AROUND THE MOUNTAIN CYCLE TRAIL PROJECT

Bridges and Structures

(April 2011)

Nga Haerenga
THE NEW ZEALAND CYCLE TRAIL

Venture Southland
Enterprise, Tourism & Community Development

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Around The Mountain Cycle Trail
Bridges and Structures

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MWH

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1 Introduction

This report defines the structure and bridge components required for the proposed cycle trail alignment based on the following considerations:

- Structures should be low maintenance and easy care
- Smaller structures should be designed to carry cycle traffic and small utility Vehicles (for maintenance)
- Larger structures should be designed to carry cycle traffic and small utility vehicles (for maintenance)
- Structure should be placed clear of likely flood water levels

This report was initially based on the findings of a four day field trip carried out during July 2011 by MWH and Barnett & Associates. This report has been reviewed following a five day field trip carried out by Heenan Consulting Limited and Barnett & Associates.

A list of the structures required is in Appencies – Bridge and Structures Schedule of this report and the location of each structure is marked in a map book supplied separately to this report.

Small drainage structures such as water tables and small culverts (less than 1m in diameter) are not covered in this report.

2 Design Standards

2.1 General

This section discusses some of the design standards that may be considered applicable for the structures discussed in this report. These standards are required to define:

- Structure widths
- Hand rail heights
- Structure capacity
- Waterway capacity

In order to define appropriate design guidelines, it is recommended:

- Consideration of the documents listed below
- Additional research into other applicable and related documents
- Consideration of the levels of risk that are deemed to be acceptable
- Consideration of the consequences of failure of the structure
- Consideration of the minimum level of track user experience

2.2 SNZ HB8630 - Track Construction and Maintenance Guidelines (Department of Conservation)

This document provides performance standards for track construction and provides a consistent framework for those responsible for the design, construction, maintenance and/or management of tracks.

Some of the relevant issues covered by this report are:

2.3 AS/NZS 1170 - Structural Design Actions

This document provides performance standards for the majority of structures built for public use in New Zealand. It specifies general procedures and criteria for the structural design of a building or structure in limit state format. It covers the limit state's design, actions, combination of actions, method of analysis, robustness and confirmation of design.

Some of the relevant issues covered by the standard are:

- Table 3.1 of Part 1 defines loading for light and medium vehicle traffic access. It is likely that a light vehicle (not exceeding 2,500 kg in mass) would be useful for maintaining the longer sections of this project.

- Part 2 defines wind loading. This section could be applicable to the larger, more valuable structures and for this project the risk of failure needs to be very low.

- Part 3 defines snow and ice loading. This section could be applicable to the larger, more valuable structures in this project where the risk of failure needs to be very low.

- Part 5 defines earthquake loading. This section could be applicable to the larger, more valuable structures in this project where the risk of failure needs to be very low.

2.4 NZTA Bridge Manual

This document provides guidance on the design of public road bridges in and around New Zealand. It is largely focused on the design for state highways and major arterials where Class 1 vehicles and occasional overweight vehicles will travel.

Section 2.3 of this manual provides guidance on the design of waterways and may be of use in the design of the larger more honourable structures and for this project the risk of failure needs to be very low. This section includes:

- Catchment/hydrology and analysis to define flood flows
- Level of service ability to define return period for design flood
- Hydraulic analysis to define flood levels and local effects (ie scour)

Section 6 of this manual provides guidance on the assessment of existing structures. This will be useful in the assessment of any existing structures in this report to ensure that they have sufficient capacity to carry the unexpected traffic load (cyclists, light vehicle).

Appendix D of this manual provides guidance on the design of lightly trafficked rural bridges.

2.5 Other Standards

Some other standards and sources of information that may be worth consideration are:

- Cycle Trail Design Guide - *Refer: Cycle Trail Design Guide* by *Ministry of Tourism*
- Track Construction and Maintenance Guidelines - *Refer: DOC*

3 Structure Type

3.1 General

For the purpose of this project, structures have been defined in types depending on purpose, design loading and material type. The following sections discuss the structure type and the criteria associated with each.

