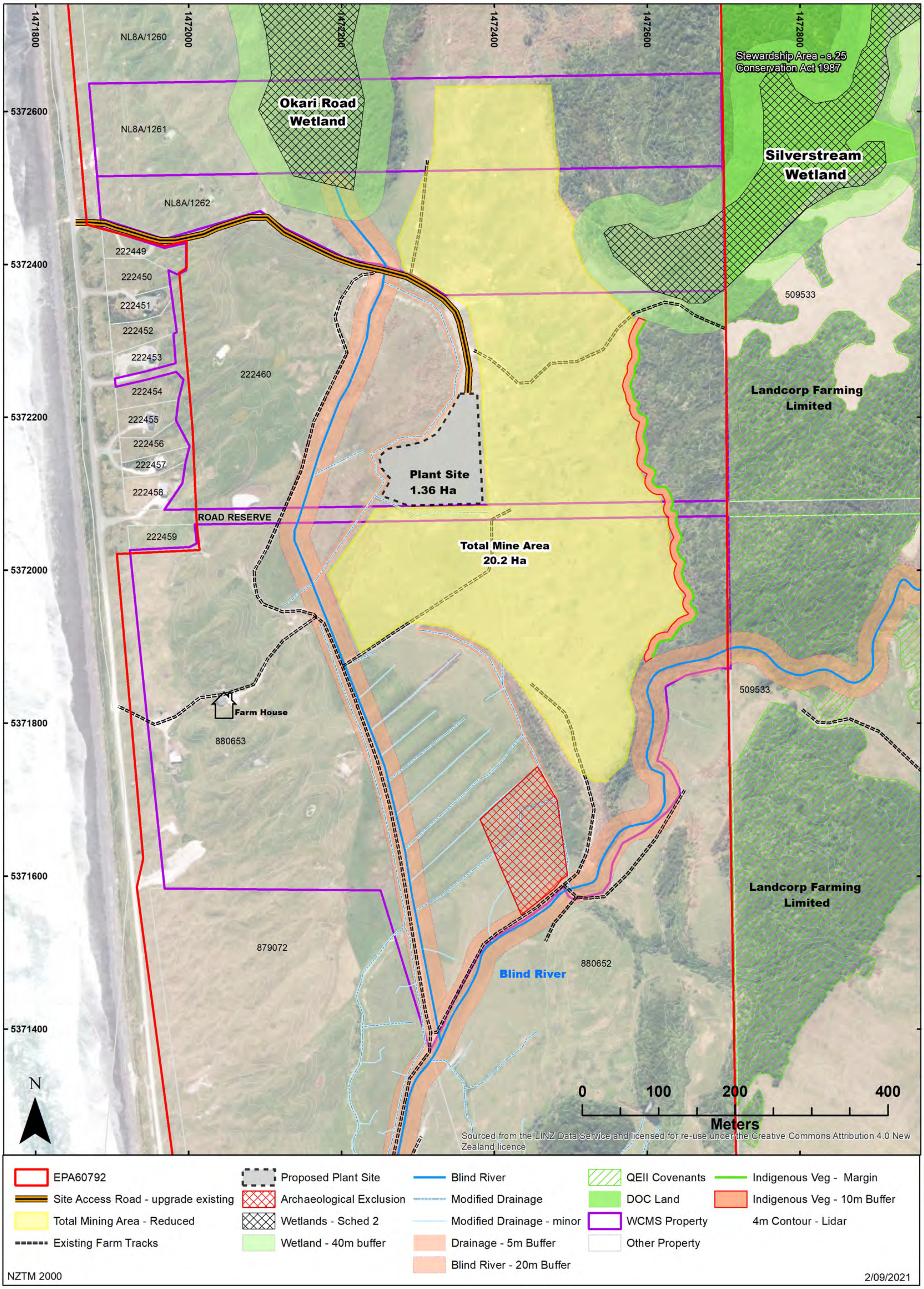
Attachments: Attachment A: Site Plan
Attachment B: Geological Summary and Plans (WMSC)
Attachment C: Technical Memorandum – Nine Mile Project Pit Slope Design
Attachment D: Report Limitations

ATTACHMENT A

Site Plan

PROPOSED SITE PLAN - NINE MILE PROJECT

Westland Mineral Sands Co.



