ENGINEERING REPORT - Resource Consent
765 MUHUNOA WEST ROAD
ŌHAU

CLIENT **GRENADIER LIMITED -** December 2020, Revision 1

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DELIVERING INNOVATIVE PROPERTY, COMMUNITY AND ENVIRONMENTAL SOLUTIONS

ENGINEERING REPORT FOR: Grenadier Limited

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1. Background & Introduction

Grenadier Ltd are applying for a resource consent to construct an 18-hole golf course, Clubhouse, 20 Accommodation Units, Stables, two Maintenance Sheds and a dwelling (Owner's Cottage) at 765 Muhunoa West Road, Ōhau. The resource consent also includes constructing new accesses, a new vehicle crossing, a car park, three composting toilets out on the course and extracting groundwater for potable water supply and irrigation.

This report considers the engineering feasibility of constructing a golf course and associated infrastructure. The report addresses the following:

- On-site stormwater attenuation and soakage disposal
- On-site sanitary sewer treatment and disposal
- Water supply, storage and treatment
- Building foundations
- Utility supply
- Access and car park design
- Earthworks
- Firefighting water supply

2. The Property

The property at 765 Muhunoa West Road, Ōhau is zoned rural. The property is located just back from the beach and is located on flat to rolling sand dunes. There is one existing dwelling (semi-permanent caravan). The property is mostly covered in pasture with some areas of mature trees.

***Figure 1** – 765 Muhunoa West Road, Ōhau. (outlined in yellow)*

3. The current situation – Base Engineering Information

3.1. Geology and Soils

The soils are mapped as sandy raw and sandy recent. The geology in this area is mapped as aeolian sand dunes. There is a thin topsoil layer on top of the sand supporting pasture.

Refer Appendix C for test pit logs.

3.2. Three Waters

There are no HDC potable water, sanitary sewer or stormwater services available on Muhunoa West Road.

3.3. Utility Services

This section outlines the existing utility services provided on Muhunoa West Road.

3.3.1. Power

Overhead power lines are located on the northern side Muhunoa West Road and terminate outside the entrance to the property. Underground distribution lines extend from the last pole to the Ōhau Sands subdivision at 762 Muhunoa West Road.

3.3.2. Telecommunications

The Chorus telecommunication network extends down the southern side of Muhunoa West Road and terminates just prior to the property.

3.3.3. Gas

There are no existing gas lines at the western end of Muhunoa West Road.

3.4. Vehicle Access

The property is accessed via a farm gate at the north eastern corner of the property. There are two formed accesses through the property. One access follows the eastern property boundary and the other cuts through the centre of the property to the existing dwelling. In the south west corner of the property there is a vehicle access to the Ōhau River mouth.

4. Engineering Assessment

This section describes how the three waters, utilities, roading and earthworks can be implemented for the Golf Course, Clubhouse, Accommodation Units, Stables, Maintenance Sheds and Owner's Cottage. The objective is to show that a Golf Course and associated infrastructure is feasible at this location.

This report is intended to be referenced in support of a resource consent application. Once the resource consent has been granted a detailed design process will be undertaken for the access, earthworks, three waters and utility connections.

Site investigations were undertaken throughout the property to inform the engineering concept solutions discussed below. The location and type of tests can be found in the engineering drawings in Appendix A.

4.1. Water use assumptions

For potable water use and sanitary sewer disposal the following water use values have been adopted. Refer Figure 2 below for building locations:

- The Clubhouse kitchen will cater for 100 people / day each using 30 liters / day
- The Clubhouse will have 8 staff each using 30 litres per day
- Ten two-bedroom accommodation units 40 people / day using 190 litres / day. This is based on an average use of 220 litres / day minus 30 litres / day for the kitchen use, see above
- The driving range has two bathrooms. Assume 50 people / day using 10 litres / day

- Owner's Cottage houses 4 people using 145 litres / day
- The stable is assumed to use 400 litres / day with a toilet and wash down facilities
- The two maintenance block buildings near the stables are assumed to use 2,000 litres / day with a toilet and wash down facilities.

***Figure 2** – Plan showing golf course buildings*

4.2. Potable Water

There is no existing water supply on Muhunoa West Road. Potable water will be provided by a bore water and roof collection. This section outlines the potable water supply, quality and storage for the golf course buildings and owner's cottage.

4.2.1. Supply

4.2.1.a. Clubhouse, Accommodation and Driving Range

Potable water for the Clubhouse, 10 accommodation units and driving range will be supplied from a shallow (approximately 10m depth) bore. The bore water will be pumped to a series of potable water storage tanks. Refer accompanying drilling report and hydrogeology reports for further details on bore water supply.

The indicative location of the potable water bore is shown on the drawings in Appendix A. Refer sections below for potable water quality and storage considerations.

4.2.1.b. Owner's Cottage, Stables and Maintenance Sheds

The Owner's Cottage potable water supply will be provided from captured roof rainwater. The approximate roof area of the cottage is 250m^2 and the average annual rainfall is approximately 1,100mm. The average amount of water captured each year is 223.6m^3. It is assumed that there will be 4 occupants in the dwelling each using 145 litres / person / day. This water use rate is from Table 3.2 in Horizons Manual for On-

site Wastewater Systems Design and Management (MOWSDM). Based on these figures the average yearly water use for the cottage will be 218.7m^3.

The 145 litres / person / day is based on a household with 6/3 flush toilets, aerator faucets, shower flow restrictors, water conserving automatic washing machines and dishwasher and no garbage grinder.

The stables will capture water from the roof to supply water to the toilets and wash facilities. The expected water use for the stables is 400 litres / day. The roof has an approximate area of 215m^2. Based on these figures and expected rainfall the yearly volumes of captured rainfall and potable water use are 240m^3 and 183m^3 respectively.

The maintenance sheds will also capture water from the roof to supply toilets, wash facilities, office and smoko room. The expected water use is 2,000 litres / day. The combined area of the two maintenance sheds is 900m^2. Based on these figures and expected rainfall the yearly volumes of captured rainfall and potable water use are 990m^3 and 730m^3 respectively.

Refer sections below for potable water quality and storage considerations. Refer flow routing analysis in Appendix B.

4.2.2. Quality

4.2.2.a. Clubhouse, Accommodation and Driving Range

The shallow water bore will supply potable water to the Clubhouse, accommodation units and driving range.

The bore water supply is classed as a small water supply under section 69G of the Health Act 1956. To be a compliant small water supplier the golf course owner will need to meet the following requirements from section 10 of the Drinking-Water Standards for New Zealand 2005 (DWSNZ) (revised 2018):

- A drinking-water assessor (DWA) must have approved a water safety plan, and the supplier must be implementing the plan
- Appropriate bacterial, protozoal and chemical treatment, as determined from the catchment assessment in the water safety plan, must be in use
- Water suppliers must monitor water quality and ensure it meets the requirements of section 10.4
- Water suppliers must undertake the remedial actions that have been specified in the water safety plan when a maximum acceptable value (MAV) is exceeded, or treatment process controls are not met.

The potable water will be treated as per DWSNZ guidelines. During detailed design the appropriate treatment will be determined and the appropriate water treatment infrastructure selected. A water safety plan will be submitted outlining the proposed water treatment system to be installed. The plan will also outline how the water quality will be monitored.

4.2.2.b. Owner's Cottage, Stables and Maintenance Sheds

Potable water for the Owner's Cottage, Stables and Maintenance Sheds will be provided from rainwater tanks that capture water from the roof. Each building will have a dedicated rainwater tank. As the potable water supplied to each building is to less than 101 people the water supplier is not considered a small water supplier and does not need to comply with DWSNZ.

However, rainwater supplies are known to contain bacteria, protozoal and particulate matter. DWSNZ section 10.3.2.1 *Rainwater supplies* suggest appropriate treatments for these contaminants. It is recommended that an appropriate treatment system be used

for the potable water supply for these buildings.

4.2.3. Storage

4.2.3.a. Clubhouse, Accommodation and Driving Range

Potable water supplied by the shallow bore for the Clubhouse, accommodation units and driving range building will be stored in multiple tanks located to the east of the accommodation units.

The estimated water use for the Clubhouse, accommodation units and driving range shed is 11.3m^3 per day. For resilience it is recommended to store enough potable water for 4 days if the bore needs servicing. This requires a total storage of 45.36m^3. Two 25,000 litre tanks will be sufficient for the potable water supply for these buildings. Two 25,000 litre firefighting water tanks will sit adjacent to the potable water tanks at this location. This provides the minimum 45,000 of firefighting water storage within 90m of the Clubhouse, accommodation units and driving range, see firefighting section below for further details.

4.2.3.b. Owner's Cottage, Stables and Maintenance Sheds

Potable water for the Owner's Cottage will be captured from the roof. HDC Subdivision and Development Principles and Requirements 2014 (SDPR), Section 12.4 states that the minimum potable water storage is 25,000 litres. It is recommended that the Owner's Cottage potable water supply be stored in two 25,000 litre rain tanks. Refer section 4.4 for more rain tank details.

It is estimated that the horse stables will require 400 litres / day. The roof area of the stables is 216m^2. The yearly rainfall capture and yearly use are 193.2m^3 and 189.9m^3 respectively. It is recommended that a 25,000 litre tank be used to store potable water for the stables.

Rainfall from the two maintenance sheds will be stored in rain tanks, one for each building. The roof area of the sheds are 360m^2 and 540m^2. It is estimated that the smaller maintenance shed will use 800 litres / day and the larger shed 1,200 litres / day. The yearly rainfall capture and yearly use for the small shed are 322.0m^3 and 292.0m^3 respectively. The yearly rainfall capture and yearly use for the large shed are 483.0m^3 and 438.0m^3 respectively. It is recommended to have two 25,000 litre tanks for potable water storage for each shed.

4.3. Irrigation

Water supply for green and fairway irrigation will be provided from a deep bore, refer to the drilling and hydrogeology reports. Water will be direct pumped from the well or into storage tanks. A shallow underground pipe network will distribute the water down each fairway and onto the greens. Automatic sprinkler heads will be installed to spray water in the specific locations required.

An irrigation network design will be developed during detailed design. A concept irrigation network is shown on the drawings in Appendix A.

4.4. Stormwater Disposal

4.4.1. Buildings

Stormwater captured from the roofs of the Clubhouse and accommodation units will be captured and conveyed to storage tanks. This water will be used for irrigation purposes.

Percolation tests were undertaken in several locations across the site. The percolation rates were high due to the sandy soils. On average a soak rate with a factor of safety of 4 applied was 400mm/hr. The driving range building will capture rain from the roof and convey this to a small soak pit.

Stormwater captured from the roofs of the Owner's Cottage, stables and two maintenance sheds

will be captured and attenuated in rain tanks. A small orifice located near the top of the water storage tanks throttles stormwater flow to be lower than predevelopment flows. See potable water calculations for rain tank sizing and see Appendix B for raintank calculations.

The rain tanks for the stables and maintenance sheds attenuate stormwater flows and capture rain for reuse as potable water in the buildings. The raintank for the Owner's Cottage attenuates stormwater, stores potable water and stores firefighting water supply.

Overflow pipes at the top of the rain tanks allow the release of water in larger stormwater events. This water can be discharged to land or to small soak pits.

During detailed design the rain tanks and soakage pits will be sized.

4.4.2. Accesses

Stormwater from sealed accesses will be captured in swales that will convey the water to soak pits at regular intervals. Sealed car parks will capture water in sumps that will discharge to soak pits. Swale and soak pit sizing will be determined during detailed design.

Unsealed accesses will not require stormwater capture.

4.5. Sanitary Sewer Disposal

There is no existing sanitary sewer network on Muhunoa West Road. It is recommended that wastewater be treated and disposed on site as discussed below. Once treated the wastewater will be discharged to ground via a pressure compensating drip irrigation (PCDI) system. A PCDI requires a minimum secondary treated effluent of BOD_5 and TSS better than 20mg / litre and 30 mg / litre respectively.

The soil logs excavated around the site showed a thin layer of topsoil over the top of sand. A soil category of 1 as per Table 7.3, Appendix B, Onsite Wastewater Management in the Auckland Region has been adopted for this resource consent. Due to the fast drainage characteristics of sand, nutrient leaching may occur and contamination of groundwater may occur. Additional treatment or special design of the land application system will be required during the detailed design stage. A minimum 150mm topsoil is required for these systems in category 1 soils. The location of disposal fields have been selected to ensure adequate clearance from the Ōhau River.

We are also mindful that iwi are interested in the disposal of wastewater and therefore the disposal fields will be in areas away from the river and integrated with ecological design.

The loading rate for a soil category 1 using a PCDI is 5mm / day as per Table 6.2 in Horizons Regional Council Manual for On-Site Wastewater Systems Design and Management (OSWSDM).

Refer Appendix G for wastewater calculations.

4.5.1. Clubhouse, Accommodation and Driving Range

The grey and black water from the Clubhouse, accommodation units and driving range building will all be gravity piped to one sewage treatment plant. It is expected that the combined flow rate from these buildings is 11,000 litres / day. Secondary treatment is required for a pressure compensating drip irrigation (PCDI) system. A Hynds Oxyfix FIXEUC90 accepts up to 14,850 litres / day. The purification performance of this treatment plant is 20mg / litre for BOD_5 and 30 mg / litre for TSS, which is compliant with OSWSDM. It is recommended to use a treatment plant like this for these buildings. Refer Appendix E for the Hynds Oxyfix information sheet.

The Clubhouse will have a commercial kitchen. Grease traps should be installed to remove grease from the sanitary sewer water from the kitchen.

Based on an areal loading rate of 5mm / day for category 1 soils and an output of 11,000 litres / day the drip field would need to be 2,200m^2 with a reserve area of 1,100m^2, as per OSWSDM Table 2.3. The drip field is shown on the drawings in Appendix A.

4.5.2. Owner's Cottage

The Owner's Cottage will have a secondary treatment sewer system with a PCDI system. Based on

an areal loading of 5mm/ day and a daily output of 580 litres / day the drip field would need to be 120m^2 with a reserve area of 60m^2.

4.5.3. Stables and Maintenance Sheds

Sanitary sewer from the stables and the maintenance sheds will be piped into one secondary treatment system. The expected sanitary sewer output from the stables and maintenance sheds is 400 litres / day and 2,000 litres / day respectively. Based on the combined inflow rate of 2,400 litres / day and an areal loading of 5 mm /day the drip field would need to be 480m^2 with a reserve area of 240m^2.

4.5.4. Composting Toilets

Three composting toilets will be spaced throughout the golf course at regular intervals, refer Appendix A drawings for toilet locations. A commercial composting toilet system will be required such as a Sun-Mar Centrex 3000 Micro Flush. Some maintenance of these products is required and a maintenance plan should be developed to ensure the toilets are functioning appropriately.

Refer Appendix F for an example of a composting toilet.

4.6. Firefighting Supply

The firefighting water supply must comply with New Zealand Fire Service Firefighting Water Supplies Code of Practice, SNZ PAS 4509:2008. It is recommended that all buildings at the golf course have a sprinkler system installed as the site is more than 10 minutes from the nearest fire station and is rural.

Firefighting connection kits will be required at the base of all firefighting water storage tanks and an appropriate access and hard stand area required as per SNZ PAS 4509:2008.

4.6.1. Clubhouse, Accommodation and Driving Range

If the Clubhouse, 10 accommodation units and driving range building have sprinklers installed these buildings will have a water supply classification of FW2. For a non-reticulated water supply a dedicated firefighting water storage facility holding 45m^3 is required within 90m of these buildings. The requirement for firefighting water storage can be removed if the water bore can provide a flow rate of 12.5 litres / sec within a distance of 135m from the building for a minimum firefighting time of 30 minutes.

Two 25,000 litre tanks will be located adjacent to the potable water tanks for the Clubhouse, accommodation units and driving range. This location is within 90m of all buildings.

If the Clubhouse does not have a sprinkler system installed the water supply classification changes to FW3 and the required firefighting storage capacity increases from 45,000 litres to 180,000 litres.