For small structures, a higher risk of flood damage is deemed to be acceptable due to the difficulty and cost associated with assessing every small catchment and waterway with any real degree of reliability. The additional risk and cost of replacing a grading of the occasional structure, that is, what way or damage should be acknowledged and allowed for in the maintenance programme.

For large structures, a lower risk of flood damage is recommended. For such structures, a specific catchment analysis and hydrology assessment for each site should be carried out to define flood water levels, potential scour locations and likelihood of debris to be carried.

3.2 Timber Bridge (TB)

It is proposed that timber bridges have the following design criteria:

- Spans — up to 8 m
- Loading — cyclist and light vehicle loading
- Carriageway — 1.5 m to 1.8 m between kerb
- Handrails — yes, both signed up to 1.4 m
- Founding — gabian baskets, simple on spread concrete footing or short driven timber piles
- Waterway — except higher risk of flood damage with no specific catchment/flood channels and plateaus while the structure remains above water level

These bridges are intended for crossing over waterways servicing small catchments where the watercourse is well defined and relatively stable. In large events, the structure may be overtopped and in some cases even pushed from its founding. One end of the structure should ideally be secured to the point of restraint to prevent the structure from washing downstream and suffering any damage.

We propose that the structures deconstructed with a beam soffit level be at least 0.3 m above the adjacent flood flows to make use of adjacent secondary flooding channels and plateaus while the structure remains above water level.

3.3 Steel Bridge (SB)

It is proposed that steel bridges have the following design criteria:

- Spans — up to 25 m
- Loading — cyclist and light vehicle
- Carriageway — 1.5 m to 1.8 m between kerb
- Handrails — yes, both sides to 1.4 m

- Founding — gabian baskets, concrete footing on rock or medium length driven timber piles

These bridges are intended for crossings over waterways servicing medium-size catchments where watercourses are well defined and relatively stable. In large events, the structure should remain clear of the flood water for sufficient additional clearance of passing flood debris.

These structures will typically consist of steel beams (or trusses) with timber decking and handrails.

3.4 Suspension Bridge (SUB)

It is proposed that suspension bridges have the following design criteria:

- Spans — up to 95 m
- Loading — cyclist and light vehicle
- Carriageway — 1.5 m to 1.8 m between kerb
- Handrails — yes, both sides up to 1.4 m
- Founding — concrete footing on rock well driven timber piles, plus cable anchors
- Waterway — reduce risk of flooding damage with specific catchment/flood flow analysis

These bridges are intended for crossing over waterways servicing large catchments where watercourses are well defined and may also break out into secondary flood channels. In large events, structure should remain clear of flood water with sufficient additional clearance to pass floating debris.

3.5 Boardwalk (BW)

It is proposed that boardwalks have the following design criteria:

- Spans — multiple spans of 2 m (normal)
- Loading — cyclist and light vehicle
- Carriageway — 1.8 m between kerb
- Handrails — no
- Founding — simple ground bearing or driven timber piles
- Waterway — except higher risk of flood damage with no specific catchment/flood flow analysis

These structures are intended for crossing over wet, swampy areas or waterways where the watercourse is poorly defined. In large events, the structure may be overtopped and in some cases may be pushed from its founding or washed away.

To avoid the need for hand rails, the structures cannot exceed a ground clearance of 1 m.

3.6 Raised Boardwalk (RBW)

It is proposed that raised boardwalks have the following design criteria:

- Spans — multiple spans of 2 m (normal)
- Loading — cyclist and light vehicle
- Carriageway — 1.8 m between kerb
- Handrails — yes, both sides to 1.4 m
- Founding — driven timber piles
- Waterway — reduce risk of flood damage with some specific catchment/flood flow analysis

These structures are intended for crossing over waterways servicing small catchments where extra elevation is required to clear likely flood water levels. This includes the crossing of secondary flood channels adjacent to larger waterways. In large events, the structure may be overtopped and in some cases be pushed from its founding or washed away.

These structures will exceed a ground clearance of 1 m and will therefore require handrails on both sides.