ATTACHMENT B

Geological Summary and Plans (WMSC)

The general geomorphology of the Nine Mile project area is characterised by two shore parallel coastal paleodunes separated by a lowlying area of lagoonal sediments. The area is presently pasture grasslands with small pockets of scrub and gorse.

The Nine Mile project geology consists of Holocene postglacial (<10ka) coastal sediments deposited on a flat wave cut marine platform during shoreline progradation. The eastern boundary of the deposit is delineated by a post glacial Holocene shoreline/cliff, found throughout Westland known as the Nine Mile shoreline. The sediments were deposited during westward progradation from the shoreline towards the present shoreline.

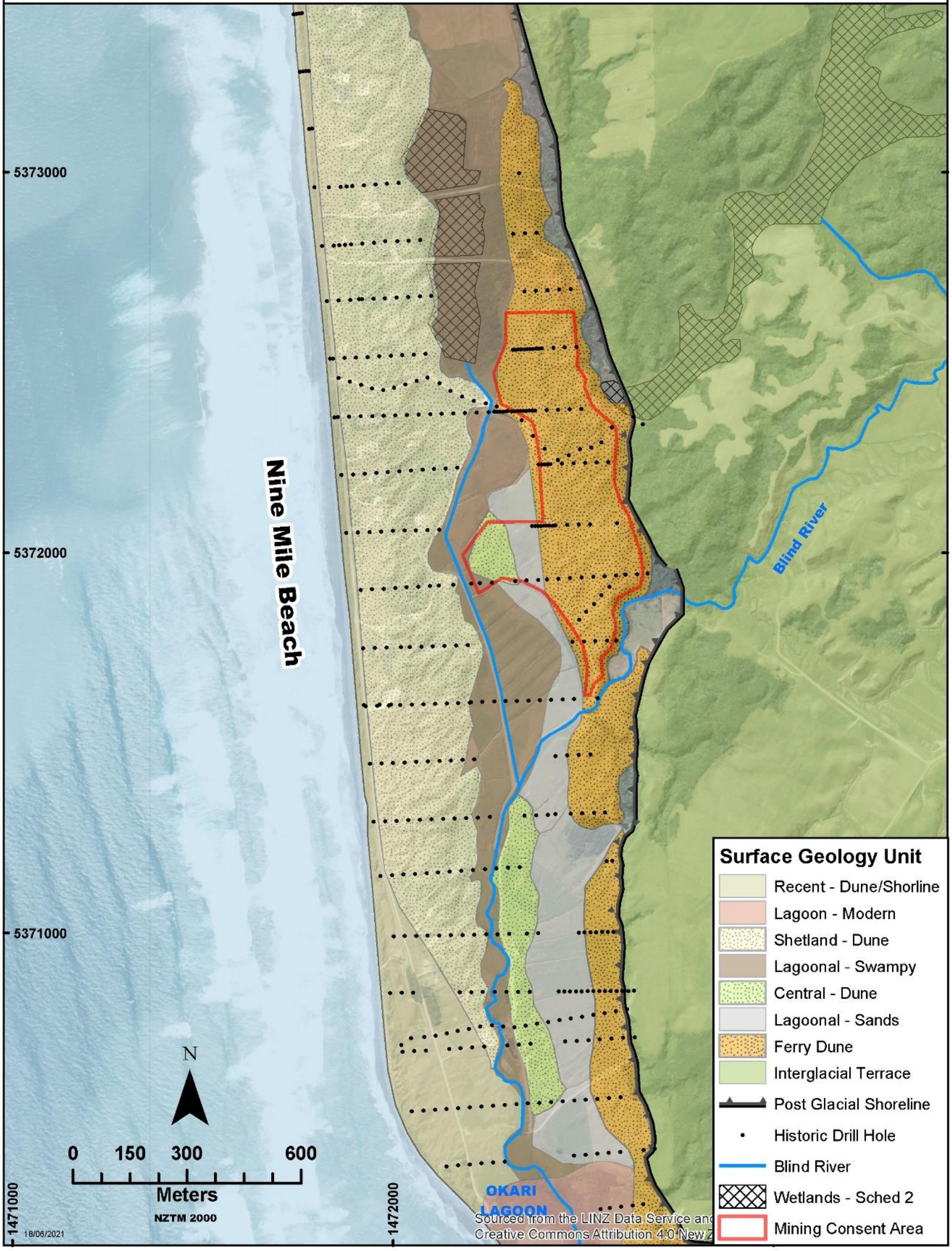
Adjacent to the shoreline cliff sits the Ferry Member Dune ridge, that is ~150m wide and upto 28m high. The Ferry dune placer deposit consists of shoreline interlayered sands with HM strandline accumulations and aeolian well sorted sands. The Ferry member is the target ore body for the project.

