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QUEENSTOWN LAKES DISTRICT COUNCIL

Trail Design Standards & Specifications – 2025

Drafted – G Chapman – Olla
Approved – A Hoddinott

Contents

Introduction

The Queenstown Lakes District Council administers over 180km of cycle and walking trails. These trails are a valuable asset to the Lakes District and the purpose of this standard is to ensure greater consistency and quality in the development of all new trails and ensure that future trails are developed in line with the active transport needs of the area, Ministry of Business, Innovation and Employment (MBIE) Standards and the relevant master plans. Connectivity of new trails is essential for a successful trail and commuting network.

This design standard is being driven by the increasing development of trails in the Queenstown Lakes District and in particular trails constructed as part of private land development projects as well as those created by volunteer organisations. These trails are predominantly designed and built as cycleway projects however they are effectively used for both cycling and walking. For the purposes of simplicity Grade 1, 2 and 3 trails shall be considered dual use walking and cycling and shall be built as per this design guide. If trails are going to be specialist MTB or walking trails, then direction is provided further on in the document on what appropriate design guides to follow.

This standard is intended to guide cycle trail designers and developers to achieve consistently high standards of cycle trail best suited to meet long term community needs (network connections and latent demand) and minimise ongoing maintenance costs to Council, as the trail owner.

The guide has been developed to closely mirror the New Zealand Cycle Trail (NZCT) "Cycle Trail Design Guide", 2024 with minor changes to take into account changes in design and construction that have arisen during local practice.

The NZCT guide implemented and widely publicised the 1-6 trail grading system used by the mountain biking community. In terms of trails developed within the QLDC, these will be graded as follows:

NZCT Grading	QLDC Classification
1	Premiere Trails
2	Premiere/Community Trails
3	Community Trails
4 and above	Natural Trails and MTB Trails

Cycle trails graded 4-6 being purpose-built mountain bike tracks and not cycle trails. Development of mountain bike tracks is outside of the scope of this standard.

Additionally, the Department of Conservation (DOC) also have track design guides. These mainly relate to walking track construction and are available on the DOC website. DOC has adopted the NZCT grading system of rating trails as 1-6.

Overarching Goal of this Design standard and Construction Specification

To guide land developers and trail designers to achieve high-quality trails specifically designed and built to cater to the needs of the community(s) it connects and serves and that minimises future maintenance costs to Council.

Scope of this Guide

The primary scope of this guide is the design and construction of Grade 1-3 trails; however, guidance and direction is also provided below for other trails such as MTB and walking. The design and construction of 'mountain bike' tracks (Grades 4-6) is very well covered by the Recreation New Zealand " New Zealand Mountain Bike Trail Design and Construction Guidelines". DOC's track design guides are best suited for the design of walking tracks only.

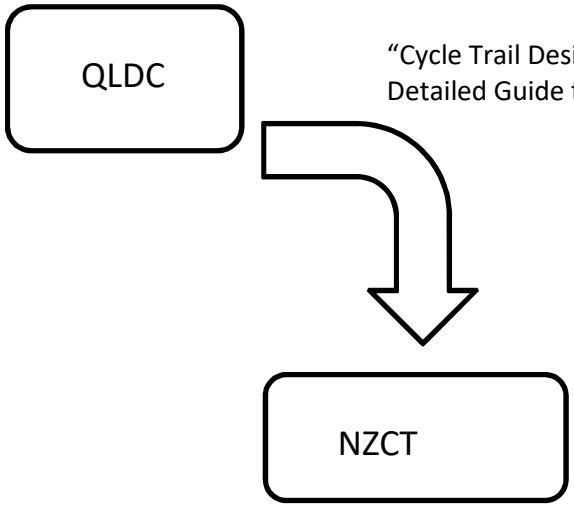
The design and construction of trails suited to horses has not been considered as part of this guide. There is good material available at the following link specific to horse trails:
http://www.fhwa.dot.gov/environment/recreational_trails/publications/fs_publications/07232816/page05.cfm

The "Nga Haerenga New Zealand Cyle Trails Design Guide" make the following comment.

It is not recommended NZCT's routes be designed to accommodate equestrian use. Horses can damage track surfaces, requiring more intensive maintenance or reducing surface quality from a cycling perspective. Sharing the trails with horses requires a much wider track and can have safety issues if horses are spooked by approaching cyclists.
The path specifications in this guide are not intended to accommodate horses and horseriding. In particular, paths designed to include equestrians would require wider widths, higher overhead clearances, increased loadings for structural design and alternative gateways for horses at cattle stops. If a path is already established, or terrain allows for dual cycle and equestrian paths, accommodation of horses is at the discretion of trail designers, owners and operators.
There are fewer complications for on-road trails, as roads are strong enough to accommodate horses and equestrians are legally allowed to ride on road shoulders.

Overview of Trail Design Standards

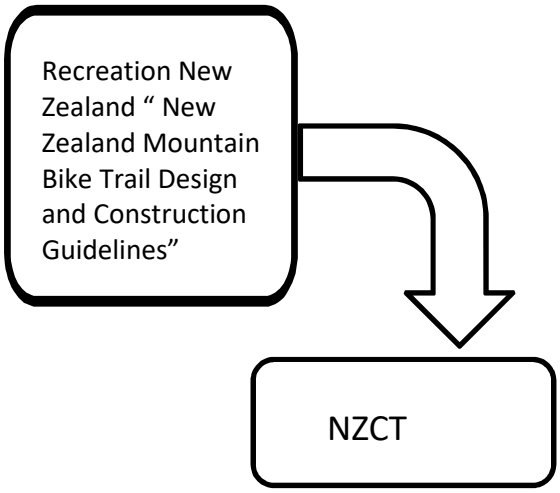
GRADE 1, 2 & 3 CYCLE TRAILS: Premiere and Community Trails



"Cycle Trail Design Standards & Specifications" - 2024
Detailed Guide to the Design and Construction of Cycle Trails

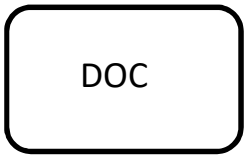
"Nga Haerenga New Zealand Cyle Trails Design Guide 2024"

GRADE 4, 5 & 6 MTB TRACKS: Natural Trails



"Nga Haerenga New Zealand Cyle Trails Design Guide 2024"

WALKING SPECIFIC TRACKS



"Track Construction & Maintenance Guidelines" DOC, 2006 & SNZ Handbook HB8630: Outdoor Visitor Structures which is a detailed guide to walking track design

Trail Grading & User Groups

The New Zealand Cycle Trail "Nga Haerenga New Zealand Cyle Trails Design Guide 2024 is the best starting point in the identification of a cycle trail grading system.1. This was further refined in 20204. This guide uses this document as a basis with minor changes for local precedent.

Over the intervening 5 years this system has been refined and present the revised grading technical specifications as follows:

1. Grade 1 – Easiest; Flat, wide, smooth trail. Trail feels safe to ride. Ideal as a first ride for non-cyclists, and those wanting an easy gradient or experience. Trail allows for cyclists to ride two abreast most of the time, and provides a social component to the ride. Cyclists will be able to ride the total distance of the trail without dismounting for obstacles.

2. Gr Grade 2 – Easy; Some gentle climbs, smooth trail. Suitable for confident beginner riders, the trail is predictable with no surprises. Social component with riders able to ride side by side at times, but possibly large sections of single trail.

3. Grade 3 – Intermediate; Narrow trail, there will be some hills to climb, obstacles may be encountered on the trail, and there may be exposure on the edge of the trail.

The majority of trails within the QLDC network are classed as Grade 1-2 with a few being Grade 3.

In order to provide the greatest accessibility to any new trails, every trail should be designed to meet Grade 1 or 2. Grade 3 should only be considered where the users are predominantly not commuters, families or novice cyclists and the trail is not forming part of a connective network to link communities or part thereof. In other words, not a critical linkage to the cycling network.

[1] http://www.nzcycletrail.com/about/resources

Detailed Trail Grade Specifications

The minimum specifications for each trail grade can be expanded as follows:

Grade 1 

1. Description: Flat, wide, smooth trail. Trail feels safe to ride. Ideal as a first ride for noncyclists, and those wanting an easy gradient or experience. Trail allows for cyclists to ride two abreast most of the time, and provides a social component to the ride. Cyclists will be able to ride the total distance of the trail without dismounting for obstacles.
2. Gradient: 0–3.5% for at least 90% of trail; between 3.5–5% for steeper slopes up to 100 metres long, and between 5–7% for steeper slopes of up to 10 metres long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 7% for up to 100m). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4).
3. Width: 'Double trail' preferred = 2.5m to 4m for 90% of trail, where cyclists may ride side by side. 'Single trail' width of 1.5m, with 1.2m minimum. Horizontal clearances as in Appendix 3A, Section A2 in the MBIE Design Guide.
4. Vertical clearance: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.
5. Radius of turn: 6m minimum to outside of turn.
6. Surface: Compacted/stabilised base course, under a top course aggregate of maximum AP 20mm. The surface shall be smooth and even, and easy to ride in all weather conditions.
7. Watercourses: All water courses bridged.
8. Bridge width: Recommended bridge width of at least 1.5m, absolute minimum width of 1.2m with handrail/barrier to fall. The approach should be the same width as the structure for 10 metres.
9. Obstacles: None. No stiles. Cattle stops should preferably be at least 1.5m wide, and minimum 1.2m wide. Length: 3.5 to 4.5 hours/day (30 to 50 km/day).
10. Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death or serious harm require handrails. The 'Fall heights' sections in Appendices 3A to 3E (Design information for contractors) contain a calculation process for confirming whether barriers are required – 'Decision framework for determining fall treatment' in the MBIE Design Guide.

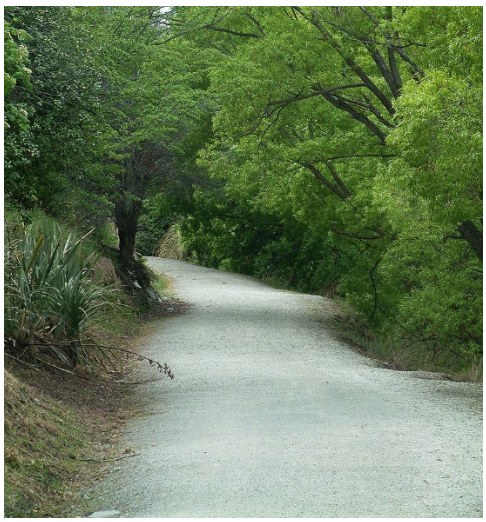


Image 1 – Frankton Trail from Queenstown to Frankton Beach

Grade 2

1. **Description**: Some gentle climbs, smooth trail. Suitable for confident beginner riders, the trail is predictable with no surprises. Social component with riders able to ride side by side at times, but possibly large sections of single trail.
2. **Gradient**: 0–6% for at least 90% of trail; between 6–8.8% for steeper slopes up to 100m long, and between 8.8–10.5% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 14%). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4) of the MBIE Design Guide.
3. **Width**: Between 0.9m and 1.5m for single trail and minimum 2.2m for double trail sections with adequate clearances. Horizontal clearances as in Appendix 3A, Section A2 in the MBIE Design Guide.
4. **Vertical clearance**: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.
5. **Radius of turn**: 4m minimum with at least 5m desirable to outside of turn.
6. **Surface**: Compacted/stabilised base course, under a maximum top course aggregate of maximum AP 30mm. The surface should be smooth and easy to ride in all weather conditions.
7. **Watercourses**: Watercourses bridged, except for fords with less than 100mm of water in normal flow, which can be easily ridden. Surface should be as smooth as adjacent trail.
8. Bridge width: Recommended bridge width at least 1.5m, minimum width of 1.0m with handrail/barrier to fall. The approach should be the same width as the structure for 10 metres.
9. Obstacles: Some rocks/roots/ruts that can either be avoided, or are less than 50mm high. No stiles. Cattle stops should be minimum 1.2m wide.
10. Length: 4 to 5 hours/day (30 to 50km/day).
11. Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death or serious harm require handrails. The 'Fall heights' sections in Appendices 3A to 3E (Design information for contractors) of the MBIE Design Guide have a calculation process for confirming whether barriers are required – 'Decision framework for determining fall treatment'.

Image 2 and 3 –Grade 2 trails, ramps and barriers

Grade 3

1. Description: Narrow trail, there will be some hills to climb, obstacles may be encountered on the trail, and there may be exposure on the edge of the trail.
2. Gradient: 0–8.8% for at least 90% of trail; between 8.8–12.3% for steeper slopes up to 100m long, and a maximum of 17.5% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 19.5%). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4) of the MBIE Design Guide.
3. Width: 0.9m for 90% of the trail, 0.6m minimum with adequate clearances. Horizontal clearances as in Appendix 3C, Section C2 of the MBIE Design Guide.
4. Vertical clearance: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.
5. Radius of turn: 2.5m minimum, with at least 4m desirable to outside of turn.
6. Surface: Generally firm, but may have some short muddy or loose sections.
7. Watercourses: Watercourses bridged, except for fords with less than 200mm of water in normal flow, which can be easily ridden.
8. Bridge width: Recommended at least 1.0m; minimum 0.75m deck if the width at handlebar height is 1.2m. If there are no handrails, then minimum width of 1m for structures less than 0.5m high.
9. Obstacles: Occasional rocks/roots and ruts may be up to 100mm high/deep and may be
10. unavoidable.
11. Length: 4 to 6 hours/day (30 to 50km/day for an intermediate cyclist).
12. Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death require handrails. Areas where a fall would likely result in serious harm require either handrails or sight rails or a warning sign, depending on the nature of the drop-off and likelihood of a fall. The ‘Fall heights’ sections in Appendices 3A to 3E (Design information for contractors) of the MBIE Design Guide have a calculation process for confirming whether barriers are required – ‘Decision framework for determining fall treatment’.

Image 4 – Grade 3 trails, Jacks Point Trail

Grade 4 – Naturel Walking/Cycling Tracks

1. Description: Steep climbs, with unavoidable obstacles on a narrow trail, and there will be
2. poor traction in places. Possibly some walking sections.
3. Gradient: 0–12.3% for at least 90% of trail; between 12.3–16% for steeper slopes up to 100m
4. long, and maximum 21% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 27%). Sealed trails can be steeper (same as the equivalent Grade of on-road trail; see Table 4) of the MBIE Design Guide.
5. Width: 0.6m minimum on steep terrain with drop-offs, 0.3m minimum on flat ground.
6. Horizontal clearances as in Appendix 3D, Section D2 of the MBIE Design Guide
7. Vertical clearance: Minimum vertical clearance of 2.2m to overhead hazards. A 2.0m vertical clearance may be used for discrete overhead hazards, such as tree branches or existing structures.
8. Radius of turn: 2m minimum, with 3m desirable to outside of turn.
9. Surface: Firm and loose.
10. Watercourses: Watercourses bridged, except for fords with less than 300mm of water in normal flow, which can be easily ridden.
11. Bridge width: Recommended 1.0m; minimum 0.6m.
12. Obstacles: Many rocks/roots and ruts up to 200mm high/deep. Also, some purposebuilt obstacles to liven things up, such as drop-offs and jumps.
13. Length: 4 to 8 hours/day (30 to 60km/day) for advanced cyclists.
14. Barriers/guard rails: Areas such as bluffs or bridges where a fall would result in death require handrails. Areas where a fall would likely result in serious harm require either handrails or sight rails or a warning sign, depending on the nature of the drop off and likelihood of a fall. The 'Fall heights' sections in Appendices 3A to 3E (Design information for contractors) of the MBIE Design Guide have a calculation process for confirming whether barriers are required – 'Decision framework for determining fall treatment'.

Image 5 – Tiki Trail - Queenstown

Cycle Trail Design Considerations

Step 1: Identify the User Group & Required Trail Grade

If the proposed trail is connecting communities and will form part of a larger network such as the Wakatipu or Wanaka Active Network's Primary and Secondary Routes, then the minimum standard will be Grade 2 (Always design to achieve the best grade where possible).

If the route has been identified as being part of a primary commuter route specific design may be required to comply with NZTA or QLDC Active Transport requirements for example cycleway surface, signage and supporting facilities, currently there is information available via https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/cycling-standards-and-guidance/cycling-network-guidance/cycle-network-and-route-planning-guide/principles/cycle-route-components-between-intersections/. If this is the case consultation with the QLDC Parks team is required where further guidance will be supplied.

The user groups for Grades 1 and 2 are as follows:

a) Families including small children

b) Novice riders who either have never ridden or ride infrequently

c) Cycle tourers and commuters*

d) Mountain bike riders

Groups (a) and (b) require a safe enjoyable cycling experience that is accessible with limited/no cycling skill. The trail must be designed with the needs of the most discerning user group in mind. For the above this would be families and novice riders. Cycle tourers, commuters and mountain bikers have a higher degree of skill and experience making them able to handle less well formed trails[2].

Having identified the user group, the designer should aim to achieve the flattest grade possible to meet the highest Grading. This ensures the maximum utility and accessibility to the community irrespective of other aspects of the design.

Step 2: Design Alignment

The designer needs to consider how to fit the trail into the land to minimise gradients, minimise hairpins, control storm runoff and drainage, climb hills, design and integrate structures and achieve the required width and finish that creates or results in a desire line.

Where the trail is expected to cross roads or state highways, specific design of road crossing must be undertaken by a suitable qualified Traffic Safety Engineers. This will include specific consultation with both NZTA representatives at Aspiring Highways and the QLDC Roading team.

* Commuter tracks require slightly different design considerations outside of the scope of this guide

Desire Line

The designer needs to understand where the trail users are coming from (How do they access the trail) and going to (where will they leave the trail network) as well as how will the riders respond to the trail alignment to understand the desire line.

