Acid Sulfate Soils Management Plan

JOB NUMBER: 23-1883

Waikato Greenfield Racing Hub

PROJECT

Waikato Thoroughbred Racing Inc

CLIENT

Substantive – Rev 0
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23-1883 Waikato Greenfield Racing Hub

MASTER PLAN - SUBSTANTIVE APPLICATION



Prepared for: Waikato Thoroughbred Racing Inc **Project no: 23-1883**

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1 INTRODUCTION

1.1 Project background

BCD Group have been engaged by Waikato Thoroughbred Racing (WTR) to produce an Acid Sulfate Soils Management Plan (ASMP) to manage potential risks of acid sulfates during earthworks at the properties located at Pencarrow Road, Tamahere, Waikato (the Site). The Site location is shown in **Appendix A**.

Acid sulfate soils contain sulfide minerals, which oxidise when exposed to oxygen (usually when waterlogged soils are drained). This produces sulfuric acid, which decreases the pH of soils and groundwater, and mobilises metals in the environment. These can cause damage to underground infrastructure and impact ground and surface water.

Acid sulfate soils are divided into two classes outlined in Table 1.

Table 1 Acid sulfate classes

Class	Description
Potential acid sulfate soils (PASS)	Potential acid sulfate soils are acid sulfate soils which would become strongly acidic if allowed to oxidise. Field pH is usually greater than 4 and commonly between pH 7-9. Oxidised pH is less than 3, with large changes from the initial pH. Saturated with water May be peat, clay, loam, silt or sand Often dark grey but can also be dark brown or medium to pale grey to white They are not harmful to the surrounding environment unless they are allowed to oxidise.
Actual acid sulfate soils (AASS)	Actual acid sulfate soils are acid sulfate soils which have already oxidised and are strongly acidic pH less than 4 Often jarosite (yellow mottling) and / or ferric iron oxides (red to orange mottling)

Avoidance of acid sulfate soils is the primary method of management, however when this is not possible management techniques can include application of AgLime, or placement of the material below the water table and clean, non-acid generating fill material.

A previous investigation (BCD Group, 2026) undertaken to support the referral application for the Site was unable to rule out the presence of acid sulfate soils at the Site. Feedback from Waikato Regional Council (WRC) on the application advised that they agreed with the conclusions of the investigation that a more in-depth assessment should be undertaken to confirm the presence of acid sulfate soils and develop a management plan for these soils.

This management plan is intended to demonstrate that the potential impacts from acid sulfates at the Site can be managed through the implementation of high-level controls and investigation. This plan will be updated as design details are confirmed and investigations at the Site are undertaken.

The purpose of the Project is to create a unique, world class greenfield racing hub designed for horse training, racing and other equine related activities, while bringing the expertise and strength of the local racing fraternity together in a centralised location.

This enables the local racing industry to be more streamlined, competitive, sustainable and future focused while bringing potential international investment and creating a 'destination' for horse racing in New Zealand, also increasing tourism opportunities for the wider region.

A key driver behind the proposed greenfield equine hub and racecourses is enabling the consolidation of four separate racecourse facilities (Te Rapa, Waipa and Cambridge thoroughbred courses, and the Cambridge harness track).

These facilities duplicate assets and resources and, given their current condition require significant levels of upgrades and investment to provide fit-for-purpose facilities that meet the higher standards of the modern-day racecourse experience. The retirement of these areas also frees up significant tracts of land within existing urban areas for future development, increasing housing supply.

To support the development's financial viability and enhance the site's long-term vibrancy as a racing, entertainment, commercial and community precinct, the proposal includes a range of complementary activities on the remaining land. These include equine support services, a residential housing development, a senior living community, a village centre and a bloodstock sales precinct

Masterplans for the Site are included in **Appendix B**. This plan shows:

- A main track, backtrack, warmup track and harness track
- Stabling and support areas for events
- Carparking
- Commercial and residential development
- Irrigation ponds

Earthworks across the Site will be required for:

- Excavation of the irrigation pond
- Stripping of topsoil and levelling of the Site
- Recontouring of the Site
- Demolition of existing structures at the Site
- Construction of foundations
- Development of roads and other surface infrastructure
- Development of subsurface infrastructure.

1.2 Purpose

The purpose of this Acid Sulfate Soils Management Plan is to provide investigation protocols for assessing the presence of acid sulfate soils at the Site and, where acidity exceeds the action criteria, site management protocols for handling, treating and disposing of acid sulfate soils; containing and treating potentially acidic water encountered during construction; monitoring soil pH and water quality; and implementing contingency measures.

These measures will allow the assessment and management of potential risks from acid sulfate soils from the proposed soil disturbance and dewatering works.

1.3 Scope

The scope of this report is to prepare an acid sulfate soil management plan for the WTR site in accordance with the Waikato Regional Council acid sulfate guidance document.

1.4 Use of this plan

Table 2 provides a breakdown of the Project stages and explains how the management plan supports the works at each stage.

Table 2 Use of this plan

Project stage	Management Plan Role
For consent	• Demonstrate that the effects from the disturbance of potential acid sulfate soils can be managed through the implementation of high-level controls. • Plan will be refined as design details are finalised including construction sequencing and excavation depths.
For tender	• Plan updated to reflect resource condition compliance, completed design elements, and construction sequencing. • Plan supports the engagement of contractors to deliver the construction.
For construction	• Plan updated to reflect Contractor and Environmental specialist details, finalised design elements. • Sampling protocols and results. • Risk management methodologies associated with excavations, stock piling, dewatering and other specific construction activities. • Accidental discovery protocols.