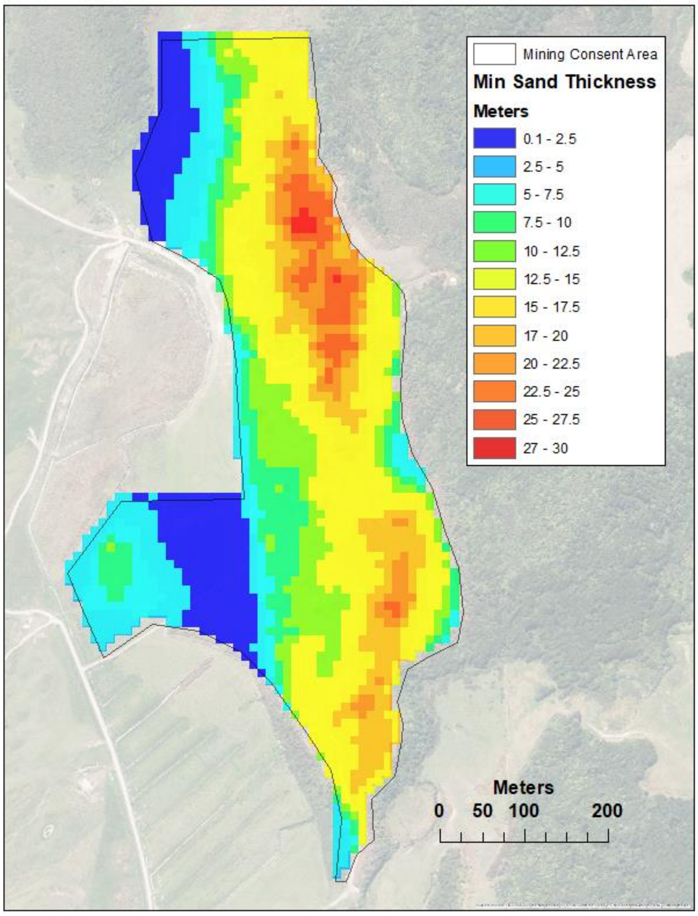
To the west of the Ferry Dune a 200m wide flat area of lagoonal sediments. These sediments are thin (1-4m thick) low-lying lagoonal sands, silts and muds. The lagoonal deposits can be subdivided into two end members; Sand or Mud(swampy) dominated. The sand dominated areas generally contain only minor HM <5%.

To the west of the lagoonal sediments, and east the modern shoreline, sits the Shetland Member dune, that is ~200m wide and less than 20m high. This ridge forms a continuous North South trending belt along most of the Nine Mile North beach. The dune ridge is separated from the present-day beach by a belt of vegetation and active dune systems about 100m wide and less than 15m high. The upper portion of the Shetland dune is dominated by aeolian sands that overlie shoreline deposited interlayer sands. A narrow dune ridge

The Ferry member orebody within the consent area consists of free flowing to slightly indurated dunal sands that contain elevated heavy mineral content notably garnet and ilmenite. The average mineable thickness of the sands is approximately 12.5 metres, in a range of 3 to 20 metres (FIGURE). The mining basement directly underlying the dunal sand is a blueish marine calcareous mudstone referred to by locals as "Papa". The sand, or ore component generally contains minor amounts of oversize material (ie 4% + 300µm) and upto 10% - 53µm or "slimes". The average ilmenite grade within the consent area is ~5% but ranges between 3-25%. The average heavy mineral content is ~15%. There is also fine gold, zircon, monazite, rutile and magnetite contained in the sands. The deposit is well understood with over 500 historic drill holes which have been digitised and using in project evaluation.