3.7 Culvert

It is proposed that culverts have the following design criteria:

- Spans — helcor type pipe or PVC up to 1 m diameter
- Loading — heavy vehicle
- Carriageway — continuous track width
- Handrails — no
- Founding — none
- Waterway — reduce risk of flood damage with specific catchment/flood flow analysis

These structures are intended for providing basic drainage through sections of raised track formation. This is typically where a long span structure is not as cost-effective. A specific catchment/flood flow should be carried out for each structure as it will restrict the flow, potentially causing flooding upstream or damage to the track formation and damage downstream.

Culvert type structures have high load capacity, provided the structures are properly installed with a suitable cover depth (typically 0.6 m). A heavy vehicle loading is therefore deemed to be acceptable.

3.8 Light Vehicle Bridge (LVB)

It is proposed that light vehicle bridges have the following design criteria:

- Spans — 4-8 m to suit existing
- Loading — light vehicles up to 2,500 kg
- Carriageway — 1.8 m light vehicle access

Structure Type

- Handrails — yes, both sides
- Founding — to suit ground conditions
- Waterway — reduced risk of flood damage with specific/blood flow analysis

These structures are intended to reinstate old rail structures that have been removed or are in poor condition. As the previous rail structure is likely to have provided an adequate waterway, the new structure is deemed to be adequate without the need for specific catchment/flood analysis.

As these structures do not have Class 1 capacity, these bridges should be posted with legal loading limits in accordance with the requirements of the NZTA Bridge Manual. This posting sign will include maximum gross, maximum axle and a speed limit.

Bridge Foundation Construction

The bridge foundation construction is dependent on the bearing capacity of the ground and the proximity of the bridge to the watercourse.

Soil bearing capacity is considered as:

- "Good Ground" as defined in NZS 3604. This criteria is where the ground has an ultimate bearing capacity of 300 kPa (allowable bearing capacity of 100 kPa). This is a typical acceptance criteria for ground conditions required for the construction of a light timber framed house.

- Less than "Good Ground". Where ground conditions are considered to have a ultimate bearing capacity of less than 300 kPa. This ground could be soft saturated silty material, unconfined sands and free running gravels.

- Rock, or a derivation of rock.

Description of Bridge Foundations

Bridge Structures up the 6.0 m span

Good Ground

Typically, the foundations for these structures will be a simple timber (H5 treated) bearing plate bedded directly on the exposed ground. All tip soil and organic matter are to be removed from the foundation footprint. Lateral restraint is provided by backfilling the bearing plate or providing waratah type piles driven adjacent to the bearing plate.

Less than Good Ground or adjacent to Watercourse Bed

Each end of the structure shall be piled with a minimum 150 mm SED Tan Post driven to refusal (solid bearing) and/or to a level determined to be below the adjacent watercourse bed to prevent future wash out of the abutments. The piles shall be capped with timber bearers of a suitable size and the bridge constructed on these bearers. The pile diameter is dependent on the height above the watercourse the bridge is to be constructed and whether the abutment is required to retain the track formations at each abutment. Driving of the piles will most likely be carried out by vibrating hammer.

Structure Type

Rock

As per "Good Ground" with a fixing to the rock for lateral restraint by drilling and grouting anchor bars as required.

Bridges 6.0 m - 12.0 m

Good Ground

Either precast concrete or poured in-situ concrete abutments with adequate allowance for ground clearances at the abutments. All topsoil and organic matter is to be removed from the foundations footprint.

Less than Good Ground or adjacent to Watercourse Bed

Either precast concrete or poured in-situ concrete abutments with adequate allowance for ground clearances at the abutments, with additional driven timber piles cast into concrete abutments. Reinforced concrete abutments are sized according to the watercourse bank profile.

Rock

As per "Good Ground". Allowance is made to key the concrete abutment into the rock surface and grouted bars to the rock if required.

18.0 m Precast Concrete Bridges

All situations

All bridge foundations and abutments are provided by stacked stone gabion baskets 1.0 m x 1.0 m x 4.0 m long (a minimum of two full gabion baskets). The bridge is bearing on a precast concrete bearing plate set into the top of the gabion baskets and held by galvanised anchor bars incorporated into the gabion baskets. All topsoil and organic matter is to be removed from the foundations footprint. If the ground bearing capacity is less than "Good Ground", additional gabion baskets are to be provided to increase the bearing area at each abutment.