1.5 Assumptions

This report assumes

- Information received from Waikato District Council (WDC), Waikato Regional Council (WRC) and any other third parties is complete and accurate
- The observations made during the previous investigations are representative of the conditions at the Site.

2 SITE RESPONSIBILITIES

Table 3 outlines project responsibilities for acid sulfate related works at the Site.

Table 3 Project responsibilities

Role	Name and contact details	Responsibility
Consent Holder	Waikato Thoroughbred Racing	• Provide this management plan to the Project Manager and Contractor ahead of the works • Engage an environmental specialist to support the delivery of works in compliance with this ASMP including sampling requirements, methodologies and reviewing analysis results. • Ensure the Project is adequately resourced to ensure compliance with this ASMP.
Project Manager	TBD	• Ensure construction activities are compliant with this ASMP. • Ensure all construction staff and sub-contractors are aware of their responsibilities in relation to this ASMP. • Coordinate with and support the Environmental Specialist to ensure sampling and reporting requirements are met • Identify areas of the Site where stockpiling and treatment can occur (as required). • Communicate the findings of the investigation through to the contactor and consent holder. • Support the Project Manager as required with communication with, and to, WRC.
Site manager	TBD	• Ensure construction works are compliant with this ASMP. • Ensure that their staff and sub-contractors are aware of their responsibilities in relation to this ASMP. • Undertake site audits to ensure compliance with this plan. • Informing the Project Manager of the discovery of unexpected acid sulfate conditions and breaches of this ASMP
Environmental Specialist	TBD	• Act as a suitably qualified and experienced person (SQEP) for working with acid sulfate soils. • Review sampling analysis results from the site and provide expert commentary and advice. • Oversee investigations prior to earthworks being undertaken • Communicate the findings of these investigations to the Project Manager • Support the preparation of site-specific management plans as required. • Provide specialist reporting to the Consent Holder and Project Manager.

3 REGULATORY CONTEXT

3.1 Waikato Regional Council

3.1.1 Discharges

WRC considers discharges from acid sulfate soils to be regulated by Section 15 of the Resource Management Act (1991) as, through the activity of a person, acid sulfate soils may discharge contaminants including acid or mobilise hazardous substances such as metals via the activities of a person. This discharge may then change the physiochemical and biological condition of the land and / or water where it is discharged. Consequently, acid sulfate soils are regulated under the Waikato Regional Plan rules, as a land disturbance activity under rules in Section 5.1 of the plan (which regulates soil disturbance) and Section 5.2 of the plan (managing discharges onto or into land). Additionally, Section 3.5 (managing discharges to water) may be relevant in some cases. As per the WRC acid sulfate guidance document (Waikato Regional Council, 2025), WRC considers assessment of the risk of acid leaching potential from ASS for resource consents is likely to be required for land disturbance activities where:

- Disturbance is proposed to occur in an area identified in the Waikato Region – Acid Sulfate Soils Preliminary Risk Assessment map as having a 'medium' or 'high' probability of occurrence of acid sulfate soils; and
- The disturbance will be:
    - Greater than 250 m^3
    - Deeper than 1 m, and / or
    - Associated with a drainage activity, and / or
    - If there are any other factors associated with the proposed activity that might increase the risk of disturbance of acid sulfate soils.

Where a discharge of contaminants is otherwise identified and is not regulated by any specific rule, it is considered a discretionary activity.

The acid sulfate guidance document also states "*to ensure that applications for consent are considered complete, Waikato Regional Council asks that applicants describe how they proposed to confirm the presence of ASS and manage the soil to avoid, minimise and / or manage the formation of acid leaching effects*"

3.1.2 WRC acid sulfate screening

Waikato Regional Council has undertaken a spatial assessment to assess the potential presence of acid sulfate soils across the Waikato region (Waikato Regional Council, 2024). This was then used to develop an acid sulfate risk screening map, classifying the areas across the Waikato at higher, medium, lower or negligible risk for the presence of acid sulfate soils.

A map showing the potential risk areas of the Site is included in **Appendix C**. Most of the Site is underlain by a lower risk ranking, with a band of higher risk potential running through the centre of the Site from the east. An area of the western boundary of the Site shows negligible risk soils.

3.1.3 Applicability to site

The WRC acid sulfate guidance (Waikato Regional Council, 2025) outlines a decision tree, based on the Tasmania Department of Primary Industries, Parks, Water and Environment Tasmanian Acid Sulfate Soil Management Guidelines (TDPIPWE, 2009). A copy of the decision tree is shown below in Table 4 below.

Table 4 Acid sulfate assessment

Step	Assessment
Is the site in a moderate to high-risk area?	Yes
Is the work: **Soil disturbance in an area risked as medium or high risk AND** **Is the disturbance** **Greater than 250 m^3** **Deeper than 1 m bgl** **Associated with a drainage activity** **If there are other activities associated with the proposed activity that might increase the risk of disturbance of acid sulfate soils**	Yes
Conduct desktop risk assessment	Undertaken – some indicators of acid sulfates were identified during works however the result of the assessment was inconclusive.
Significant disturbance to acid sulfate soils likely?	Potentially – earthworks are likely to occur in the areas of high risk; therefore, acid sulfates may occur.
Conclusion	Undertake an investigation to assess the presence of acid sulfates and create an acid sulfate soil management plan.