NINE MILE PROJECT: SURFACE GEOLOGY





Map showing Sand/resource thickness map of consent area

Figure showing the location of Ferry Formation and Shetland Formations within the Nine Mile permit area and the slightly indurated dunal sands containing visible HM deposits that comprise the formations

ATTACHMENT C

Technical Memorandum – Nine Mile Project Pit Slope Design

TECHNICAL MEMORANDUM

NINE MILE PROJECT

Pit Slope Design

From: Karen Goh

Date: 17 August 2021

1. SUMMARY

Mine Planning and Design Services Ltd (MPD Services) was engaged by Westland Mineral Sands Co. Ltd (WMSC) to develop a pit design for the Nine Mile project. The design was based on geotechnical slope stability study for a similar deposit conducted by Geotech Consulting Ltd[1].

A factor of safety of 1.2 (2h:1v or 27°) for the slope stability has been adopted for the project as the term of the exposed pit side walls is expected to be short, since backfilling is likely to be carried out within months. This has been confirmed by the preliminary mine schedule. In addition, the backfilling operation is planned to commence from the base of the pit and develop upwards through a series of lifts, thus providing further stabilisation at the toe of the exposed pit slopes.

The height of the groundwater level to the base of the pit is 2-3 metres. This means much of the pit wall is expected to be relatively dry.

2. PIT SLOPE DESIGN

The pit walls have been designed to achieve a factor of safety of 1.2. As the operation is planned to be mined with backhoe excavators, the profile of the pit wall has a 45° cut batter with a 7 m berm at every 5 m vertical bench height. This profile results in an overall slope angle of approximately 27° (crest to toe). Based on industry experiences at Waikato North Head and Taharoa ironsand mines, MPD Services believes this overall slope angle is comparable to those operations.

One of the major risks for pit wall stability is in the areas near or adjacent to wetlands, due to the wetlands ability to contain and recharge water. Other considerations are the pit wall stability adjacent to the Blind River and native vegetation.

To understand the location of the pit in relation to its excavated height, groundwater levels and vicinity to wetlands and surrounding vegetation, a series of cross-sections have been created and these are shown in Figures 1 and 2.

[1] Geotechnical Interpretive Report - Ruatapu Garnet Project, Geotech Consulting Ltd, Reference 5506, Dec 2019