Where bridge is to be elevated, the abutments shall be constructed with braced driven timber piles. Piles shall be driven to refusal or to a depth determined to be suitable for the depth of any adjacent watercourse.

12.0 m - 25.0 m Steel Truss Bridges

Good Ground

Either precast concrete or poured in-situ concrete abutments with adequate allowance for ground clearances at the abutments. All topsoil and organic matter is to be removed from the foundations footprint.

Where bridge is to be elevated, the abutments shall be constructed with braced driven timber piles. Piles shall be driven to refusal or to a depth determined to be suitable for the depth of any adjacent watercourse.

Structure Type

Less than Good Ground or adjacent to Watercourse Bed

Either precast concrete or poured in-situ concrete abutments with adequate allowance for ground clearances at the abutments, with additional driven timber piles cast into concrete abutments. Reinforced concrete abutments are sized according to the watercourse bank profile.

Rock

As per "Good Ground". Allowance is made to key the concrete abutment into the rock surface and grouted bars to the rock if required.

Suspension Bridges

Tower foundations

Reinforced concrete pad foundation:

- Less than Good Ground or adjacent to Watercourse Bed

  Cast in-situ reinforced concrete pad foundations with additional driven timber piles.

- Rock

  Cast in-situ reinforced concrete pad foundations with additional galvanised steel key bars drilled and grouted to rock.

Anchor Blocks

Cast in-situ reinforced concrete anchor blocked poured directly against excavated ground. Where rock is encountered at anchor locations, anchor rods are to be drilled and grouted to competent rock to a length determined depending on the quality of rock encountered. All rock grouted anchor road will be subject to load testing.

Tower stay cables and sway cables

Either driven timber piles or drill and concrete encase timber piles to ground as required.

Existing Bridges

Within the original rail alignment there are several bridges which have either existing concrete abutments or existing hardwood timber piles. All existing foundation structures are used where possible.

4 Route Selection

4.1 General

For the purpose of this report the route has been separated into a number of distinct sections which reflect the changing character of the Trail. The Trail is described in the direction of the flow (ie Mount Nicholas - Mossburn - Lumsden - Kingston).

Note that some of the structures which are included in this section are existing and potentially adequate to reuse without modification. New and existing structures are identified in the bridge and structure Schedule 6.

4.2 Walter Peak to Oreti River Bridge (DOC Carpark)

This section of the Trail is largely on existing formed gravel road and, as such, many of the existing waterway crossing points will be adequate for cyclists to use.

There are three major crossings required to provide flood access when the road fjord is carrying significant flow:

- Structure No. 102 - Station Stream, 18 m steel beam bridge
- Structure No. 107 - New hand rail on existing bridge
- Structure No. 109 - Gorge Burn Flood Channel, 18 m precast concrete bridge beams
- Structure No. 110 - Gorge Burn at Pretty Hut, 18 m precast concrete bridge beams

4.3 Oreti River Bridge (DOC Carpark on Mount Nicholas Road) to Oreti Suspension Bridge

4.3.1 General

Bridge and crossing structures on the proposed cycle trail between the DOC carpark on Mount Nicholas Road to Mossburn are discussed in the following sub-sections.

4.3.2 DOC Carpark to Three Kings

We have identified the requirements for 10 structures along the section of trail:

- Ashton Burn, No. 127 - 18 m precast concrete bridge beams
- Structure No. 129 - 8 m steel beam bridge
- Structure No. 130c - 10 m steel beam bridge
- Structure No. 135 - 12 m steel beam bridge
- Structure No. 161 - 12 m steel beam bridge
- Structure No. 180 - 10 m steel beam bridge
- Structure No. 182 - 33 m wooden bridge
- Structure No. 183 - 6 m wooden bridge
- Structure No. 193a - 6 m wooden bridge
- Structure No. 200 - 30 m suspension bridge