3.2 Applicable guidance

The following guidelines have been used in the development of this management plan.

Table 5 Reference documents

Document	Use	Reference in this document
Waikato Region Acid Sulfate Soils Preliminary Risk Assessment (Waikato Regional Council, 2024)	Risk assessment for the Waikato Region	"Waikato Risk Assessment"
WRC acid sulfate soils technical guidance (Waikato Regional Council, 2025)	Regulatory guidance for the management of acid sulfates in the Waikato	"Waikato Technical Guidance"
National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Identification and Laboratory Methods Manual (Water Quality Australia, 2018)	Sampling methodology for acid sulfate soils	"Sampling Guidance"
Department of Resources and the Department of Environment, Science and Innovation (2024). Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines Version 5.1 (Dear, et al., 2024)	Management and treatment of acid sulfate soils	"Queensland Guidelines"
Tasmania Department of Primary Industries, Parks, Water and Environment (DDPIPWE) Tasmanian Acid Sulfate Soil Management Guidelines (TDPIPWE, 2009)	Referenced in Regulatory Guidance	"Tasmanian Guidance"

4 SITE DESCRIPTION

4.1 Site identification

Site identification details are outlined in Table 6.

Table 6 Site identification

Attribute	Details
Address and legal description	37 Hooker Rd and 38 Duncan Rd, Tamahere, Hamilton Section 2 SO 547526 [RT 1027516] 69.7 ha 90 Duncan Road, Tamahere, Hamilton Lot 2 DP 16925 [RT SA383/181] 14.2 ha 536 Pencarrow Road, Tamahere, Hamilton Lot 2 DP 471383 [RT 650204] 18.5 ha 592 Pencarrow Road, Tamahere, Hamilton Lot 1 DP 471383 [RT 650205] 23.9 ha 636 Pencarrow Road, Tamahere, Hamilton, Section 49 SO 457609 [RT: 632409] 37.6 ha 644 Pencarrow Road, Tamahere, Hamilton Section 46 SO 457609 [RT 632392] 1.36 ha
Site Area	Approximately 165.5 ha

4.2 Site setting

Site setting details are outlined in Table 7.

Table 7 Site setting

Attribute	Details
Elevation and topography	The site has generally level contours, with steeper slope angles towards the western boundary. The western side of the site has a hill sloping down to the east, with contours ranging between 60 m and 53 m RL (NZVD2016). The southeastern corner of the site is also slightly elevated at 56.9 m RL
Geology	The published geology for the Site shows most of the Site is underlain with Late Pleistocene River deposits from the Hinuera Formation described as "cross-bedded pumice sand, silt and gravel with interbedded peat". There is an intrusion along the western boundary of the Site of early-middle Pleistocene River and igneous deposits of the Walton subgroup, described as alluvium dominated by primary and reworked, non-welded ignimbrite.
Soils	The Site is underlain with Typic Orthic Allophonic soils, with an area of Typic Orthic Gley soils intruding into the site from the eastern boundary. There are also Typic Orthic Granular soils coming into the site across the western boundary.
Hydrology	The Mangaomapu Stream is located in the base of a gully approximately 400 m to the north of the Site. The Waikato River is approximately 500 m to the south of the Site. An unnamed tributary of the Stream, which has been extensively modified as part of the stormwater drain system at the Site runs through the Site. Within the Site multiple stormwater drains run along the paddock boundaries. Due to the topography surface water flows into these drains, before leaving the Site to the north.
Hydrogeology	Groundwater was identified at between 0.9 – 2.3 m bgl across the Site during geotechnical investigations. Groundwater measurements taken during this investigation indicate that the shallow groundwater underlying the Site flows towards the north.
Acid sulfate risk (from WRC mapping)	Most of the Site is underlain by a low risk ranking for acid sulfate soils, with a band of high potential risk running through the middle of the Site. An area of the western boundary of the Site shows negligible risk soils.

4.3 Previous acid sulfate assessments

BCD prepared a preliminary report (BCD Group, 2026) assessing the risk associated with acid sulfate soils at the Site because the Waikato Regional Council acid sulfate risk screening map showing the Site as in a medium / high risk area.

This report presents a desktop assessment of the presence of acid sulfate soils, including undertaking field screening of 28 samples from six sampling locations. Samples targeted the higher risk locations of the Site. Samples were collected from the top metre of the Soil profile.

All sampling locations presented at least one indicator of acid sulfate soils as per the Sampling Guidance. Consequently, acid sulfates could not be conclusively ruled out under the Waikato Regional Council "Acid Sulfate Soils Decision Tree". A more comprehensive acid sulfate soil management plan was therefore recommended once the civil earthworks design had progressed beyond the concept stage, to mitigate potential risks from acid sulfate soils at the Site.

4.4 Conceptual site model

The conceptual site model for acid sulfate risk at the Site is shown in Table 8.

