Before a Board of Inquiry
Transmission Gully
Notices of Requirement and Consents

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under: the Resource Management Act 1991

in the matter of: Notices of requirement for designations and resource consent applications by the NZ Transport Agency, Porirua City Council and Transpower New Zealand Limited for the Transmission Gully Proposal

between: **NZ Transport Agency**
Requiring Authority and Applicant

and: **Porirua City Council**
Local Authority and Applicant

and: **Transpower New Zealand Limited**
Applicant

Second statement of rebuttal evidence of Andrew Gough (Erosion and Sediment Control) for the NZ Transport Agency and Porirua City Council

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Dated: 16 February 2012

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SECOND STATEMENT OF REBUTTAL EVIDENCE OF ANDREW GOUGH FOR THE NZ TRANSPORT AGENCY AND PORIRUA CITY COUNCIL

INTRODUCTION

1 My full name is Andrew Gough.

2 I have the qualifications and experience set out at paragraphs 2 to 5 of my statement of evidence in chief, dated 18 November 2011 (*EIC*).

3 I repeat the confirmation given in my EIC that I have read, and agree to comply with, the Code of Conduct for Expert Witnesses (Consolidated Practice Note 2011).

4 In this statement of rebuttal evidence, I respond to:

4.1 The supplementary evidence of Mr Brian Handyside on behalf of the Director General of Conservation; and

4.2 The section 42A report of Mr Gregor McLean (Sediment Mitigation Controls).

5 The fact that this rebuttal statement does not respond to every matter raised in the evidence of submitter witnesses within my area of expertise should not be taken as acceptance of the matters raised. Rather, I rely on my evidence, including this statement, to set out my opinion on what I consider to be the key erosion and sediment control matters for this hearing.

SUMMARY OF EVIDENCE

6 The evidence Mr Handyside requests further details in relation to the SSEMPs. In this statement of evidence, I present further construction details at two sites – Te Puka (ch 3700 – ch 4900) and Bridge 19 on Duck Creek (ch 22780 – ch 22940).

7 Mr McLean's Section 42A report is largely consistent with my evidence. This statement of evidence clarifies matters of sediment pond sizing, chemical treatment, and pond efficiency.

8 I do not depart from the opinions expressed in my EIC and rebuttal evidence, except insofar as I have agreed to amendments to conditions, discussed both in this statement, and in conferencing.

SUPPLEMENTARY EVIDENCE OF MR BRIAN HANDYSIDE

9 In paragraph 7 of his supplementary evidence, Mr Handyside notes that he does not consider that the SSEMP prepared for the upper

reaches of the Te Puka Stream provides sufficient detail for him to develop a realistic understanding of how potential effects of works can be adequately addressed. His comments in paragraphs 7 to 10 include noting that there are no details presented to show:

9.1 The proposed diversion is designed for the 20 year flow;

9.2 The difficulty in constructing diversions and dealing with side slope runoff; and

9.3 The implications of side slope flows on sediment pond sizing.

10 He requests more specific detail, including site specific calculations for a range of worst case type situations and suggests that this be done for all SSEMPs.

11 In response to these comments (and also similar comments from Mr McLean[1]), I have directed the preparation of additional construction plans, including details of proposed erosion and sediment control measures and comment on Q20 flows used in the designs. This has been done for the Te Puka catchment and for Bridge 19 on Duck Creek. These locations were chosen because they demonstrate the application of erosion and sediment control measures to two different sets of difficult site conditions that are representative of conditions encountered elsewhere along the TGP alignment.

12 Details of each work package are attached as **Appendix A** to this evidence. The additional documentation provides some of the information sought by Mr Handyside, and responds to a number of his specific comments. In particular, the documents show details of diversions, pond size, location, and other erosion and sediment control measures associated with each stage of work at each site.

13 The documents have been prepared to a **preliminary** level of detail. The final SSEMPs and ESCPs which are to be provided to the Regional Council for certification will contain full details of the design and supporting calculations for the proposed erosion and sediment control measures and other requirements as set out in conditions G 15A and E5.

14 In his paragraph 12, Mr Handyside restates his position on winter works controls. I note that in conferencing on 8 February 2012 there was agreement in principle that a form of winter works condition would be appropriate. This was also discussed in conferencing on 15 February 2012. I understand **Ms Rickard** is working on the drafting of this condition.

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[1] Section 3.3.

SECTION 42A REPORT BY MR GREGOR MCLEAN

15 In section 3.1 of his section 42A report , Mr McLean describes an adaptive management approach to environmental management. I note that the adaptive management mechanisms I propose for the TGP are more proactive than Mr McLean describes in the 4th paragraph of section 3.1. For the TGP, action trigger levels will be established at a level that is higher than the compliance criteria, requiring the parties involved to assess the results and take corrective action to avoid a breach of compliance criteria. This is intended to substantially reduce the risk that a breach may occur.