4.3.3 Three Kings to Oreti Suspension Bridge

We have identified the requirements for five structures along the section of Trail. This includes a 95 m suspension bridge across the Oreti River:

- Structure No. 201 - board walk
- Structure No. 206 - 10 m steel beam bridge
- Structure No. 215 - 8 m steel beam bridge
- Structure No. 221 - 6 m wooden bridge
- Structure No. 223 - 95 m suspension bridge

4.3.4 Option B - DOC Carpark to Three Kings and Three Kings to Oreti Suspension Bridge

We have identified the requirements for 9 structures along the section of trail:

- Rock Groyne, 194 m identified on Map 23A
- 45 m suspension bridge identified on Map 23A across the Oreti river
- 8m bridge identified on Map 23A
- 12m steel beam bridge identified on Map 23A
- 12m steel beam bridge identified on Map 24
- 10 m steel beam bridge identified on Map 25
- 8m bridge identified on Map 26
- 18m concrete bridge identified on Map 28
- 95 m suspension bridge identified on Map 28 across the Oreti river

4.4 Oreti Suspension Bridge to Mossburn

We have identified requirements for five structures on the section of Trail, including a 36 m concrete beam bridge at Rocky Point, Mossburn:

- Structure No. 501 - board walk
- Structure No. 516 - 10 m steel beam bridge
- Structure No. 517 - 18 m precast concrete bridge beams
- Structure No. 518 - 18 m precast concrete bridge beams
- Structure No. 520 - 18 m precast concrete bridge beams
- Structure No. 521 - 36 m precast concrete bridge beams

4.5 Mossburn to Lumsden

We have identified the requirement for one structure along the section of Trail. This includes:

- One large culvert

It is noted that no clip-on bridge is required for the Oreti River crossing just north of Lumsden. NZTA has advised that given the low traffic numbers and the existing 8 m carriageway on this bridge, a cycle clip-on is not deemed to be necessary. It is, however, noted that the guard rail on this bridge is only 0.7 m in height and that consideration should be given to adding a suitable pedestrian rail to the side of the bridge that the cyclists will be

using (upstream). It is also further noted that the interaction of cycle traffic and vehicle traffic will be managed on this bridge has not been determined.

4.6 Oreti River Bridge to Five Rivers Road

We have identified the requirement of six structures along the section of Trail. This includes:

- Structure No. 337 - 18 m precast concrete bridge beams
- Structure No. 329 - 4.25 m wooden bridge on existing rail bridge beams
- Structure No. 329A - 22.6 m stock overpass timber bridge
- Structure No. 330 - 3 m bridge on existing rail beams
- Structure No. 330A - 22.6 m stock overpass timber bridge
- Structure No. 330 - 3.75 m bridge on existing rail beams

4.7 Rivers Road to Athol

We have identified the requirement of 13 structures along the section of Trail. This includes:

- Structure No. 340 - 36 m precast concrete bridge beams
- Structure No. 341 - 54 m timber bridge on existing rail beams
- Structure No. 344 - 36 m precast concrete bridge beams
- Structure No. 355 - 4.1 m timber bridge on existing rail beams
- Structure No. 373 - 5.64 m timber bridge on existing rail beams
- Structure No. 378 - 18 m precast concrete bridge beams
- Structure No. 357 - 60 m suspension bridge
- Structure No. 358 - 18 m precast concrete bridge beams

4.8 Athol to Garston

We have identified the requirement for six structures along the section of Trail. This includes:

- Structure No. 360 - 25 m steel truss bridge
- Structure No. 379 - 18 m precast concrete bridge beams
- Structure No. 384 - 10 m steel bridge
- Structure No. 300 - 75 m suspension bridge

4.9 Option B (Alternative Route)

We have identified the need for two suspension bridges if Option B (Alternative Route) was the option. This is not the preferred option for the following reasons:

- Would require two additional bridges across the Oreti River.
- Would impact on a favourite fishing location.
- Would impact on the vista (significant landscape) of Three Kings.
- The 60 m suspension bridge would require rock protection on true right bank.
- Both bridges in Option B would be structurally at risk from flooding compared to the preferred route.