Table 8 Conceptual site model

Contaminant	Pathway	Receptor	Discussion
Acid sulfate soils – release of acidity from the oxidation of sulfides	Conversion of PASS to AASS via the disturbance of soils or lowering of the groundwater table allowing the oxidation of sulfides and the generation of acids.	Groundwater underlying the Site	Potentially complete – if acidity is released during the conversion of PASS to AASS, then metals may be mobilised into the groundwater underlying the Site.
		Surface water at the Site	Potentially complete – if acidity is released from the conversion of PASS to AASS, then the pH of the surface water and metal concentrations may be impacted.
		Biota in surface waters	Potentially complete – if acidity is released from the conversion of PASS to AASS, then the biota in surface water receptors may be impacted by the change in pH and the mobilisation of metals into the environment.
		In ground infrastructure and foundations	Potentially complete – if acidity is released from the conversion of PASS to AASS, acidity may impact the in-ground infrastructure and building foundations.
	Potable water extracted from the aquifer underlying the Site.	Humans, animals	Potentially complete – if contaminants are mobilised from the acidification, future users of groundwater from the Site(such as humans or horses) may ingest the contaminants.

5 SUMMARY OF PROPOSED WORKS

As the Project remains at an early stage of construction design, the proposed works described below may change as the potential presence and extent of acid sulfate soils are confirmed. Following contractor engagement, the construction design and methodology will be finalised collaboratively, supported by additional testing and an adaptive management approach.

The cut and fill diagram for the Site is included in **Appendix D**. The plan includes racing tracks and associated buildings, residential and commercial developments, and associated supporting infrastructure such as roads, carparking and underground infrastructure.

Depths of excavations, earthworks staging and excavation methodology are currently unknown. Currently approximately 518,500 m^3 of soil will be disturbed as part of the topsoil stripping at the Site, with additional cuts of 406,434 m^3. Approximately 538,187 m^3 of fill would then be placed across the Site.

This would provide a shape that then requires pavement construction, building and foundation construction and topsoil spreading (modelled at 400 mm deep, and reusing approximately 331,196 m^3 of the stripped topsoil).

These volumes do not include undertaking temporary site works, service trenching or additional excavation where unsuitable material is found. Currently a maximum cut depth of 6 m (for the construction of a swale) and a maximum fill depth of 6.7 m (infilling of the effluent ponds) is proposed, with the cut across most of the Site being advanced to a depth of 1.5 – 2.0 m bgl.

Earthworks staging is currently unconfirmed, but development is likely to start with the construction of the main and harness tracks.

The majority of the Site is ranked as low or neglectable risk. Works in these areas can be managed via the implementation of acid sulfate soil discovery protocols.

Most of the work in the higher risk areas of the Site involve the placement of fill to develop the track and level the Site. The major excavation works in this area are related to the excavation of the main track irrigation pond, with additional works for recontouring and levelling of the site as well as small scale works for trenching and the installation of services and infrastructure.

Dewatering will be required during the excavation of the irrigation pond. Depths of site infrastructure are currently unknown but may require dewatering works as part of the construction methodology.

6 PROPOSED SAMPLING METHODOLOGY

6.1 Investigation objectives

Collection of soil samples will be required to:

- Identify if acid sulfate soils materials are present or absent at the Site
- Delineate the extent of acid sulfate soils
- Provide data for the design of the treatment and / or management requirements for the material

The data from this assessment will be used to develop a detailed understanding of the acidity hazard at the Site. This information will then be used to input into design and soil management requirements for the Site. Depending on the results of this sampling or changes in design, additional investigations may be required. These will then update the management practices which may need to be implemented.

6.2 Construction activities

The following construction activities have the potential to cause impacts from acid sulfates:

- Shallow / deep excavations
- Stockpiling of impacted material
- Transport of impacted material
- Dewatering

6.3 Sampling design

Acid sulfate sampling should take place in locations of the Site which are:

- Classified as High Risk
- Where construction activities are being proposed

High risk areas of the Site are shown in **Appendix C**.

6.3.1 Sampling Density

Sampling density should be guided by the WRC guidance document. The appropriate number of sampling locations and samples will be specific to the project and should be informed by the judgement of an appropriately qualified and experienced practitioner. This includes if an investigation is being undertaken to assess the presence of acid sulfate soils in the area where works are proposed, or for programmes which would require a thorough analysis of the conditions at the Site such as informing liming rates for soil management. If an assessment does not meet the sampling density in the Sampling Guidance a rationale for this should be outlined, and a comment made about the appropriate use for the sampling data.

Recommended sampling densities from the Sampling Guidance are outlined in Table 9.

Table 9 Sampling density

Area of site	Typical number of sampling locations
Up to 1 ha	4
1-2 ha	6
2-3 ha	8
3-4 ha	10

For small scale, non-linear disturbances (less than 1,000 m^3 excluding drains or trenches) where dewatering will not be undertaken, a reduced number of laboratory analyses may be undertaken, provided sufficient information is collected to inform management practices. These are outlined in Table 10. These samples are selected based on their field properties and behaviour to have the highest potential of an acidity hazard.

Table 10 Small scale disturbances

Volume of disturbed soils	Maximum disturbance depth			
	< 1	1 – 2 m	2 – 3 m	3 – 4 m
≤ 250 m^3	3	4	5	6
251 – 500 m^3	4	5	6	7
500 – 1000m^3	5	6	7	8

6.3.2 Sampling and Analysis Plan

The rationale and detail for the sampling intensity will be provided in a Sampling and Analysis Plan (SAP). The SAP will consider:

- the likelihood of acid sulfates
- site-specific factors such as surface water
- results of previous sampling across the wider site.