16 In section 3.4, in the last bullet point on end of page 15, Mr McLean refers to sediment ponds sized as 3% of the contributing catchment area. I note that proposed condition E3A requires ponds to be designed to a minimum of 3% of the contributing catchment. Therefore, there is no impediment to the application of the NZTA ESC standard to this Project.

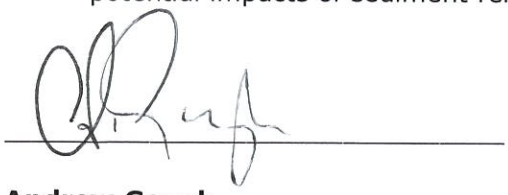
17 On page 19, Mr McLean states that no testing of the TGP soil has been undertaken to determine the response of soils to the addition of chemicals. I can confirm that a number of soils in the area have been tested and the copies of the test results have been provided to both Messrs Handyside and McLean. Those tests suggest that chemical treatment will be successful in the Project area. New condition E.19A requires that flocculation and settlement bench tests be carried out prior to submission of the Chemical Treatment Plan.

18 In section 4.2, Mr McLean comments on the design efficiency of ponds, on the basis of a NIWA ALPURT pond study. As noted in paragraph 32 of my rebuttal evidence of 20 January 2012, I expect the ponds used for the TGP to have greater efficiencies than is indicated by the ALPURT results.

19 The performance of the ponds will be monitored throughout the period of construction. If monitoring shows that the design criteria (70% efficiency) is at risk of being breached (as identified by trigger levels), then by application of the adaptive management approach, corrective actions will be taken (e.g. by reducing open areas served by a pond, which will increase the ratio of pond size to catchment area) to avoid non-compliance.

20 I agree with Mr McLean that erosion and sediment control measures other than ponds do not meet this performance standard. The proposed consent condition E5(b) for erosion and sediment control plans will require the use of such measures to be detailed in the plan submitted to GWRC for approval. This will allow GWRC to assess the use of measures with lower efficiency giving

consideration to matters including soil types, ground slopes and the potential impacts of sediment release.



Andrew Gough
16 February 2012

APPENDIX A

ADDENDUM TO SITE SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN (SSEMP)

Duck Creek Focus Area
Bridge 19
(From Chainage 22740 - 22980)

The construction methodology presented for Bridge 19 specifically explores the following issues:

- Erosion and sediment control;
- Construction of access to pier and abutment locations
- Stabilisation of works areas;
- Installation of temporary culverts;
- Bridge Pile and Abutment Construction..

February 2012
Version 1.

1 INTRODUCTION

This SSEMP covers a length of alignment of approximately 250m in the vicinity of Bridge #19, from ch22740 - 22980.It covers the upgrading of a short section the existing farm access road, establishment of erosion and sediment control structures, installation of temporary culverts, construction of access to pier and abutment locations, construction of bridge #19.

2 PLANS

Drawings relevant to this ADDENDUM are contained in Volume 5 of the document set. These show the location of the proposed works and sediment control structures as outlined below:

- E4 SSEMP Bridge 19-Plan and Elevation
- S19-01 Bridge no. 19 Plan and Long Section
- E24 Bridge Construction Staging
- E23 Overview Plan
- E25 Abutment 1 Sediment Control
- E26 Pier 2 Sediment Control
- E27 Pier 3 Sediment Control
- E28 Pier 4 Sediment Control
- E29 Abutment 2 Sediment Control

3 ENVIRONMENTAL CONSIDERATIONS

3.1 Erosion and Sediment Control and Stormwater

The area covered by this SSEMP falls within the wider watershed of Pauatahanui Inlet, the northern arm of Porirua Harbour. This harbour is recognised as nationally significant. It is the ultimate receiving environment for any discharges from site. Considerable care is therefore essential in the management of sediment and contaminants.

3.2 Stream Works

This bridge section of the alignment will cross a tributary of Duck Creek. The bridge 19 spans 160m from Chainage 22780 - 22940

Care will be needed during its construction to protect the stream from earthworks related sediments and bridge construction related contaminants in particular the use of cement, as this is toxic to freshwater fauna.

There is an existing culvert crossing over the Duck Creek tributary which will be extended as part of the works to enable construction of Pier 2. Careful management is also required to avoid uncontrolled sediment discharge to this stream.

3.3 Indigenous Fish

Duck Creek has a number of fish species, several of which are Threatened or At Risk (banded kokopu, giant kokopu, longfinned eel, redfinned bully). During construction special attention needs to be paid to the protection of native fish within any section of stream being culverted.

3.4 Utilities

The 220 kV transmission line does not cross the proposed alignment between ch 22740 – 22980.

The GWRC Water Main passes under the alignment at 20800, follows the existing farm track that sidles below the alignment to 233000, and then passes beneath the alignment again.