Route Selection

- Structure No. 00 - 60 m suspension bridge
- Structure No. 00 - 95 m suspension bridge

5 Existing Structures

There are several existing intact structures along the old railway formation. As these structures were previously subject to loading from the railway, they are likely to have more than enough capacity to carry cyclist traffic and light vehicles.

Existing structures have been inspected for capacity assessment by engineering consultants, Heenan Consulting. To confirm the actual loading, if required, suitable posting signage should be installed at each structure to advise of any load restrictions that might apply to vehicles.

Posting of the structures should be carried out in accordance with the NZTA Bridge Manual and publicly advised in accordance with the HMV Regulations. Failure to do so could leave the asset owner open to significant liability in the event of a structural failure (ie the Berryman's farm bridge failure).

6 Summary & Recommendations

This report defines the structure and bridge components required for the proposed cycle trail alignment based on the following considerations:

- Structure should be low maintenance and easy care
- Smaller structures should be designed to carry cycle traffic and light vehicles (for maintenance and emergency management purposes)
- Larger structures should be designed to carry cycle trail traffic and light vehciles
- Structures should be placed clear of likely flood water levels

7 Shelters

There are three shelters planned on the Around the Mountains cycle trail. These shelters are required as safe shelters for cyclists in inclement weather conditions. The shelter in the Von Valley will also be a café is at the half way point on the 50 km cycle ride from Walter peak to Mavora lakes. There are no other options or facilities in this area.