4.6.2. Owner's Cottage

A sprinklered single family home has a water supply classification of FW1. The required firefighting water storage is 7,000 litres. If the home does not have a sprinkler system the water supply classification increases to FW2 and the storage requirement increases to 45,000 litres.

4.6.3. Stables and Maintenance Sheds

If the stables and maintenance sheds have sprinkler systems installed the water supply classification is FW2. The minimum water storage required within 90m of the stables and maintenance sheds is 45,000 litres. It is recommended to have one firefighting storage source for both the stables and the maintenance sheds as these buildings are within 90m of each other.

Note if these buildings do not have sprinklers installed then the water supply classification changes to FW7 and a special assessment is required to calculate the water storage requirements. The FW7 classification is due to the likely bulk storage of fuels in the small maintenance shed.

4.7. Utilities

4.7.1. Power

Overhead power lines are located on the northern side Muhunoa West Road and terminate

outside the entrance to the property. The buildings can be supplied from these existing overhead lines.

4.7.2. Telecommunications

The Chorus telecommunication network extends down the southern side of Muhunoa West Road and terminates just prior to the property. This existing network could be used to service the new golf course buildings. Satellite internet is available country wide and would provide faster internet speeds.

4.7.3. Gas

There is no existing gas supply at this end of Muhunoa West Road. No gas connections are proposed for the Gold Course.

4.8. Roading & Transportation

4.8.1. Vehicle Crossing to Muhunoa West Road

Tim Kelly Transportation Planning Limited has assessed the external transportation aspects. This report covers internal layout matters only. There is an existing vehicle crossing to Muhunoa West Road in the north east corner of the property. This access will be retained and used as the main access to the Golf Club, accommodation units and driving range. A second vehicle crossing to the west is proposed to access the maintenance sheds, stables and Owner's Cottage. The vehicle accesses will comply with HDC Engineering Appendix One, Vehicle Crossings, Drawing 6 Rural Crossings.

4.8.2. Access

4.8.2.a. Clubhouse, Accommodation Units and Driving Range

The access to the Clubhouse, accommodation units and driving range will be formed with a minimum carriageway width of 5.5 to 5.7m, with 0.5m sealed shoulders on both sides as per NZS 4404 Table 3.2, rural access to trade. The total formed width will be 6.5-6.7m. Table 3.2 requires a pedestrian width of 1.5m on each side of the road. However, this is not considered necessary as it is unlikely that pedestrians will be accessing the golf course from Muhunoa West Road.

Stormwater runoff from the access will be captured in stormwater swales on both sides. The swales will discharge into soak pits at regular intervals along the access.

The access will be two-way from Muhunoa West Road to the Clubhouse. A car park is provided to the south east of the Clubhouse and provides an alternative route to exit the Clubhouse.

Refer Appendix D for access scala results and a concept pavement design for the Clubhouse access.

4.8.2.b. Owner's Cottage, Stables and Maintenance Sheds

The access to the maintenance sheds will be formed with a minimum carriageway width of 5.5 to 5.7m, with 0.5m formed shoulders on both sides as per NZS 4404 Table 3.2, rural access to trade. Swales on the side of the access will capture runoff to discharge into soak pits at regular intervals.

The access from the maintenance sheds to the stables and the Owner's Cottage will have a carriageway width of 3.0m inclusive of shoulders as per NZS4404 Table 3.2, rural live and play and will be unsealed. Swales on the side of the access will capture access runoff to discharge into soak pits at regular intervals.

4.8.3. Car Park

The Clubhouse car park has been designed in accordance with AS/NZS 2890.1 and has a one-way aisle. The car park and proposed access to the Clubhouse form a "roundabout" circulating in an anti-clockwise direction. Where the car park exits onto the access, signs and road marking will be provided to indicate that exiting vehicles must give way to vehicles on the access.

The car park provides 61 car parks. All car parks are at 90 degrees. The aisle widths allow for one-way movement. There is one dedicated entry point to the car park and one dedicated exit

point from the car park.

The 61 car parks will allow for the following.

- Two car parks for each accommodation unit (20 total)
- 8 staff car parks
- 3 disability car parks as per NZS4121, Table 1
- 25 car parks for the Clubhouse
- 5 car parks for the driving Range.

The maintenance sheds will have staff parking around the outside of the buildings. These will be design in accordance with AS/NZS 2890.1.

4.8.4. Sight Distance

At the location of the two vehicle crossings, Muhunoa West Road is straight and flat. The accesses are also located at the end of a no exit road. There is one existing access to the west on the north side of the road to Ōhau Sands subdivision. Sightlines to the west and east along Muhunoa West Road are good and compliant with HDC District Plan Rule 21, Table 21-1.

4.9. Earthworks

Earthworks are required to construct the accesses and car parks. The sand dune that the Clubhouse and accommodation units are located will be shaped to provide a flat building platform. The Clubhouse will sit at approximate RL 22.0m and the 10 accommodation units will sit at RL 21.0m. The material cut from the dune for the building platforms will be used to fill in areas on the dune. Refer to architectural drawings for plan cut and fill zones and earthworks cross sections.

Some earthworks will be required to shape the fairways and greens, however, the golf course has largely been designed to follow the existing shape of the land.

The total indicative volumes of cut and fill are 118,000m^3 and 83,000m^3 respectively. The total area of earthworks is 114,000m^2. All earthwork volumes are bulk volumes. Refer Appendix A for earthwork plans.

4.9.1. Erosion and Sediment Controls

During construction erosion and sediment control devices will be installed in accordance with Greater Wellington Regional Council's Erosion and Sediment Control Guidelines. It will be important to stabilize exposed sand faces to prevent wind blown sediment blowing into adjacent properties. Refer Appendix A for the earthworks management plan.

4.10. Venue Foundations

All the proposed buildings within the property will have an importance level of 2 as per NZS3604. Ground investigations as prescribed in NZS3604 Section 3 were undertaken. Based on these investigations and the scala penetrometer results the soil conditions are not classed as good ground. Specific engineering design will be required for all building foundations.

5. Conclusions & Recommendations

Based on the discussions in this report a Golf Course, Clubhouse, 10 Accommodation Units, a Driving Range, a Residential Dwelling, Stables and Maintenance Sheds at 765 Muhunoa West Road is achievable. This report is a preliminary design only and further detailed design will be required.

Overall, we recommend:

1. Potable water for the Clubhouse, 20 accommodation units and driving range will be sourced from a shallow bore.
2. Potable water for the Owner's Cottage, Stables and Maintenance sheds will be captured from the

roof of each building and stored in tanks.

3. Stormwater neutrality is achieved for the Owner's Cottage, stables and maintenance sheds by attenuating the peak discharge in a 10-year, 10-minute duration event by capturing the water from the roof in rain tanks and releasing it slowly through a small orifice.
4. Stormwater from the Clubhouse and accommodation units will be piped to storage tanks to be used for irrigation on the golf course.
5. Stormwater from the driving range building will be disposed via soakage.
6. Stormwater from accesses will be captured in swales and disposed of in soak pits located at regular intervals.
7. Wastewater from the Clubhouse, accommodation units, and driving range building will be treated in an on-site secondary treatment plant. The treated effluent will be disposed using a PCDI system.
8. Wastewater from the owner's cottage will be treated in a residential secondary treatment tank and disposed using a PCDI system.
9. Wastewater from the stables and maintenance sheds will be treated in one secondary treatment plant and disposed of via a PCDI system.
10. Three composting toilets will be installed at regular intervals around the course. These will require regular maintenance as per the manufacturer's specifications.
11. Power will be provided by connecting to existing infrastructure on Muhunoa West Road.
12. Telecommunications will be provided by connecting to the existing network on Muhunoa West Road or connecting to satellite internet.
13. One new rural vehicle crossing will be provided to Muhunoa West Road. The existing access will be upgraded to a rural vehicle crossing standard.
14. The access to the Clubhouse and the car park will be formed in accordance with NZS4404. The access to the maintenance sheds will be formed in all weather formation. The access to the Owner's Cottage and stables will be unsealed.
15. Erosion and sediment controls will be installed in accordance with Greater Wellington Regional Council's Erosion and Sediment Control Guidelines during all land disturbance activities and these will remain in place until all cut faces are stabilized.
16. A dedicated firefighting water source will be required for each building and will be designed in accordance with SNZ PAS 4509:2008. It is recommended that all buildings have sprinklers installed. A total of 2 x 45,000 litres is required for firefighting purposes for the Clubhouse, accommodation units and driving range building. A total of 45,000 litres is required for firefighting purposes for the stables and maintenance sheds. A total of 7,000 litres is required for firefighting purposes for the Owner's Cottage. Hard stand areas and appropriate fittings will be required at each firefighting water source as per SNZ PAS 4509:2008.

APPENDIX A – Drawings

PREPARED BY
LANDMATTERS

CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
OVERALL ENGINEERING PLAN

DATE	PROJECT NO.
21/12/20	709
SCALE	1:2000 @ A1 1:4000@ A3
DRAWING NO.	REV
J709-ENG-130	A

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OHAU SANDS
GATED ENTRANCE

PCDI TRICKLE
FIELD 480m²

VEHICLE CROSSING TO MAINTENANCE SHEDS, STABLES AND OWNER'S COTTAGE. DESIGN AS PER HDC ENGINEERING APPENDIX ONE, DRAWING 6: RURAL CROSSING

STORMWATER ROOF
CAPTURE AND POTABLE
WATER SUPPLY

PCDI TRICKLE FIELD
RESERVE AREA 240m²

FIREFIGHTING WATER SUPPLY
FOR MAINTENANCE SHEDS
AND STABLES, 45,000 LITRES

VEHICLE CROSSING TO GOLF COURSE, CLUBHOUSE, ACCOMMODATION UNITS AND DRIVING RANGE. DESIGN AS PER HDC ENGINEERING APPENDIX ONE, DRAWING 6: RURAL CROSSING

STABLES

STORMWATER ROOF
CAPTURE AND POTABLE
WATER SUPPLY

SECONDARY
WASTEWATER
TREATMENT PLANT

STORMWATER ROOF CAPTURE
AND POTABLE WATER SUPPLY

MUHUNOA WEST ROAD

OWNER'S
COTTAGE

MAINTENANCE SHEDS

STORMWATER ROOF CAPTURE.
POTABLE WATER AND
FIREFIGHTING SUPPLIES

CHORUS LINE TO GOLF COURSE,
CLUBHOUSE, ACCOMMODATION
UNITS AND DRIVING RANGE

RESIDENTIAL SEPTIC TANK
FOR SECONDARY
WASTEWATER TREATMENT

POWER MAIN TO GOLF COURSE,
CLUBHOUSE, ACCOMMODATION
UNITS AND DRIVING RANGE

PCDI TRICKLE
FIELD 120m²

PCDI TRICKLE FIELD
RESERVE AREA 60m²

CLUBHOUSE, ACCOMMODATION
UNITS AND DRIVING RANGE ACCESS

LEGEND:

- POTABLE WATER MAIN
- POTABLE WATER CONNECTION
- SANITARY SEWER MAIN
- SANITARY SEWER LATERAL
- SANITARY SEWER MANHOLE
- STORMWATER MAIN
- STORMWATER LATERAL
- STORMWATER MANHOLE
- IRRIGATION LINES
- CHORUS MAIN
- CHORUS CONNECTION
- POWER
- POWER CONNECTION
- VEHICLE ACCESS / CAR PARK
- EXISTING BOUNDARY

10 5 0 10 20 30 m

PREPARED BY
LANDMATTERS

CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
ENGINEERING PLAN
MAINTENANCE SHEDS, STABLES AND OWNER'S COTTAGE

DATE	PROJECT NO.
21/12/2020	709
SCALE	1:500 @ A1 1:1,000 @ A3
DRAWING NO.	REV
J709-ENG-131	A

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CLUBHOUSE

DRIVING RANGE ACCESS

CLUBHOUSE, ACCOMMODATION UNITS AND DRIVING RANGE CAR PARK

MAIN VEHICLE ACCESS

POTABLE WATER FOR CLUBHOUSE, ACCOMMODATION UNITS AND DRIVING RANGE STORAGE 2 X 25,000 LITRE TANKS

SOAK PIT FOR ROOF RUNOFF

POTABLE WATER TREATMENT SYSTEM

DRIVING RANGE BUILDING

SEWAGE SECONDARY TREATMENT PLANT

BORE WATER SUPPLY

DRIVING RANGE ACCESS

45,000 LITRE FIREFIGHTING STORAGE TANK FOR SOUTHERN ACCOMMODATION UNITS

STORMWATER MAIN COLLECTING ROOF WATER FROM THE CLUBHOUSE AND ACCOMMODATION UNITS

ACCOMMODATION UNIT ACCESS

ACCOMMODATION UNITS

PCDI TRICKLE FIELD 2,200m^2

STORMWATER RUNOFF WATER STORAGE TANKS 4 X 25,000 LITRE TANKS. WATER TO BE USED FOR GOLF COURSE IRRIGATION

PCDI TRICKLE FIELD RESERVE AREA 1,100m^2

IRRIGATION LINES

LEGEND:

- PW — POTABLE WATER MAIN
- — — — POTABLE WATER CONNECTION
- SS — SANITARY SEWER MAIN
- — — — SANITARY SEWER LATERAL
- SANITARY SEWER MANHOLE
- SW — STORMWATER MAIN
- — — — STORMWATER LATERAL
- STORMWATER MANHOLE
- IRRIGATION LINES
- CHORUS — CHORUS MAIN
- — — — CHORUS CONNECTION
- PWR — POWER
- — — — POWER CONNECTION
- — — — VEHICLE ACCESS
- GOLF COURSE PROPERTY BDRY
- — — EXISTING BOUNDARY