The access to the work platform at piers 3 and 4 will cross the water main. The crossings will have to be reinforced and/or pipes protected to allow traffic of the 60 to 80 ton crawler cranes over the water main.

4 WORK PROGRAMME

4.1 Staging

The exact timing and construction staging is still to be confirmed however generally the construction process includes:

- Access road (existing) widening and reinforcing the GWRC Water Main at access points to piers 3 and 4.
- Installations of temporary culverts (access road water table drains).
- Stabilisation of the access road (existing) with RAP product or similar.
- Extension of existing culvert, including in-stream sediment controls.
- Establishment and stabilisation of Erosion and Sediment Control measures around earthworks areas.
- Creation of access to pier and abutment locations (work platforms).
- Stabilisation of the work platforms.
- Establishment of additional Erosion and Sediment Control measures.
- Earthworks and bridge construction
    a. Construct abutment piles
    b. Construct pier piles
    c. Construct abutment casing and platform
    d. Construct piers and pier and abutment caps, layout the first sections of girders for launching
    e. Launch girders – start at abutment 1, end abutment 5
    f. Lay bridge surface
    g. Pavement Works; rigid barriers, central reserve, lane and shoulder markings
- Decommissioning of pile work platforms (to be undertaken concurrently with bridge construction).
- Construction of access road under the bridge.
- Removal of Erosion and Sediment Control measures after agreement with GWRC.
- Landscaping for the batter slopes, pier earthworks and stream banks.

4.2 Programme

The works will be undertaken in a sequential manner. The stream work for the culvert construction in drawing E26 will be completed prior to commencement of earthworks to form access to Pier 2.

A detailed work programme will be prepared in due course by the constructor but may be undertaken in the following sequence.

No.	Activity	Duration	Preceding Activity
	ENABLING WORKS		
1	Retire pasture and fence	2 weeks	-
2	Extend existing culvert	1 weeks	-
3	Upgrade existing access track (widening)	1 week	1
	CONSTRUCTION WORKS		
4	Initial erosion and sediment control structures	2 weeks	-
5	Bulk earthworks to create work platforms	3 weeks	4
6	Earthworks Stabilisation	1 week	5
7	Install additional ESC measures	3 days	6

8	Construct pier piles	TBL	7
9	Construct abutments and bulk earthworks	TBL	
10	Decommission work platforms	2 weeks	8
11	Decommission ESC measures	1 week	8, 9
12	Revegetation of earthworked areas	2 weeks	11
	POST CONSTRUCTION WORKS		
13	Monitor and maintain revegetation.	Ongoing	

5 ENABLING WORKS

The following works will be carried out prior to the main construction commencing.

5.1 Site Access

The Duck Creek focus area falls within one front of the three simultaneous construction fronts in the proposed staging of construction of Transmission Gully Project. Bridge 19 is scheduled to begin construction in Year 3 (2018), by which time the roadworks from SH58 to the Whitby interchange will have been completed.

Access to the bridge 19 site will be via an existing farm access road, which is accessed via either Takapu Road or from the newly created Whitby interchange. A temporary access track will branch off from the main farm track at approximately Chainage 22,630 to access Abutment 1 on the top of the ridgeline [Plan E23 and E25]. Similar tracks are proposed for access to each of the pier locations and Abutment 2. [Plans E25 - 29]

5.2 Laydown Areas

Two laydown areas are proposed at Abutment 1 (at Chainage 22760) and Abutment 2 (at Chainage 22980) where the temporary access tracks link with the existing access road. The laydown areas will be formed in advance of bulk earthworks.

The location of the Abutment 1 laydown area is shown in drawing SSEMP/E20.

The location of the Abutment 2 laydown area is shown in drawing SSEMP/E21.

5.3 Stockpile Areas

Topsoil stripped from the pier work platforms will be stored as a bund and hydro-seeded alongside the access road for later respreading around the piers. Excess suitable cut material where will be used to fill over the culvert extension between piers 2 and 3 with the surplus placed as fill within the gully between Chainage 22600 – 22760 (not covered by this addendum).

5.4 Utilities

The GWRC Water Main passes under the alignment at 20800 and follows the existing farm track that sidles below the alignment to 233000, and then passes beneath the alignment again. Care will be needed during construction of the site access roads to protect the pipe work.

5.5 Stream Works

Work will be required within the tributary to install an extension to the existing culvert.

The culvert will be constructed in the dry by installing a small coffer dam and a temporary pumped diversion around the work area and then diverting water into the culvert on completion. This work will coincide with work on the existing culvert to improve fish passage.

The project ecologist will confirm the use of the pumped diversion method will not adversely affect fish passage.

The location of the extended culvert is shown in SSEMP/E22. The culvert will be the same diameter as the existing. The works will be undertaken outside the fish migration season.