Shelter Points

a) Point 105, page 4 Von Delta, maps, this shelter is also a shelter/café 150m^2

b) Point 181, page 21 Windy Track, maps, this shelter will be 30m^2

c) Point 193V, page 28 Three Kings, maps this shelter will be 30m_2

8 Appendices: Bridge and Structures Schedule

Around the Mountains Cycle Trail

Structure & Site Locations

SDC Map Ref	Site N	Site Description	Grid Reference (NZTM2000)			Elevatio	Notes	Concrete Beam Bridge span	Beam Bridge sp	Suspension Bridge Spa	Classification
1	101	Mt Nicholas Toilets	CC10	1241381	4995134	371					Toilet
3A	102	Mt Nicholas Stn Bridge	CC10	1241500	4995153	417	18.0m modular truss bridge		18		Bridge
3A	103	Old Nicholas Homestead Toilets	CC10	1235640	4991402	400					Café
4A	104	Von Hill Café	CC10	1232856	4985490	485					Shelter
4A	105	Von Hill Shelter	CC10	1232856	4985490	485					Toilet
4A	106	Von Hill Toilets	CC10	1232856	4985490	485					Bridge
5	107	Von Road Bridge at Bush Creek	CC10	1233995	4980125	718	Side barriers to existing road bridge				Toilet
10	109	Gorge Burn Ford Flood Channel	CD09	1227901	4972597	649	Pretty Hill 4.0m wide channel approx 600mm deep	18			Bridge
13	111	Upper Oreti Car Park	CD09	1224750	4969300		Formed Car Park				Car Park
15	GE1	Gravel Borrow Pit	CD09	1225331	4967052		Gravel borrow pit				Gravel Pit
17	GE2	Gravel Borrow Pit	CD09	1225807	4965551		Gravel borrow pit				Gravel Pit
17	127	Ashton Burn Bridge	CD09	1225689	4965533	580	18mm span concrete beam bridge	18			Bridge
17	129	Bridge	CD09	1225812	4965058	590	8.0 m span std bridge		8		Bridge
18	130C	Bridge	CD09	1225679	4964393	584	10m span standard bridge. u/s beams to be 300mm above abutments		10		Bridge
18	GE3	Gravel Borrow Pit	CD09				Gravel borrow pit				Gravel Pit
18		Upper Oreti Hut (DOC)	CD09	1225587	4964193		Existing Department of Conservation Hut				Hut
18	134	Upper Oreti Hut Toilets	CD09	1225587	4964193		Toilets				Toilet
18	135	Upper Oreti Hut Creek Bridge	CD09	1225570	4964120	581	12 m standard bridge. 900mm clearance at abutments		12		Bridge
19	161	Bridge	CD09	1225166	4963470	582	Standard 12.0 m bridge. u/s beams to be 500 above GL. 4.0m water course		12		Bridge
20	GE4	Lincoln Hut Gravel Borrow pit	CD09	1224106	4962895		Gravel Borrow Pit				Gravel Pit
20	GE5	Gravel Borrow Pit	CD09	1224014	4962779		Gravel Borrow Pit				Gravel Pit
20	180	Bridge	CD09	1223442	4962469	554	Standard 10.0 m bridge.		10		Bridge
21	181	Patersons Bush Toilet	CD09	1223203	4962391		Toilets				Toilet
21	181A	Patersons Bush Shelter	CD09	1223203	4962391		Shelter				Shelter
22	182	Patersons Bush Bridge	CD09	1223006	4961262	530	Three span timber bridge / modular truss bridge		36		Bridge
22	183	South Patersons Bush Bridge	CD09	1222566	4960806	523	Standard 6.0 m Bridge		6		Bridge
22	GE6	Gravel Borrow Pit	CD09	1222575	4960609		Gravel Borrow Pit				Gravel Pit
22	GE7	Gravel Borrow Pit	CD09	1222451	4960423		Gravel Borrow Pit				Gravel Pit
24		Rock Groyne Start Up stream	CD09								Rock Groyne
24		Rock Groyne End Downstream	CD09								Rock Groyne
24		Second Rock Groyne Start Upstream	CD09								Rock Groyne
24	193AA	Bridge	CD09	1220891	4959355	501	Standard 6.0m bridge		6		Bridge
24		Second Rock Groyne End Downstream	CD09								Rock Groyne
25		Possible Rock Groyne Start Upstream	CD09								Rock Groyne
25		Possible Rock Groyne End Downstream	CD09								Rock Groyne
25		Rock Groyne Start Upstream	CD09								Rock Groyne
25		Rock Groyne End Downstream	CD09								Rock Groyne
26	GE8	Gravel Borrow Pit	CD09	1219313	4957220		Gravel Borrow Pit				Gravel Pit
28	200	South Three Kings Bridge	CD09	1219896	4955791	475	30.0 m suspension Bridge with TR aproach board walk			30	Bridge
29	GE9	Gravel Borrow Pit	CD09	1219281	4954873						Gravel Pit
29	206	Bridge	CD09	1219303	4954465						Bridge
29	GE10	Gravel Borrow Pit	CD09	1219195	4954255		Gravel Borrow Pit				Gravel Pit
31	215	Bridge	CD09	1218600	4952784	449	6.0 - 8.0 m span Incl abutments. Aprox 1.5 m fall height		8		Bridge
31	GE11	Gravel Borrow Pit	CD09	1218555	4952292		Gravel Borrow Pit				Gravel Pit