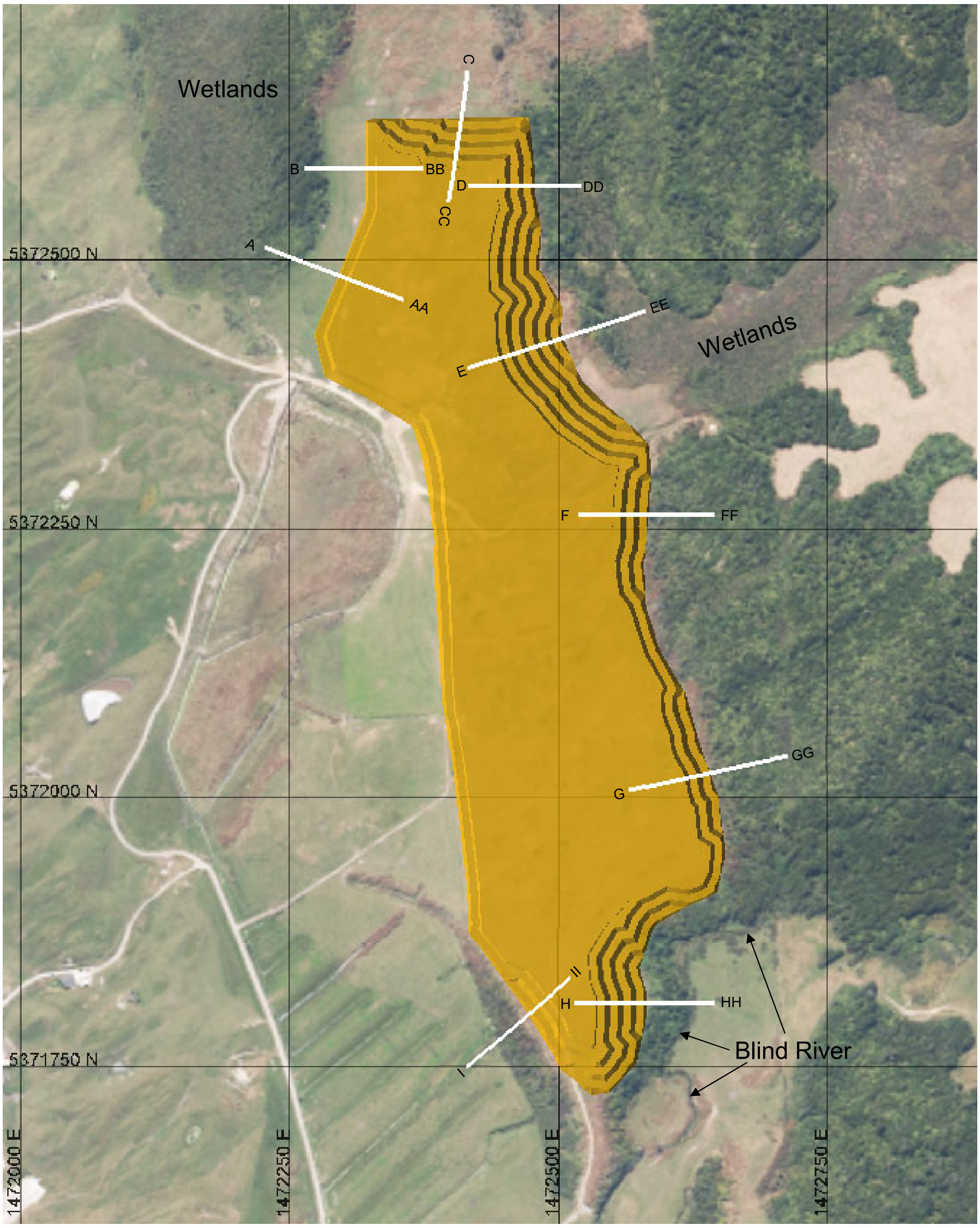


Figure 1: Cross-section layout

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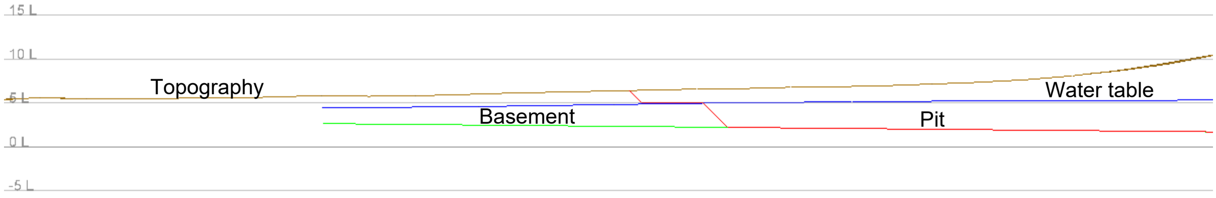
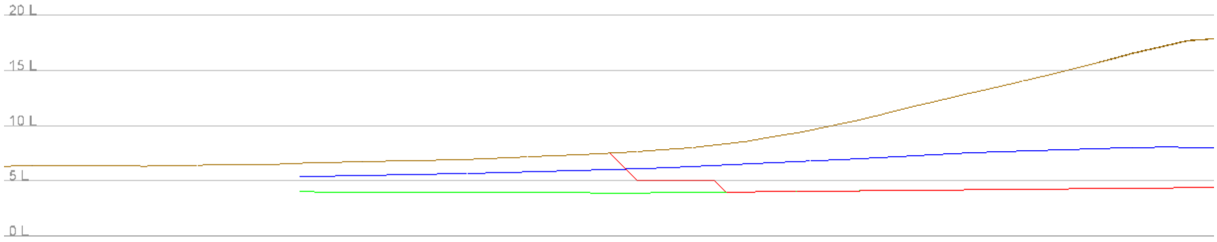