10 5 0 10 20 30 m

PREPARED BY LANDMATTERS

CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

DRAWING TITLE: ENGINEERING PLAN CLUBHOUSE, ACCOMMODATION UNITS AND DRIVING RANGE

DATE: 21/12/20

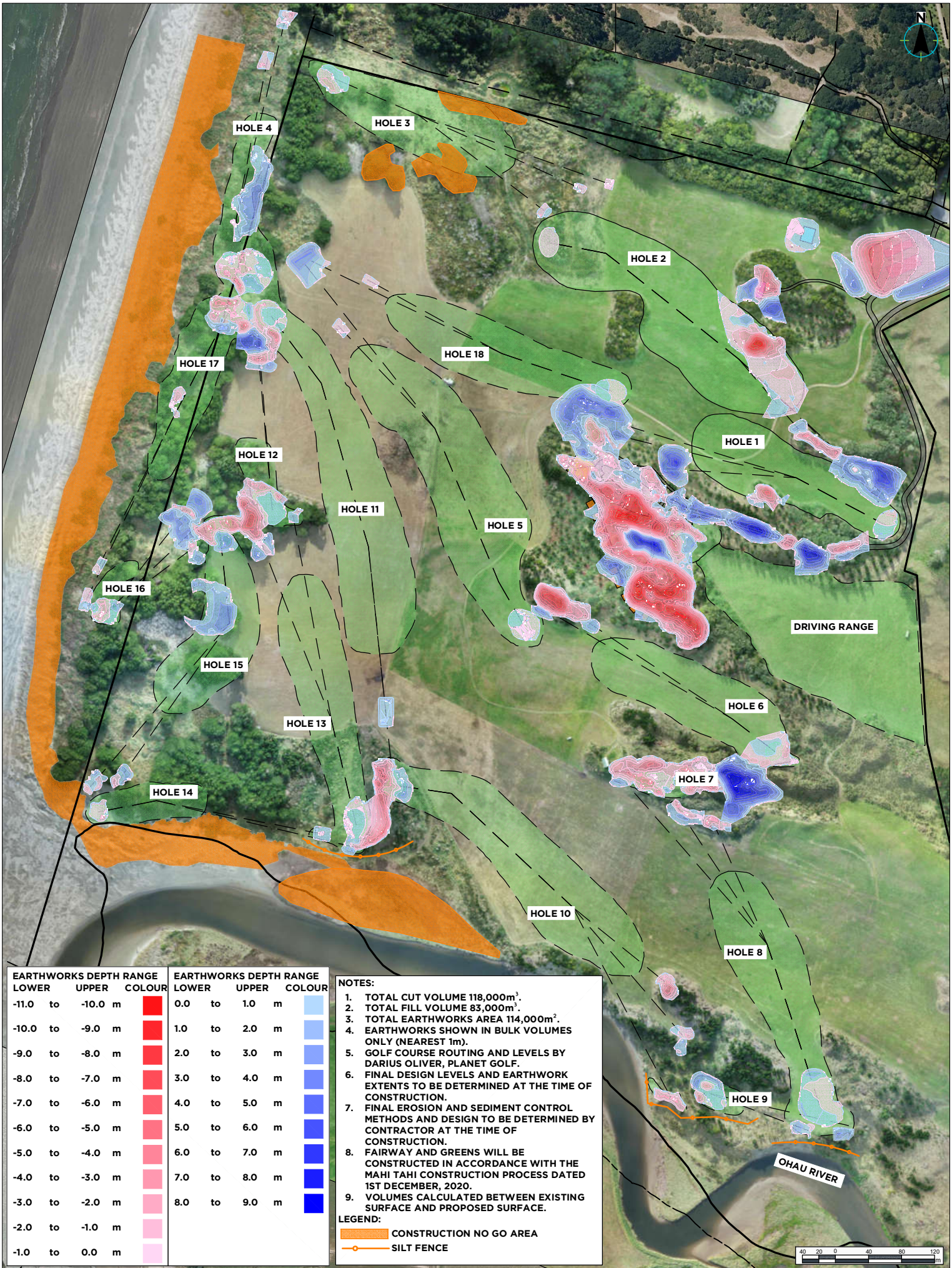
PROJECT NO.: 709

SCALE: 1:500 @ A1, 1:1000@ A3

DRAWING NO.: J709-ENG-132

REV: A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:41:24 AM



EARTHWORKS DEPTH RANGE

LOWER		UPPER		COLOUR
-11.0	to	-10.0	m	
-10.0	to	-9.0	m	
-9.0	to	-8.0	m	
-8.0	to	-7.0	m	
-7.0	to	-6.0	m	
-6.0	to	-5.0	m	
-5.0	to	-4.0	m	
-4.0	to	-3.0	m	
-3.0	to	-2.0	m	
-2.0	to	-1.0	m	
-1.0	to	0.0	m	

EARTHWORKS DEPTH RANGE

LOWER		UPPER		COLOUR
0.0	to	1.0	m	
1.0	to	2.0	m	
2.0	to	3.0	m	
3.0	to	4.0	m	
4.0	to	5.0	m	
5.0	to	6.0	m	
6.0	to	7.0	m	
7.0	to	8.0	m	
8.0	to	9.0	m	

NOTES:

1. TOTAL CUT VOLUME 118,000m^3.
2. TOTAL FILL VOLUME 83,000m^3.
3. TOTAL EARTHWORKS AREA 114,000m^2.
4. EARTHWORKS SHOWN IN BULK VOLUMES ONLY (NEAREST 1m).
5. GOLF COURSE ROUTING AND LEVELS BY DARIUS OLIVER, PLANET GOLF.
6. FINAL DESIGN LEVELS AND EARTHWORK EXTENTS TO BE DETERMINED AT THE TIME OF CONSTRUCTION.
7. FINAL EROSION AND SEDIMENT CONTROL METHODS AND DESIGN TO BE DETERMINED BY CONTRACTOR AT THE TIME OF CONSTRUCTION.
8. FAIRWAY AND GREENS WILL BE CONSTRUCTED IN ACCORDANCE WITH THE MAHI TAHI CONSTRUCTION PROCESS DATED 1ST DECEMBER, 2020.
9. VOLUMES CALCULATED BETWEEN EXISTING SURFACE AND PROPOSED SURFACE.

LEGEND:

CONSTRUCTION NO GO AREA

SILT FENCE

PREPARED BY LANDMATTERS

CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

DRAWING TITLE: EARTHWORKS MANAGEMENT PLAN

DATE: 22/12/20

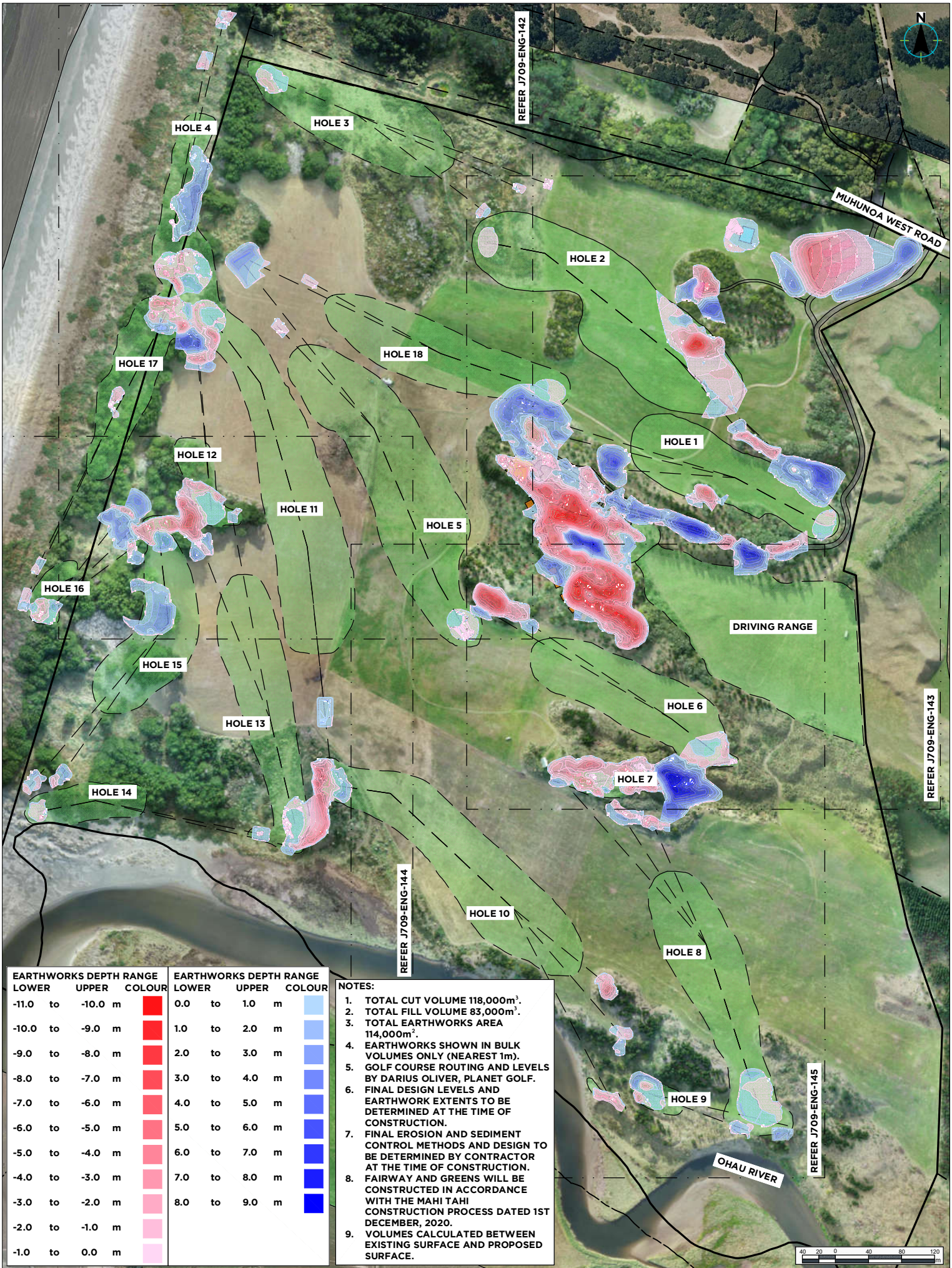
PROJECT NO.: 709

SCALE: 1:2000 @ A1, 1:4000@ A3

DRAWING NO.: J709-ENG-140

REV: A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:16:01 AM



EARTHWORKS DEPTH RANGE LOWER		UPPER		COLOUR
-11.0	to	-10.0	m	
-10.0	to	-9.0	m	
-9.0	to	-8.0	m	
-8.0	to	-7.0	m	
-7.0	to	-6.0	m	
-6.0	to	-5.0	m	
-5.0	to	-4.0	m	
-4.0	to	-3.0	m	
-3.0	to	-2.0	m	
-2.0	to	-1.0	m	
-1.0	to	0.0	m	

EARTHWORKS DEPTH RANGE LOWER		UPPER		COLOUR
0.0	to	1.0	m	
1.0	to	2.0	m	
2.0	to	3.0	m	
3.0	to	4.0	m	
4.0	to	5.0	m	
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9. VOLUMES CALCULATED BETWEEN EXISTING SURFACE AND PROPOSED SURFACE.

PREPARED BY
LANDMATTERS

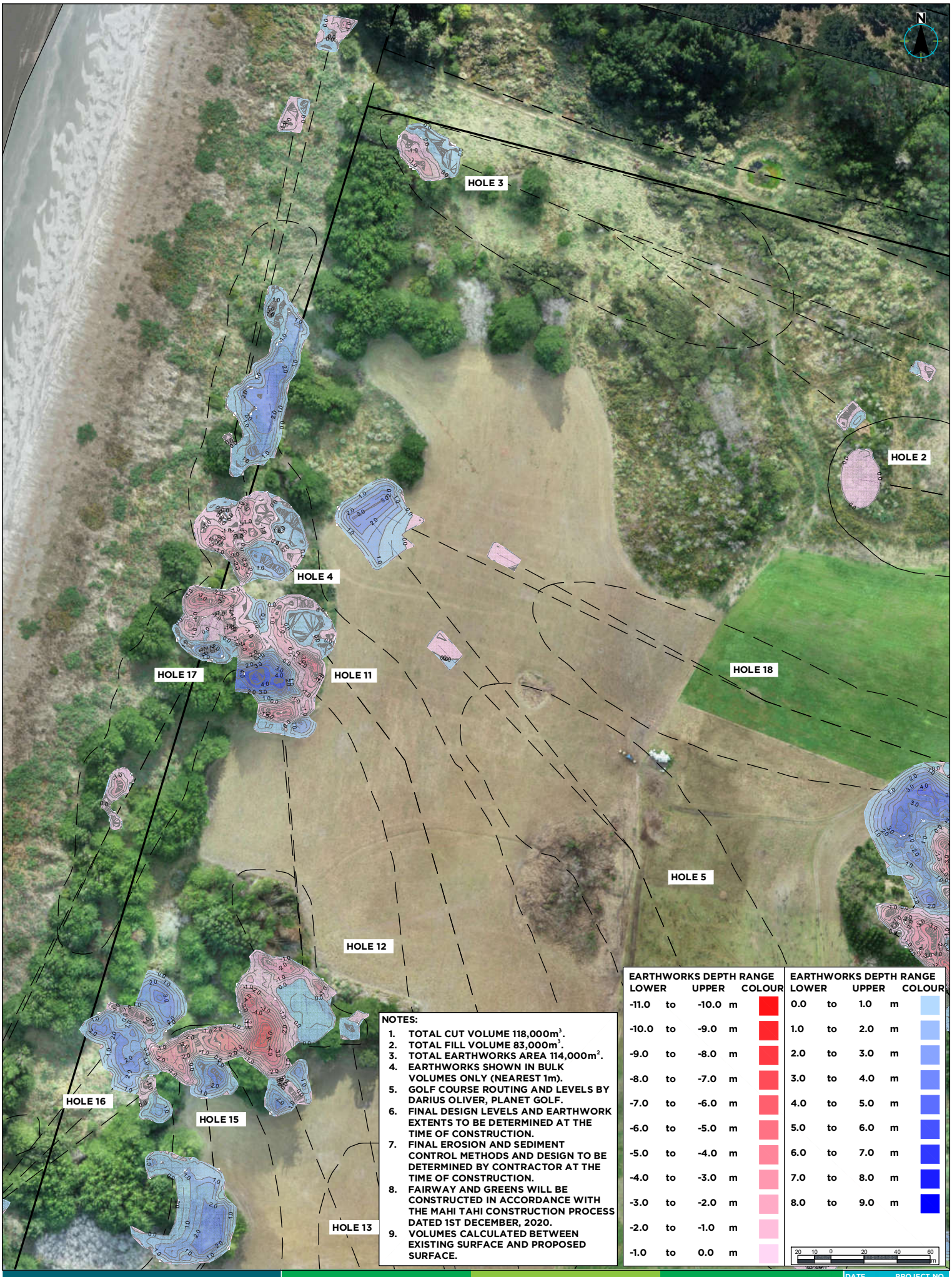
CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
OVERALL EARTHWORKS PLAN

DATE 22/12/20
PROJECT NO. 709
SCALE 1:2000 @ A1 1:4000@ A3
DRAWING NO. J709-ENG-141
REV A

C:\12dSI\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:16:39 AM



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EARTHWORKS DEPTH RANGE					EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR	LOWER		UPPER		COLOUR
-11.0	to	-10.0	m		0.0	to	1.0	m	
-10.0	to	-9.0	m		1.0	to	2.0	m	
-9.0	to	-8.0	m		2.0	to	3.0	m	
-8.0	to	-7.0	m		3.0	to	4.0	m	
-7.0	to	-6.0	m		4.0	to	5.0	m	
-6.0	to	-5.0	m		5.0	to	6.0	m	
-5.0	to	-4.0	m		6.0	to	7.0	m	
-4.0	to	-3.0	m		7.0	to	8.0	m	
-3.0	to	-2.0	m		8.0	to	9.0	m	
-2.0	to	-1.0	m						
-1.0	to	0.0	m						