The trail should act as efficient travel alternative, making connecting trails a significant factor in the alignment of the trail. Every effort to connect trails and easements should be made to allow best possible access for the users. This may include pre-marking easement locations before the trail alignment is chosen. These easements as well as other access points should connect to other modes of transport and integrate into the Active Travel Network.

Desire line refers to the preferred alignment for trail users and manifests itself in riders cutting corners or short cutting sections of trail they consider 'undesirable' when it has not been achieved.

An example of an error in desire line is making curves across a flat open section of terrain when a straighter piece of trail would suffice. Riders are likely to cut corners in this situation. Each section of trail should be considered from the rider's perspective to ensure that *desire line* is achieved as much as possible.

Ultimately desire line can be hard to predict. A designer needs to consider this especially in open country where riders can see the destination.

Hair Pins or Switchbacks

It is often necessary to use hair pins (corners of ~180 degrees) to negotiate steep terrain. The use of hairpins needs very careful consideration to avoid rutting, erosion damage and safety issues for novice or inexperienced riders.

Hairpins should be graded such that the longitudinal grade through the corner is no more than 2 degrees with the cross-fall sloped to the inside to match the speed of travel such that the corner at the design speed feels safe and secure without sideways slipping.

Hairpin radius should be as wide a possible within the terrain constraints but not less than the minimum specified in design drawing R4030_E3_3 attached in the Appendix.

The approach to a hairpin should provide enough sight distance for riders to slow down prior to the corner without locking their brakes and skidding. This requires that the approach gradient is quite flat (0-2 degrees) and the surface is well compacted. It is unacceptable to have a constant 4 degree grade into and through a hairpin as the approach will rut causing operational and maintenance issues. Designers may use a rolling-up grade dip (sag) to slow riders naturally prior to a corner. This reduces the likelihood of skidding and loss of control through the corner and helps control stormwater run off..

Curves, Hills and Cross-Fall

In hilly terrain, curves should follow the terrain. Additionally, the terrain should be used to assist drainage with low points in gullies and higher points near ridges. This promotes drainage towards gullies.

The trail surface cross-fall should reflect the terrain and trail geometry. Out sloped corners (very dangerous) are to be avoided at all costs. When a corner is properly designed and built a rider feels well connected to the trail through adequate cross-fall for the design speed and side friction. Refer to the typical cross sections attached for guidance. There are no set rules, but the designer must ensure that the completed trail rides without inducing side slip or fear in the target user group.

Geotechnical Assessment of Trails

At the initial scoping stage, it is desirable to undertake a desktop assessment of available information to pin

point any possible areas of instability where a trail is proposed. This allows appropriate planning and funding to be included at the design stage. Additionally, the designer should walk the trail alignment to confirm no obvious areas of instability

During the design stage known areas of instability should be addressed by specific design or alignments. If avoidable, this is the preferred option. However, as most trails are built on public land adjoining water ways, often the only option is to build over these areas.

As part of the following approval process, areas of instability should be clearly identified on the design plans together with site assessment and solutions. Council wish to avoid ongoing maintenance issues relating to instability in cycle trails and it is hoped such planning will reduce the incidence.

Long Term Stability

Tracks typically traverse a wide variation in topography and ground conditions. Full engineering assessment would be impractical and a poor return on investment. As areas of instability may become apparent following construction, the defects liability period is expected to address these issues.

For any slope stability scenario, a slope is considered to have suitable long-term stability if its performance and design is fit for purpose. Stakeholder agreement is required on what constitutes fit for purpose for the project.

The proposed definition of long-term stability for a gravel off-road rural cycle trail is as follows.

- The slopes, either cut or fill, should be formed so that deep-seated failure affecting a significant portion of the track does not occur in the static (non-seismic) case, or result in the closure of the trail, provided the slope profile, track condition and drainage are maintained.
- It is acceptable to have slope angles that result in minor fretting and slumping that can be addressed via cyclic maintenance using readily available tools and equipment.
- Slopes and batters are resistant to scouring and sediment run-off.
- No significant failures are observed within two years of completion.

Design Approval by QLDC

Prior to any works commencing on the site, the trail designer shall submit the trail design plan, long section (if available – for large projects it is often not possible or cost effective to prepare detailed terrain models), typical cross section, trail design user group and outline of how the trail caters to the user group and fits the trail network together with construction specifications to QLDC for approval prior to commencing any trail works on site.

QLDC along with the Queenstown Trails Trust have both undertaken the installation of directional signage, to ensure that the proposed signage is fit for purpose QLDC requires to see mock ups of proposed signage to ensure that it complies with the trail signage strategy, dimensions and reflectivity.

A specific plan shall be produced showing property boundaries and any easements required. Post completion as-builts are to confirm that the trail has been built on the intended alignment and is within the intended parcels of land.

Additionally, the designer shall ensure the proposed trail is marked out on site with flagging tape at no more than 20m intervals and staked in detail for hairpins and curves to ensure the proposed alignment is able to be assessed in detail. The assessment will include a minimum of alignment and gradient checks.

QLDC shall have the opportunity to inspect the trail alignment on site with the designer. Any amendments requested by the Council shall be addressed to Council's satisfaction prior to approval of the works.

While the approval process is designed to identify errors in the design and layout of the trail, it is not possible to anticipate every issue. Further, due to terrain constraints, vegetation cover and access, it may not be possible to assess and design every section of trail in a cost-effective manner. Therefore, the **design approval does not** in itself **reduce any liability on the trail developer** to achieve the standards and riding requirements detailed in earlier sections of this standard.

Project Management

The complexity involved with trail design and construction should not be underestimated. An understanding of planning, health and safety, design, earthworks and contract negotiations is required for a successful project. When a design is being submitted to QLDC a project manager must be named in the application along with their relevant experience for the acceptance by council. The nominated person must be able to demonstrate that they have the knowledge and experience to deliver the project.

It should be noted that during construction of the trail it is the Project Managers reasonability to ensure that the construction is undertaken in line with all relevant council requirements.

Trail Construction & Completion

At the completion of works, the trail contractor and developer shall certify the works as complete and issue a completion certificate in the form of NZS 4404:2010 Schedules 1B & 1C. The Council shall then inspect the works to confirm the completed trail meets the needs of the user groups/community the trail serves. This shall include test riding the completed trail, measuring grades and cross falls and corner radius. The completion inspection is not solely a compliance check but a confirmation of achieving the needs of the trail user.

Where the trail is found to be deficient in terms of grades, alignment, cross fall or other defects (see defects section), the trail developer shall remedy the defect prior to Council signing the s224c certificate and/or taking over the trail asset. Alternatively, the trail developer may enter a cash bond for the value of the works in accordance with Council's bonding policy for land development works.

For trails involving structures that do not require a building consent the trail developer shall submit the following to Council:

- NZS 4404:2010 Schedule 1B (contractor's completion)
- NZS 4404:2010 Schedule 1C certificate (Construction review)
- Typical design details for the structure verifying they meet the requirements of this specifcation

Where a structure requires a building consent, the trail developer shall supply Council's Parks Department a copy of the building consent documents including PS1, PS3, PS4 and Code Compliance together with design drawings and/or as-built drawings prior to sign off/acceptance of the asset. While this may be a double up on the BC process, often the design detail is not readily accessible and the purpose is to ensure the Parks Department has a complete set of documents for ongoing operation and maintenance.

Additionally, all trails and structures including bridges, culverts, signs, bollards, cattle stops, fences etc. shall be accurately surveyed and an as-built plan prepared and submitted in accordance with Council's land development standards to detail all trail related assets being taken over by Council.

The Defects Period

Once the works have been signed off by Council as complete, the trail developer shall be responsible for a 36-month defects period. At the completion of the defects period, Council shall be advised and a final inspection undertaken. The final inspection shall assess the trail as if it were in the **new as- built state**. That is the trail developer shall be required to present the trail in an as-new condition at the end of the defects period.

If the trail requires changes to alignment to avoid or remedy rutting, surface erosion or desire line errors, the trail developer shall be responsible for such modifications at their cost prior to Council taking over responsibility irrespective of whether these were noted at the time of the design approval or completion inspection as often it takes time for errors in design and construction to manifest through use of the trail.

The following parameters shall be achieved for completed trails at the end of the defects period:

- The trail shall have good flow and speed control that does not result in rutting or surface erosion from skidding
- Finished surface shall be interlocking at the end of the defects period and free from loose gravel.
- The surface of the gravel and +0.5m either side of the formation edge shall be clear of all weeds. If there are weeds within the surface gravel, this shall be considered a defect and the developer shall be liable to remedy by mechanical removal.

- Within all the earthworked areas adjoining the trail, all noxious weeds shall be removed
- All verges shall be mown/cut to a maximum 350mm height up to +0.5m off the edge of the formation
- Any stormwater erosion shall be stabilised with rock protection or matting
- Adverse cross fall shall be rectified
- Any silting of culverts or debris in culverts or water tables shall be cleared
- Full design width shall be presented
- Vegetation shall be clear 1.0m beyond the edge of the trail and 2.5m above the trail
- Track surface free from any water ponding more than 20mm

Trail Reinstatement and Repair Specification

As stated above the trail shall be presented to QLDC in a new as-built state at the end of the defects period, however it is acknowledged that work may be required on trails which is not related to the original contractor or developer, for example the installation of services or the like.

Attached to the appendix is a typical detail for reinstatement of the trail post service installation or storm damage. The detail shall be read in conjunction with the material specifications.

Trail Construction Specification – Grade 2

Attached as Appendix A is the standard Construction Specification for a Grade 2 Trail. The specification outlines the standard work methodologies required to complete a cycle trail to Council standards.

Where designers are forming a Grade 1 or Grade 3 trail, the specification shall be modified in accordance with the section “Detailed Trail Grade Specifications” to take account of differing maximum gradients, curve radius, surface and so forth.

Trail Construction – Typical Cross Sections & Details

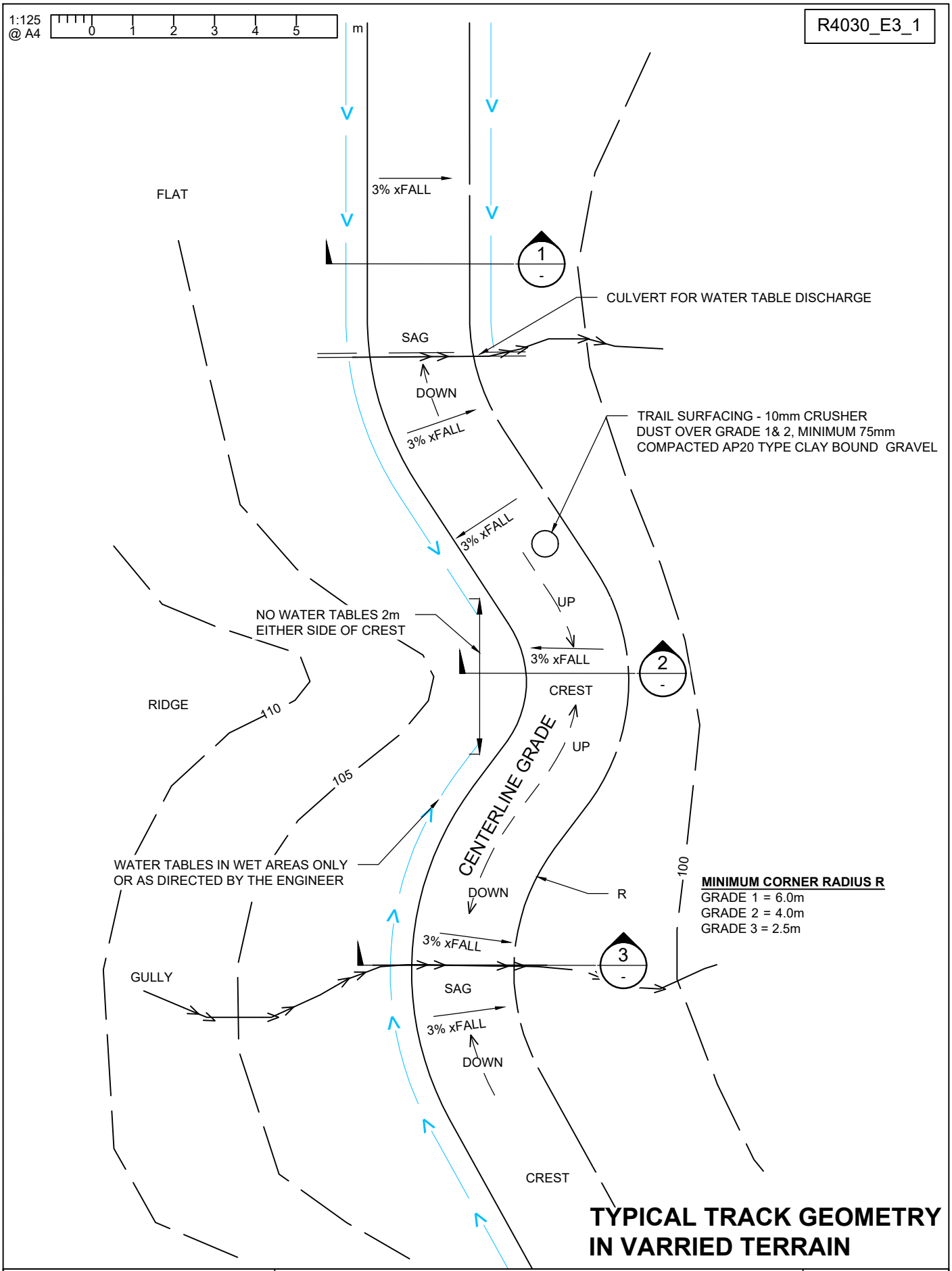
Attached as Appendix B are typical cross section and detail plans ref R4030_E3_1-4. These provide design detail in relation to typical cross sections in different terrain, use of curves and hairpins and other typical details used in cycle trail construction but are not intended to cover every aspect of trail construction.

References

- Recreation New Zealand " New Zealand Mountain Bike Trail Design and Construction Guidelines"
- Standards New Zealand NZS HB 8630:2004 – Tracks and Outdoor Visitor Structures
- "Nga Haerenga New Zealand Cyle Trails Design Guide 2024"Standards New Zealand NZS 4404:2004 – Land Development & Subdivision Engineering
- "Track Construction & Maintenance Guidelines" 2006, Department of Conservation

Appendices

Drawings



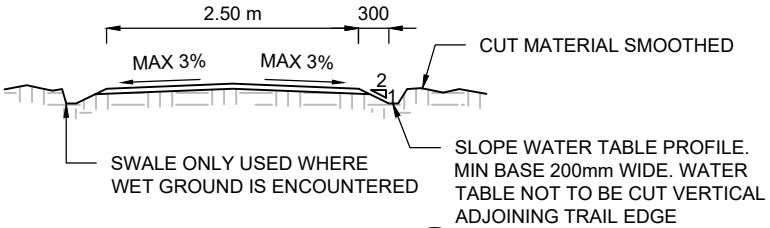
QUEENSTOWN LAKES DISTRICT COUNCIL

TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS				SCALE: 1:125 @ A4
PREPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015		DATUM & LEVEL: NA
REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2024	DRAWING REFERENCE: R4030_E3_1	Revision: B

Original Sheet Size A4 [210x297] Plot Date 2018-11-28 at 10:53:05 AM Path \\icsv01\GroupLib\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail\Sheet01.dwg C01

1:75 @ A4

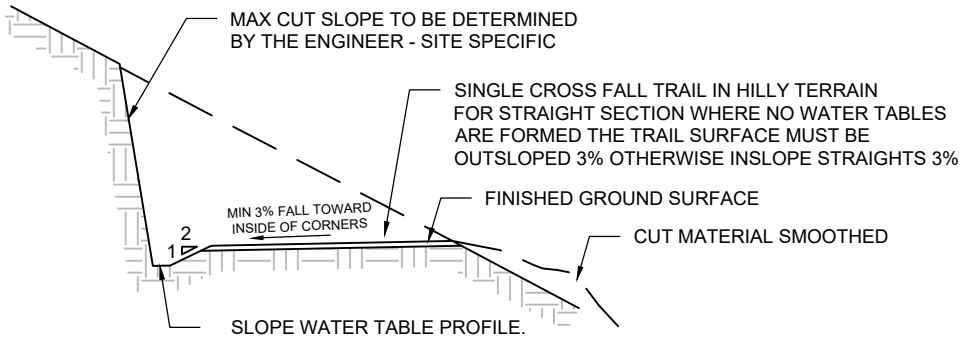
R4030_E3_2



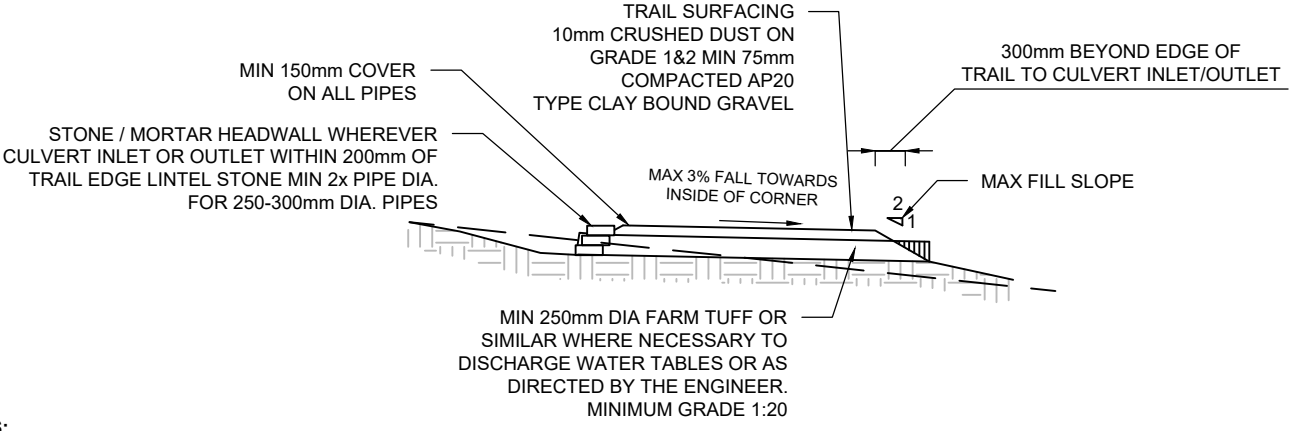
TRAIL DESIGN WIDTH
GRADE 1 = 2.5m - 4.0m
GRADE 2 = 2.2-3.0m
GRADE 3 = 0.6-0.9m

SINGLE CROSSFALL (1 C02)
USE IN FLAT COUNTRY

ALL CORNERS MUST BE FINISHED WITH SINGLE CROSS FALL SLOPING TO THE INSIDE OF THE CORNER.