The SAP may also recommend a staged approach to sampling.

6.3.3 Sampling Depth

Depths of sampling will be based on the maximum depth of earthworks and the potential impacts on the groundwater table.

Sampling will be undertaken within the footprint of the proposed works and will extend 1 m below the proposed excavation depth or 1 m below the lowest estimated groundwater drawdown, whichever is deeper. Samples should be collected at regular intervals through the soil profile and at each change in lithology.

6.4 Field observations

The following field observations are associated with the presence of acid sulfate soils. If observed during fieldwork these should be noted and included in the assessment.

- Iron staining in the surficial material or excavated material left exposed to the environment. This is likely to be a red / orange colour in the soil profile.
- Clear or milky green water in surface water at the Site.
- Jarosite minerals (yellow staining in the soil profile)
- Corrosion and iron staining of nearby concrete / steel structures
- Sulfuric odours
- Distressed vegetation, including dead, dying or stunted vegetation.

6.5 Sampling methodology

6.5.1 Sampling

Sampling should be undertaken with appropriate sampling equipment that is washed down and cleaned between samples.

Sampling should be supervised by a person suitably qualified and experienced in acid sulfate soil sampling. Full instructions on sampler training requirements will be included in the Sampling and Analysis Plan or the finalised management plan.

The following records should be kept:

- Sampling location
- The soil profile should be logged in accordance with the NZGS Field Description of Soil and Rock.
- Colour and mottling
- Presence of shell material
- Water table height
- Photographs of the soil profile
- Samples collected

6.5.2 Field screening

Field screening at the Site will be undertaken in accordance with the Sampling Guidance.

This includes:

- collection of soil samples
- mixing with water,
- testing the pH_F,
- application of 30% hydrogen peroxide to the mixture,
- observing the reaction
- recording the pH_{FOX}.

Results of the field screening should be recorded on a field sheet.

If field screening indicates the presence of acid sulfate soils at the Site, then laboratory analysis should be undertaken.

6.5.3 Laboratory analysis

Samples for laboratory analysis are to be collected in accordance with the Sampling Guidance.

Samples are to be collected in laboratory supplied plastic bags for acid sulfate soils. Headspace in the bags should be minimised to prevent oxidation. Samples need to be placed immediately into an ice-filled chilly bin. If samples cannot be delivered to the laboratory before the end of the day samples should be frozen before delivery to the laboratory.

Samples should be delivered to the laboratory with full chain of custody documentation. All laboratory analysis will be undertaken by an IANZ accredited laboratory.

6.5.4 Sample scheduling

Samples should be assessed for a chromium reducible sulfur testing suite. This will include:

- Potential sulfidic acidity

- Actual acidity
- Retained acidity
- Acid neutralising capacity

6.6 Action criteria

6.6.1 Field screening

As per the sampling methodology, exceedances of the field screening criteria are shown in Table 11.

Table 11 Field screening action criteria

Criteria	Exceedance
pH_F	< 4
pH_{Fox}	< 3
Difference between pH_F and pH_{Fox}	> 1
Effervescence	Extreme / volcanic
Release of sulfuric gasses	Sulfuric odour

If these criteria are exceeded, then comparison against Tables A2 and A3 of the sampling guidance document should be made to assess the presence of acid sulfate soils. Although potential indicators of acid sulfate soils, the presence of one does not necessarily show the presence of acid sulfate soils and results of analysis should be considered in relation to the other results and associated field observations.

If field screening identifies the potential presence of acid sulfates, then further analysis should be undertaken by a laboratory to further assess concentrations of acid sulfates and the management requirements.

6.6.2 Laboratory analysis

Action criteria are based on the mass of soil disturbance and soil textures and are outlined in Table 12.

Table 12 Action criteria

Type of material		**Action criteria 100 – 1,000 tonnes disturbed**		**Action criteria if 1,000 + tonnes disturbed**	
Texture range	Approx clay content (%<0.002 mm)	Equivalent sulfur (S%)	Equivalent acidity (mol H+/tonne)	Equivalent sulfur (S%)	Equivalent acidity (mol H+/tonne)
Coarse texture	≤ 5	0.03	18	0.03	18
Medium texture	5 – 40	0.06	36		
Fine texture	≥ 40	0.1	62		

Acid sulfates with net acidity below the action criteria may still be acid sulfate soils but not require management.

As per the Queensland guidance Net Acidity is calculated as below.

$$Net\ acidity = potential\ sulfidic\ acidity + actual\ acidity + retained\ acidity$$

If acid neutralising capacity is included the following calculation should be used.

$$Net\ acidity = potential\ sulfidic\ acidity + actual\ acidity + retained\ acidity - acid\ neutralising\ capacity$$

If the action criteria are exceeded acid sulfate management protocols should be put into place. A high-level discussion of these is included in Section 8. Full management should be undertaken under the supervision of an environmental specialist.

6.7 Quality assurance / quality control

At a minimum the following quality assurance and quality control procedures should be implemented during the sampling programme:

- Collection of one field duplicate / 20 samples
- Use of standardised field forms, sampling methods and chain of custody forms
- Documents showing the calibration of field equipment

Field duplicates must be taken from the same soil sample after mixing and submitted to the laboratory as blind samples with no indication to the laboratory that they are duplicate samples.

These procedures should be documented and included in the reporting of the investigation.