20 10 0 20 40 60 m

PREPARED BY LANDMATTERS

CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

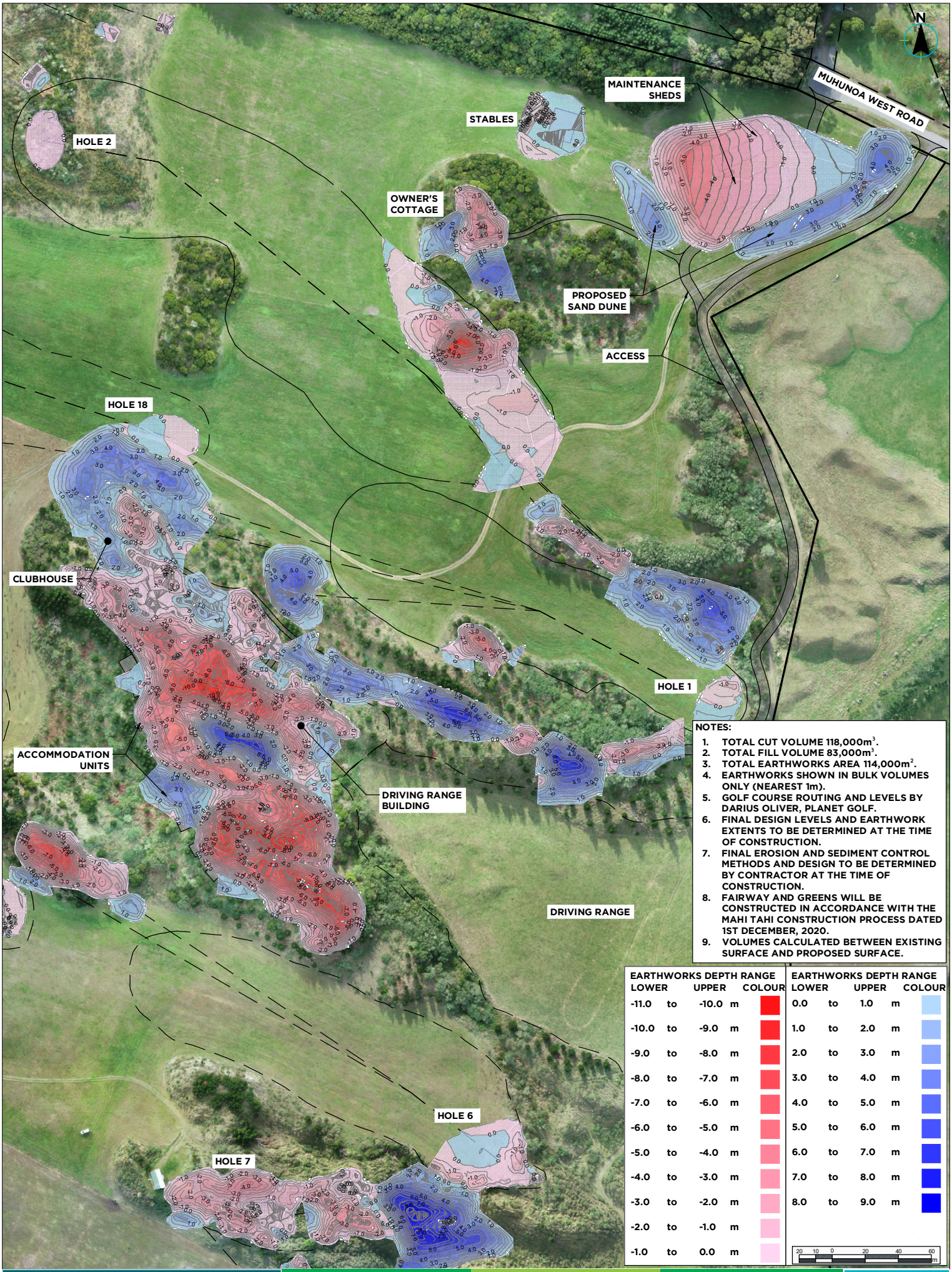
DRAWING TITLE: EARTHWORKS PLAN NORTH WEST CORNER

DATE 22/12/20 | PROJECT NO. 709

SCALE 1:1000 @ A1, 1:2000 @ A3

DRAWING NO. J709-ENG-142 | REV A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:17:01 AM



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EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR
-11.0	to	-10.0	m	
-10.0	to	-9.0	m	
-9.0	to	-8.0	m	
-8.0	to	-7.0	m	
-7.0	to	-6.0	m	
-6.0	to	-5.0	m	
-5.0	to	-4.0	m	
-4.0	to	-3.0	m	
-3.0	to	-2.0	m	
-2.0	to	-1.0	m	
-1.0	to	0.0	m	

EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR
0.0	to	1.0	m	
1.0	to	2.0	m	
2.0	to	3.0	m	
3.0	to	4.0	m	
4.0	to	5.0	m	
5.0	to	6.0	m	
6.0	to	7.0	m	
7.0	to	8.0	m	
8.0	to	9.0	m	

20 10 0 20 40 60 m

PREPARED BY LANDMATTERS

CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

DRAWING TITLE: EARTHWORKS PLAN NORTH EAST CORNER

DATE: 22/12/20

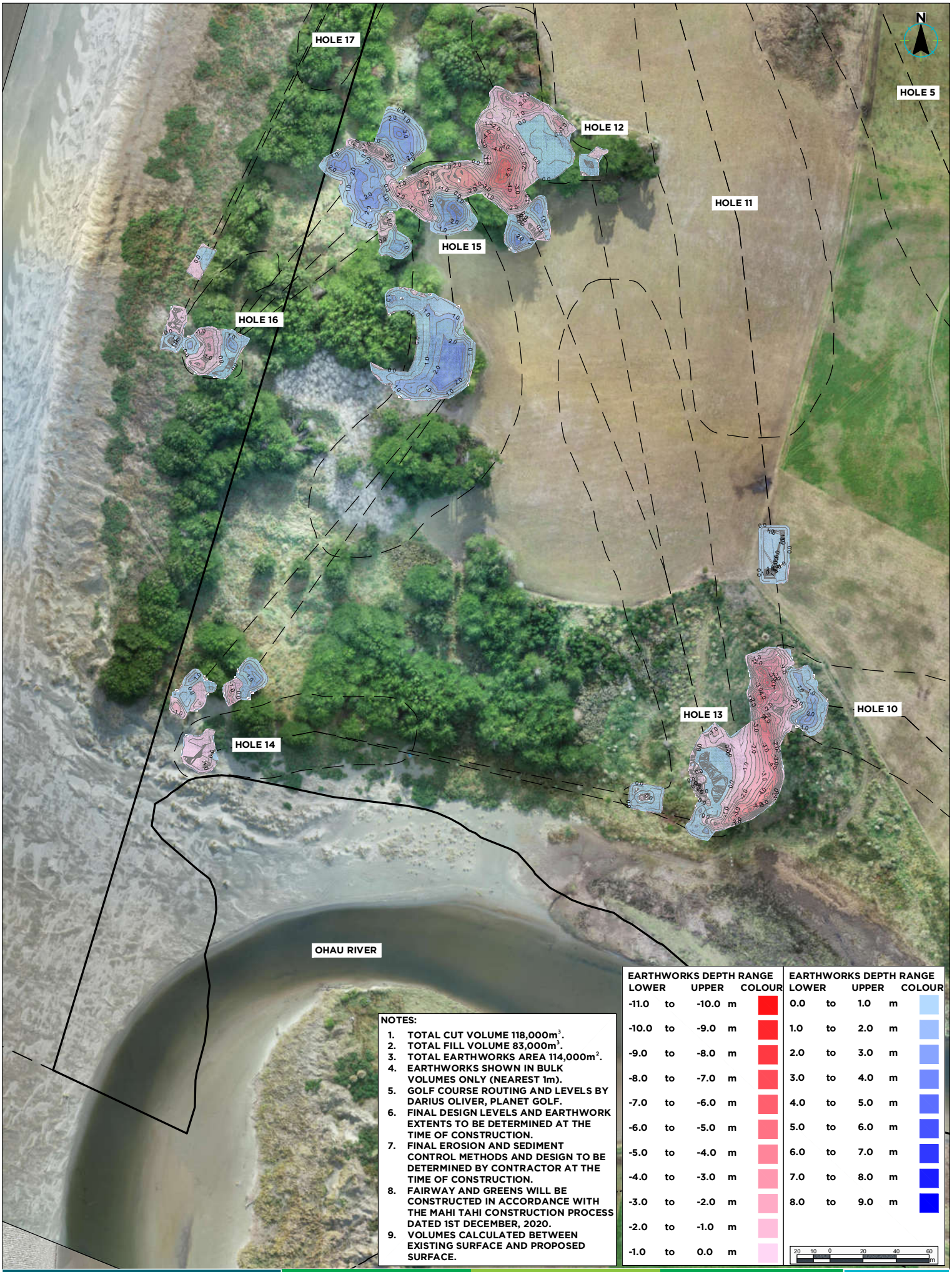
PROJECT NO.: 709

SCALE: 1:1000 @ A1, 1:2000 @ A3

DRAWING NO.: J709-ENG-143

REV: A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:17:24 AM



EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR
-11.0	to	-10.0	m	
-10.0	to	-9.0	m	
-9.0	to	-8.0	m	
-8.0	to	-7.0	m	
-7.0	to	-6.0	m	
-6.0	to	-5.0	m	
-5.0	to	-4.0	m	
-4.0	to	-3.0	m	
-3.0	to	-2.0	m	
-2.0	to	-1.0	m	
-1.0	to	0.0	m	

EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR
0.0	to	1.0	m	
1.0	to	2.0	m	
2.0	to	3.0	m	
3.0	to	4.0	m	
4.0	to	5.0	m	
5.0	to	6.0	m	
6.0	to	7.0	m	
7.0	to	8.0	m	
8.0	to	9.0	m	

20 10 0 20 40 60 m

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PREPARED BY
LANDMATTERS

CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
EARTHWORKS PLAN SOUTH WEST CORNER

DATE 22/12/20
PROJECT NO. 709
SCALE 1:1000 @ A1 1:2000 @ A3
DRAWING NO. J709-ENG-144
REV A

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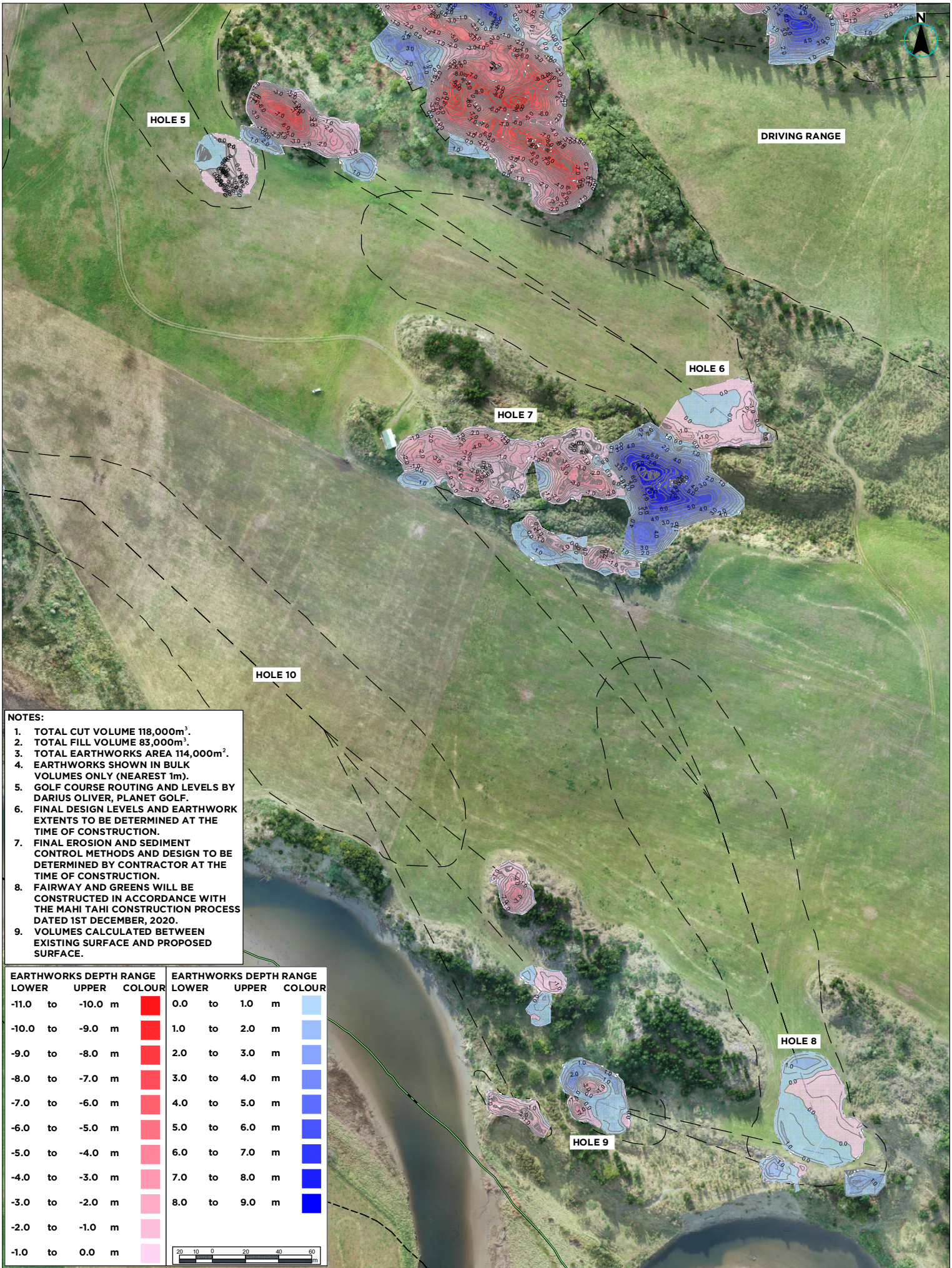

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EARTHWORKS DEPTH RANGE					EARTHWORKS DEPTH RANGE				
LOWER		UPPER		COLOUR	LOWER		UPPER		COLOUR
-11.0	to	-10.0	m		0.0	to	1.0	m	
-10.0	to	-9.0	m		1.0	to	2.0	m	
-9.0	to	-8.0	m		2.0	to	3.0	m	
-8.0	to	-7.0	m		3.0	to	4.0	m	
-7.0	to	-6.0	m		4.0	to	5.0	m	
-6.0	to	-5.0	m		5.0	to	6.0	m	
-5.0	to	-4.0	m		6.0	to	7.0	m	
-4.0	to	-3.0	m		7.0	to	8.0	m	
-3.0	to	-2.0	m		8.0	to	9.0	m	
-2.0	to	-1.0	m						
-1.0	to	0.0	m						

20 10 0 20 40 60 m

PREPARED BY LANDMATTERS

CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

DRAWING TITLE: EARTHWORKS PLAN SOUTH EAST CORNER

DATE	PROJECT NO.
22/12/20	709
SCALE	1:1000 @ A1 1:2000 @ A3
DRAWING NO.	REV
J709-ENG-145	A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:18:00 AM

PREPARED BY LANDMATTERS

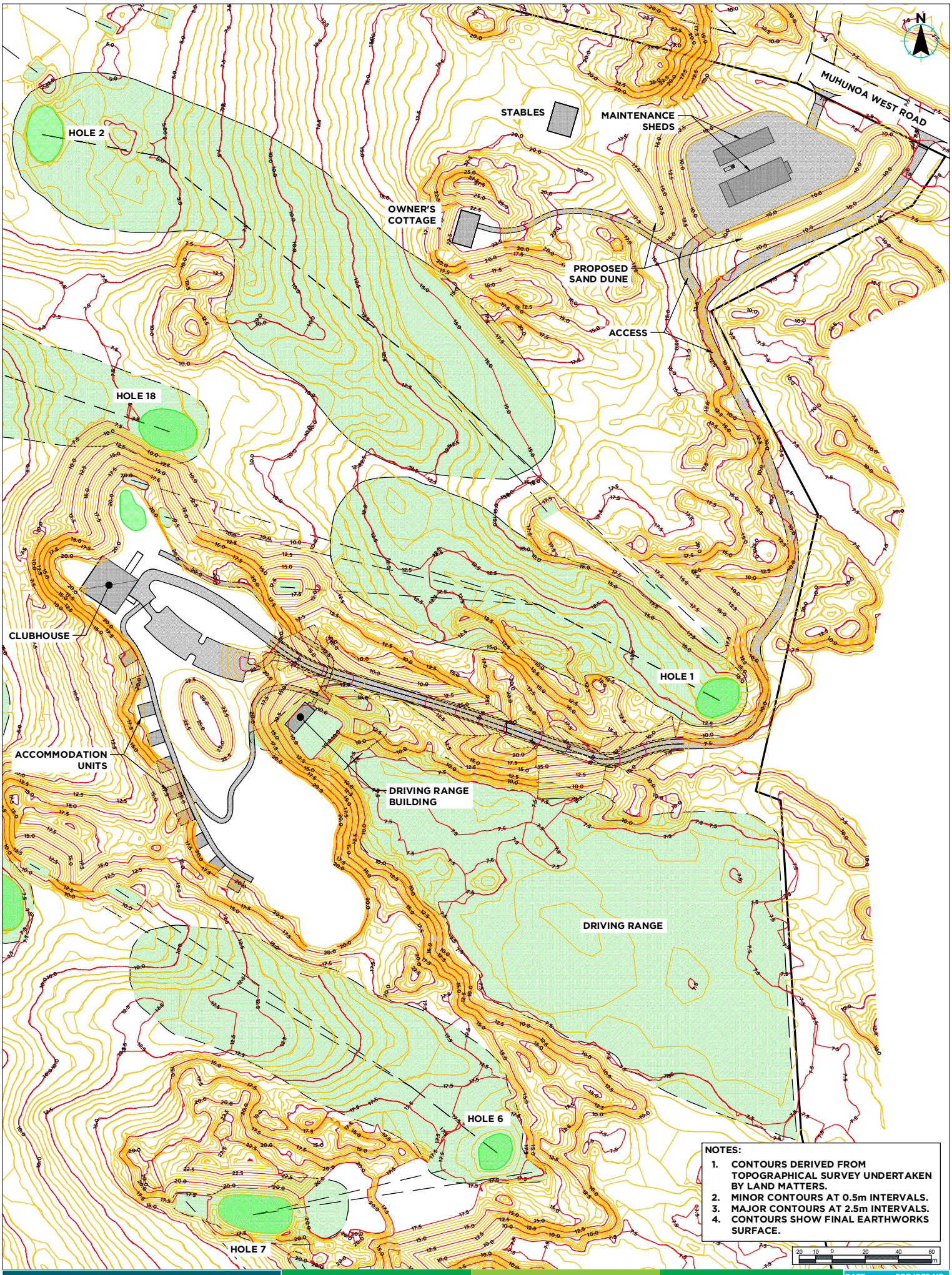
CLIENT: GRENADIER DEVELOPMENTS LIMITED

PROJECT: DOUGLAS LINKS - OHAU

DRAWING TITLE: FINAL INDICATIVE CONTOURS NORTH WEST CORNER

DATE	PROJECT NO.
22/12/20	709
SCALE	1:1000 @ A1 1:2000 @ A3
DRAWING NO.	REV
J709-ENG-146	A

C:\12dSI\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:18:14 AM



NOTES:

1. CONTOURS DERIVED FROM TOPOGRAPHICAL SURVEY UNDERTAKEN BY LAND MATTERS.
2. MINOR CONTOURS AT 0.5m INTERVALS.
3. MAJOR CONTOURS AT 2.5m INTERVALS.
4. CONTOURS SHOW FINAL EARTHWORKS SURFACE.