FULL CUT BENCH (2 C02)
USE WHERE CROSS SLOPE > 3:1 (>18°)



USE WHERE CROSS SLOPE < 3:1 (<18°)

CUT & FILL (3 C02)
USE WHERE CROSS SLOPE < 3:1 (<18°)

NOTES:

1. MINIMUM TRAIN CROSS FALL ON CORNERS = 3%
2. TRAIL SHOULD SAG AT GULLIES AND CREST AT RIDGES TO ASSIST DRAINAGE
3. USE FULL CUT BENCH WHERE SLOPE IS >3:1; USE A COMBINATION OF CUT & FILL WHERE SLOPE <3:1
4. WATER TABLES, WHERE USED, SHALL BE SLOPED AND NOT VERTICALLY CUT AT TRAIL EDGE

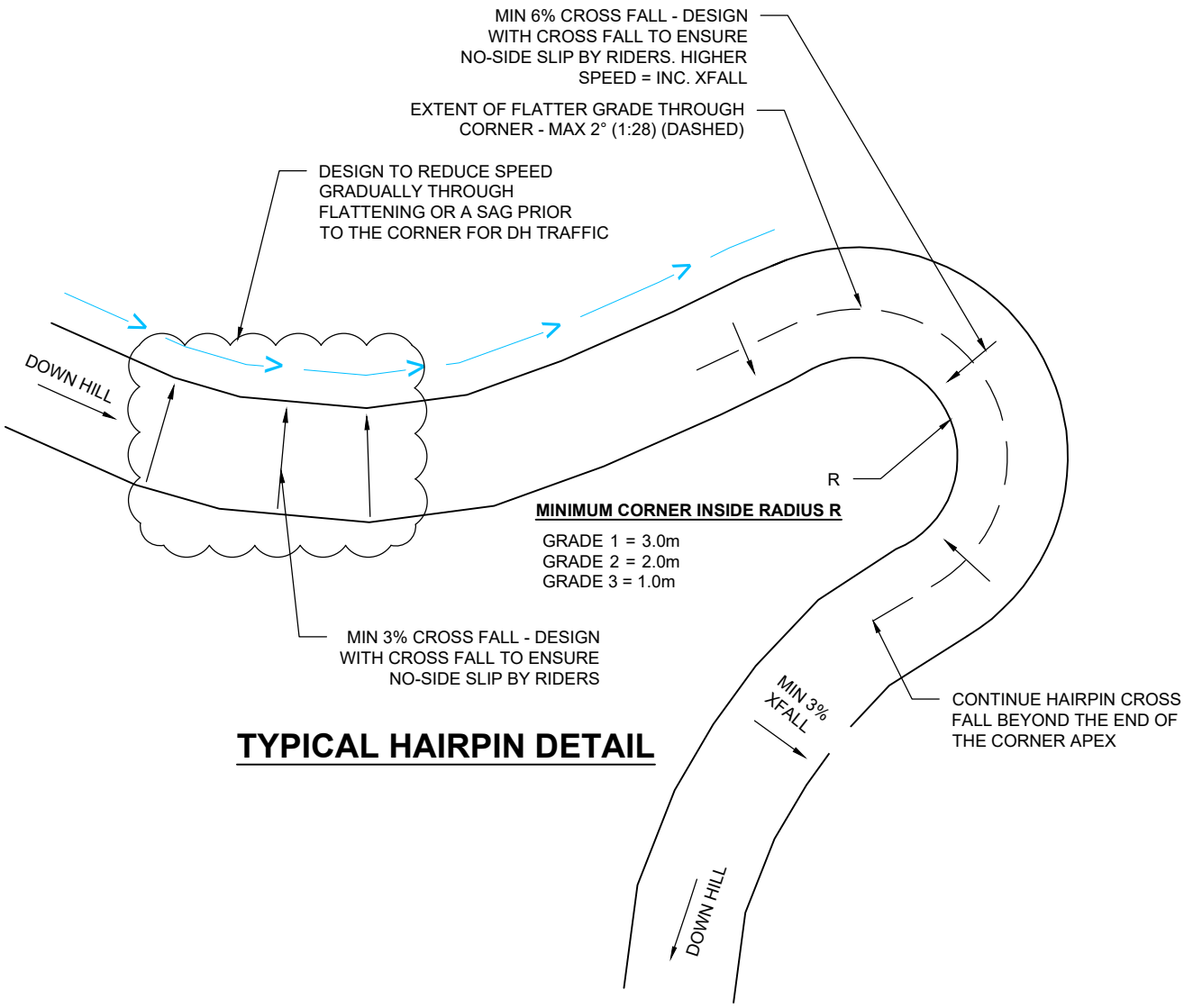
QUEENSTOWN LAKES DISTRICT COUNCIL

TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS				SCALE: 1:75 @ A4
PREPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015		DATUM & LEVEL: NA
REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2024		DRAWING REFERENCE: R4030_E3_2 / Revision: B

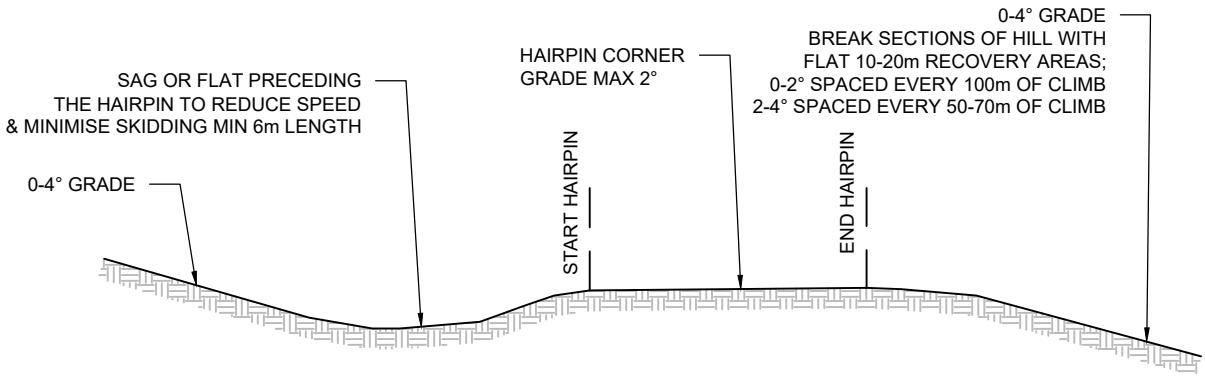
1:150 @ A4

0 1 2 3 4 5 6 7 m

R4030_E3_3



TYPICAL HAIRPIN DETAIL



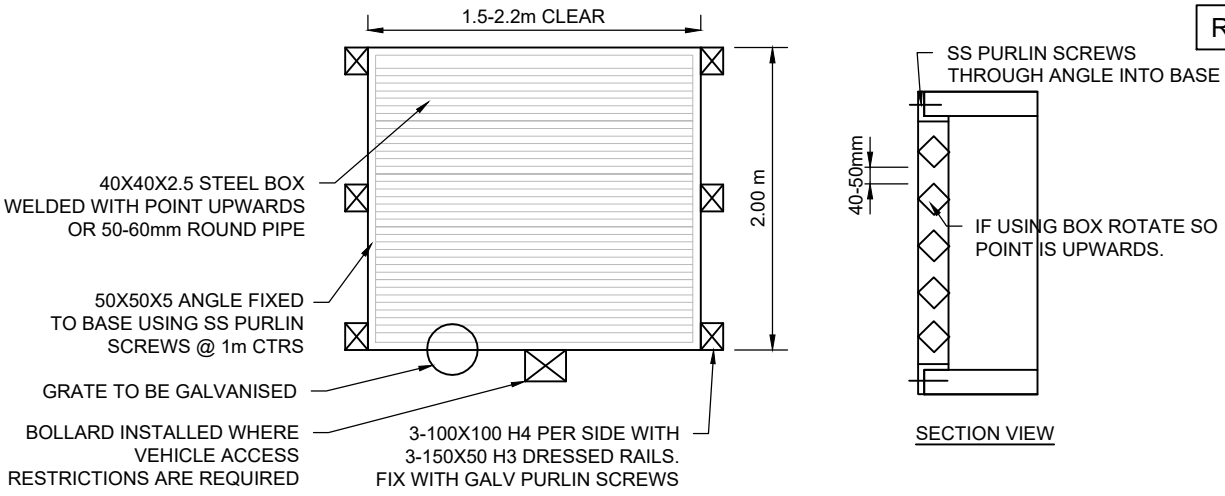
TYPICAL HAIRPIN LONG SECTION DETAIL

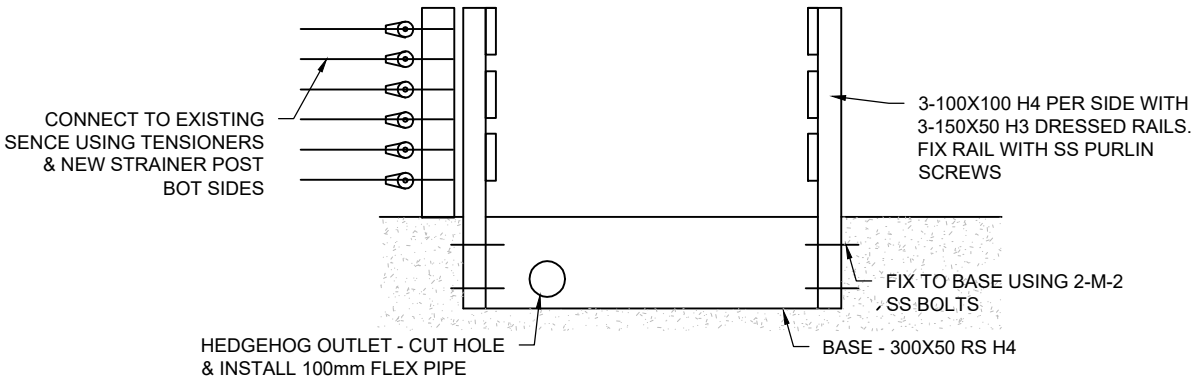
QUEENSTOWN LAKES DISTRICT COUNCIL

TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS			SCALE: 1:150 @ A4
PREPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015	DATUM & LEVEL: NA
REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2024	DRAWING REFERENCE: R4030_E3_3 / Revision: B

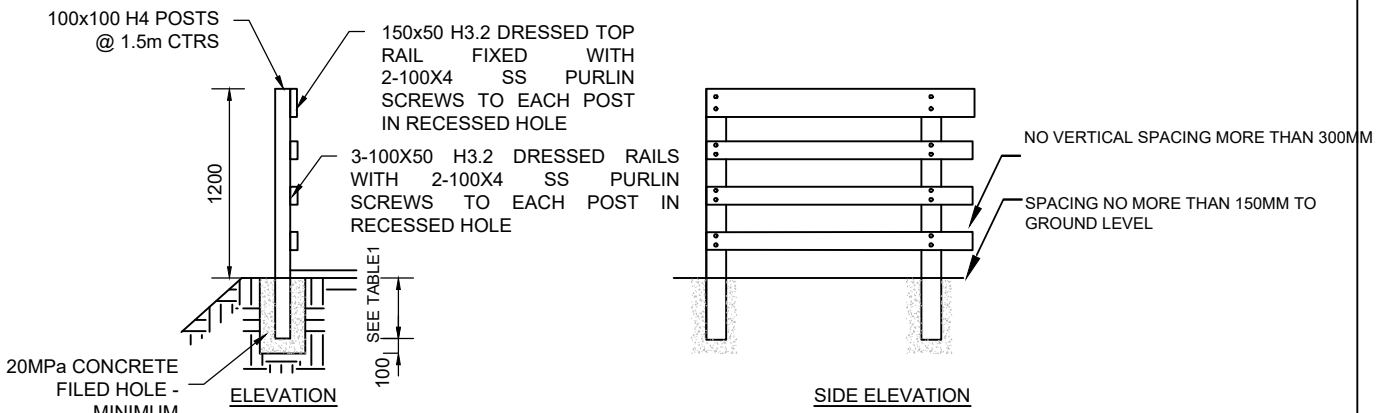
Original Sheet Size A4 [210x297] Plot Date 2018-11-28 at 10:53:30 AM Path \\icsv01\GroupLib\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail\Sheet01.dwg C03

R4030_E3_4





CATTLE STOP



TYPICAL TIMBER FENCE IN SOIL

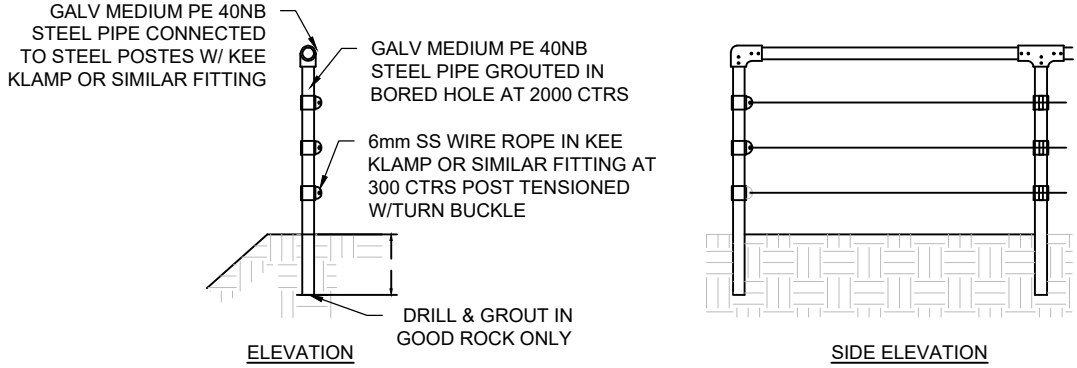


TABLE 1 - EMBEDMENT
1) For a 0.75kN/m load gravelly silt conditions, embedment = 0.7m
2) For a 0.75kN/m load , silty conditions, embedment = 0.8m
3) For a 1.5kN/m load (viewing point), gravelly silt conditions, embedment = 0.85m
4) For a 1.5kN/m load (viewing point), silty conditions, embedment 1m

TYPICAL STEEL FENCE

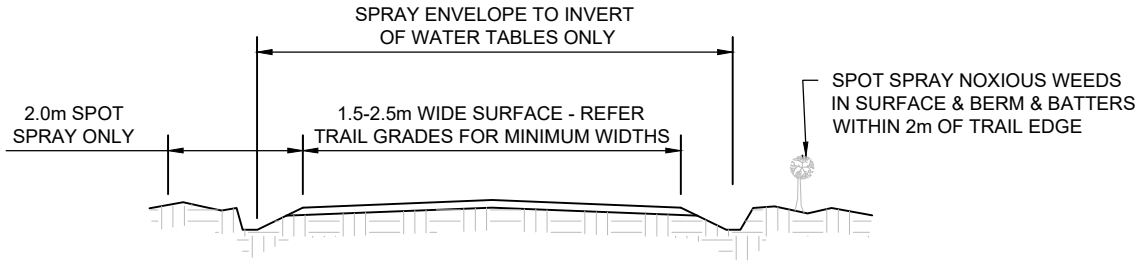
QUEENSTOWN LAKES DISTRICT COUNCIL

TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS			SCALE: N.T.S
PRAPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015	DATUM & LEVEL: NA
REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2024	DRAWING REFERENCE: R4030_E3_4 / Revision: B

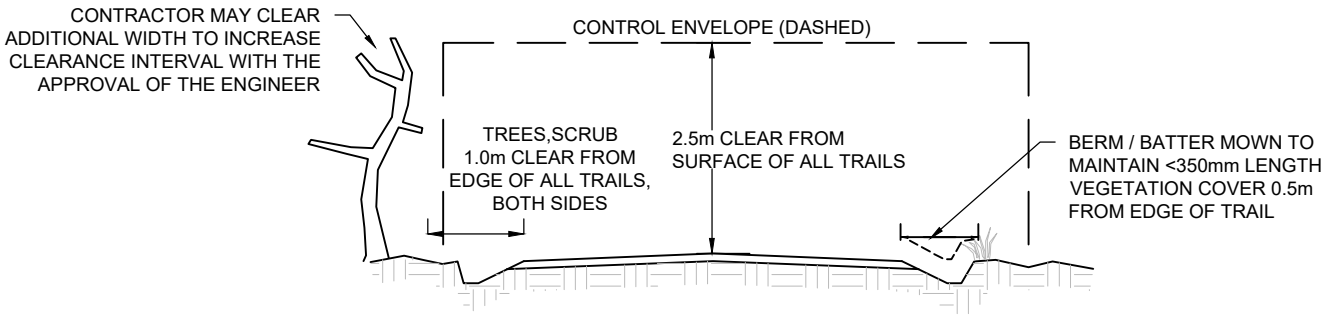
Original Sheet Size A4 [210x297] Plot Date 2018-11-28 at 10:53:43 AM Path \\icsv01\GroupLib\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail\Sheet01.dwg C04