7 SURFACE AND GROUNDWATER ASSESSMENTS

7.1 Surface water assessment

7.1.1 Sampling objectives

If acid sulfate soils are identified within 50 metres of a waterway at the Site, a baseline water-quality assessment should be undertaken to establish surface-water triggers for construction monitoring.

7.1.2 Sampling location

The baseline monitoring programme will be designed by the environmental specialist and include an upgradient surface-water sample to establish background conditions, sampling where the waterway leaves the Site, sampling in relevant surface-water bodies, and sampling from existing groundwater wells located between the acid sulfate soils and the receiving water body.

Samples should be assessed for pH and field observations (including clarity, colour, iron staining, etc) should be noted.

7.1.3 Trigger criteria

Results of the baseline testing will be used to establish the surface-water action criterion. The trigger will be a decrease in pH of more than 0.5 units from the baseline level.

7.2 Dewatering

A programme of dewatering will be undertaken at the Site. As described in 6.3.3 sampling should be undertaken to a depth of 1 m below the anticipated dewatering level in the zone of influence. If acid sulfate soils are identified these results should be incorporated into the dewatering plan and treatment options for the dewatered water should be implemented by the environmental specialist. This will likely include on-site retention of water and treatment before discharge.

8 SITE MANAGEMENT AND MONITORING

8.1 Soil management strategy

As per the guidance document avoidance and minimisation strategies are preferred strategies for managing acid sulfates at a Site. However, due to site layout requirements these will not always be able to be implemented. However, they remain valuable philosophies which should be included in the design of earthworks to minimise the volumes of acid sulfates which are disturbed.

Strategic reburial may be used to minimise soil exposure to oxygen by placing material in an anoxic, and preferably anaerobic, environment. However, groundwater levels recorded at 0.9–2.3 m bgl in November 2025, together with the Site's fill requirements, may make it difficult to achieve a burial depth of at least 1 m below the seasonally lowest water-table elevation.

Offsite disposal of material may also be undertaken. This will require engaging with the proposed fill sites regarding the presence of acid sulfate soils at the Site and confirming that they are able to accept the material as per their consenting requirements. Material is unlikely to be accepted at Class 4 and 5 fills due to requirements to only accept inert materials.

Based on this the preferred management strategy for acid sulfates identified at the Site is via treatment and neutralisation. This consists of excavation of the soils at the Site and blending with agricultural lime (AgLime) ($CaCO_3$) to neutralise the acidity generated by the oxidation of the soils.

Regardless of the strategy selected it should be agreed and implemented (including treatment requirements, if any) before earthworks begin at the Site to minimise the generation of acidity.

8.2 Short-term holding

Untreated acid sulfate soils may be temporarily stockpiled with open excavations as part of earthworks. Chip tray testing should be implemented to inform the short-term holding time for stockpiled material. If material is stockpiled a precautionary application of AgLime should be made to the surfaces before reinstatement.

8.3 Treatment rates

If material cannot be reinstated, or if falls outside of the holding times, it may require treatment with AgLime on-site prior to reuse or disposal.

Liming should be calculated using the following equation:

$$S\% \times 30.59 \times 1.02 \times 1.5 \times 1.3 \times 0.98 = adopted\ liming\ rate$$

8.4 Stockpile design

Stockpiling at the Site should be undertaken in accordance with the Queensland Guidelines.

This guidance includes

- The construction of a 300 mm low permeability layer preventing leachate from pooling in the pad and directing runoff into the collection drains.
- A guard layer of AgLime placed on top of the base pad
- Containment of the stockpile, which includes bunding of the stockpile and construction of leachate collection drains.
- Design, including the placement on level ground away from surface water and overland flow pathways, and keeping stockpiles to sizes of < 500 m^3
- Treatment of runoff as required, including pH adjustment and removal of metals.
- Stockpile cover to prevent the ingress of rain into the stockpile.

8.5 Unexpected discovery protocols

If field indicators of acid sulfates such as those discussed in Section 6.4 are observed in the low, or negligible risk areas, of the Site during earthworks, then works should stop, and the worksite made safe (including covering of exposed material and testing of any groundwater) and the environmental specialist should make an assessment in accordance with the methods in the sampling design.

8.6 Groundwater discharge

pH readings from groundwater should be collected before dewatering begins. Provided that the pH is above the relevant discharge criteria, the water may be discharged to ground without treatment. Groundwater should then be tested twice daily for the first three days of dewatering. If these records show successive comparable results, testing may be reduced to once daily.

If trigger values are exceeded water will need to be held and treated with AgLime to a neutral pH before discharge.

8.7 Monitoring and record keeping

To assess the effectiveness of the management monitoring should be undertaken in accordance with the requirements in Table 13.

Table 13 Monitoring requirements

Requirement	Frequency	Measurement	Action
Stockpile monitoring	Daily	Soil pH testing	If material has a pH < 5.5 it should be immediately retreated If material has a pH 5.5 – 6.0 it should be relimed.
Runoff monitoring	Daily	pH and electroconductivity in treatment areas and sediment basins	If pH is below 6.5, water should be collected and AgLime should be applied before discharge in lined basins or bunded areas.
Surface water monitoring	Daily	Water pH	If pH is more than 0.5 below baseline monitoring works should cease and further assessment be undertaken. Inform Waikato Regional Council of discharge within 24 hours.
Dewatering monitoring	Twice daily for three days, then daily if trend observed	Water pH	If pH is below 6.5 or baseline groundwater pH range water should be retained and pH raised before discharge.
Records	Daily	• Location of the stockpile • Origin of the material and descriptions of the texture • Monitoring records • Quantity of AgLime used at the stockpile.	
	As required	Non-conformance and corrective actions	

9 VALIDATION SAMPLING

Treated acid sulfate soils should be sampled to verify the neutralisation. The environmental specialist will prepare a validation sampling plan with collections of samples at a density of at least one per 250 m^3, which will be sent to an IANZ accredited laboratory for chromium reducible sulfur analysis.