20 10 0 20 40 60 m

PREPARED BY
LANDMATTERS

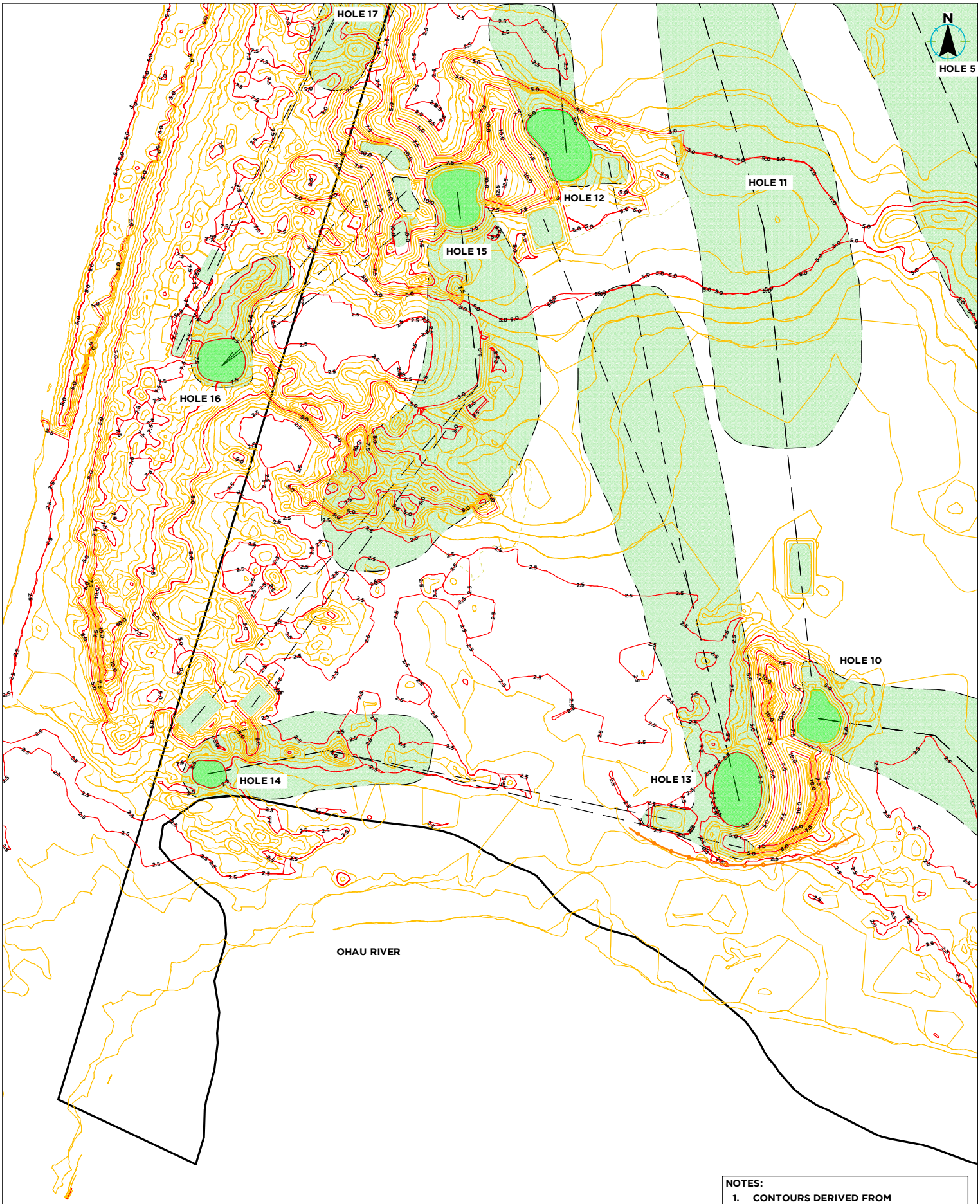
CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
FINAL INDICATIVE CONTOURS NORTH EAST CORNER

DATE 22/12/20
PROJECT NO. 709
SCALE 1:1000 @ A1 1:2000 @ A3
DRAWING NO. J709-ENG-147
REV A

C:\12dSI\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:18:25 AM



NOTES:

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4. CONTOURS SHOW FINAL EARTHWORKS SURFACE.

20 10 0 20 40 60 m

PREPARED BY
LANDMATTERS

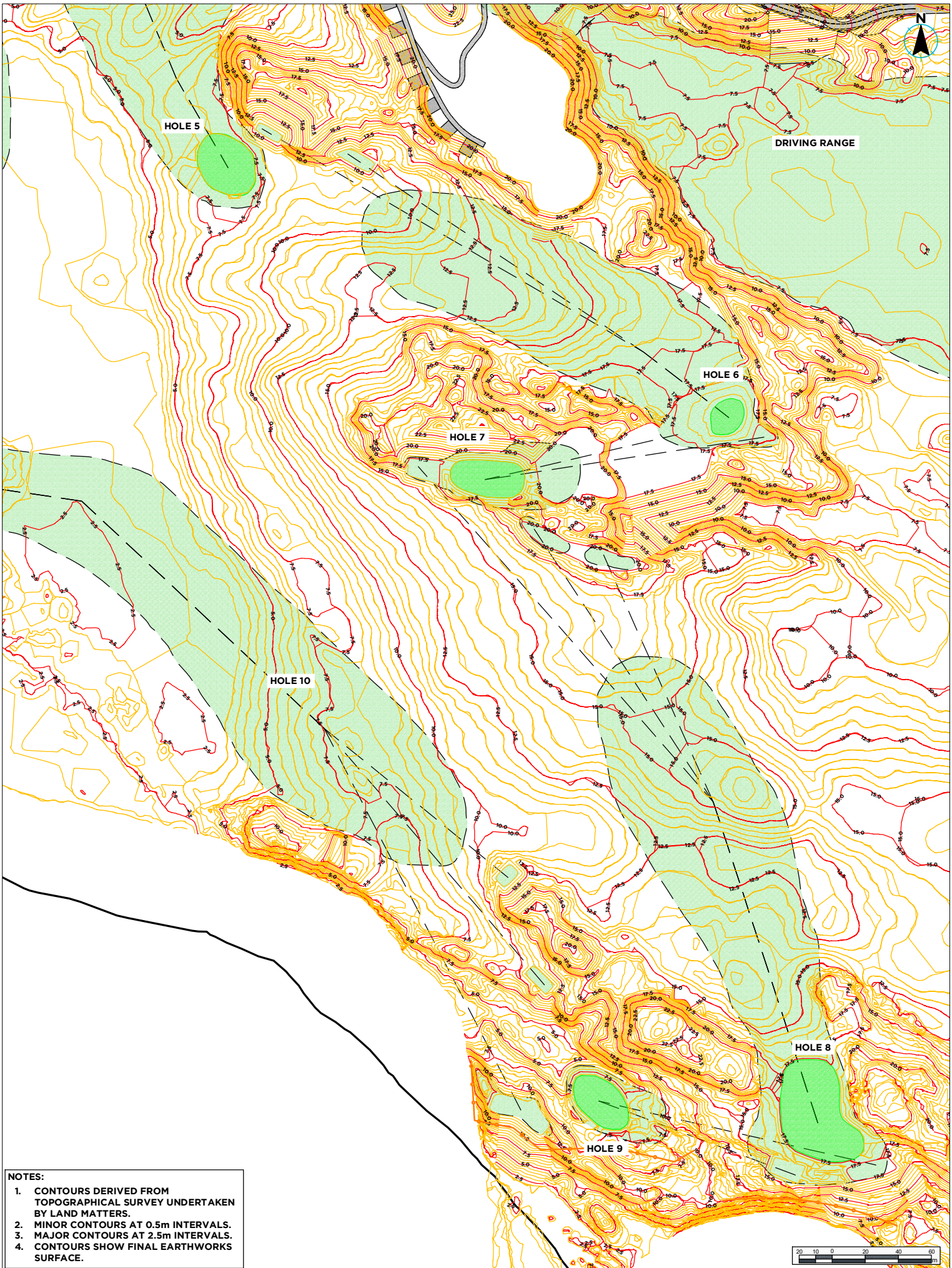
CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
FINAL INDICATIVE EARTHWORKS SOUTH WEST CORNER

DATE 22/12/20
PROJECT NO. 709
SCALE 1:1000 @ A1 1:2000 @ A3
DRAWING NO. J709-ENG-148
REV A

C:\12dS\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:18:38 AM



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2. MINOR CONTOURS AT 0.5m INTERVALS.
3. MAJOR CONTOURS AT 2.5m INTERVALS.
4. CONTOURS SHOW FINAL EARTHWORKS SURFACE.

PREPARED BY
LANDMATTERS

CLIENT
GRENADIER DEVELOPMENTS LIMITED

PROJECT
DOUGLAS LINKS - OHAU

DRAWING TITLE
FINAL INDICATIVE EARTHWORKS SOUTH EAST CORNER

DATE 22/12/20
PROJECT NO. 709
SCALE 1:1000 @ A1 1:2000 @ A3
DRAWING NO. J709-ENG-149
REV A

C:\12dSI\12dSWorkspace\data\LM-DATA\709 - Grenadier Developments Limited - Douglas Links - Ohau_786\10 Plans, Aerials, CAD\Plans\ENG For RC - 2020-12-18.dwg, Plotted by Dan Turner at 21/12/2020 8:18:49 AM

APPENDIX B – Flow Routing Calculations

Rain tank - Flow routing analysis for Owner's Cottage

Determine Temporary Storage Zone Requirements

(A) Site Data			
Soil type:	sand		
Areas:			C Value
Roof and impervious	250	m^2	0.9
Pervious area	250	m^2	0.4
(B) Tank details			
Orifice diameter calculation			
$Q=3.47 \times C_d \times d^2 \times h^{0.5}$			
Tank radius	1.75	m	
Number of tanks	2	ea	
Combined tank area	19.2	m^2	
Depth to overflow	2.50		
Depth to outlet	2.30		
Max head height	0.20	m	
Tank volume	3.85	m^3	
Orifice diam (max), d	0.03	m	
Orifice diam sqared, d^2	0.0009	m^2	
Orficie discharge coef	0.69	Cd	
Orfice area	0.0007	m^2	
Peak flow	1.0	l/s	
(c) Hydrology - by rational method			
Tc	10	min	
Storm duration	10	min	
Rainfall I (10% AEP)	89.44	mm/hr	
	C value	Peak discharge	
Pre development	0.4	2.5	l/s
Post development	0.9	5.6	l/s

		Tank inflow	Tank		Adjusted	Tank		Net device	Site runoff cals	
Time	Tank inflow	volume	Storage	Tank WL	Av WL	Outflow	Outflow vol	Storage	R-o-S	Total
mins	l/s	m^3	m^3	m	m	l/s	m^3	m^3	l/s	l/s
t	A	$B=A_{av}*t$	$C=G_{t-1}+B$	E=C/Area		F	$F*t$	$G=C-F*t$	H	I=F+H
0	0.00	0.00	0	0	0	0	0	0	0.0	0.0
2.5	1.40	0.10	0.105	0.005	0.003	0.112	0.017	0.088	0.0	0.1
5	2.79	0.31	0.402	0.021	0.013	0.247	0.074	0.328	0.0	0.2
7.5	4.19	0.52	0.852	0.044	0.033	0.389	0.175	0.677	0.0	0.4
10	5.59	0.73	1.411	0.073	0.059	0.523	0.314	1.097	0.0	0.5
12.5	4.19	0.73	1.831	0.095	0.084	0.625	0.469	1.362	0.0	0.6
15	2.79	0.52	1.886	0.098	0.097	0.670	0.603	1.283	0.0	0.7
17.5	1.40	0.31	1.598	0.083	0.091	0.648	0.681	0.917	0.0	0.6
20	0.00	0.10	1.022	0.053	0.068	0.562	0.675	0.347	0.0	0.6
22.5	0	0.00	0.347							

Result:		
Tank area	19.2	m^2
Max water level	0.10	m
Orifice diameter	0.03	m
Temp storage req'd, V	1.9	m^3
Temp storage provided	3.8	m^3

Determine Potable Water Storage Zone Requirements

Inputs		
Roof area	250	m^2
No. of people	4	
Per capita use	145	l/p/d
Non summer	580	l/d
Summer	58	l/d
Total summer	638	l/d
Target % demand from tank	100	%
Rainfall loss factor	0.8	SDPR

	Ave rainfall	**Inflow**	Days in	Outflow	**Difference**	**Net storage**
	NIWA	**Total**		dwelling		
	(mm)	**m^3**	month	m^3	**m^3**	**m^3**
						8.2
January	76	**15.2**	31	19.8	**-4.6**	**3.6**
February	77	**15.4**	28	17.9	**-2.5**	**1.2**
March	93	**18.6**	31	19.8	**-1.2**	**0.0**
April	96	**19.2**	30	17.4	**1.8**	**1.8**
May	112	**22.4**	31	18.0	**4.4**	**6.2**
June	106	**21.2**	30	17.4	**3.8**	**10.0**
July	98	**19.6**	31	18.0	**1.6**	**11.6**
August	100	**20.0**	31	18.0	**2.0**	**13.6**
September	93	**18.6**	30	17.4	**1.2**	**14.8**
October	99	**19.8**	31	18.0	**1.8**	**16.7**
November	90	**18.0**	30	17.4	**0.6**	**17.3**
December	78	**15.6**	31	19.8	**-4.2**	**13.1**
Total	1118	**223.6**	365	218.718		**17.3**
		Minimum permanent storage required				**9.1**

Tank sizing

Total storage required, T:		
Temporary storage (attenuation), V	3.8	m^3
Potable water invert height	0.8	m
Permanent storage required, S	17.3	m^3
Permanent storage provided, S	28.9	m^3
Firefighting outlet invert height	0.1	m
Firefighting storage	13.5	m^3
Dead storage, D	1.9	m^3
Total tank capacity	48.1	m^3

Top overflow pipe diameter, F		
Design discharge, Q = 0.00028 x A x I_2		
A, roof area	250	m^2
I_2, 2% AEP rainfall for 10min storm	125.28	mm/hr
Design discharge, Q	8.8	l/s
Q = 3470 x C_d x X d^2 x $h^{0.5}$		
C_d	0.65	
Head h equals pipe diameter	0.11	m
Solve for d =SQRT (Q /(3470 xC_dx$h^{0.5}$))	0.11	m
Difference	0.00	m