1:50 @ A4 0 1 m

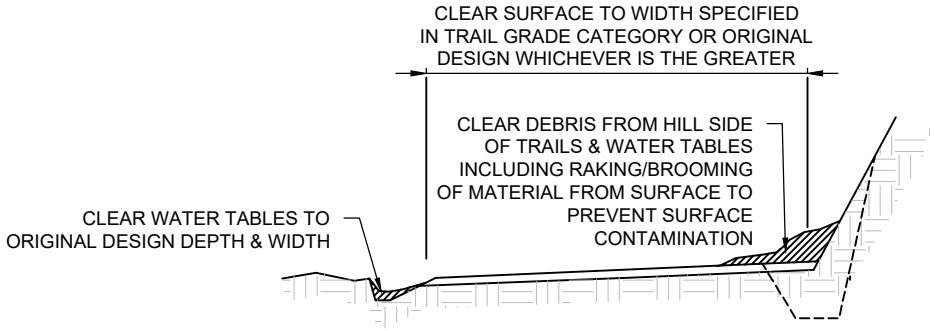
R4030_E3_5



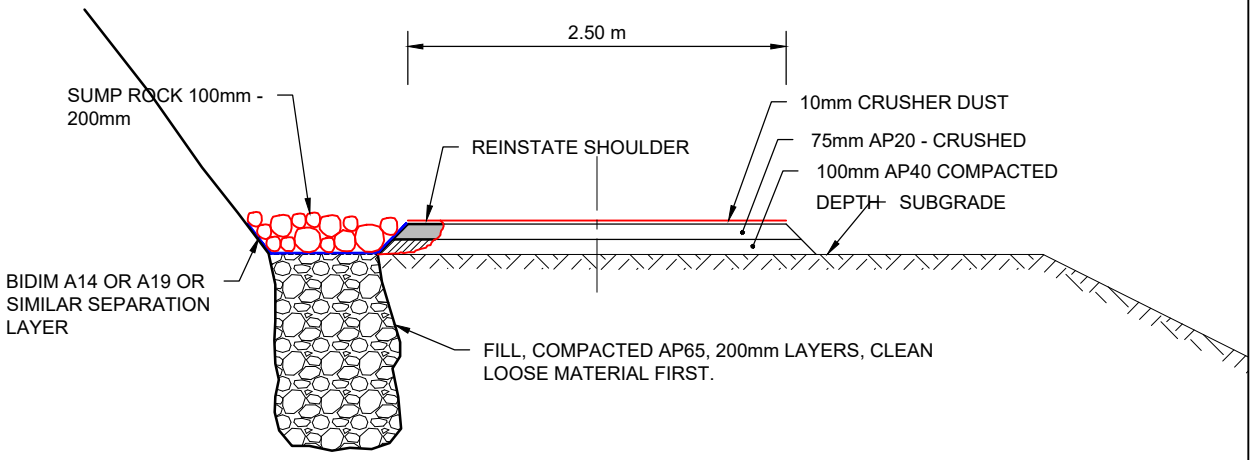
WEED SPRAYING ENVELOPE



VEGETATION CONTROL ENVELOPE



DEBRIS CLEARANCE



TRAIL REPAIR CROSS SECTION

QUEENSTOWN LAKES DISTRICT COUNCIL

TITLE: QLDC CYCLE TRAIL TYPICAL MAINTENANCE DETAILS				SCALE: 1:50 @ A4
PREPARED FOR: Queenstown Lakes District Council		SURVEYED: -	DATE: 2015	DATUM & LEVEL: NA
REVISION: A - ORIGINAL ISSUE		DRAWN: -	DATE: 8/2024	DRAWING REFERENCE: R4030_E3_5 / Revision: B

Urban Proposal

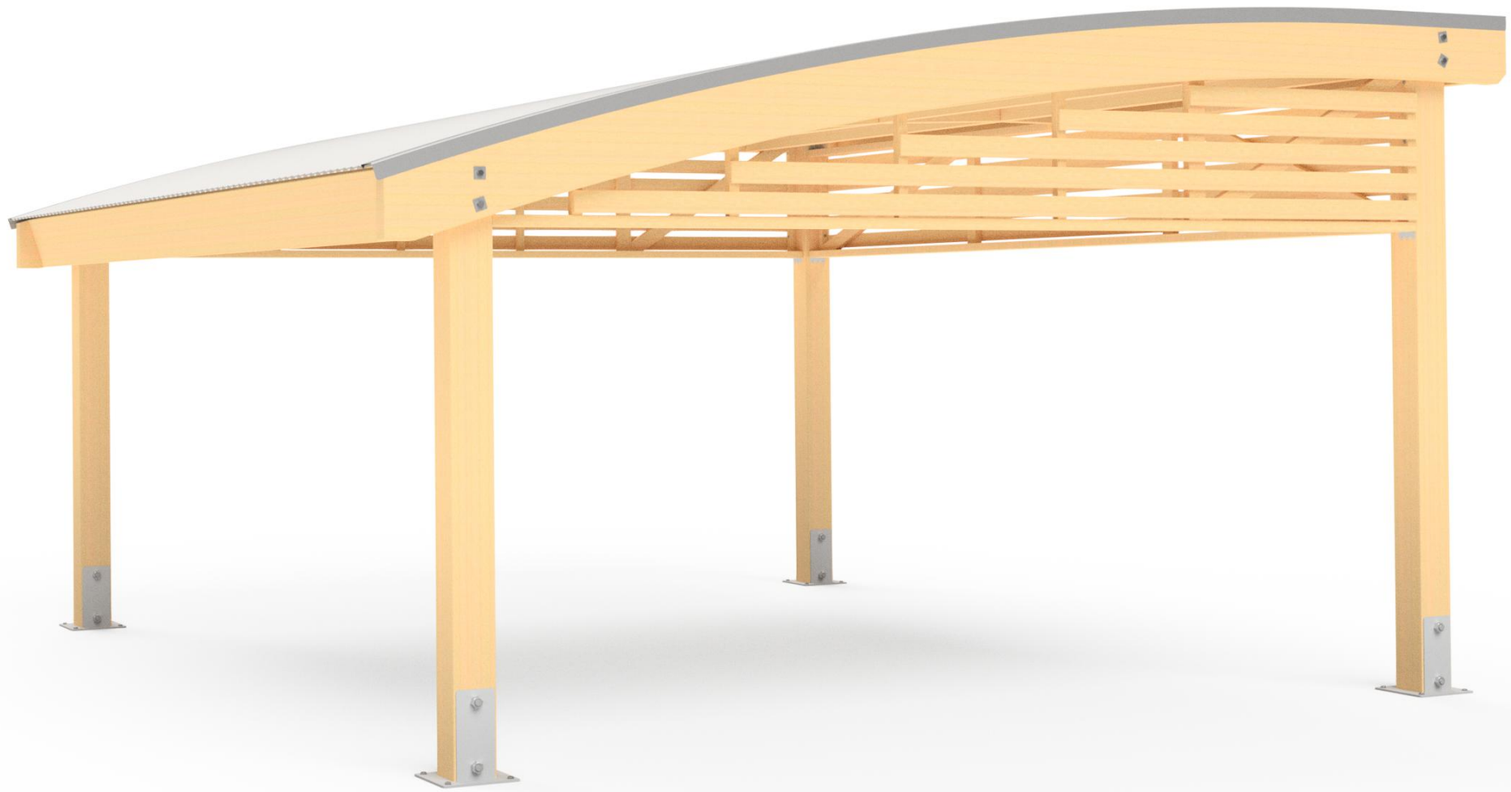
1/02/2022 UESHKICS656 Revision: 1

Kiwi Curved Shelter 6m

Urban Proposal

1/02/2022 UESHKICS656 Revision: 1

Kiwi Curved Shelter 6m

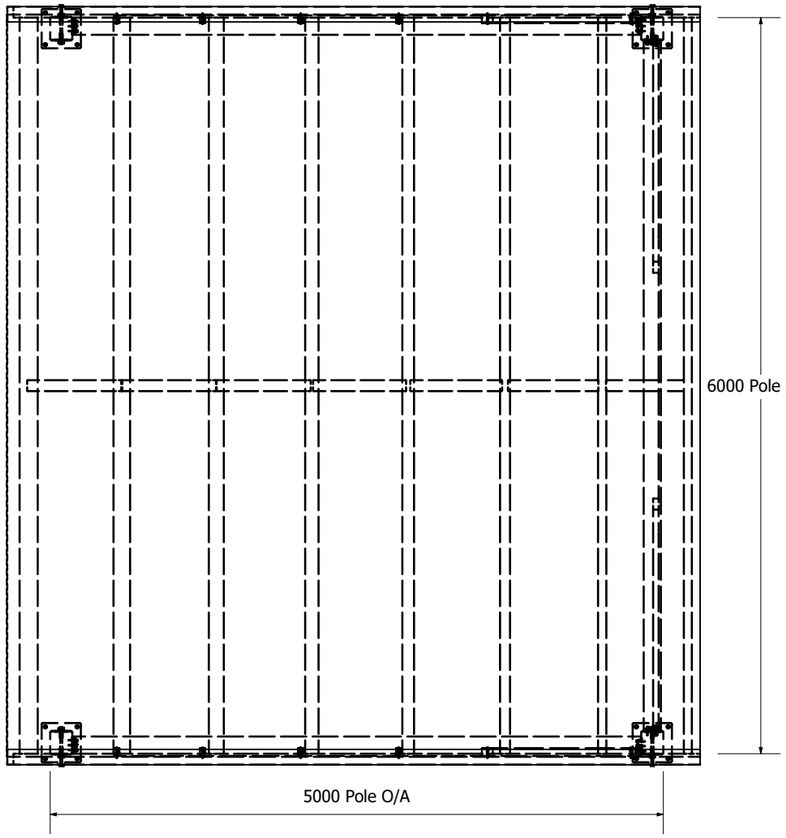


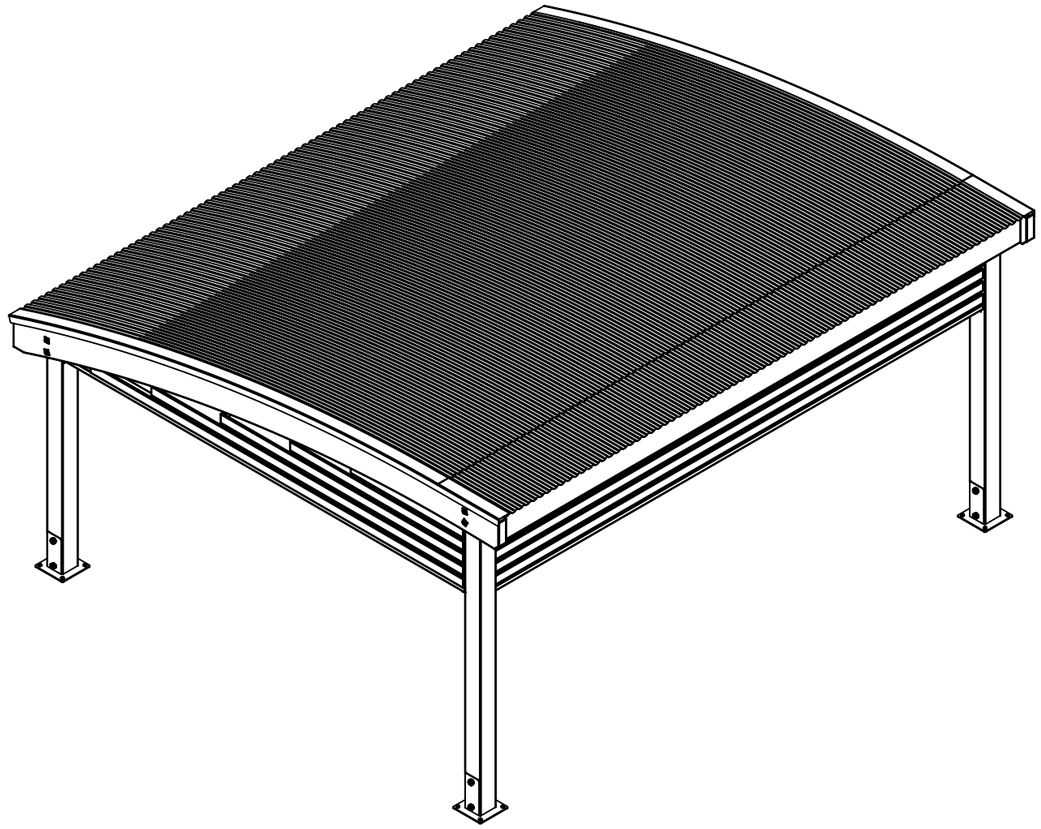
Production Drawing

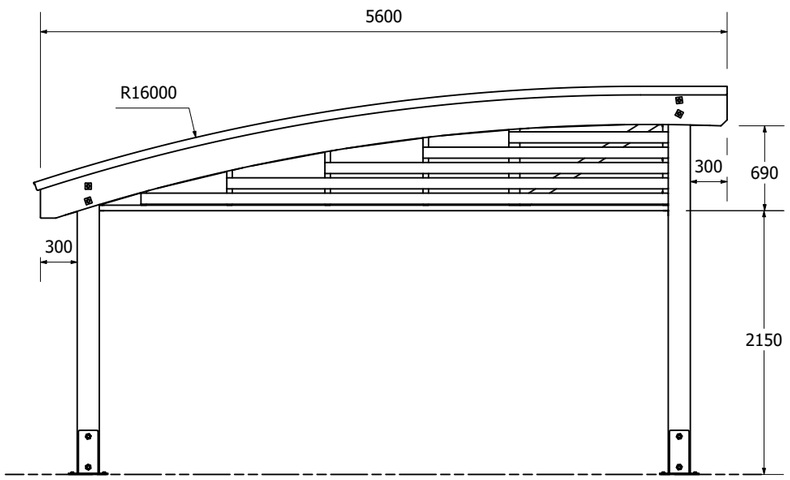
1/02/2022 UESHKICS656 Revision: 1

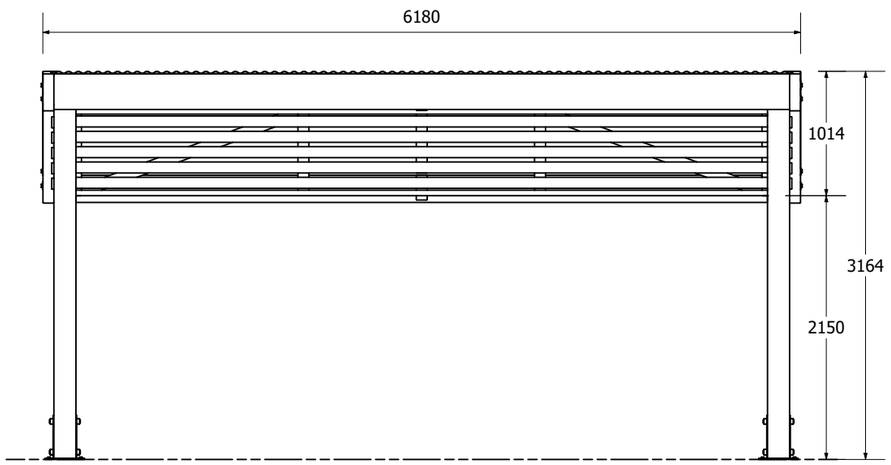
Kiwi Curved Shelter 6m

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
0	Creation	21/05/2021	Conor
1	Add brackets and increase timber size.	1/02/2022	Conor

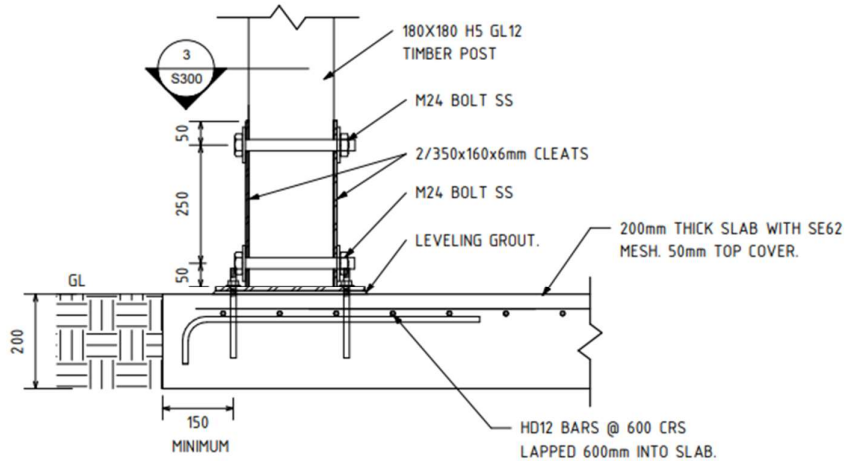








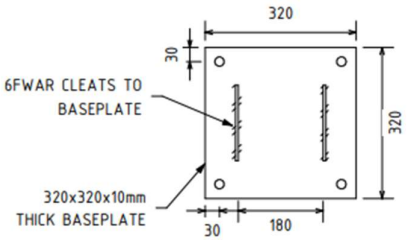
DRAWN BY	Conor	SCALE		PART NUMBER	UE0015	DESCRIPTION	Kiwi Curved Shelter 6m	SHEET
DATE DRAWN	1/02/2022	1 : 50 @ A3						1/4