Site	E	N	Comments
Culvert_DC-01	1758049.5394	5442709.7649	Duck Main Channel - Upper – True right branch

6 CONSTRUCTION WORKS

6.1 Earthworks

The construction work within the study area is programmed to commence in 2018. The bridge construction will be completed within a one year period.

The earthworks in the study area primarily involve the formation of cut tracks and benches to provide crane access for construction of the bridge piers. Suitable cut material will be used where fill material is required and unsuitable material will be either partially mixed with the suitable material for fill, or placed at a disposal site as noted in para 5.3. Access tracks to the work platforms will be cut from the existing access, generally as side cuts (at times on steep slopes). Erosion and Sediment controls will be installed to minimise the release of sediment to the environment

Closure of earthworks is defined when stream diversions, or permanent culverts have been installed, slopes have been stabilised with geotextile where necessary and sufficient re vegetation has occurred that temporary erosion and sediment control measures are confirmed by GWRC as no longer required.

6.2 Cut & Fill Treatments

Both cut and fill batters to receive final revegetation treatment at the earliest possible time following completion of construction *provided* this timing is conducive to vegetation growth. If the Site Environmental Management Auditor finds that conditions are not acceptable an interim treatment (hydro-seeded grass) will be applied prior and the final landscape treatment carried out at an appropriate time within the following year.

- Benches where practical will be spaced evenly *except* for the first bench which will be a minimum of 4m above finished access road level.
- Faces will be left with a rough surface to facilitate vegetation growth.
- Tops and sides of cuts rounded off to reduce hard edges.
- Topsoil material will be left on benches to aid re-vegetation.
- Benches shaped to retain water and facilitate vegetation growth.

6.3 Bridge

The bridge construction methodology is shown in drawing SSEMP/E24.

Construction will require earthworks on the slopes above the stream being bridged, to facilitate construction of the abutments and three pier towers.

Use of concrete for pier construction will be managed to avoid cement discharge to the streams. During the construction of the bridge nets and extra fencing will be installed where necessary to maintain a margin from the stream banks and avoid debris spilling into the stream.

6.4 Erosion Control Measures

The primary construction methodology for mitigation against sediment release to the environment is targeted erosion control. This will involve the development of benched slopes during earthworks; roughing up the soil, importing and laying topsoil, mulch or compost blankets; and the use of sprayed and bound straw mulch or hydro seeding. On steeper slopes rolled erosion control blankets or netting may be

used, and if any particularly steep vulnerable slopes are worked, wire blankets or cellular confinement will be used to provide sufficient control. It is noted that existing cut slopes are near vertical on the east side of the existing access road, with exposed rock faces and a thin topsoil mantle.

The initial stage of earthworks primarily focuses on prevention of erosion during stream diversions. The following describes erosion control works in the stream at the tributary to Duck Creek.

In the first phase of works the existing culvert will be improved to incorporate fish passage and the culvert will be extended further upstream to provide access to a work platform around pier 2. A coffer dam will be installed within the stream above the culvert and a pipeline will divert (via pump if required) water from the dam, past the work site for discharge back into the stream below the work area.

Works will be completed outside the fish migration season.

Once the culvert works are completed, the dam and pipeline will be removed, and the stream flow will recommence through the newly extended culvert.

6.5 Sediment Control Measures

During the second phase of earthworks, the first super silt fences, sediment diversion bunds and contour drains will be constructed to convey sediment-laden water to sediment treatment devices. These are located in appropriate places down-gradient of the initial areas of earthworks. The chemically treated decanting earth bunds (DEB's) have been sized on the basis of 3% of the final contributing catchment (see sediment calculations in the Technical Report 15 for further details).

In the third phase further super silt fences and contour drains will be installed to collect areas of earthworks and the earthmoving operation continues, creating the work platforms for the bridge piers.