Recommend using 2 x 25,000 litre rain tanks			
Devan 25,000 litre rain tank (or similar) design parameters			
Number of tanks	2	no.	
Tank diameter	3.5	m	
Radius	1.75	m	
Base area (total)	19.2	m^2	
Overflow pipe height	2.50	m	
Overflow pipe diam (min.)	0.11	m	
Orifice diameter (max.)	0.030	m	
Orifice height (temp. storage)	2.30	m	
Temporary storage provided	3.8	m^3	
Outlet height (potable water)	0.8	m	
Permanent storage provided	28.9	m^3	25,000 litres minimum water storage requirement as per HDC SDPR, Section 12.4
Fire fighting outlet pipe height	0.1	m	
Firefighting storage	13.5	m^3	7,000 litres for a dwelling with a sprinkler system, 45,000 litres if no sprinkler system
Dead storage at base of tanks	1.9	m^3	
Total of four volumes	48.1	m^3	
Total tank storage	48.1	m^3	

Rain tank - Flow routing analysis for Stables

Determine Temporary Storage Zone Requirements

(A) Site Data			
Soil type:	sand		
Areas:			C Value
Roof and impervious	216	m^2	0.9
Pervious area	216	m^2	0.4
(B) Tank details			
Orifice diameter calculation			
$Q=3.47 \times C_d \times d^2 \times h^{0.5}$			
Tank radius	1.75	m	
Number of tanks	1	ea	
Combined tank area	9.6	m^2	
Depth to overflow	2.50		
Depth to outlet	2.30		
Max head height	0.20	m	
Tank volume	1.92	m^3	
Orifice diam (max), d	0.03	m	
Orifice diam sqared, d^2	0.0009	m^2	
Orficie discharge coef	0.69	Cd	
Orfice area	0.0007	m^2	
Peak flow	1.0	l/s	
(c) Hydrology - by rational method			
Tc	10	min	
Storm duration	10	min	
Rainfall I (10% AEP)	89.44	mm/hr	
	C value	Peak discharge	
Pre development	0.4	2.1	l/s
Post development	0.9	4.8	l/s

		Tank inflow	Tank		Adjusted	Tank		Net device	Site runoff cals	
Time	Tank inflow	volume	Storage	Tank WL	Av WL	Outflow	Outflow vol	Storage	R-o-S	Total
mins	l/s	m^3	m^3	m	m	l/s	m^3	m^3	l/s	l/s
t	A	$B=A_{av}*t$	$C=G_{t-1}+B$	E=C/Area		F	$F*t$	$G=C-F*t$	H	I=F+H
0	0.00	0.00	0	0	0	0	0	0	0.0	0.0
2.5	1.21	0.09	0.091	0.009	0.005	0.148	0.022	0.068	0.0	0.1
5	2.41	0.27	0.340	0.035	0.022	0.322	0.097	0.243	0.0	0.3
7.5	3.62	0.45	0.696	0.072	0.054	0.500	0.225	0.471	0.0	0.5
10	4.83	0.63	1.105	0.115	0.094	0.659	0.396	0.709	0.0	0.7
12.5	3.62	0.63	1.343	0.140	0.127	0.769	0.576	0.767	0.0	0.8
15	2.41	0.45	1.220	0.127	0.133	0.786	0.708	0.512	0.0	0.8
17.5	1.21	0.27	0.783	0.081	0.104	0.695	0.730	0.053	0.0	0.7
20	0.00	0.09	0.144	0.015	0.048	0.473	0.568	-0.424	0.0	0.5
22.5	0	0.00	-0.424							

Result:		
Tank area	9.6	m^2
Max water level	0.14	m
Orifice diameter	0.03	m
Temp storage req'd, V	1.3	m^3
Temp storage provided	1.9	m^3

Determine Potable Water Storage Zone Requirements

Inputs		
Roof area	216	m^2
Water use	400	l/d
Target % demand from tank	100	%
Rainfall loss factor	0.8	SDPR

	Ave rainfall	**Inflow**	Days in	Outflow	**Difference**	**Net storage**
	NIWA	**Total**		stables		
	(mm)	**m^3**	month	m^3	**m^3**	**m^3**
	NIWA					**0.0**
January	76	**13.1**	31	12.4	**0.7**	**0.7**
February	77	**13.3**	28	11.2	**2.1**	**2.8**
March	93	**16.1**	31	12.4	**3.7**	**6.5**
April	96	**16.6**	30	12.0	**4.6**	**11.1**
May	112	**19.4**	31	12.4	**7.0**	**18.1**
June	106	**18.3**	30	12.0	**6.3**	**24.4**
July	98	**16.9**	31	12.4	**4.5**	**28.9**
August	100	**17.3**	31	12.4	**4.9**	**33.8**
September	93	**16.1**	30	12.0	**4.1**	**37.9**
October	99	**17.1**	31	12.4	**4.7**	**42.6**
November	90	**15.6**	30	12.0	**3.6**	**46.1**
December	78	**13.5**	31	12.4	**1.1**	**47.2**
Total	1118	**193.2**	365	146		**0.7**
		Minimum permanent storage required				**0.7**

Tank sizing

Total storage required, T:		
Temporary storage, V	1.9	m^3
Permanent storage required, S	0.7	m^3
Permanent storage provided, S	21.2	m^3
Dead storage, D	1.0	m^3
Total tank storage	24.1	m^3

Top overflow pipe diameter, F		
Design discharge, Q = 0.00028 x A x I_2		
A, roof area	216	m^2
I_2, 2% AEP rainfall for 10min storm	125.28	mm/hr
Design discharge, Q	7.6	l/s
Q = 3470 x C_d x X d^2 x $h^{0.5}$		
C_d	0.65	
Head h equals pipe diameter	0.10	m
Solve for d =SQRT (Q /(3470 xC_dx$h^{0.5}$))	0.10	m
Difference	0.00	m

Recommend using 3 x 25,000 litre rain tanks		
Devan 25,000 litre rain tank (or similar) design parameters		
Number of tanks	1	no.
Tank diameter	3.5	m
Radius	1.75	m
Base area (total)	9.6	m^2
Overflow pipe height	2.50	m
Overflow pipe diam (min.)	0.10	m
Orifice diameter (max.)	0.030	m
Orifice height (temp. storage)	2.30	m
Temporary storage provided	1.9	m^3
Outlet height (potable water)	0.1	m
Permanent storage provided	21.2	m^3
Dead storage at base of tanks	1.0	m^3
Total of three volumes	24.1	m^3
Total tank storage	24.1	m^3

Rain tank - Flow routing analysis for the Small Maintenance Shed

Determine Temporary Storage Zone Requirements

(A) Site Data			
Soil type:	sand		
Areas:			C Value
Roof and impervious	360	m^2	0.9
Pervious area	360	m^2	0.4
(B) Tank details			
Orifice diameter calculation			
$Q=3.47 \times C_d \times d^2 \times h^{0.5}$			
Tank radius	1.75	m	
Number of tanks	2	ea	
Combined tank area	19.2	m^2	
Depth to overflow	2.50		
Depth to outlet	2.20		
Max head height	0.30	m	
Tank volume	5.77	m^3	
Orifice diam (max), d	0.03	m	
Orifice diam sqared, d^2	0.0009	m^2	
Orficie discharge coef	0.69	Cd	
Orfice area	0.0007	m^2	
Peak flow	1.2	l/s	
(c) Hydrology - by rational method			
Tc	10	min	
Storm duration	10	min	
Rainfall I (10% AEP)	89.44	mm/hr	
	C value	Peak discharge	
Pre development	0.4	3.6	l/s
Post development	0.9	8.0	l/s

		Tank inflow	Tank		Adjusted	Tank		Net device	Site runoff cals	
Time	Tank inflow	volume	Storage	Tank WL	Av WL	Outflow	Outflow vol	Storage	R-o-S	Total
mins	l/s	m^3	m^3	m	m	l/s	m^3	m^3	l/s	l/s
t	A	$B=A_{av}*t$	$C=G_{t-1}+B$	E=C/Area		F	$F*t$	$G=C-F*t$	H	I=F+H
0	0.00	0.00	0	0	0	0	0	0	0.0	0.0
2.5	2.01	0.15	0.151	0.008	0.004	0.135	0.020	0.131	0.0	0.1
5	4.02	0.45	0.583	0.030	0.019	0.298	0.089	0.494	0.0	0.3
7.5	6.04	0.75	1.249	0.065	0.048	0.470	0.212	1.037	0.0	0.5
10	8.05	1.06	2.094	0.109	0.087	0.635	0.381	1.713	0.0	0.6
12.5	6.04	1.06	2.769	0.144	0.126	0.766	0.574	2.195	0.0	0.8
15	4.02	0.75	2.949	0.153	0.149	0.831	0.748	2.202	0.0	0.8
17.5	2.01	0.45	2.654	0.138	0.146	0.822	0.863	1.791	0.0	0.8
20	0.00	0.15	1.942	0.101	0.119	0.745	0.894	1.048	0.0	0.7
22.5	0	0.00	1.048							

Result:		
Tank area	19.2	m^2
Max water level	0.15	m
Orifice diameter	0.03	m
Temp storage req'd, V	2.9	m^3
Temp storage provided	5.8	m^3

Determine Potable Water Storage Zone Requirements

Inputs		
Roof area	360	m^2
Water use	800	l/d
Target % demand from tank	100	%
Rainfall loss factor	0.8	SDPR

	Ave rainfall	**Inflow**	Days in	Outflow	**Difference**	**Net storage**
	NIWA	**Total**		main shed		
	(mm)	**m^3**	month	m^3	**m^3**	**m^3**
	NIWA					**0.0**
January	76	**21.9**	31	24.8	**-2.9**	**-2.9**
February	77	**22.2**	28	22.4	**-0.2**	**-3.1**
March	93	**26.8**	31	24.8	**2.0**	**-1.2**
April	96	**27.6**	30	24.0	**3.6**	**2.5**
May	112	**32.3**	31	24.8	**7.5**	**10.0**
June	106	**30.5**	30	24.0	**6.5**	**16.5**
July	98	**28.2**	31	24.8	**3.4**	**19.9**
August	100	**28.8**	31	24.8	**4.0**	**23.9**
September	93	**26.8**	30	24.0	**2.8**	**26.7**
October	99	**28.5**	31	24.8	**3.7**	**30.4**
November	90	**25.9**	30	24.0	**1.9**	**32.3**
December	78	**22.5**	31	24.8	**-2.3**	**30.0**
Total	1118	**322.0**	365	292.0		**32.3**
		Minimum permanent storage required				**32.3**

Tank sizing

Total storage required, T:		
Temporary storage, V	5.8	m^3
Permanent storage required, S	32.3	m^3
Permanent storage provided, S	40.4	m^3
Dead storage, D	1.9	m^3
Total tank storage	48.1	m^3

Top overflow pipe diameter, F		
Design discharge, Q = 0.00028 x A x I_2		
A, roof area	360	m^2
I_2, 2% AEP rainfall for 10min storm	125.28	mm/hr
Design discharge, Q	12.6	l/s
Q = 3470 x C_d x X d^2 x $h^{0.5}$		
C_d	0.65	
Head h equals pipe diameter	0.13	m
Solve for d =SQRT (Q /(3470 xC_dx$h^{0.5}$))	0.13	m
Difference	0.00	m

Recommend using 3 x 25,000 litre rain tanks		
Devan 25,000 litre rain tank (or similar) design parameters		
Number of tanks	2	no.
Tank diameter	3.5	m
Radius	1.75	m
Base area (total)	19.2	m^2
Overflow pipe height	2.50	m
Overflow pipe diam (min.)	0.13	m
Orifice diameter (max.)	0.030	m
Orifice height (temp. storage)	2.20	m
Temporary storage provided	5.8	m^3
Outlet height (potable water)	0.1	m
Permanent storage provided	40.4	m^3
Dead storage at base of tanks	1.9	m^3
Total of three volumes	48.1	m^3
Total tank storage	48.1	m^3

Rain tank - Flow routing analysis for the Large Maintenance Shed

Determine Temporary Storage Zone Requirements

(A) Site Data			
Soil type:	sand		
Areas:			C Value
Roof and impervious	540	m^2	0.9
Pervious area	540	m^2	0.4
(B) Tank details			
Orifice diameter calculation			
$Q=3.47 \times C_d \times d^2 \times h^{0.5}$			
Tank radius	1.75	m	
Number of tanks	2	ea	
Combined tank area	19.2	m^2	
Depth to overflow	2.50		
Depth to outlet	2.20		
Max head height	0.30	m	
Tank volume	5.77	m^3	
Orifice diam (max), d	0.03	m	
Orifice diam sqared, d^2	0.0009	m^2	
Orficie discharge coef	0.69	Cd	
Orfice area	0.0007	m^2	
Peak flow	1.2	l/s	
(c) Hydrology - by rational method			
Tc	10	min	
Storm duration	10	min	
Rainfall I (10% AEP)	89.44	mm/hr	
	C value	Peak discharge	
Pre development	0.4	5.4	l/s
Post development	0.9	12.1	l/s

		Tank inflow	Tank		Adjusted	Tank		Net device	Site runoff cals	
Time	Tank inflow	volume	Storage	Tank WL	Av WL	Outflow	Outflow vol	Storage	R-o-S	Total
mins	l/s	m^3	m^3	m	m	l/s	m^3	m^3	l/s	l/s
t	A	$B=A_{av}*t$	$C=G_{t-1}+B$	E=C/Area		F	$F*t$	$G=C-F*t$	H	I=F+H
0	0.00	0.00	0	0	0	0	0	0	0.0	0.0
2.5	3.02	0.23	0.226	0.012	0.006	0.165	0.025	0.202	0.0	0.2
5	6.04	0.68	0.881	0.046	0.029	0.365	0.110	0.771	0.0	0.4
7.5	9.06	1.13	1.903	0.099	0.072	0.580	0.261	1.642	0.0	0.6
10	12.07	1.58	3.227	0.168	0.133	0.787	0.472	2.755	0.0	0.8
12.5	9.06	1.58	4.340	0.226	0.197	0.955	0.717	3.623	0.0	1.0
15	6.04	1.13	4.755	0.247	0.236	1.048	0.943	3.812	0.0	1.0
17.5	3.02	0.68	4.491	0.233	0.240	1.056	1.109	3.382	0.0	1.1
20	0.00	0.23	3.609	0.188	0.210	0.989	1.186	2.422	0.0	1.0
22.5	0	0.00	2.422							

Result:		
Tank area	19.2	m^2
Max water level	0.25	m
Orifice diameter	0.03	m
Temp storage req'd, V	4.8	m^3
Temp storage provided	5.8	m^3

Determine Potable Water Storage Zone Requirements

Inputs		
Roof area	540	m^2
Water use	1200	l/d
Target % demand from tank	100	%
Rainfall loss factor	0.8	SDPR

	Ave rainfall	**Inflow**	Days in	Outflow	**Difference**	**Net storage**
	NIWA	**Total**		main shed		
	(mm)	**m^3**	month	m^3	**m^3**	**m^3**
	NIWA					**0.0**
January	76	**32.8**	31	37.2	**-4.4**	**-4.4**
February	77	**33.3**	28	33.6	**-0.3**	**-4.7**
March	93	**40.2**	31	37.2	**3.0**	**-1.7**
April	96	**41.5**	30	36.0	**5.5**	**3.7**
May	112	**48.4**	31	37.2	**11.2**	**14.9**
June	106	**45.8**	30	36.0	**9.8**	**24.7**
July	98	**42.3**	31	37.2	**5.1**	**29.9**
August	100	**43.2**	31	37.2	**6.0**	**35.9**
September	93	**40.2**	30	36.0	**4.2**	**40.0**
October	99	**42.8**	31	37.2	**5.6**	**45.6**
November	90	**38.9**	30	36.0	**2.9**	**48.5**
December	78	**33.7**	31	37.2	**-3.5**	**45.0**
Total	1118	**483.0**	365	438.0		**48.5**
		Minimum permanent storage required				**48.5**

Tank sizing

Total storage required, T:		
Temporary storage, V	5.8	m^3
Permanent storage required, S	48.5	m^3
Permanent storage provided, S	40.4	m^3
Dead storage, D	1.9	m^3
Total tank storage	48.1	m^3

Some water will be released to ground during the wetter months.