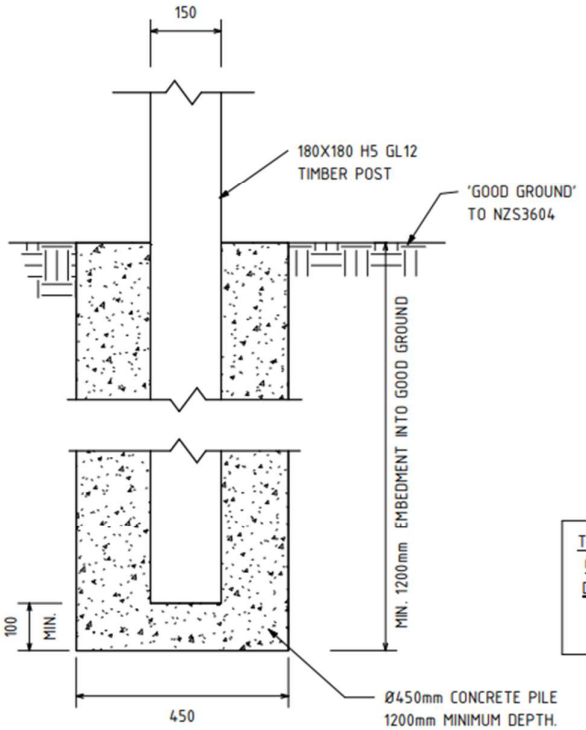


CONCRETE STRENGTH = 30 MPa

1 S100 SLAB FOOTING OPTION

1 : 10





2 S100 PILE FOOTING OPTION

1 : 10

REFER TO STRUCTURAL SPECIFICATIONS SHEET FOR CONCRETE REINFORCING & OTHER NOTES

INSPECTIONS BY CHESTER CONSULTANTS REQUIRED FOR

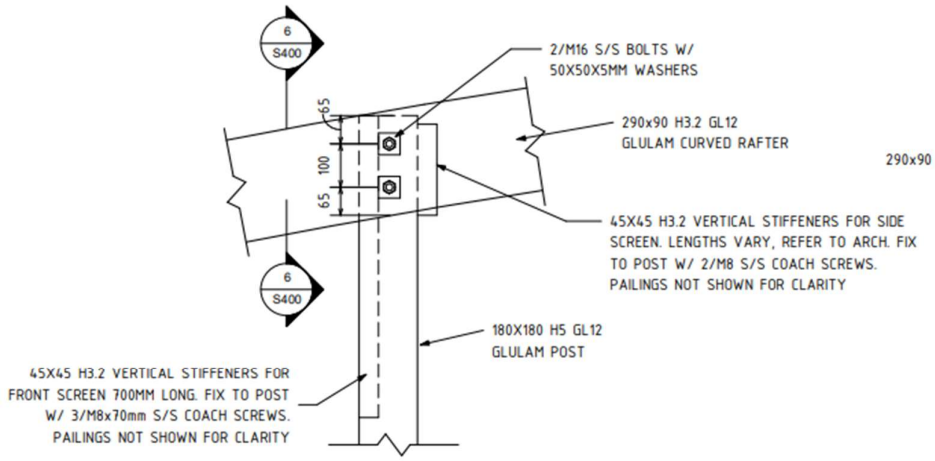
1. FOUNDATION INSPECTION

2. ENGINEERED BEAMS, COLUMNS & CONNECTIONS/SUPPORTS.

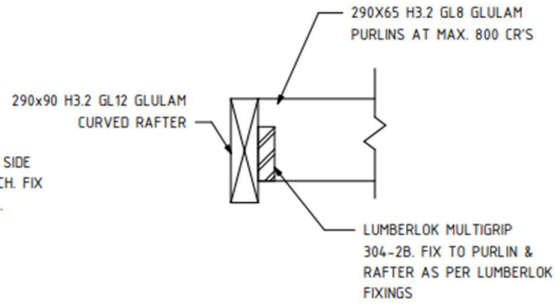
REFER ALSO TO BUILDING CONSENT CONDITIONS AND CONSULT WITH ENGINEER IF IN DOUBT PRIOR TO POURING/LINING.

CONTRACTOR TO CONFIRM ALL LEVELS AND DIMENSIONS AND LOCATE AND MARK ALL SERVICES & DRAINS ON SITE BEFORE COMMENCING WORK.

THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE ARCHITECTS DOCUMENTATION. REFER ARCHITECT'S LATEST PLANS FOR CORRECT DIMENSIONS, SET OUT AND LEVELS



4 S101 **POST TO RAFTER CONNECTION (SIDE VIEW)**
1 : 10



5 S101 **PURLIN TO RAFTER CONNECTION**
1 : 10

REFER TO STRUCTURAL SPECIFICATIONS SHEET FOR CONCRETE REINFORCING & OTHER NOTES

INSPECTIONS BY CHESTER CONSULTANTS REQUIRED FOR

1. FOUNDATION INSPECTION

2. ENGINEERED BEAMS, COLUMNS & CONNECTIONS/SUPPORTS.

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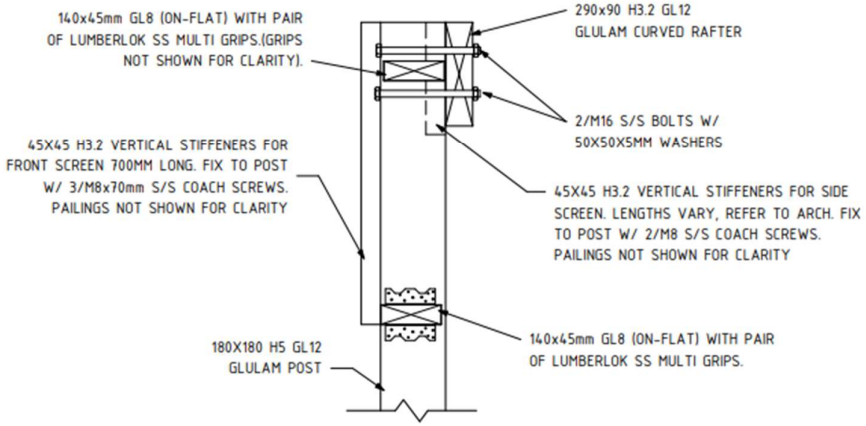
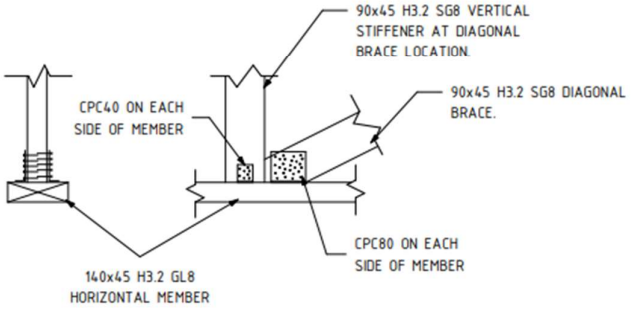
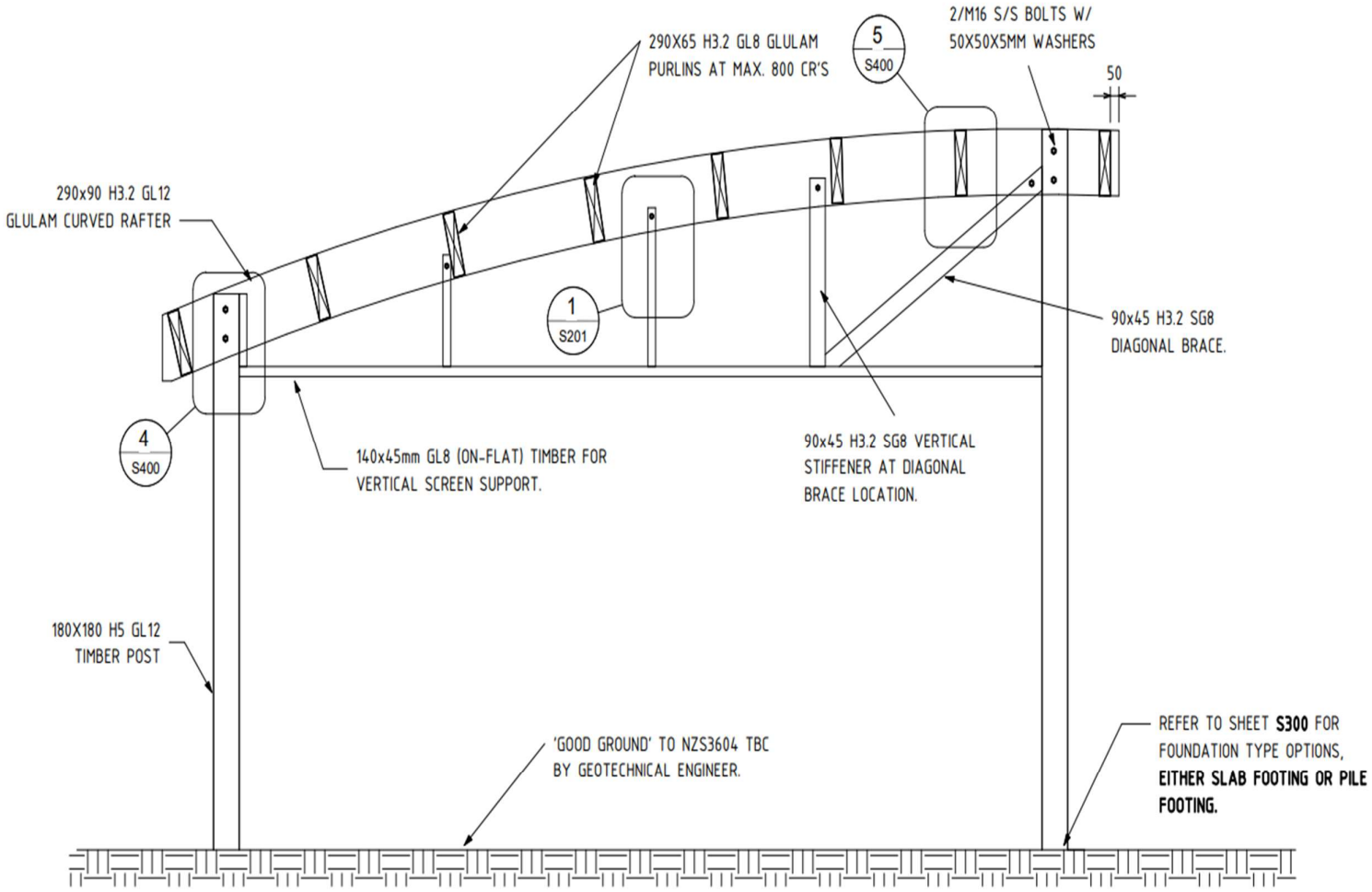
THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE ARCHITECTS DOCUMENTATION. REFER ARCHITECT'S LATEST PLANS FOR CORRECT DIMENSIONS, SET OUT AND LEVELS



6 S101 **POST TO RAFTER CONNECTION (FRONT VIEW)**
1 : 10



7 S201 **BRACE MEMBER CONNECTION**
1 : 10



REFER TO STRUCTURAL SPECIFICATIONS SHEET FOR CONCRETE REINFORCING & OTHER NOTES

INSPECTIONS BY CHESTER CONSULTANTS REQUIRED FOR

1. FOUNDATION INSPECTION

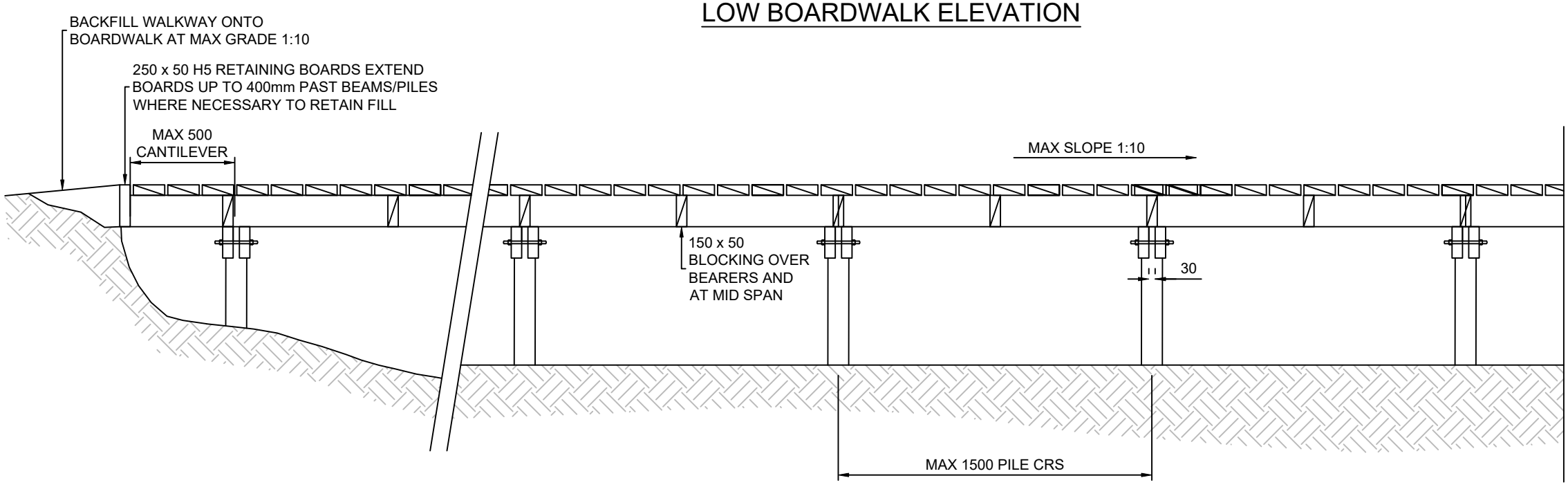
2. ENGINEERED BEAMS, COLUMNS & CONNECTIONS/SUPPORTS.

REFER ALSO TO BUILDING CONSENT CONDITIONS AND CONSULT WITH ENGINEER IF IN DOUBT PRIOR TO POURING/LINING.

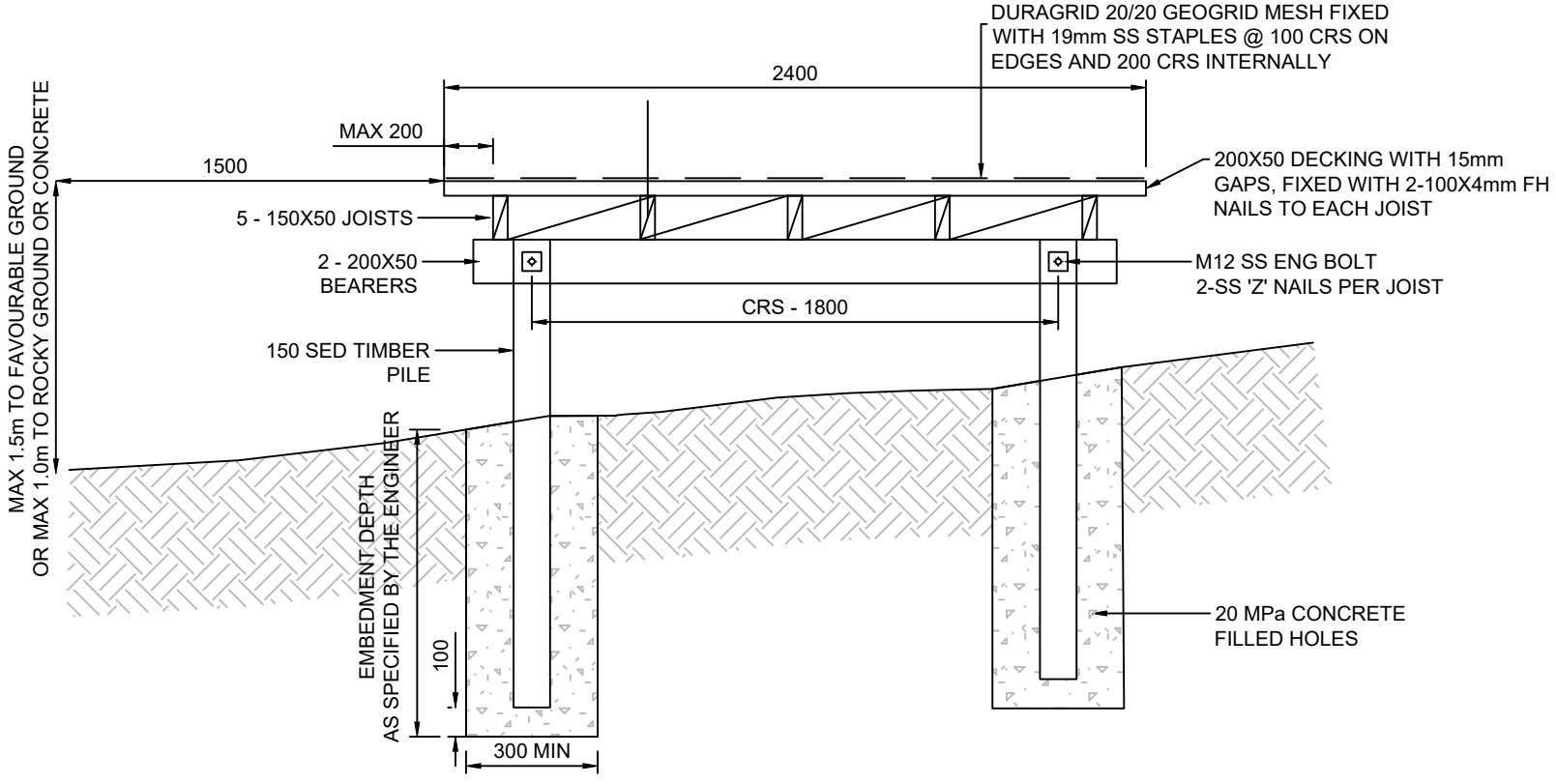
CONTRACTOR TO CONFIRM ALL LEVELS AND DIMENSIONS AND LOCATE AND MARK ALL SERVICES & DRAINS ON SITE BEFORE COMMENCING WORK.

THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE ARCHITECTS DOCUMENTATION. REFER ARCHITECT'S LATEST PLANS FOR CORRECT DIMENSIONS, SET OUT AND LEVELS

LOW BOARDWALK ELEVATION

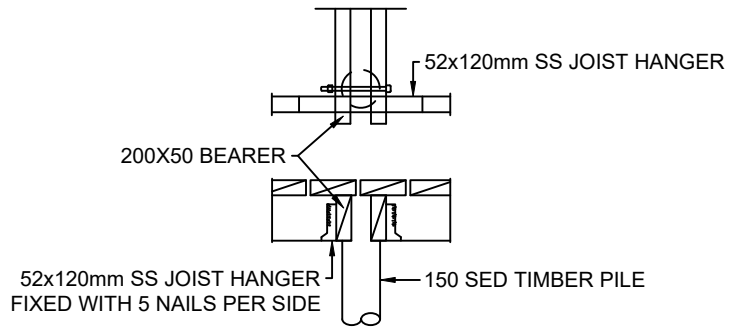


LOW BOARDWALK CROSS SECTION



JOIST HANGER FIXING

(ALTERNATIVE FIXING DETAIL)



NOTES

1. A BUILDING CONSENT IS REQUIRED FOR THE STRUCTURE IF THE FALL HEIGHT IS GREATER THAN 1.5m.
2. ENSURE BEARING CAPACITY OF POST HOLE IS GREATER THAN 100kPa

GENERAL

G1 THE STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH OTHER PROJECT DRAWINGS AND WITH THE SPECIFICATIONS AND OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.

G2 ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THESE NOTES UNLESS SPECIFIED OTHERWISE ON THE DRAWINGS OR PROJECT SPECIFICATIONS.

G3 ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR DECISION BEFORE PROCEEDING WITH THE WORK.

G4 ALL SETOUT DIMENSIONS SHALL BE COMFIRMED AND VERIFIED ON SITE BY THE CONTRACTOR BEFORE COMMENCEMENT OF WORK. NO DIMENSIONS SHALL BE OBTAINED BY SCALING THE DRAWINGS.

G5 DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVER STRESSED.

G6 ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH WORKSAFE NZ STANDARDS.

G7 ALL TEMPORARY SUPPORT DESIGN SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

G8 ALL MATERIALS TO BE SUPPLIED BY THE CONTRACTOR UNLESS OTHERWISE SPECIFIED.

G9 SUBSTITUTION OR AMENDMENT OF DETAILS SHALL NOT BE CARRIED OUT WITHOUT THE APPROVAL OF THE ENGINEER.

G10 ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

G11 CONTRACTOR SHALL LOCATE AND POSITIVELY IDENTIFY ALL UNDERGROUND SERVICES PRIOR TO COMMENCEMENT. THE PRESENCE OF UNDERGROUND SERVICES IS UNKNOWN.

G12 ALL DISTURBED AREAS TO BE RETURNED TO PREVIOUS STATE.

G13 THE CONTRACTOR SHALL PROVIDE A METHODOLOGY FOR UNEXPECTED FINDS PROCEDURE FOR REVIEW AND APPROVAL BY THE CLIENT.

G14 CONTRACTOR TO PROVIDE ENVIRONMENTAL PLAN AND SEDIMENT AND EROSION CONTROLS FOR REVIEW AND APPROVAL.

EARTHWORKS

E1 ALL EARTHWORKS SHALL BE CARRIED OUT IN STRICT ACCORDANCE WITH THESE DRAWINGS AND SPECIFICATION.

E2 ALL EXCAVATED FOUNDATIONS ARE TO BE INSPECTED BY A GEOTECHNICAL ENGINEER PRIOR TO PROCEEDING.

E8 ALLOWABLE BEARING CAPACITY FOR EACH FOUNDATION TO BE 100 kPa MINIMUM.

CONCRETE WORK

C1 ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH NZS 3109 AND OTHER RELEVANT CODES.

C2 CONCRETE STRENGTH

STRUCTURAL ELEMENT	NZS 3109 f'c TARGET STRENGTH	MAX. SIZE AGGREGATE
FOUNDATIONS	20 MPa	20mm

C3 SURFACE FINISHES SHALL BE IN ACCORDANCE WITH NZS 3114 AND AS FOLLOWS.

INSITU CONCRETE			
OFF THE FORM		UNFORMED SURFACES	
BURIED SURFACES	F2	BURIED SURFACES	U2

C4 ALL CONCRETE SHALL BE PLACED IN THE DRY.

C5 ALL CONCRETE TO BE WELL VIBRATED AND CURED. CURING METHOD TO BE PRESENTED TO THE ENGINEER FOR APPROVAL.

TIMBER

T1 ALL TIMBER CONSTRUCTION SHALL BE CARRIED OUT IN ACCORDANCE WITH NZS 3604:2011 AND NZS3603:1993.

T2 ALL TIMBER BEARERS AND BARRIER POSTS SHALL BE GRADE SG8, H4 TREATED PINUS RADIATA.

T3 ALL JOISTS, DECKING AND HANDRAIL TIMBER SHALL BE GRADE SG8, H3.2 TREATED PINUS RADIATA.

T4 ALL KERBS AND BLOCKING SHALL BE H3.2 TREATED NO. 1 FRAMING GRADE TIMBER .

T5 ALL PILES AND RETAINING BOARDS SHALL BE GRADE SG8, H5 TREATED PINUS RADIATA.

T6 ALL TIMBER SHALL BE ROUGH SAWN, EXCEPT THE HANDRAIL TIMBERS SHALL BE DRESSED.

T7 UNLESS NOTED OTHERWISE IN THE DRAWINGS, ALL BOLTS USED THROUGH TIMBER SHALL HAVE WASHERS OF THE FOLLOWING DIMENSIONS:
- i, M12 - 50x50x3.0 WASHER.
- ii, M16 - 50x50x6.0 WASHER

T8 ALL BOLTS IN CONTACT WITH TIMBER SHALL BE GREASED WITH GP GREASE IN PRE GREASED HOLES

T9 ALL STEEL SHALL BE ISOLATED FROM TIMBER WITH AN EPDM STRIP / WASHER.

T10 ALL CUT ENDS OF TIMBER SHALL BE TREATED WITH METALEX OF SIMILAR APPROVED AND APPLIED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS.

T11 ALL FIXINGS IN CONTACT WITH TREATED TIMBER SHALL BE GRADE 316 STAINLESS STEEL UNLESS NOTED OTHERWISE ON THE DRAWINGS.

T12 ALL GENERAL PURPOSE STRUCTURAL NAILS SHALL BE 100 x 4.0 STAINLESS STEEL FLAT HEAD NAILS IN ACCORDANCE WITH NZS3603:1993 U.N.O. ALL NAILS SHALL PENETRATE THE SECOND HOLDING TIMBER AT LEAST HALF THEIR LENGTH.

T13 ALL NAIL ON PLATES AND BRACKETS SHALL BE GRADE 316 STAINLESS STEEL .

T14 DECK FIXING SCREWS TO BE 140 x 8.0 SPAX WASHER HEAD T-STAR PLUS SCREWS, GRADE 316 STAINLESS STEEL.

DO NOT SCALE - IF IN DOUBT, ASK

200mm 150 100 90 80 70 60 50 40 30 20 10 0

ORIGINAL SIZE A1

FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	FOR CONSTRUCTION	JH	DC	DC	05.2025

SURVEYED		
DESIGNED	Lachlan Goldsworthy	05.2025
DRAWN	Jim Hunt	05.2025
CAD REVIEW	Lachlan Goldsworthy	05.2025
DESIGN CHECK	Derek Chinn	05.2025
DESIGN REVIEW	Derek Chinn	05.2025
APPROVED	Lachlan Goldsworthy	05.2025
PROF REGISTRATION:		

Stantec

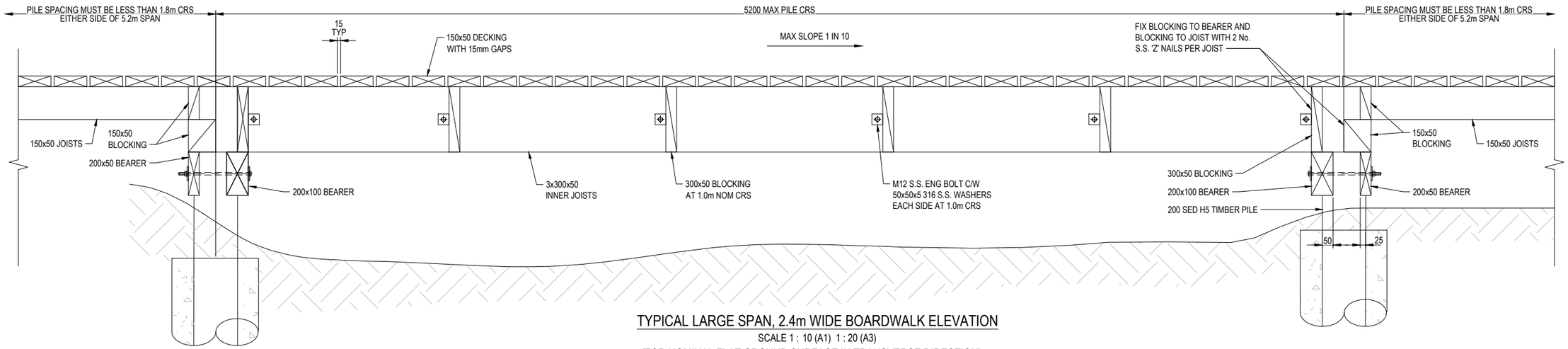
Client: QUEENSTOWN LAKES DISTRICT COUNCIL

QUEENSTOWN LAKE DISTRICT COUNCIL
BOARDWALKS

GENERAL STRUCTURAL NOTES

Status Stamp: **FOR CONSTRUCTION**
Date Stamp: **15.05.25**
Scales: AS SHOWN
Drawing No.: 310104416-04-001-G001
Rev.: A

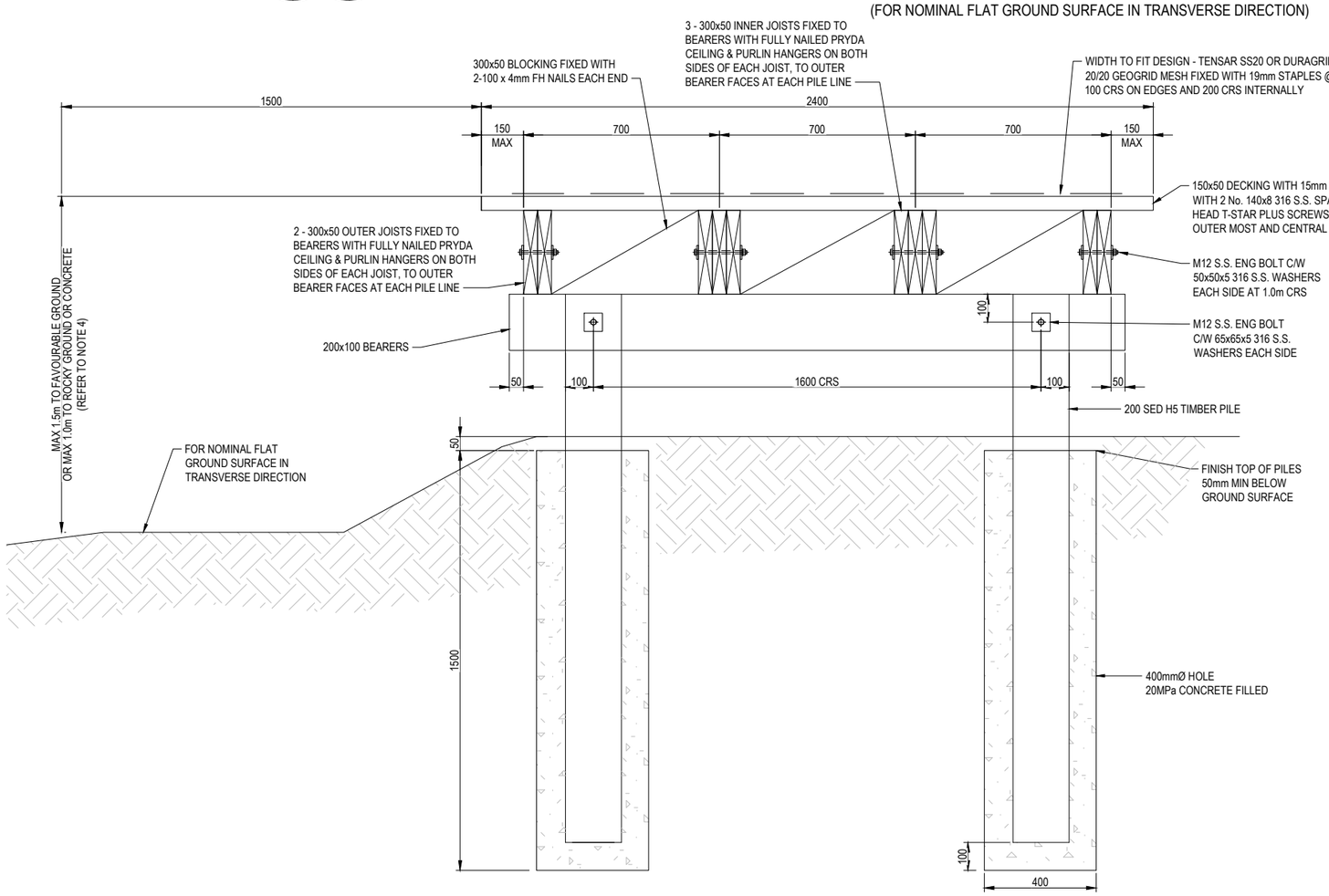
pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\Queenstown Lakes District Council\310104416 - QLDC Boardwalks\01\Civil\310104416-04-001-G001



TYPICAL LARGE SPAN, 2.4m WIDE BOARDWALK ELEVATION

SCALE 1 : 10 (A1) 1 : 20 (A3)

(FOR NOMINAL FLAT GROUND SURFACE IN TRANSVERSE DIRECTION)



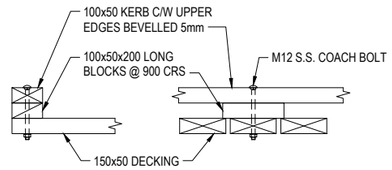
TYPICAL LARGE SPAN, 2.4m WIDE BOARDWALK CROSS SECTION

SCALE 1 : 10 (A1) 1 : 20 (A3)

(FOR NOMINAL FLAT GROUND SURFACE IN TRANSVERSE DIRECTION)

200 0 500mm

SCALE 1:10



SECTION ELEVATION

TYPICAL KERB DETAIL

SCALE 1 : 10 (A1) 1 : 20 (A3)

KERBS TO BE CONSTRUCTED WHERE BOARDWALKS ARE REQUIRED TO BE ACCESSIBLE. CONSTRUCT ON EDGES WHERE NO BARRIER IS PRESENT ONLY

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE GENERAL STRUCTURAL NOTES ON DRAWING G001.
2. MINIMUM BEARING CAPACITY AT FOUNDATIONS SHALL BE 100kPa.
3. THE PILE DETAILS THAT HAVE BEEN PROVIDED ARE FOR FIRM CLAY, GRAVEL OR SAND CONDITIONS ONLY. FOR ANY OTHER CONDITIONS, THE PILE DETAILS SHALL BE RECONFIRMED WITH THE GEOTECHNICAL ENGINEER
4. REFER TO MAXIMUM FALL HEIGHTS ON THE TYPICAL CROSS SECTION AND IF FALL HEIGHTS EXCEED THESE VALUES, A BARRIER IS REQUIRED.

FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	FOR CONSTRUCTION	JH	DC	DC	05.2025

SURVEYED		
DESIGNED	Lachlan Goldsworthy	05.2025
DRAWN	Jim Hunt	05.2025
CAD REVIEW	Lachlan Goldsworthy	05.2025
DESIGN CHECK	Derek Chinn	05.2025
DESIGN REVIEW	Derek Chinn	05.2025
APPROVED	Lachlan Goldsworthy	05.2025
PROF REGISTRATION:		

Stantec

Client: QUEENSTOWN LAKES DISTRICT COUNCIL

QUEENSTOWN LAKE DISTRICT COUNCIL
BOARDWALKS

LARGE SPAN BOARDWALK
CROSS SECTIONS

Status Stamp: **FOR CONSTRUCTION**

Date Stamp: **15.05.25**

Scales: AS SHOWN

Drawing No.: 310104416-01-001-S001

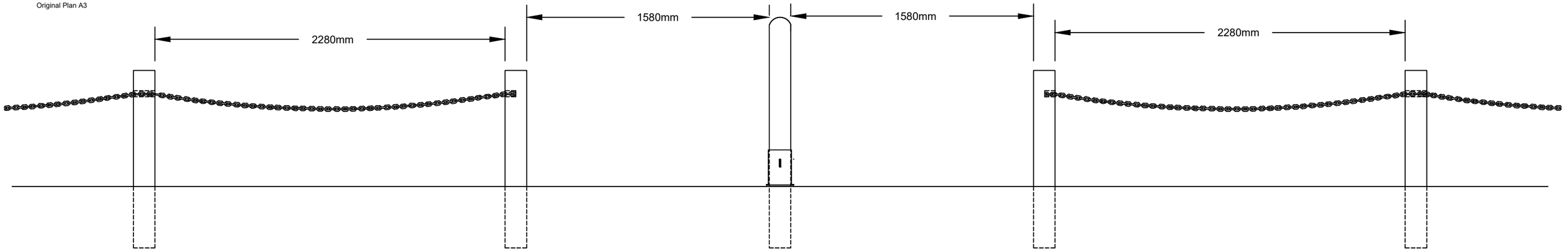
Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\Queenstown Lakes District Council\310104416 - QLDC Boardwalks\01\Civil\310104416-01-001-S001

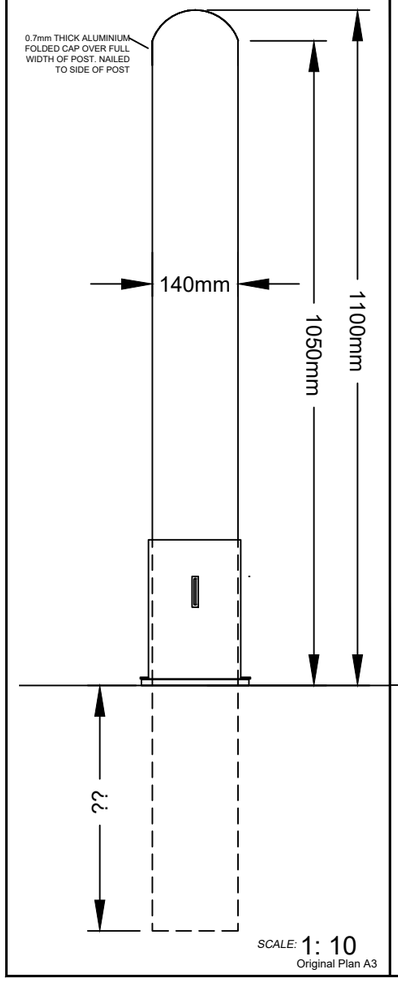
ORIGINAL SIZE A1

DO NOT SCALE - IF IN DOUBT, ASK

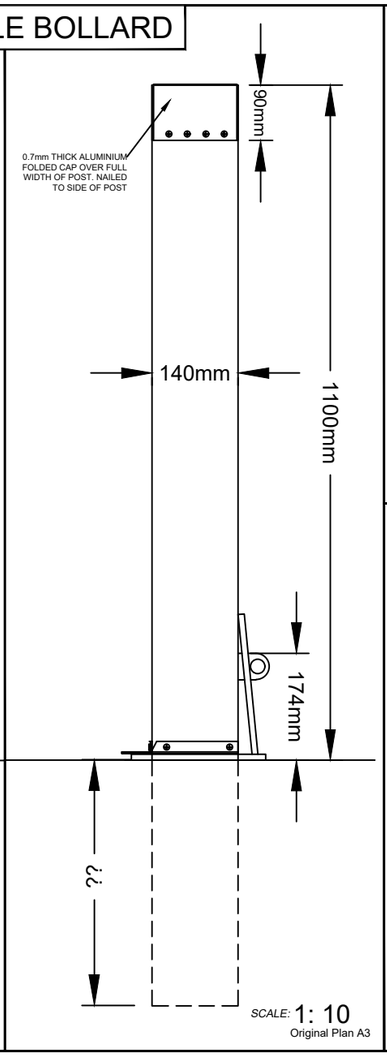
SCALE: 1: 25
Original Plan A3



REMOVEABLE BOLLARD



SCALE: 1: 10
Original Plan A3



SCALE: 1: 10
Original Plan A3

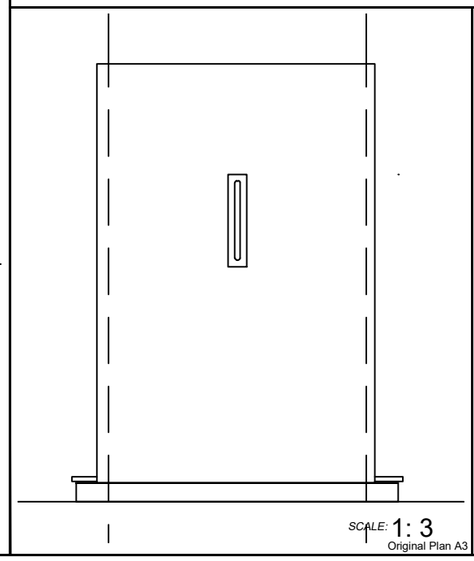
NOTES:

LINE POST SPECIFICATIONS:
1. Line Posts to be Radiata Clears 2 Grade - 140mm x 140mm x 1500mm - H4 MicroPro - D4 - Splay Cut Head - All edges rounded over
2. Set with 20MPA Concrete into 250mm dia. hole, 800mm deep at maximum spacing of 240mm

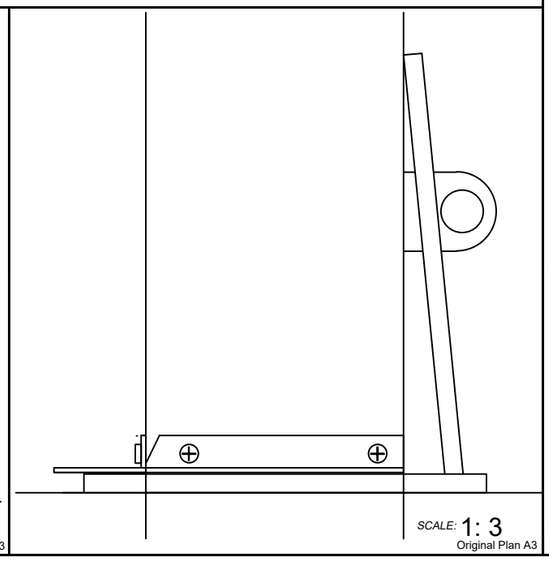
END POST SPECIFICATIONS:
1. End Posts to be Radiata Clears 2 Grade - Ex 140mm x 140mm x 1500mm - H4 MicroPro - D4 - Splay Cut Head - All edges rounded over
2. Set with 20MPA concrete into 250mm dia. hole, 800mm deep

CHAIN SPECIFICATIONS:
1. Chain to be 8mm medium link HDG 50 pulled through posts at 600mm above ground level with a maximum deflection of 200mm between posts
2. Chain fixed with one 125mm galvanized Bugle screw at each post

REMOVEABLE BOLLARD SPECIFICATIONS:
1. Milburn Fences/ QLDC Hasp and Staple Removable Bollard

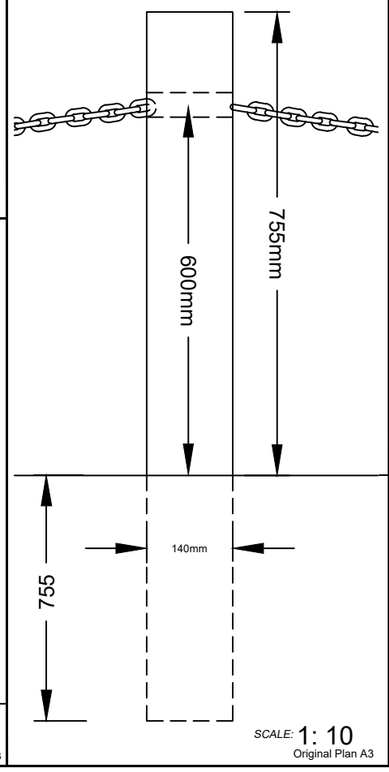


SCALE: 1: 3
Original Plan A3

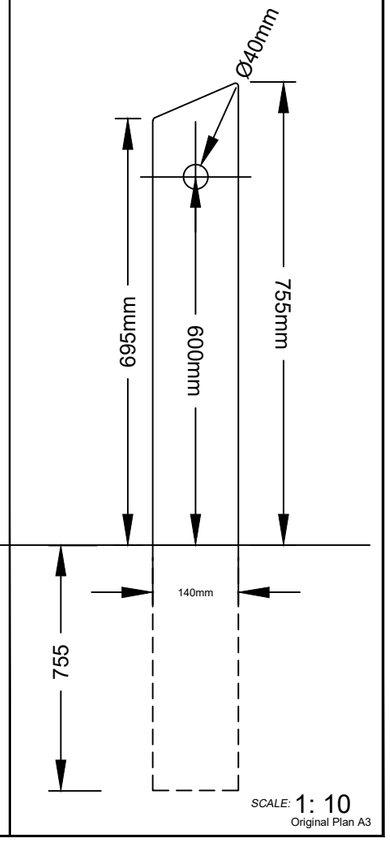


SCALE: 1: 3
Original Plan A3

LINE POSTS



SCALE: 1: 10
Original Plan A3



SCALE: 1: 10
Original Plan A3

QUEENSTOWN LAKES DISTRICT COUNCIL

NOTES:

KEY:

WARNING NOTES:
This proposed court trail realignment plan has been prepared for the client from field investigation and existing records for the purpose of upgrade on the site. It should not be used by the client company for any other purpose. The plan is not to be relied on by any other person for any purpose whatsoever.
A person/company using Southern Civil Consultants drawings and other data accepts the risk of:
1. using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions;
2. using the drawings or other data for any purpose not agreed to in writing by Southern Civil Consulting.

TITLE: STANDARD DETAIL

PROJECT: REMOVEABLE BOLLARD
POST & CHAIN FENCE

STANDARD DETAIL

FIELDWORK: -	SCALE: VARIES Original Plan A3	DATE CREATED: SEP 2024
DRAWN: KB		
APPROVED: GCO		
JOB No. SCC.017	SHEET No. 01	REV. B

QUEENSTOWN LAKES DISTRICT COUNCIL

GRADE 2 - CYCLE TRAIL CONSTRUCTION
-TECHNICAL SPECIFICATION –

Overarching Requirements

Trail Construction must be compliant with QLDC District Plan requirements for example Earthworks, and have the appropriate Consents, be that Building Consent or Resource Consent. It is the Developer and Project Managers responsibility to ensure that the construction is compliant in this regard.

1. TRACK CONSTRUCTION

1.1. Track Alignment

1.1.1. The track alignment is marked on site with RED/WHITE flagging tape. Markers are generally spaced at 20-50m intervals.

1.1.2. The Contractor is responsible for setting out and constructing the track following these markers.

1.1.3. If the Contractor wishes to deviate the track formation more than two meters either side of the design line, specific approval shall be obtained from the Engineer for every deviation.

1.1.4. Deviation from the design line up to two meters either side may be made to avoid living trees, archaeological features, fallen logs, rocks or adverse ground conditions. Approval from the Engineer is not required in such instance.

1.1.5. The Contractor shall be responsible for ensuring the maximum track gradient requirements in this specification are not exceeded on the track. If the Contractor believes this cannot be achieved on the design line or within two meters of this then he shall advise the Engineer.

1.1.6. The constructed formation shall follow the most practical line to achieve the design grades and to create an enjoyable riding experience appropriate to a Grade 2 trail (See QLDC Cycle Trail Design Standards 2024).

1.2. Formation Earthworks, Width & Grade

1.2.1. During construction compliance with the QLDC Land Development and Subdivision Code of Practice is a requirement, attention is drawn to the following key points;

- During construction sediment control measures should be put in place such as keeping drains clear of loose soil and the use of silt fences, traps or bunds around water bodies. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Long term options include draining to sediment retention ponds where high levels of sediment run off are expected
- Dust mitigation should be used during construction or on any maintenance areas left exposed for extended periods of time. Mitigation incudes wetting ground and long term; use of vegetation on bare land
- Earthworks undertaken must be stable and not prone to erosion

1.2.2. All organic material shall be removed from the track formation area prior to commencing any formation earthworks. Where possible, leaf litter and top soil shall be retained adjacent to the track for spreading over exposed earthworks on completion of the formation.

1.2.3. Tree roots up to 100mm diameter shall be removed where necessary to enable formation excavation.

1.2.4. Where the track is constructed on a cross slope of less than 3 horizontal to 1 vertical, the track bench may be constructed using a combination of cut and fill formation or fill formation as shown on the drawings. Excavated material from the formation may be used to fill the outer edge of the track bench provided it is compacted in place with suitable equipment and all organic materials is stripped prior to placing fill, including benching of the receiving face.

1.2.5. Where the track is constructed on a cross slope of greater than 3 horizontal to 1 vertical, a full cut formation (full bench) detail shall be used as shown on the typical detail. Cut slope batters may be constructed with a max height of 2m with a 1m horizontal bench if higher slope is required. Slope angles (H:V) of 2.5:1 for silt, 2:1 for sand and, 1.5:1 for gravels can be used. Vertical faces can be used for intact rock only, consult Engineer for non-intact rock faces otherwise revert to 1.5:1 specification.

1.2.6. The track formation shall be shaped to achieve the required track width and to ensure the track longitudinal grade is within the required maximum limits. The maximum grade on any section of track shall not exceed the following:

- 0–6% for at least 90% of trail; between 6–8.8% for steeper slopes up to 100m long, and between 8.8–10.5% for steeper slopes up to 10m long. If the track is designed and promoted to be ridden predominantly in one direction, then the downhills can be steeper (up to 14%). Sealed trails can be steeper (same as the equivalent Grade of on-road trailOr as directed by the Engineer

1.2.7. The required ‘usable cycling surface’ width shall be 2.2m unless otherwise specified by the Engineer. This shall consider horizontal clearances required from cut/fill batter slopes, handrails (0.5m), trees (0.5m) etc. as detailed in Section 2.2 of NZCT Cycle Trail Design Guide Feb 2024.

1.2.8. Final shaping of the track surface shall take place **after** the installation of culverts.

1.3. Filling

1.3.1. There should be no vegetation or other organic matter in fill material that forms part of the track formation.

1.3.2. Fill material shall be placed in layers not exceeding 300mm loose depth and shall be compacted using appropriate mechanical equipment. Where the slope exceeds 3 horizontal

to 1 vertical a bench shall be formed to enable fill material to key into the existing ground and facilitate compaction.

1.3.3. Fill material shall not be used where the moisture content is at or above the plastic limit as densification cannot be achieved. Such material shall be placed outside the track formation.

1.3.4. Fill materials should have an even grading with no segregation, the image below is an example of a non-complying material

1.3.5. Fill slopes shall be left in a smooth and tidy condition. It shall be the contractor's responsibility to make good any batter slumping or subsidence which occurs during the operation of this contract and including during the defects liability period.

1.3.6. Where fill is intended to be placed onto soft or swampy ground, the Engineer may advise the Contactor to lay geotextile material to separate the fill material. Geotextile shall be laid in accordance with manufacturers recommendations.

1.4. Track Drainage

1.4.1. Rolling grade dips (grade reversals) shall be formed in the track surface to divert surface water on sloping sections of track at

1.4.2. ≤30m spacing's where water tables are not installed. Grade reversals shall be 2-3m in length and be of a smooth profile to ensure a smooth ride for cyclists.

1.4.3. Water tables in accordance with the typical details shall be installed on each section of track formation prior to placing top course metal.

1.4.4. Water tables shall have a grade of >1% towards the discharge point (if any). A discharge point shall be provided anywhere there is a sag point in the track.

1.4.5. Water table discharge points shall be installed at the following spacing's or as directed by the Engineer:

1.4.6. 50m where the track grade is ≤ 20:1 (3°)

1.4.7. 15m where the track grade is between 10:1 and 20:1 (3°-6°)

1.4.8. Water table discharge shall consist of minimum 250mm smooth walled culvert under the track to direct water to lower ground on the down slope side of the track.

1.4.9. Culvert pipes shall be installed with a minimum 5% fall to the outlet and a minimum of 150mm cover to the finished track surface.

1.4.10. Culverts shall be of sufficient length to pass under the track and extend beyond any fill.

1.4.11. The outlets of culvert pipes shall discharge at ground level without a free fall from the end of the pipe. Where the outlet slope is on steep loose material, a rock apron or sock shall be provided to prevent scour.

1.4.12. Culverts shall be smooth bore Farm Tough type colored black of minimum 250mm internal diameter or similar as approved by the Engineer.

1.4.13. The inlet and outlet of culverts that discharge continuous water flows shall include local stone/mortar headwalls.

1.4.14. Where the culvert discharges only stormwater and the inlet or outlet may be subject to maintenance vehicle loads (that is they are within 300mm of the track edge), the headwalls shall be mortared.

1.4.15. For all other culverts where the inlets and outlets are not able to be driven on, headwalls are optional

1.4.16. Lintel rocks for headwalls shall have a minimum diameter (or long side) of not less than 2x culvert diameter for pipe sizes 250- 500mm diameter.

1.5. Track Shaping

1.5.1. Prior to placement of track surfacing aggregate, the track sub- grade shall be shaped as follows

- Crowned surface having a **maximum 3%** fall to each side from the centerline for straight sections in flat country.
- Single slope formation with a 3% fall to the downhill side for straight sections in hilly country or where side drains are not provided.
- Single cross slope formation with a **5-10% fall to the inside of corners** for winding sections.
- If after rain, water is left sitting or pooling on the surface at more than 20mm depth, this will be considered a defect and require rectification by the contractor.

1.6. Pavement Surfacing

1.6.1. Prior to placement of track surfacing, the strength and density of the track sub-grade shall, wherever possible, be improved by the use of suitable compaction equipment such as vibrating rollers or plate compactors.

1.6.2. Suitable surfacing material shall be a crushed & well graded AP2O (or smaller) type aggregate having a maximum particle size of 20mm and be supplied from a weed free source. The stone particles shall be durable with at least 50% crushed faces. Rounded particle river gravels or beach gravels are not acceptable as a track surfacing aggregate.