Section B-BB



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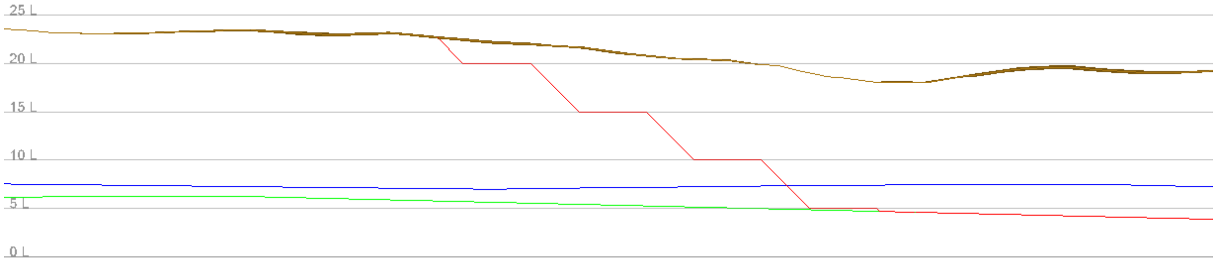

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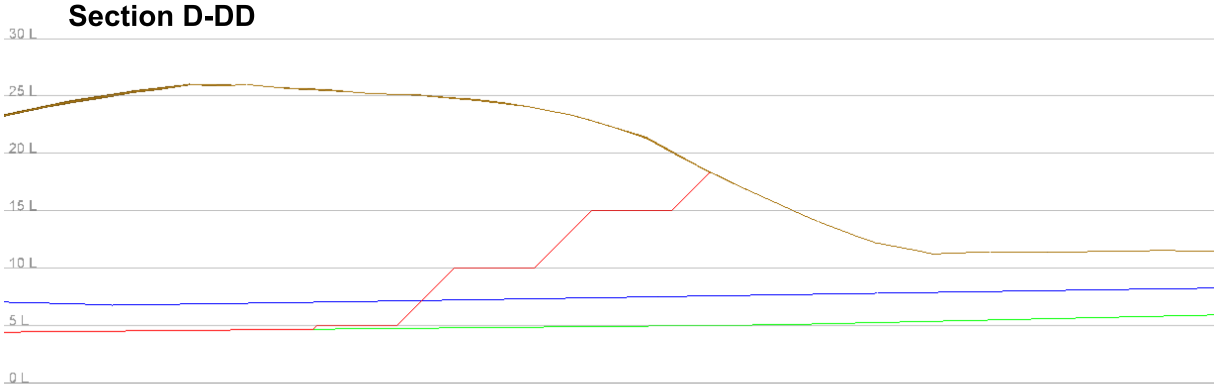

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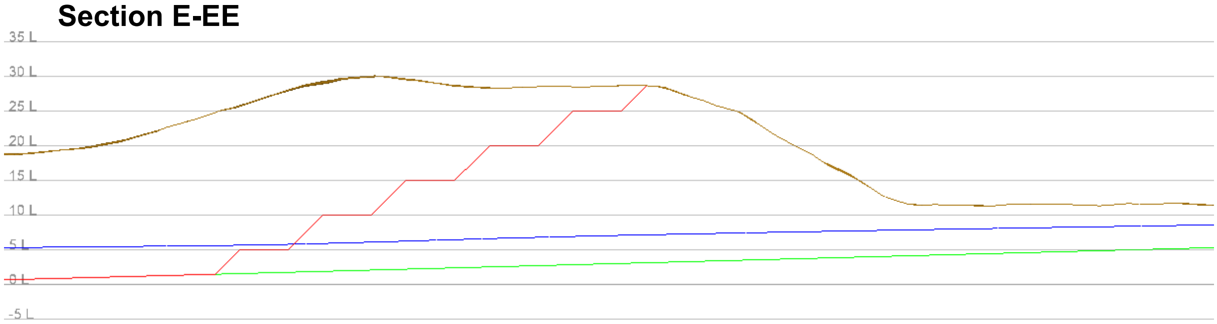