Top overflow pipe diameter, F		
Design discharge, Q = 0.00028 x A x I_2		
A, roof area	540	m^2
I_2, 2% AEP rainfall for 10min storm	125.28	mm/hr
Design discharge, Q	18.9	l/s
Q = 3470 x C_d x X d^2 x $h^{0.5}$		
C_d	0.65	
Head h equals pipe diameter	0.15	m
Solve for d =SQRT (Q /(3470 xC_dx$h^{0.5}$))	0.15	m
Difference	0.00	m

Recommend using 3 x 25,000 litre rain tanks		
Devan 25,000 litre rain tank (or similar) design parameters		
Number of tanks	2	no.
Tank diameter	3.5	m
Radius	1.75	m
Base area (total)	19.2	m^2
Overflow pipe height	2.50	m
Overflow pipe diam (min.)	0.15	m
Orifice diameter (max.)	0.030	m
Orifice height (temp. storage)	2.20	m
Temporary storage provided	5.8	m^3
Outlet height (potable water)	0.1	m
Permanent storage provided	40.4	m^3
Dead storage at base of tanks	1.9	m^3
Total of three volumes	48.1	m^3
Total tank storage	48.1	m^3

APPENDIX C – Test Pit Logs

LANDMATTERS

LOG OF TEST PIT TP01
Existing access near gate to Muhunoa West Road
Geotechnical investigations

765 Muhunoa West Road, Ohau

Client: Grenadier Developments
Date: 24/11/2020
Digger type / size: N/A
Location: Near entrance

Logged by: DT SN
Auger size: 100mm
Existing ground level: 8.0m RL
Max test pit depth: 0.9m

Depth (m)	Material	Excavatability (Relative scale) Easier–Harder	USCS Symbol	Description	Graphic symbol	Water Level	Moisture Cond.	Consistency / Density Index	Scala Penetrometer Blows per 100mm (2 4 6 8 10)
0.25	Sand		SP	Grey Sand		Not encountered	Slightly Moist	Loose	
0.5									
0.75									
				Required depth reached					
1.0									
1.25									
1.5									
1.75									

LANDMATTERS

LOG OF TEST PIT TP02
Maintenance Sheds
Geotechnical investigations

765 Muhunoa West Road, Ohau

Client: Grenadier Developments
Date: 24/11/2020
Digger type / size: N/A
Location: Maintenance sheds

Logged by: DT SN
Auger size: 0.1m
Existing ground level: 11.0m RL
Max test pit depth: 0.875m

Depth (m)	Material	Excavatability (Relative scale) Easier–Harder	USCS Symbol	Description	Graphic symbol	Water Level	Moisture Cond.	Consistency / Density Index	Scala Penetrometer Blows per 100mm (2 4 6 8 10)
0.25	Sand		SP	Grey Sand		Not encountered	Dry / Slightly Moist	Loose	
0.5									
0.75									
1.0									
1.25									
1.5									
1.75									
1.9									

Required depth reached

LANDMATTERS

LOG OF TEST PIT TP03
Owner's Cottage
Geotechnical investigations

765 Muhunoa West Road, Ohau

Client: Grenadier Developments
Date: 24/11/2020
Digger type / size: N/A
Location: Owner's Cottage

Logged by: DT SN
Auger size: 0.1m
Existing ground level: 20.0m RL
Max test pit depth: 1.5m

Depth (m)	Material	Excavatability (Relative scale) Easier–Harder	USCS Symbol	Description	Graphic symbol	Water Level	Moisture Cond.	Consistency / Density Index	Scala Penetrometer Blows per 100mm (2 4 6 8 10)
0.25	Sand		SP	Grey Brown Sand		Not encountered	Dry / Slightly Moist	Loose	
0.5									
0.75									
1.0									
1.25									
1.5									

Required depth reached

LANDMATTERS

LOG OF TEST PIT TP05
Driving range and trickle field
Geotechnical investigations

119 Rangiuru Road,
Otaki Beach

Client: Grenadier Developments
Date: 24/11/2020
Digger type / size: N/A
Location: Driving range

Logged by: DT and SN
Auger size: 0.1m diam
Existing ground level: 7.0m RL
Max test pit depth: 0.9m

Depth (m)	Material	Excavatability (Relative scale) Easier–Harder	USCS Symbol	Description	Graphic symbol	Water Level	Moisture Cond.	Consistency / Density Index	Scala Penetrometer Blows per 100mm (2 4 6 8 10)
0	TS		OL	TOPSOIL, dry, dark brown, rootlets to 50mm		Not encountered	Slightly Moist	Loose	No scalas undertaken
0.25	Sand		SP	Dark brown sand					
0.5									
0.75				Grey sand					
1.0				Orange Sand					
1.25				Grey sand					
1.5				Target depth reached					
1.75									

LANDMATTERS

LOG OF TEST PIT TP06
Existing dwelling
Geotechnical investigations

765 Muhunoa West Road, Ohau

Client: Grenadier Developments
Date: 24/11/2020
Digger type / size: N/A
Location: Existing dwelling

Logged by: DT SN
Auger size: 0.1m
Existing ground level: 21.0m RL
Max test pit depth: 1.4m

Depth (m)	Material	Excavatability (Relative scale) Easier–Harder	USCS Symbol	Description	Graphic symbol	Water Level	Moisture Cond.	Consistency / Density Index	Scala Penetrometer Blows per 100mm (2 4 6 8 10)
0				Orange sands with trace of gravels			Dry		
0.25									
0.5									
0.75	Sand		SP	Grey Sand		Not encountered	Slightly Moist	Loose	
1.0									
1.25									
1.4									

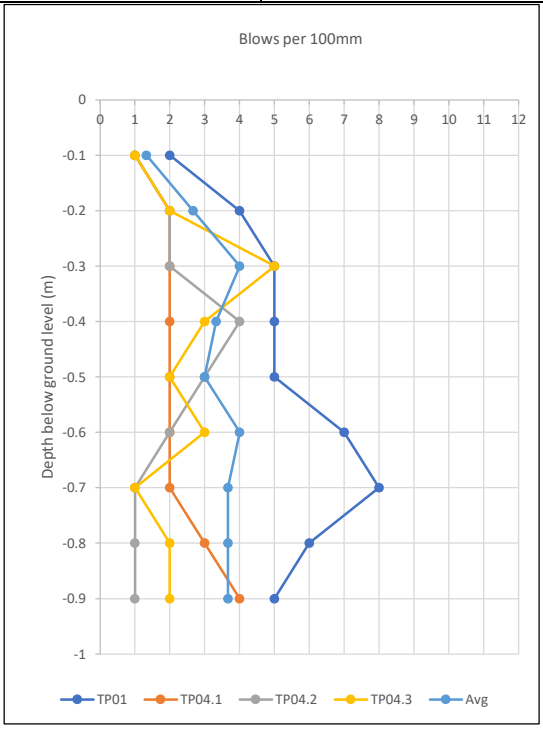
Required depth reached and no change

APPENDIX D – Scala Test Results

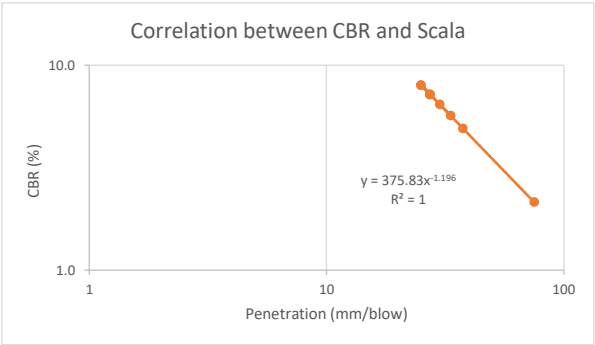
LANDMATTERS

Scala Penetrometer Test Results and Concept Pavement Design for the Clubhouse Access at TP01 and TP04

Client: Grenadier Developments Logged by: DT SN
Date: 24/11/2020 Existing ground level: 9.0m RL (approx.)
Location: 765 Muhunoa West Road, Ohau Max test pit depth: 0.9m

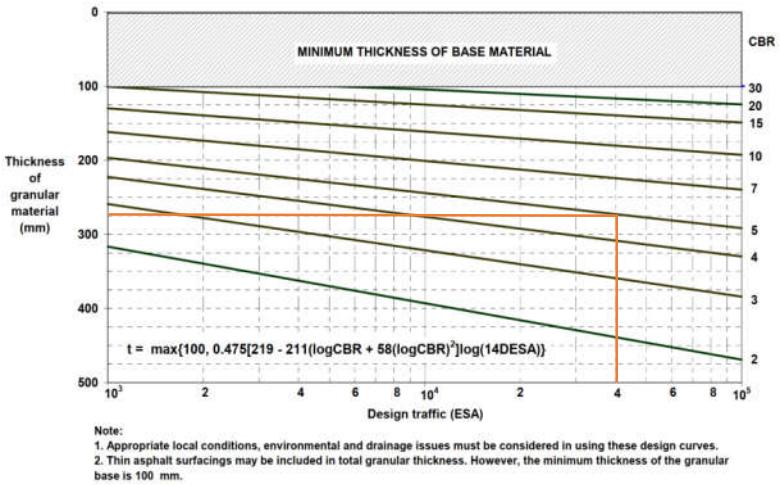


	Blows per 100mm (number)						
Depth (m)	TP01	TP04.1	TP04.2	TP04.3	Ave.	mm/ blow	CBR
0	0	0	0	0	0.0		
-0.1	2	1	1	1	1.3	75	2.1
-0.2	4	2	2	2	2.7	38	4.9
-0.3	5	2	2	5	4.0	25	8.0
-0.4	5	2	4	3	3.3	30	6.4
-0.5	5	2	3	2	3.0	33	5.7
-0.6	7	2	2	3	4.0	25	8.0
-0.7	8	2	1	1	3.7	27	7.2
-0.8	6	3	1	2	3.7	27	7.2
-0.9	5	4	1	2	3.7	27	7.2



In accordance to Austroads:Pavement Design for Light Traffic

5 %	CBR
Steet type:	Local access with no buses
400 v/day	AADT
4 %	Heavy vehicles
8	AADHV (single lane)
20 years	Design period
1 %	Annual growth rate
22	Cumulative growth factor
2.1 no.	Axle groups per heavy vehicle
128,480	Cumulative HVAG
0.3	ESA/HVAG
4 x 10^4 ESA	Indicative design traffic, Pavement Design for Light Traffic, Table 7.9
40,000 ESA	Indicative design traffic
275 mm	Thickness of granular material required, Figure 8.5



Note:
1. Appropriate local conditions, environmental and drainage issues must be considered in using these design curves.
2. Thin asphalt surfacings may be included in total granular thickness. However, the minimum thickness of the granular base is 100 mm.

Figure 8.5: Light traffic design chart for granular pavements with thin bituminous surfacings

APPENDIX E – Wastewater Treatment Plant Example

Product : Sewage treatment plant

Type : Oxyfix® FIXEUC90
Model : 14.85 m³/day - C-90 CB 99 PE (3) Tri 3x400V + N
Process : Submerged Aerated Fixed Film (SAFF) Technology

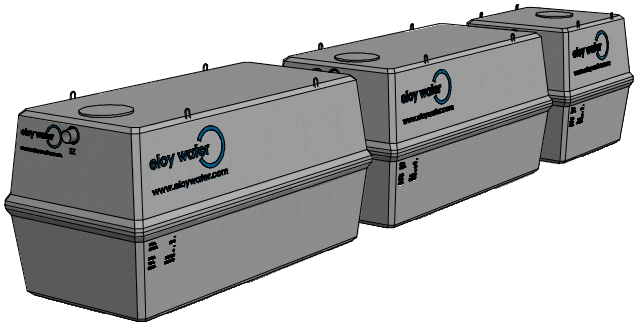
PERFORMANCE

Assumed Influent Values

Application :	Wastewater Treatment*	
Pollutant load BOD_5 :	400	mg/L
Pollutant load TSS :	600	mg/L
Pollutant load Ntot :	80	mg/L
Pollutant load Ptot :	13	mg/L

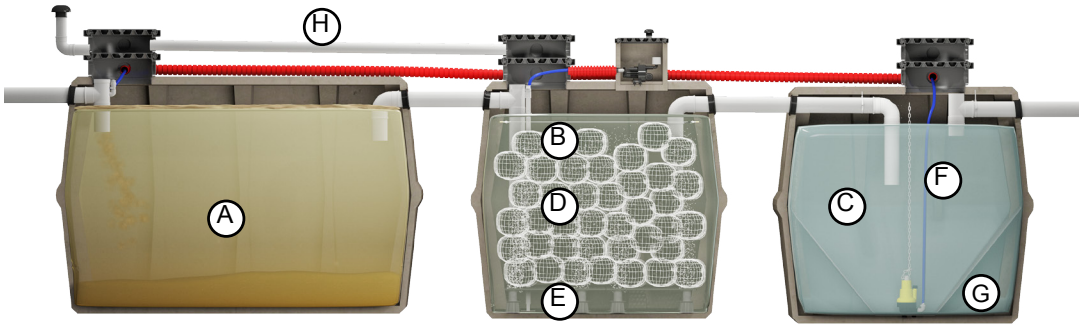
Purification performance

BOD_5 :	20	mg/L
TSS :	30	mg/L



* We recommend placing a grease trap for treating waste water generated by a restaurant, kitchens used for commercial purposes, etc.

FEATURES



ELECTROMECHANICAL COMPONENTS

Blower

Quantity :	1	pc(s)
Type :	side channel air blower	
Installed power :	1.50	kW
Power consumption :	1.05	kW
SPL (Sound Performance Lab) :	61	dB(A)
On / Off :	32/28	min.
Voltage :	3x400V	

Air Diffusers

Quantity :	15	pc(s)
Type :	fine bubbles	

Sludge recirculation

Type :	submerged pump	
Installed power :	0.85	kW
Power consumption :	0.85	kW
On / Off :	14/46	min.