32	221	Bridge	CD09	1218968	4951329	439	6.0 m span incl abutments. u/s beams 500mm above GL. Fall height > 1.500m		6		Bridge
33	223	Big Bridge	CD09	1219001	4950619	434	95.0 m span suspension Bridge			95	Bridge
33	GE11A	Gravel Borrow Pit	CD09	1219104	4950420		Gravel Borrow Pit (Ex MWH survey)				Gravel Pit
36	510	Bridge / Boardwalk	CD09	1219774	4947582		Start of causeway. 9.0 - 12.0 std bridge Height < 1.0m		12		Bridge
37	GE12	Gravel Pit	CD09	1219769	4946735		Confirm ownership ?				Gravel Pit
42	516	Bridge	CD09	1221366	4939053	337	Std 6.0-9.0 m bridhe beside existing farm bridge		9		Bridge
43	517	Bridge Weydon Burn	CD09	1221614	4938598	353	18.0 m Concrete beam bridge	18			Bridge
43	518	Bridge Russel Farm No. 2	CD09	1221723	4938173	350	18.0 m Concrete beam bridge	18			Bridge
44	520	So Big Creek Bridge 892	CE09	1222145	4937198	346	State Highway 94 18.0m concrete bridge				Bridge
49	521 + 522	Mossburn Creek Corner	CE09	1227270	4932652		Bridge and causeway through willows to existing Mossburn Creek Flood Bank	36			Bridge
49		Mossburn Creek Corner	CE09				Road barrier between cycle trail and SH94 approx 350m long				Road Barrier
							STAGE ONE	126	173	125	
60		Oreti River Bridge at Lumsden					Provide new hand rail to upsream side approx 220m long				Bridge
60		Menlove Property	CE10	1244716	4926951	209	Extend existing 915mm ID concrete culvert & provide rock to culvert outlet				
60	319	Menlove Property	CE10	1244618	4927073	206	Head wall to existing culvert and back fill embankment for alignment				
		Lumsden - Kingston									
67	337	Bridge 36	CE10	1244341	4934139	247	18.0m Concrete Bridge beams	18			Bridge
67	335						Culvert				Culvert
68	329	Bridge 37	CE10	1244609	4934934	246	Existing timber bridge : Reuse existing beams and deck. Cut back deck and new barrier				Bridge
68	329A	Cow overbridge No. 2	CE10	1244628	4934973	243			8		Bridge
69	330	South Five Rivers No. 1	CE10	1244872	4935500	255	Existing timber bridge : Reuse existing beams and deck. Cut back deck and new barrier				Bridge
69	330A	Cow overbridge No. 1	CE10	1244957	4935678	258			8		Bridge
70	331	Existing Box Culvert	CE10	1245120	4936252	270	approx 1.0x1.0 existing timber box culvert				Culvert
70	338	Existing Culvert	CE10	1245204	4937040	280	600 mm dia culvert approx 7.000 m long				Culvert
71	340	Stoney Creek North Five Rivers	CD10	1245834	4938827	289	2 span 18.0 m concrete beam bridge. Rock rip rap to TL upstream bank	36			Bridge
72	341	Bridge	CD10	1246208	4939798	297	New timber bridge to existing concrete abutments		5.4		Bridge
73	344	Tank Creek / Andrews Road	CD10	1246222	4940689	317	Two span 18.0 m concrete beam bridge over flood plain beside existing track	36			Bridge
76	355	Kerrs Bridge	CD10	1247977	4943702	316	Existing timber bridge. Redeck only and barriers				Bridge
78		Gate / Cattle Stop	CD10				South boundary Parawa Stn				Cattle Stop
79	375	Rosies Culvert	CD10	1246724	4946553	281	Existing culvert. Requires head and outlet work				Culvert
80	373	Rosies Bridge : Parawa Stn	CD10	1250906	4947121	272	Existing timber bridge. Redeck and barriers		5.1		Bridge
81	371	Culvert		1252446	4948076						Culvert
82	378	Bridge	CD11	1252871	4949268	270	18.0 m Concrete beam bridge over 13.0m water course. Noted for Willow removal	18			Bridge
83	357	Eyre Creek Bridge	CD11	1253102	4949517	272	60 m Suspension bridge			60	Bridge
83	358	Eyre Creek Flood Bridge	CD11	1253469	4949927	271	18.0m Concrete Bridge beams on new abutment between existing rail abutments	18			Bridge
85	360	Mataura River Bridge Athol Flagstaff	CD11	1255229	4950201	291	Steel Truss Bridge	18			Bridge
88	379	Petersons Greek	CD11	1258317	4950365	293	18.0 m Concrete Bridge beams	18			Bridge
90	379A	Naylor Road	CD11	1260900	4952600		18.0 m Concrete Bridge beams	18			Bridge
92	384	Blackmore Road Bridge at Garston	CD11	1262395	4955510	315	10 m standard bridge . u/s bridge to be 300mm clear TR ground level		10		Bridge
96	300	Matuara River Bridge Fairlight	CD11	1261638	4961032	333	75 m Suspension Bridge			75	
							STAGE TWO	**180**	**36.5**	**135**	
							TOTAL FOR CYCLE TRAIL	306	209.5	260	