10 REPORTING

10.1 Finalised management plan

A finalised acid sulfate management plan should be presented to Waikato Regional Council for approval at least 20 days before works begin at the Site. This will incorporate the results of sampling undertaken as per Section 6 of this report.

10.2 Updates to the management plan

If additional updates are required for this plan based on changes in construction methodology or additional sampling these will be submitted to council for approval. Works within 20 metres of the area where the change has occurred will be paused until council accepts the updates to the report.

10.3 Monitoring reports

Records from the monitoring discussed in Section 8.6 should be collated weekly and submitted as part of compliance reporting required by the consent.

10.4 Verification reporting

If soil treatment is undertaken, or if material is removed offsite for disposal verification reporting should be undertaken under the supervision of the environmental specialist to demonstrate that the treatment has been successful. This should include (but is not limited to)

- The treatment measures, including quantities of AgLime and the treatment method
- Verification sampling results
- A plan showing
    - The area of the Site where the material was removed from
    - The location of the stockpile / treatment
    - The location the material was reinstated / disposed to

11 REPORT STATUS

This Acid Sulfate Soils Management Plan has been prepared by David Jackson, who holds a Bachelor of Science in Chemistry and a Postgraduate Certificate in Chemistry. He has experience undertaking acid sulfate soil investigations and management projects in the Waikato, Auckland, and Whanganui regions. The content of this report aligns with the approaches in the Waikato Regional Council Acid Sulfate Soils Technical Guidance, the investigation methodology in the Water Quality Australia National Acid Sulfate Soils Guidance, and the management practices in the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines.

12 REFERENCES

BCD Group. (2026). *Acid sulfate soils desktop assessment.* Hamilton: BCD Group.

Dear, S., Williams, K. M., Ahern, C., Dobos, S., Moore, N., & O'Brien, L. (2024). *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines, Version 5.1.* Brisbane: Department of Environment, Science and Innovation, Queensland.

TDPIPWE. (2009). *Tasmanian Acid Sulfate Soil Management Guidelines.* Hobart: TDPIPWE.

Waikato Regional Council. (2024). *Waikato Region Acid Sulfate Soils Preliminary Risk Assessment.* Kirikiriroa: Waikato Regional Council.

Waikato Regional Council. (2025). *Acid Sulfate Soils Technical Guidance.* Hamilton: Waikato Regional Council.

Water Quality Australia. (2018). *National Acid Sulfate Soils Guidance.* Water Quality Australia.

13 REPORT LIMITATIONS

This document is prepared by BCD Group Limited (BCD) for Waikato Thoroughbred Racing (the Client) for the limited purposes described in this document. BCD accepts no liability if the document is used for a different purpose or if it is used or relied on by another person. Any such use or reliance will be solely at their own risk.

This report has been prepared by BCD based on information provided by the Client and other third parties. BCD has not independently verified the information and has relied upon it being accurate, complete, and sufficient for use by BCD in preparing the report. BCD accepts no responsibility for errors or omissions in, or the currency or sufficiency of the provided information.

This document has been prepared based on observations of the site vicinity, review of third-party information, desktop review of historical aerial photographs and analysis of selected soil samples. The site conditions as described in this document have been interpreted from and are subject to this information and its limitations, and accordingly, BCD does not represent that its interpretation accurately represents the full site conditions.

Laboratory test results provide an approximation of the concentration of the tested analytes and are subject to the inherent limitations of the laboratory techniques used for the tests. Interpretations of subsurface conditions, including contaminant concentrations, are not guaranteed at distances away from the specific points of sampling.

Appendix A Site Location



Client: WAIKATO THOROUGHBRED RACING — TE RAPA · CAMBRIDGE · WAIPA

Contractor:

BCD GROUP

Sheet: Site Location

Project Title: Waikato Thoroughbred Racing
Pencarrow, Hooker & Duncan Roads

Revision	Date	By	Reason
01	12/12/2025	SL	Master Planning

Drawn: SL
Engineer: SL
SCALE: N/A
At: A3
Job Number: 23-1883
Sheet Number:
Revision: 01

All dimensions to be verified on site before making any shop drawings or commencing any work

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LEGEND

- Site Boundaries
- Internal roads
- Existing Structures

Tamahere Drive
Strawberry Fields Lane
Summerfield Lane
Pencarrow Road
Waikato Expressway State Highway 1
Duncan Road
Hautapu Road
Hooker Road
State Highway 1
Discombe Road

0 300 600 900 m

Notes:
Elevation Contours are in terms of NZVD2016, generated using QGIS based on 2021 Lidar sourced from LINZ.
Aerial imagery, property boundaries, etc sourced from LINZ.