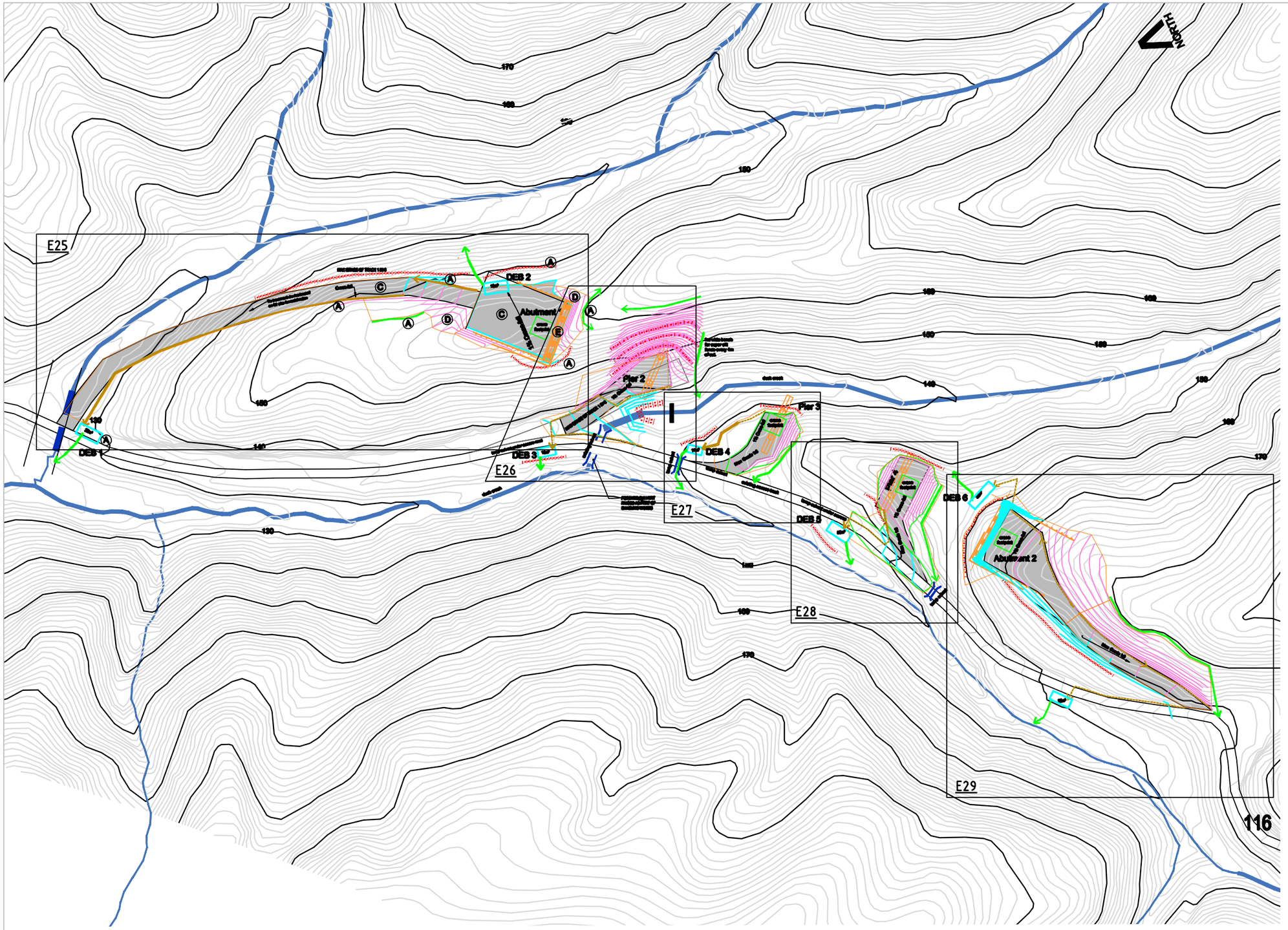
In the final phase, erosion control measures will be installed on steep batter faces, which are on final grade and the fill the fill batters.

The sediment controls will remain in place until all earthworks are complete and all areas are stabilised.

6.5.1 Chemically Treated Decanting Earth Bunds

The following bunds will be installed during works at Bridge 19:-

CHAINAGE	CATCHMENT AREA (ha)	POND SIZE m^3	POND NUMBER	Drawing	COMMENTS
22680	0.093	28	DEB 1	E25	Access road for laydown and abutment
22740	0.057	18	DEB 2	E25	Abutment 1, Pier 1 (includes laydown)
22770	0.060	18	DEB 3	E26	Pier 2
22840	0.045	14	DEB 4	E27	Pier 3
22900	0.100	30	DEB 5	E28	Pier 4
22980	0.125	38	DEB 6	E29	Abutment 2, Pier 5 (includes laydown)
23030	0.730	22	DEB 7	E29	Access road for laydown and abutment



LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

OUTLINE METHODOLOGY

1) ACCESS TRACK WIDENING AND REINFORCING THE GWRC WATER MAIN ACCESS POINTS TO PIERS 3 AND 4.
2) STABILISATION OF THE ACCESS ROAD WITH RAP PRODUCT OR SIMILAR.
3) EXTENSION OF EXISTING CULVERT, INCLUDING IN-STREAM SEDIMENT CONTROLS.
4) ESTABLISHMENT AND STABILISATION OF EROSION AND SEDIMENT CONTROL MEASURES AROUND EARTHWORKS AREAS.
5) CREATION OF PIER AND ABUTMENT WORK PLATFORMS
6) STABILISATION OF THE WORK PLATFORMS.
7) ESTABLISHMENT OF ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES.
8) EARTHWORKS AND BRIDGE CONSTRUCTION
9) CONSTRUCT ABUTMENT PILES
10) CONSTRUCT PIER PILES
11) CONSTRUCT ABUTMENT CASING AND PLATFORM
12) CONSTRUCT PIERS AND PIER AND ABUTMENT CAPS, LAYOUT THE FIRST SECTIONS OF GIRDERS FOR LAUNCHING
13) LAUNCH GIRDERS - START AT ABUTMENT 1, END ABUTMENT 5
14) LAY BRIDGE SURFACE
15) PAVEMENT WORKS; RIGID BARRIERS, CENTRAL RESERVE, LANE AND SHOULDER MARKINGS
16) DECOMMISSIONING OF PILE WORK PLATFORMS (TO BE UNDERTAKEN CONCURRENTLY WITH BRIDGE CONSTRUCTION).
17) CONSTRUCTION OF THE FINAL ACCESS TRACK UNDER THE BRIDGE
18) REMOVAL OF EROSION AND SEDIMENT CONTROL MEASURES AFTER AGREEMENT WITH GWRC.
19) LANDSCAPING FOR THE BATTER SLOPES, PIER EARTHWORKS AND STREAM BANKS.

CONCEPT DESIGN

1:750 @ A1

Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AB	19.2.12

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

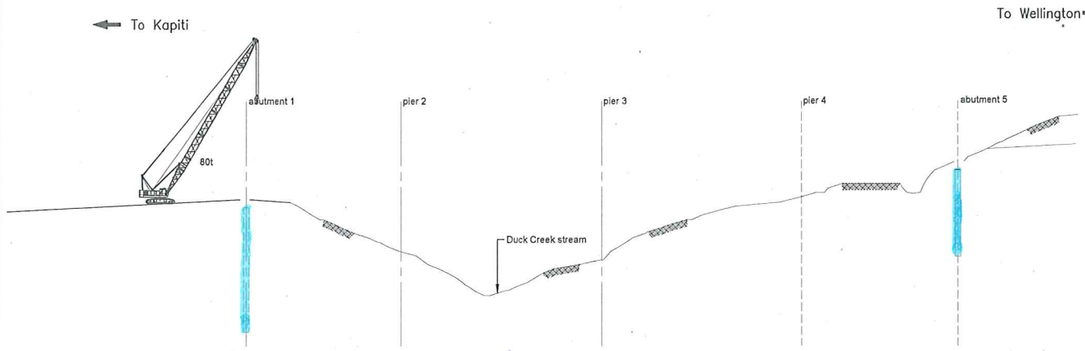
Title. Site Environmental Management Plan
Duck Creek Bridge
Abutment and Pier Access

Status. For Consenting

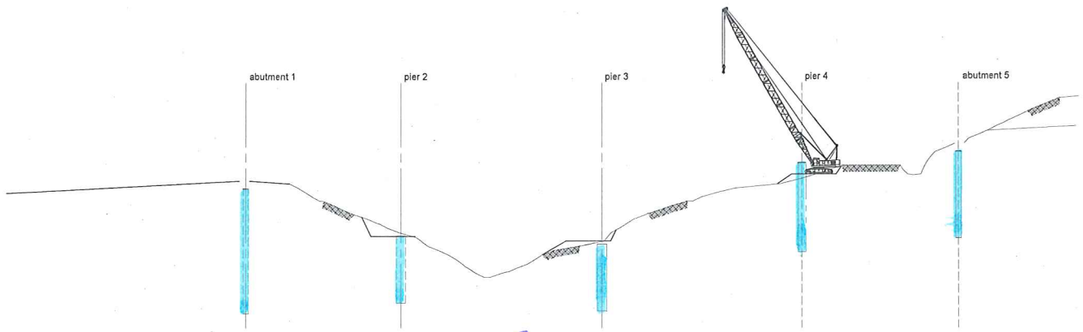
Sheet. No. SSEMP/E23

Version No. A

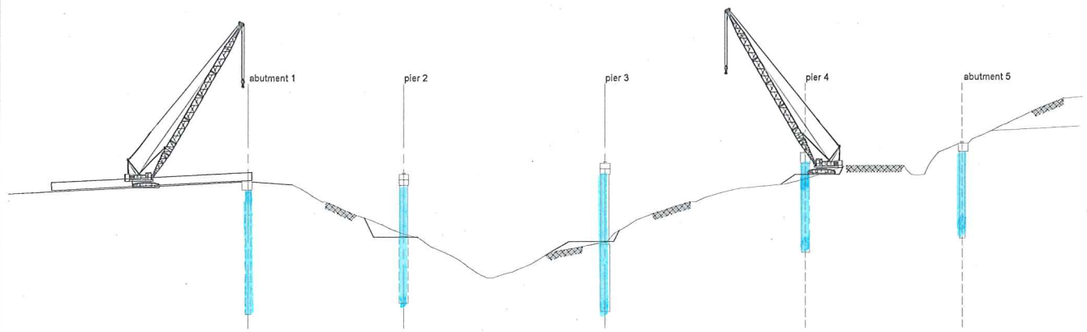
Plot Date 20.07.2011 P:\projects\65-C1691.00 Transmission Gully Phase2\999 Technical\04Cad\Drawings for AEE\Section 9\Indesit\Index_09SEMP_P12.dwg