1.6.3. Ideally the track surfacing aggregate shall have a range of particle size distribution including between 5-8% by weight portion of clay content to facilitate binding the surface.

1.6.4. A sample of aggregate shall be provided to the Engineer for approval prior to placement.

1.6.5. The track surface layer shall have a minimum compacted depth of 75mm minimum (equates to 100mm loose). This layer shall be placed and compacted in a single layer or where additional material is added after compaction the original layer shall be scarified prior to placement of the additional aggregate.

1.6.6. A 5-10mm layer of crusher dust shall be used to cap the aggregate layer and provide a smooth riding surface.

1.6.7. The aggregate shall be placed in such a way as to minimize segregation of the particle sizes. Shovels, beam rakes or excavator buckets should be used to move material if required.

1.6.8. The surface shall be shaped to achieve the required cross fall and longitudinal smoothness with a grader or similar machine. Grading with an excavator is not acceptable.

1.6.9. The aggregate surface shall be compacted after placement with a plate compactor or other vibrating equipment to achieve a well bound surface suitable for cycling. The cross fall of the finished track surface shall be as stated in Section 4.5.1.

1.6.10. To achieve optimum compaction, water shall be sprayed onto the aggregate surface. Compaction will be deemed complete when a well bound pavement surface is achieved which is free of voids and loose stone.

1.6.11. The completed track surface shall be free from loose stones (interlocking mosaic is required) and **surface undulations** to achieve a smooth & comfortable riding experience. Wavy or corrugated surfaces shall be deemed a defect and shall not be acceptable. Trail edges should be straight with no overspill of aggregate outside the straight edge. The final test shall consist of riding a standard non- suspended bicycle along the completed surface to check for such defects. A clegg value of 27 is required on the finished surface (prior to crusher dust application)

1.7. Rock Excavation & Blasting

1.7.1. Areas requiring rock excavation are not necessarily shown on the design drawings.

1.7.2. Blasting of rock may be used where it is not practical to break or remove rock by mechanical means and achieve a solid level surface finish for the formation.

1.7.3. Any rocks that are too large to move whole shall be drilled and blasted.

1.7.4. All blasting shall be carried out in accordance with the Department of Labor Code of Practice for Construction Blasting Safety.

1.7.5. The Contractor shall provide the Engineer with at least 48 **hours' notice before blasting operations are to commence.** The Ministry of Business Innovation & Enterprise shall be notified at least 24 hours prior to the blasting commencing.

2. HERITAGE & ENVIRONMENT

2.1. Archaeological Matters

2.1.1. If any archaeological evidence in the form of mining relics, stacked stone tailings, water races, sluicing, shell, bone, charcoal, greenstone, hangi stone, or artefact is uncovered during any construction, work must cease in that particular area and the Engineer must be notified immediately.

2.1.2. Work in the vicinity of sites where archaeological evidence is uncovered shall not re-commence until the Engineer gives approval. Delays due to unexpected finds may be a variation at the applicable rates.

2.1.3. The contractor shall implement all mitigation measures approved in any archaeological authority obtained from the Historic Places Trust relating to track works. If this is not practical, they shall advise the Engineer prior to any works covered by such Authority.

2.2. Vegetation

2.2.1. The survey line/design plans marked will identify all vegetation requiring removal. Mature trees will be affected in some areas due to legal access constraints but in general the track alignment should consider options around mature trees and any significant fauna. Endeavor to minimize destruction of native flora and promote growth of native species over non-native species.

2.2.2. Any tree exceeding 300mm diameter, that needs removal will be identified prior to the start of any works; any tree exceeding 300mm diameter must have the approval of the Engineer before it can be removed.

2.2.3. The completed track must have a cleared vegetation line of 2.5m vertical and a horizontal line of 1.0m either side of the track edge. All stumps created in the course of the construction are to be removed from track area unless indicated by the engineer. All slash, branches and removed stumps must be removed from site or chipped or burned (note burning requires a permit from the TA).

2.2.4. If a tree has to be retained details are to be supplied to protects the roots of trees and Will ensure that disturbance to any trees & roots systems is minimised during construction or done in arboriculturally sensitive manner that is within the tolerances of the tree(s).

2.3. Sediment & Dust Control

2.3.1. Silt fences, traps or bunds should be used around water bodies. and cleared regularly to maintain functionality. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Where high levels of sediment run off is expected retention ponds

may be deemed appropriated.

2.3.2. Dust shall be mitigated during construction and maintenance activities through wetting of bare soil, covering stockpiles or revegetation.

2.4. Health & Safety

The Contractor shall comply with the requirements of the Health and Safety Legislation for all work carried out under this contract. The Contractor shall be the "person in control of the work" for the purposes of the Health and Safety at Work Act 2015.

In addition to the requirements of Clause 5.13 of NZS 3910, the Contractor shall locate and make safe all services related to the work site that may affect the health and safety of workers on site.

The Contractor shall nominate a person responsible for health and safety in relation to the contact and that person shall be the Contractor's person with responsibilities for ensuring the obligations under the Health Legislation are met.

Any breach of the above act will be treated as a serious breach of contract for which the Engineer reserves the right to suspend work in accordance with the provisions of Clause 6.7 of NZS 3910:2013.

Without limiting the foregoing, the Contractor shall:

- establish and maintain a register of hazards and risks to health and safety (noting the Principal's previously completed hazard assessment) in which the Contractor shall record any identified significant hazard or risk, the date it was identified and any steps taken to eliminate, isolate or minimise the significant hazard or risk;
- make the register of hazards and risks available for inspection by the Principal and the Principal's agent and shall keep the Principal informed of any changes subsequently made to the register;
- have in place effective methods to identify risks to health and safety and communicate those risks and management strategies to each Person on Site;
- ensure that all Persons on the Site undertake an appropriate safety induction;
- ensure that all Persons on Site for whom the Contractor is responsible have attended task specific training and where required by the Health and Safety Legislation and industry standards/approved

codes of practice and obtained any required certificates of competency;

- maintain an appropriate level of site supervision;
- have proper procedures for investigating and dealing with emergencies that may arise;
- undertake a full investigation and meet any requirements of the Principal if directed by the Principal or the Engineer; and
- respond to all emergencies arising in accordance with the Principal's policies as referred to in this Preliminary & General Specification. Emergencies are not limited to health and safety incidents and include damage to property, equipment and infrastructure, hazardous substance spills, health hazards, biological release, severe weather, acts of violence, criminal activity or terrorism.

The above shall be documented as part of the Site Specific Safety Plans submitted for the works.

For the purposes of determining the extent of the Contractor's indemnity to the Principal for any failure to comply with the Health and Safety at Work Act 2015, the place of work shall be any part of the works is being carried out by the Contractor from time to time (whether construction, maintenance or safety).

For the purposes of this clause, the place of work shall include:

1. Any area between "advance warning" and "end of work" signs.
2. Any area adjacent to that where work is being carried out affected or capable of being affected by the Contractor in carrying out work.

2.5. Building Consent

2.5.1. The Contractor shall comply with all conditions of Building Consents relating to structures.

2.5.2. If inspections are required by the Council building inspectors, it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.5.3. The Principal shall obtain all building consents unless otherwise noted.

2.6. Resource Consent

2.6.1. The Contractor shall comply with all conditions of Resource Consents relating to track formation and structures.

2.6.2. If inspections or monitoring is required by either the QLDC or ORC it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.7. Producer Statements

2.7.1. The Contractor shall, on completion of the works, provide the Engineer with a Producer Statement-Construction (PS3) as setout in NZS 3910:2003 Schedule 6. The issuing of a Certificate of Practical Completion is subject to the receipt of the PS3.

2.8. Reinstatement of Area & Grassing

2.8.1. The Contractor and any Sub-constructors employed by the Contractor shall reinstate all land affected by the works, including the re-establishment of working areas, to a condition at least equal to that at the commencement of the works. Grass seed shall be spread on all areas of spoil where appropriate. All fencing disturbed shall be reinstated with new fencing of the same style as what was removed

2.9. Materials brought onto Site

2.9.1. All aggregate brought onto the site for the purpose of track surfacing or any materials brought in as fill, are to be from a weed free source and are to be inspected and approved by the Engineer prior to delivery on site.

2.9.2. Materials are to be stockpiled in approved places and all remnants removed from the site on the completion of the project, except where the Engineer has approved surplus materials that may be left in stockpiles on the site.

2.10. Removal of Waste Material

2.10.1. All timber cut-offs, surplus materials and any waste is to be removed from the site at the completion of the work

2.10.2. Waste is defined as all foreign material on the site. This includes but is not limited to spilt concrete, nails, wood, plastic and metal off-cuts.

2.10.3. Waste or rubbish being held at the site prior to removal is to be stored in such a fashion that it cannot be blown about by the wind. No tyres are permitted.

2.10.4. Major repairs to machines are not permitted on site without approval of the Engineer.

2.11. Helicopter Operations

2.11.1. The Contractor shall obtain prior approval from the Engineer before each and every helicopter operation.

2.11.2. The Contractor is responsible for obtaining all required Civil Aviation and other permits necessary for helicopter operations.

2.11.3. The Contractors Safety Plan shall include procedures for such operations and the proposed measures to ensure public safety during the operations.

2.11.4. All materials dropped by a helicopter operator either by accident or on purpose outside of approved sites must be reported to the Engineer as soon as possible and any such materials shall be removed as soon as possible. Site restoration work must be carried out to the satisfaction of the Engineer in the event of any damage from dropped items.

3. TIMBER STRUCTURES

3.1. Relevant Standards

3.1.1. The underlying Standards relevant to this Section are:

NZS 3601	Metric Dimensions of Timber
NZS 3602	Timber & Wood Based Products for use in Buildings
NZS 3603	Timber Structures
NZS 3604	Light Timber Framed Buildings
NZS 3605	Timber Piles & Poles for use in Buildings
NZS 3622	Verification of Timber Properties
NZS 3631	New Zealand Timber Grading Rules
NZS 3640	Timber Treatment Specifications
NZS 1328	Glue Laminated Structural Timber

3.2. Scope & General

3.2.1. This section of the contract work shall consist of all carpentry including the associated jointing brackets, cleats, bolts, nails etc. as shown on the drawings or specified herein or otherwise.

3.2.2. This includes, but is not exclusive to the construction of boardwalks, barriers and retaining walls.

3.2.3. **All timber shall be sound, free from knots** and well-seasoned and maintain figured dimensions.

3.2.4. All timber shall have a moisture content based on oven dried weight not greater than 16%.

3.2.5.

3.2.6. All timber shall be rough sawn sizes unless specifically noted otherwise.

3.2.7. Timber shall comply with Table 1

3.3. Timber Treatment

3.3.1. Treatment shall be as noted in the table below. Treatment shall comply with the current requirements of the Timber Preservation Council. All treated timber shall be branded with the appropriate woodmark. It is preferred that timbers be treated at least 2 months prior to installation.

3.3.2. Cut faces of timber sections greater than 50mm thick shall be treated with Metalex or similar field applied preservative treatment.

Table 1: Timber Specification and Treatment

Structure & Application	Species	Grade	Treatment
Round piles	Pinus Radiata.	NZS 3605	H5
Retaining wall boards, Boardwalk end boards and bearers and other sawn timber in contact with the ground or within 150mm of the ground.	Pinus Radiata	G8	H4
Boardwalk joists, bracing, decking and blocking. Barrier balusters and rails	Pinus Radiata	G8	H3.2
Blocking	Pinus Radiata	SG6	H3.2
Glulam Beams	Pinus Radiata	GL10 – unless approved otherwise	H3.2

3.4. Fixtures & Fittings

3.4.1. Bolts shall be engineers' bolts of the diameters and sizes shown on the drawings fitted with washers both ends unless specified otherwise.

3.4.2. Bolts, washers and nuts in contact with treated timber shall be Grade 304/316 stainless steel.

3.4.3. Bolts in contact with treated timber may consist of stainless steel threaded rod cut to length on site.

3.4.4. Bolts, washers and nuts that are not in contact with treated timber shall be hot dip galvanized. Bolts not in contact with treated timber may consist of hot dip galvanised threaded rod cut to length on site.

3.4.5. All bolts in contact with timber shall be greased with GP grease in pre-greased holes.

3.4.6. If at the time of placement of the bolts the timber is less than 8 weeks out of the treatment process the bolts are to be isolated from the timber by a protective membrane or similar (to be approved by the Engineer).

3.4.7. Thread protrusion past the nut shall be a minimum of two thread pitches after tightening.

3.4.8. All nails shall be 100mm x 4.0mm FH Grade 304/316 stainless steel unless specified otherwise.

3.4.9. The contact faces of washers shall be coated with grease.

3.4.10. Washers shall be fitted to both ends of bolts and shall comply with the following minimum standards:

Bolt Size	Washer (mm)
M12	*50 x 50 x 3.0*
M16	*65 x 65 x 6.0*

3.5. Protection Up to Installation

3.5.1. All materials shall be protected against physical damage.

3.6. Standards of Workmanship

3.6.1. All work shall be in accordance with industry best practice

3.6.2. Details not shown on the drawings shall be formed according to the principles of NZS 3604 or

referred to the Engineer.

3.6.3. All work is to be accurately set out.

3.6.4. All structural members are to be fixed true to line.

3.7. Foundations & Concrete Work

3.7.1. All Concrete used for the embedment of posts or headwalls shall have a 20mm maximum aggregate size and be a mix designed to have a minimum 28-day compressive strength of 20MPa.

3.7.2. All concrete shall comply with NZS 3104 or NZS 3108 including specification and techniques setout herein.

3.7.3. The contractor shall be responsible for locating any services on site. Any damage to underground services shall be repaired at the Contractors expense.

3.7.4. Excavations for foundations are to be built to the dimensions and details shown allowing for working room as required.

3.7.5. Where holes are dug or augured for foundations, the Contractor is responsible for ensuring the stability of the hole to ensure the hole maintains its required dimensions before pouring concrete. The costs of any stability work will be deemed to be included in the Contractors tender price.

3.8. Glue Laminated Structural Members

3.8.1. All beams shall comply with AS/NZS 1328.1

3.8.2. Glulam timber shall be graded as GL10 unless approved otherwise by the engineer.

3.8.3. All glulam timber shall be treated in accordance with Table 1.

3.8.4. All members shall be made for Service Class 3: Exterior. All members to be bonded with Type 1 Adhesive as specified in AS/NZS 1328.1 (requirement for all members in damp conditions)

3.8.5. All end joints in laminations shall be structural finger joints in accordance with AS5068. End joints shall be staggered throughout the member to avoid stacking of joints and shall not be located in the outer laminations at the mid-span (between supports) or over cantilever support.

3.8.6. Finish shall be ‘standard’ in accordance with NZS 3606 unless specified otherwise.

3.8.7. All glulam timber shall have two coats of Dryden Wood Oil (or similarly approved by the Engineer) applied in the factory, unless specified or approved otherwise by the Engineer.

3.8.8. Manufacturer to provide manufacturers certificate to confirm timber meets strength and durability requirements.

4. GABION PROTECTION

4.1. Installation

4.1.1. Gabion baskets unless otherwise specified shall be 2m long by 1m high and 1m wide and made from 2.7mm pvc coated wire.

4.1.2. Gabion baskets shall be installed in accordance with the manufacturers recommendations and industry best practice including appropriate backfill, inter-connections and tying and geotextile separation (filter cloth) to prevent backfill migration.

4.1.3. All areas requiring gabion wall installation shall be marked on site by the Engineer prior to installation and agreed with the contractor.

4.1.4. Where gabions are laid more than 1m in height, subsequent layers shall be offset 300mm.

5. TIMBER RETAINING WALLS

5.1. Installation

5.1.1. Timber retaining walls shall be installed in accordance with the design drawings to achieve minimum embedment depths, maximum heights and angles.

5.1.2. All timber retaining walls shall be fixed together with either Grade 304/316 stainless steel bolts/washers or Grade 304/316 stainless steel purlin screws. Nails shall not be used for fixing timbers.

5.1.3. All timbers shall comply with Section 3.3 Table 1 above.

6. TIMBER CRIB WALLS

6.1. Installation

6.1.1. Crib walls shall be installed in accordance with the design drawings

6.1.2. All timber shall comply with Section 3.3 Table 1 above

6.1.3. Timber shall not be joined with nails. All timbers shall be either plated and bolted or plated and Grade 304/316 stainless steel purlin screwed together to prevent breakage and splitting of timber.

6.1.4. The end and corners of such walls are to be protected with a minimum 100x50 timber running vertically to prevent end breakage

7. CATTLE STOPS & BOLLARDS

7.1. Design & Installation

7.1.1. Cattle stops shall generally be as per the typical detail plan Sheet R4030_E3_4 The cattle stops shall have a minimum trafficable width as per the required minimum structure width for the trail Grade to enable maintenance access

7.1.2. Cattle stops shall have as a minimum a galvanized steel grate consisting of either rounds or flats sharp side up welded to a steel surround. Base and sides may be either timber or metal.

7.1.3. Cattle stops shall be installed at grade with the adjoining cycle trail and in line. Where restricting vehicle access is necessary, a timber bollard shall be installed in the center of one approach and be of the lockable type.

7.1.4. A minimum 100mm flexible pipe shall be installed into the base of the cattle stop to enable hedgehogs to exit from the sump

7.1.5. Bollards for use on QLDC trails shall be as per attached typical detail plan XXXXX and shall be installed in accordance with this plan. Bollards can be Macrocarpa but must be treated at ground level and below, frangible and capped on the top surface.