Figure 2: Cross-sections

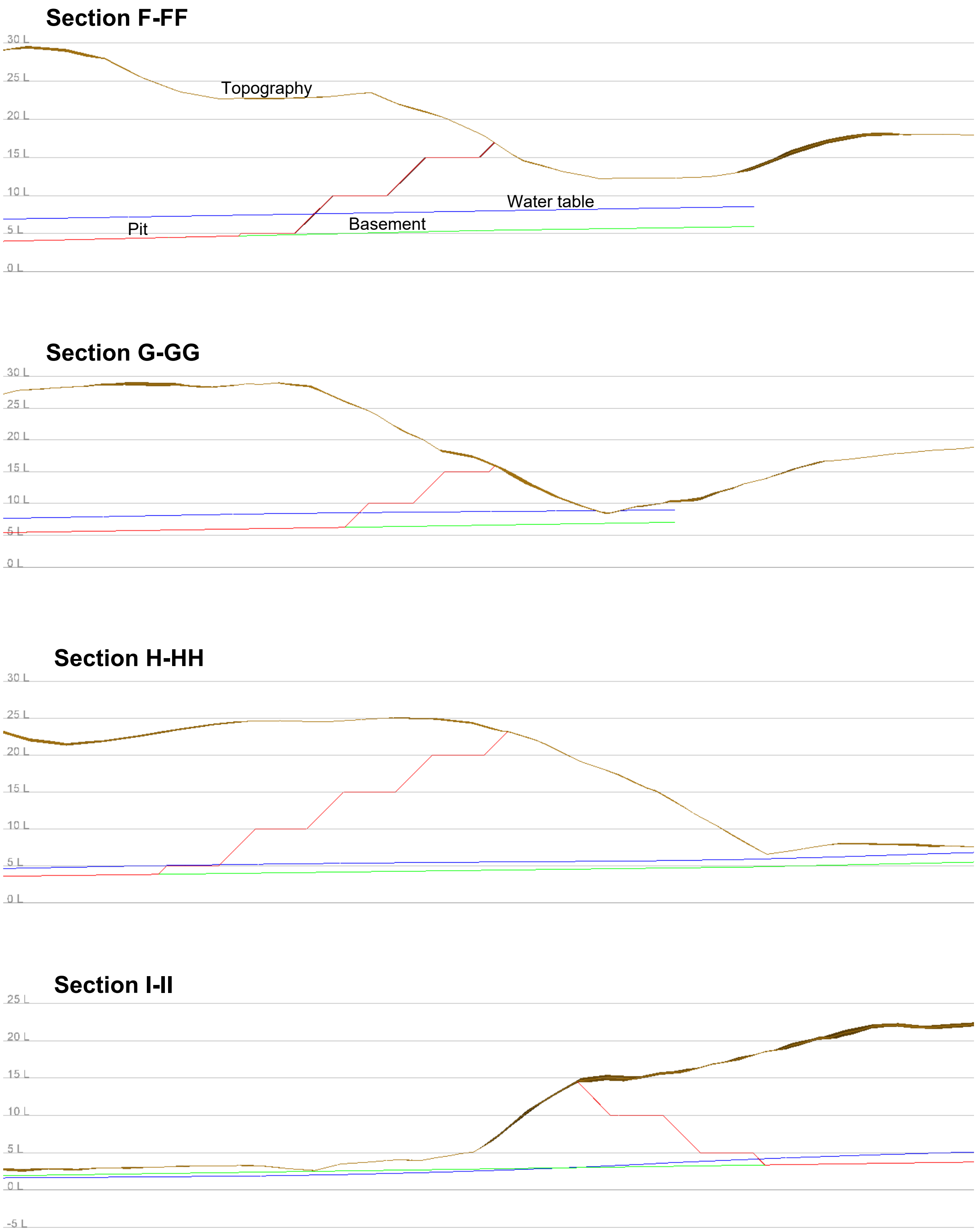

Figure 2: Cross-sections (cont.)

ATTACHMENT D

Report Limitations

Report Limitations

This Report/Document has been provided by Golder Associates (NZ) Limited ("Golder") subject to the following limitations:

i) This Report/Document has been prepared for the particular purpose outlined in Golder's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. Golder's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all of its subconsultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golder's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against Golder's affiliated companies, and their employees, officers and directors.

viii) This Report/Document is provided for sole use by the Client and is confidential to it. No responsibility whatsoever for the contents of this Report/Document will be accepted to any person other than the Client. Any use which a third party makes of this Report/Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report/Document.