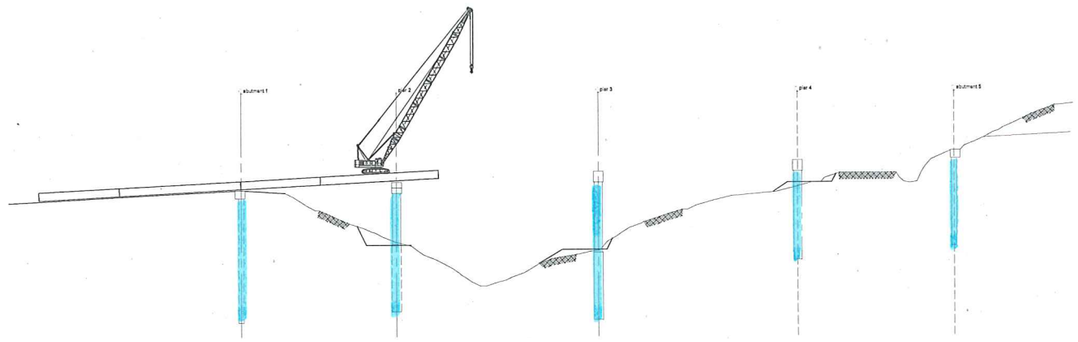
1. Construct abutment piles



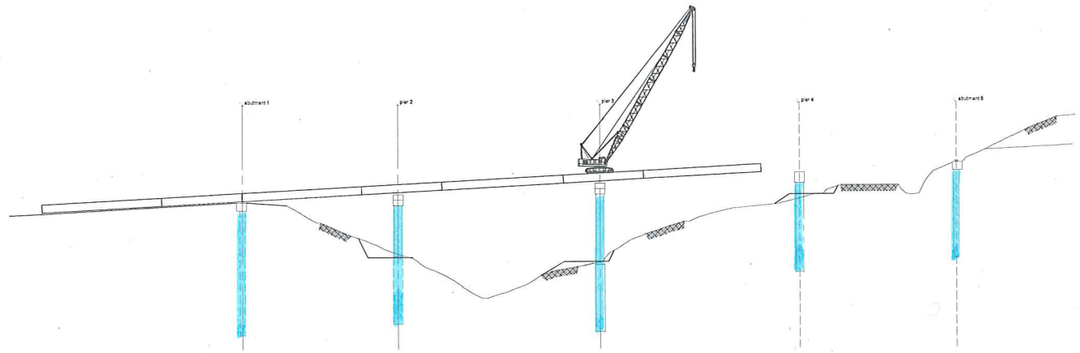
2. Construct pier piles



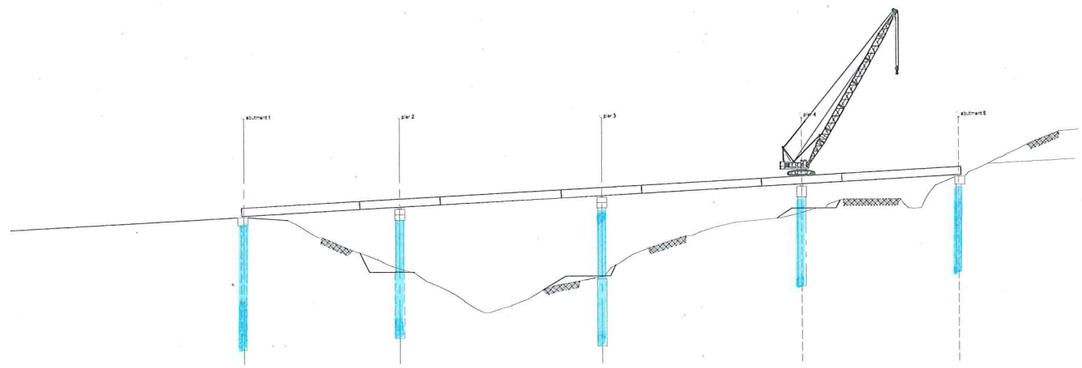
3. Construct piers and pier and abutment caps and layout the first sections of a pair of girders for launching