Control panel

Type :	inside

Legend

A	Primary settling compartment
B	Biological reactor
C	Secondary settling compartment
D	Bacterial support
E	Diffusers
F	Sludge recirculation
G	Settling cone

APPROVALS AND CERTIFICATES

: 2014/04/142/A

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DIMENSIONS | VOLUMES | WEIGHTS

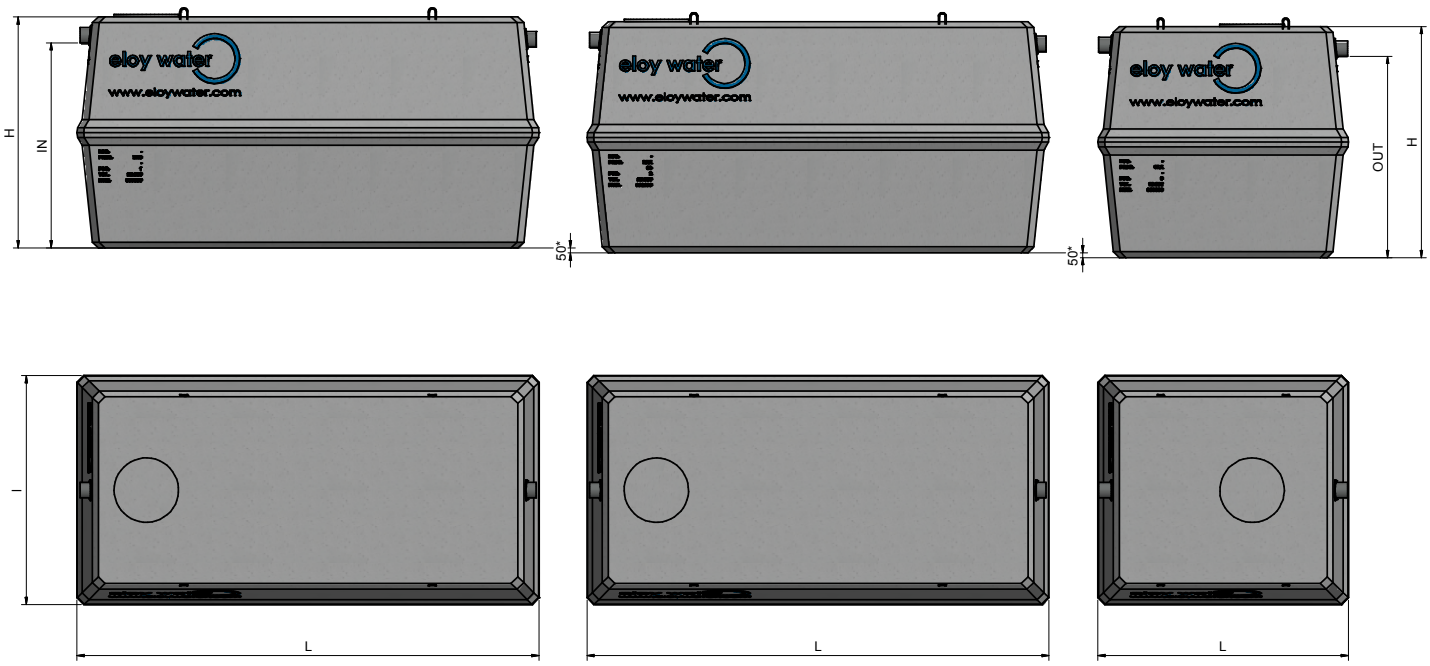
Measure	Unit	Tank 1	Tank 2	Tank 3
Total height* :	(cm)	240	240	240
Entry height* :	(cm)	213	213	213
Exit height* :	(cm)	209	209	209
Length :	(cm)	480	480	260
Width :	(cm)	238	238	238
Total volume :	(m^3)	20.00	20.00	10.00
Useful volume :	(m^3)	18.16	18.16	9.19
Weight :	(T)	9.10	9.95	5.82
Weight (w/o shipping cover):	(T)	-	-	-
Manhole(s) :	(cm)	1 x Ø60	1 x Ø60	1 x Ø60
Ø In / Out :	(mm)	160/160	160/160	160/160

* tolerance ± 2 cm

Material

Tank(s):	High performance steel reinforced concrete
Biocarrier:	Recycled PP
Air feed pipes:	PVC PN16

TANK DIMENSIONS



OPERATION

Useful volumes/surfaces

Primary settling compartment:	18.16	m^3
Biological reactor:	18.16	m^3
Clarifier:	4.41	m^2

Operation

Sampling chamber:	integrated
Theoretical desludging frequency:	every 13 months
Approximate energy consumption:	6,643 kW
Maintenance frequency :	annually (recommended)
Admissible load :	80 cm of fill + pedestrian load

Consumables

Blower filter:	annually
Blower membranes:	-
Air diffusers:	every 8 years

OPTIONS

Wall support for blower	
PE/concrete tank cover riser	3 pces
PE/steel tank cover	3 pces

GUARANTEES

Electromechanical kit :	2 years
Tanks :	10 years
Resistance :	B125

Eloy Water reserves the right to modify, or more generally, to update this document at any time without prior notice.

Sheet version: 20150609
Product version: 20140606

APPENDIX F – Composting Toilet Example

EarthEnergy.us.com
285 SW 41st Street
Renton, WA 98057

Sun-Mar

Composting Toilets

Sun-Mar Composting Toilets

Protecting the environment for over 25 years

At Sun-Mar, we are proud of our history and the role our products play in protecting the environment.

- Sun-Mar toilets are the safest and most environmentally friendly method of waste treatment
- Sun-Mar composting toilets evaporate liquids and compost the solids, so on most models there is absolutely no output and no contamination of ground water
- Sun-Mar composting toilets have saved over 3.3 billion gallons of water, and counting!

WHAT IS COMPOSTING?

- Composting converts organic matter back to its essential minerals
- Aerobic microbes do this in the presence of moisture and air, by converting carbon to carbon dioxide gas, and hydrogen to water vapor
- As a result, some 95% of the starting material is evaporated
- The resulting compost is recycled back to nature

Sun-Mar units have no equal!

Sun-Mar is a world leader in composting toilet technology.

- Our unique, patented Bio-drum™ design means fast, odor-free composting
- Sun-Mar toilets are the only ones certified by NSF to NSF/ANSI Standard #41 for residential and cottage use (most regulators require NSF certification)
- Sun-Mar toilets are designed so that air is constantly being drawn in and up the vent stack providing odor-free operation
- Sun-Mar toilets are sold by a global network of thousands of dealers
- Sun-Mar's unique 3 chamber technology means easy operation and maintenance

Why use a Sun-Mar composting toilet?

General Benefits

- No Plumbing
- No Water
- Odor-Free
- Inexpensive Solution

Environmental Benefits

- No Pollution
- Saves Water
- Recycles Nutrients
- Little or No Liquid Output

Global Composting Experts

Sun-Mar Toilets are easily installed anywhere!

They are an ideal solution:

- Where it is not possible or cost-effective to install a conventional toilet
- As an environmentally friendly alternative

Sun-Mar toilets are used in:

- Homes, cottages, garages, warehouses, barns, pool cabanas, cabins, mines, eco resorts, RV's, boats and many other locations

WARRANTY

All units carry a full 5 year replacement warranty on the fibreglass tank and a comprehensive 3 year replacement warranty on all other parts

There is only one performance standard for composting toilets in North America. This is National Sanitation Foundation (*) NSF/ANSI Standard #41, 2005.

Sun-Mar is certified by NSF under this stringent standard. Testing is conducted for 6 months at a NSF recognized independent testing laboratory under a strict test protocol. To be certified the unit must operate odor-free at maximum capacity (including overload conditions) and produce clean, safe compost.

As additional verification, NSF obtains and tests additional compost samples from randomly selected units in regular field operation, and conducts interviews with the users of these units. For verification check NSF website.

Electrical features are CSA APPROVED LR 55925-2

Certified to comply with applicable European Product Safety Standards and satisfies the provision for CE marking

Certified for 220 Volt units

AUST STANDARD AS/NZS 1546.2 Lic #20630 SAI GLOBAL

United States Coast Guard Certified

(*) NSF International is a not for profit, non-governmental organization. It is the world leader in standards development, product certification, education, and risk management for public health and safety and for 65 years, has been committed to public health, safety, and protection of the environment

Model Overview - CENTREX Units

Sun-Mar central systems are ideal for those who want to have a conventional looking toilet in the bathroom with the central unit separate. Sun-Mar has three series of central units; the regular capacity CENTREX 1000, the high capacity CENTREX 2000, and the ultra high capacity CENTREX 3000.

For typical seasonal use, compost is extracted annually. CENTREX 3000 units also incorporate Sun-Mar's unique Autoflow® technology that causes compost to move automatically through the Bio-drum™ and drop into a separate collection chamber.

Central units may be operated in low water or A/F waterless mode.

Low water style systems
- Feature a conventional looking porcelain toilet in the bathroom
- Can be connected to multiple toilets up to 15 feet from the CENTREX unit
- For use with model 510 and/or 511 ultra low flush toilets (ordered separately)

Waterless style for CENTREX 2000 and CENTREX 3000 systems (A/F waterless kit required)
- Feature a conventional looking toilet in the bathroom positioned above the CENTREX unit
- No plumbing necessary
- For use with Sun-Mar dry toilet (ordered separately)

For optimal operation of all CENTREX units use Compost Sure Blue for low water style systems or Compost Sure Green for waterless systems.

Central Units	Model	Description	COMPOSTING CAPACITY Residential/ Continuous	COMPOSTING CAPACITY Weekend/ Vacation	Voltage	Water
	CENTREX 1000 Series	Regular Capacity Electric Unit	-	5 Adults or Family of 7	115V or 230V or Non-Electric or AC/DC option*	Ultra Low Water Flush
	• Capacity reduced by 1 person for non electric model					
	CENTREX 2000 Series	High Capacity Electric Unit	4 Adults or Family of 6	7 Adults or Family of 9	115V or 230V or Non-Electric or AC/DC option*	Ultra Low Water Flush, or A/F Waterless Option*†
	• Capacity reduced by 1 person for non electric model					
	CENTREX 3000 Series	High Capacity Electric Unit	6 Adults or Family of 8	9 Adults or Family of 11	115V or 230V or Non-Electric or AC/DC option*	Ultra Low Water Flush, or A/F Waterless Option*†
	• Capacity reduced by 1 person for non electric model • Incorporates Autoflow® technology (automatic discharge of compost to a separate collection chamber)					

†Contact Sun-Mar for A/F capacity ratings
*Kit required

Electrical installation

Electric units are fitted with a standard 115 Volt outlet (230V for international). Power is supplied to the fan and heating element.

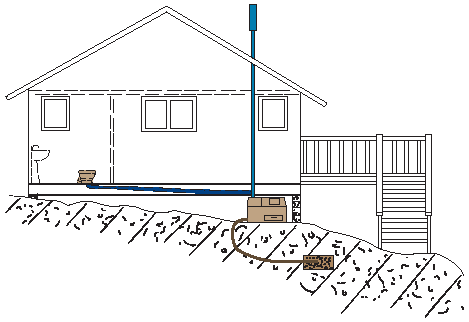
Evaporation

- Sun-Mar units have been engineered to automatically evaporate liquids without drying out the compost
- Sun-Mar's advanced evaporation process uses little or no power
- Electric units incorporate a fan featuring adjustable re-circulation and stainless steel shaft for extended life

Handling excess liquid

Self-contained electric units (Except Mobile) and CENTREX electric waterless units will evaporate all liquids under normal operation. As a precautionary measure Sun-Mar recommends that the drains on all toilets be connected.

Collect and/or treat excess liquid in an approved facility such as a recycling bed, old septic system, holding tank or drain pit.
All installations should conform to local regulations.



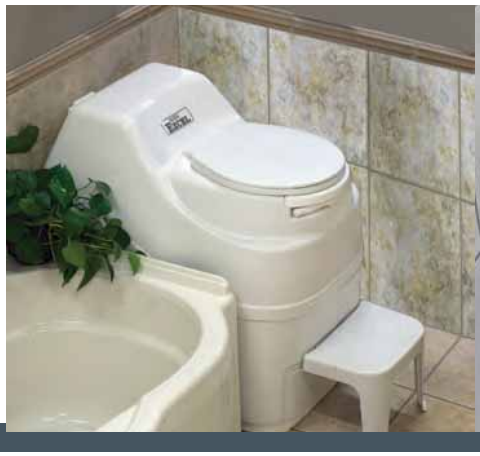
For more details and recommendations on recycling beds please visit our website.

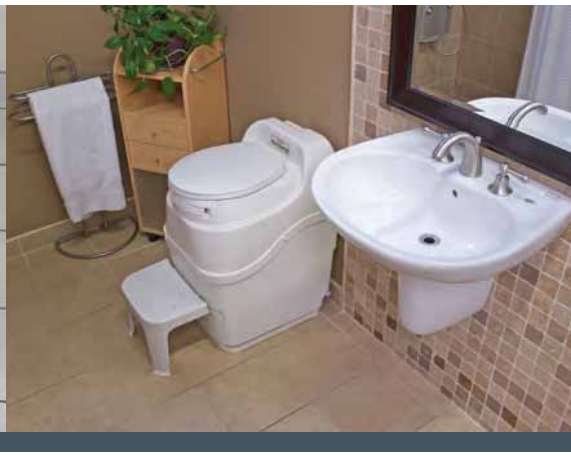
Winter Use

For extended winter use the composting unit has to be kept above 13° Celsius or 55° Fahrenheit.

Limited Winter Use

For limited use in cold temperatures you can use the unit as a holding tank as long as there is enough space in the patented Bio-drum™.





CENTRAL UNITS	1000	1000 NE	2000	2000 NE	3000	3000 NE
Average Power use in watts (heater on ½ time)	150	N/A	200	N/A	200	2 .4 opt.
UNIT DIMENSIONS (INCHES)						
Height	28½	27½	28	26½	30¼	29¼
Depth	32½	32½	27	26½	27½	27½
Unit Width, and Width required to turn handle	22½ x 24½	22½ x 24½	45½ x 49	45½ x 49	71	71
VENT & DRAINS						
Vent Pipe (2" cent. vac. tubing; 3" & 4" sewer)	2"	4"	2"	4"	2"	4"
1" Drains (required or optional hook-up)	Req.	Req.	Req.	Req.	Req.	Req.
WEIGHT (LBS)						
Product Weight - Shipping Weight	50-95	45-90	97-118	87-108	102-172	88-164
SHIPPING CARTON DIMENSIONS (INCHES)						
Width	28	27	28½	28½	28	28
Length	35	35	47	47	60½	60½
Height	31½	36	30	36	33	33
ROUGH-IN MEASUREMENTS (INCHES)						
Depth required to remove drawer (unit plus drawer)	46¼	46¼	45	45	45½	45½

Option Kits

A/F Waterless Kit

Kit required for use with Sun-Mar waterless toilets and CENTREX 2000 and CENTREX 3000 systems. Includes a 12V fan and hardware kit.

AC/DC Kit

This kit allows an electric unit to be converted to operate in a 12 volt or non-electric mode. When converted the unit will have both a 2 inch and 4 inch vent stack. This kit can only be used with the EXCEL, CENTREX 1000, CENTREX 2000 and CENTREX 3000.

APPENDIX G – Wastewater Calculations

Pressure Compensating Dripper Irrigation Design (PCDI) for Club House, Accommodation Units and Driving Range Shed

Daily flow:	11,000	litres/day/person	Guidelines for on-site sewage systems in the Wellington Region; Table 7
Soil category:	1		AS/NZS 1547:2012, Table 5.1
Areal loading rate:	5	litres/m^2/day or mm/day	Auckland Council Guideline GD2018/006, E2.2.2.1
Design land application area:	2200	m^2	
Reserve land application (50%):	1100	m^2	Auckland Council Guideline GD2018/006, E2.2.2.1
Total land area:	3300	m^2	
Land application dimensions:	10m x 37m + (5m x 37m {reserve})		
Line spacing 1m centres	3300	linear metres	

Pressure Compensating Dripper Irrigation Design (PCDI) for Owner's Cottage

Daily flow:	580	litres/day/person	Guidelines for on-site sewage systems in the Wellington Region; Table 7
Soil category:	1		AS/NZS 1547:2012, Table 5.1
Areal loading rate:	5	litres/m^2/day or mm/day	Auckland Council Guideline GD2018/006, E2.2.2.1
Design land application area:	116	m^2	
Reserve land application (50%):	58	m^2	Auckland Council Guideline GD2018/006, E2.2.2.1
Total land area:	174	m^2	
Land application dimensions:	10m x 37m + (5m x 37m {reserve})		
Line spacing 1m centres	174	linear metres	

Pressure Compensating Dripper Irrigation Design (PCDI) for Stables and Maintenance Sheds

Daily flow:	2,400	litres/day/person	Guidelines for on-site sewage systems in the Wellington Region; Table 7
Soil category:	1		AS/NZS 1547:2012, Table 5.1
Areal loading rate:	5	litres/m^2/day or mm/day	Auckland Council Guideline GD2018/006, E2.2.2.1
Design land application area:	480	m^2	
Reserve land application (50%):	240	m^2	Auckland Council Guideline GD2018/006, E2.2.2.1
Total land area:	720	m^2	
Land application dimensions:	10m x 37m + (5m x 37m {reserve})		
Line spacing 1m centres	720	linear metres	