Client: WAIKATO THOROUGHBRED RACING — TE RAPA · CAMBRIDGE · WAIPA

Contractor:

BCD GROUP

Sheet: Internal Infrastructure

Project Title: Waikato Thoroughbred Racing
Pencarrow, Hooker & Duncan Roads

Revision	Date	By	Reason
02	27/02/2026	BB	Fast Track Referral Application
01	12/12/2025	SL	Master Planning

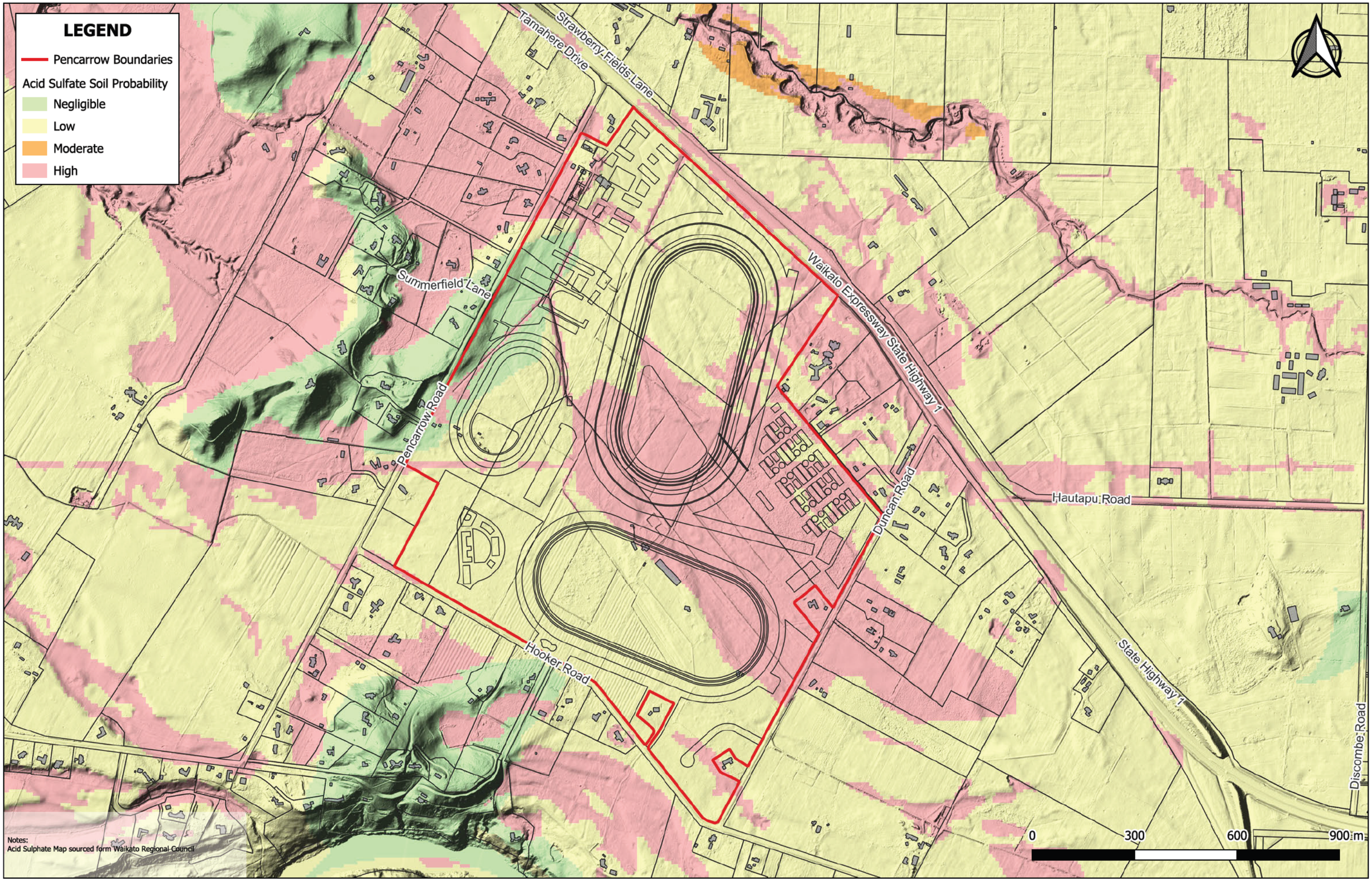
Drawn: SL
Engineer: SL
SCALE: 1000
At: A3
Job Number: 23-1883
Sheet Number:
Revision: 02

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Appendix B Site Masterplans (refer Appendix M: Architectural Master Plan and Drawings – Fast Track Substantive Application Planning Assessment – Over-all summary)

Appendix C Acid Sulfate Soils Risk



Client: WAIKATO THOROUGHBRED RACING — TE RAPA · CAMBRIDGE · WAIPA

Contractor:

BCD GROUP

Sheet: WRC Acid Sulphate Map

Project Title: Waikato Thoroughbred Racing
Pencarrow, Hooker & Duncan Roads

Revision	Date	By	Reason
03	25/04/2026	BB	Substantive Application
02	15/04/2026	BB	Master Planning
01	03/12/2025	BB	Master Planning

Drawn: BB
Engineer: BB
SCALE: 1:10000
At: A3

Job Number:	Sheet Number:	Revision:
23-1883	1	03

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Appendix C

Change of Levels (cut and fill)

(Refer Civil Design Drawing “Change in Levels – Overall C-200 revision 3)