4. launch girders

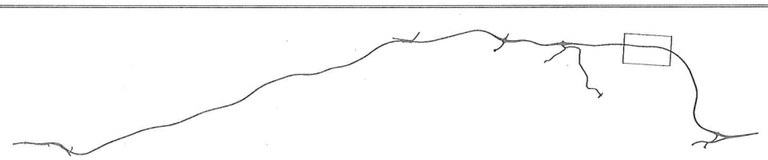


5. launch girders



6. launch girders

Pier locations



Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

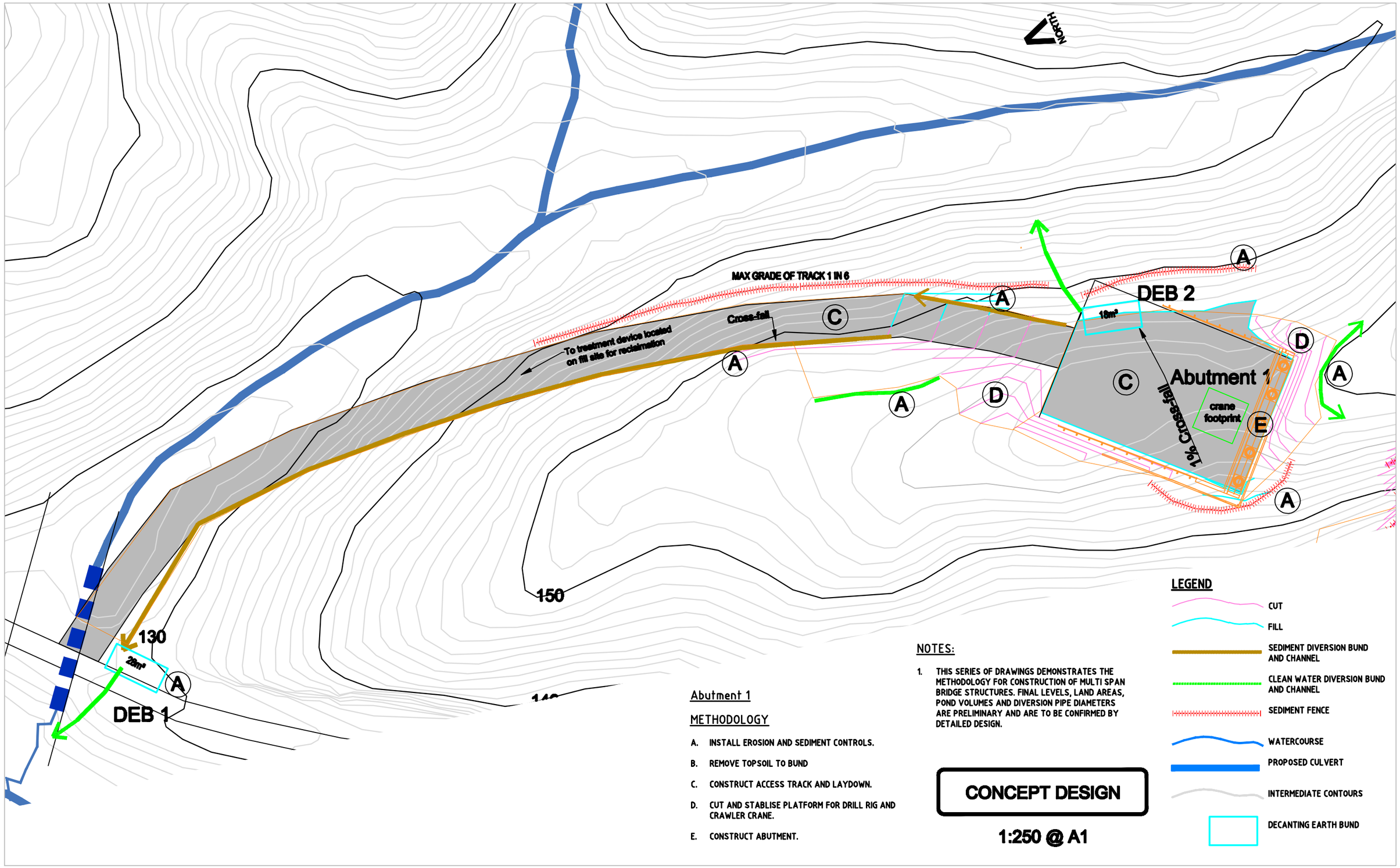
Title.
Site Environmental Management Plan
Duck Creek Bridge
Bridge Construction Staging

Status. For Consenting

Sheet. No. SSEMP/E24

Version No. A

Plot Date 29.07.2011 P:\projects\5-C1591.00 Transmission Gully Phase2\500 Technical\#Cad\Drawings for AEE\Section 5\Linden\Linden_SSEMP_F12.dwg



Abutment 1

METHODOLOGY

A. INSTALL EROSION AND SEDIMENT CONTROLS.

B. REMOVE TOPSOIL TO BUND

C. CONSTRUCT ACCESS TRACK AND LAYDOWN.

D. CUT AND STABLISE PLATFORM FOR DRILL RIG AND CRAWLER CRANE.

E. CONSTRUCT ABUTMENT.

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

CONCEPT DESIGN

1:250 @ A1

LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AB	19.8.12

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

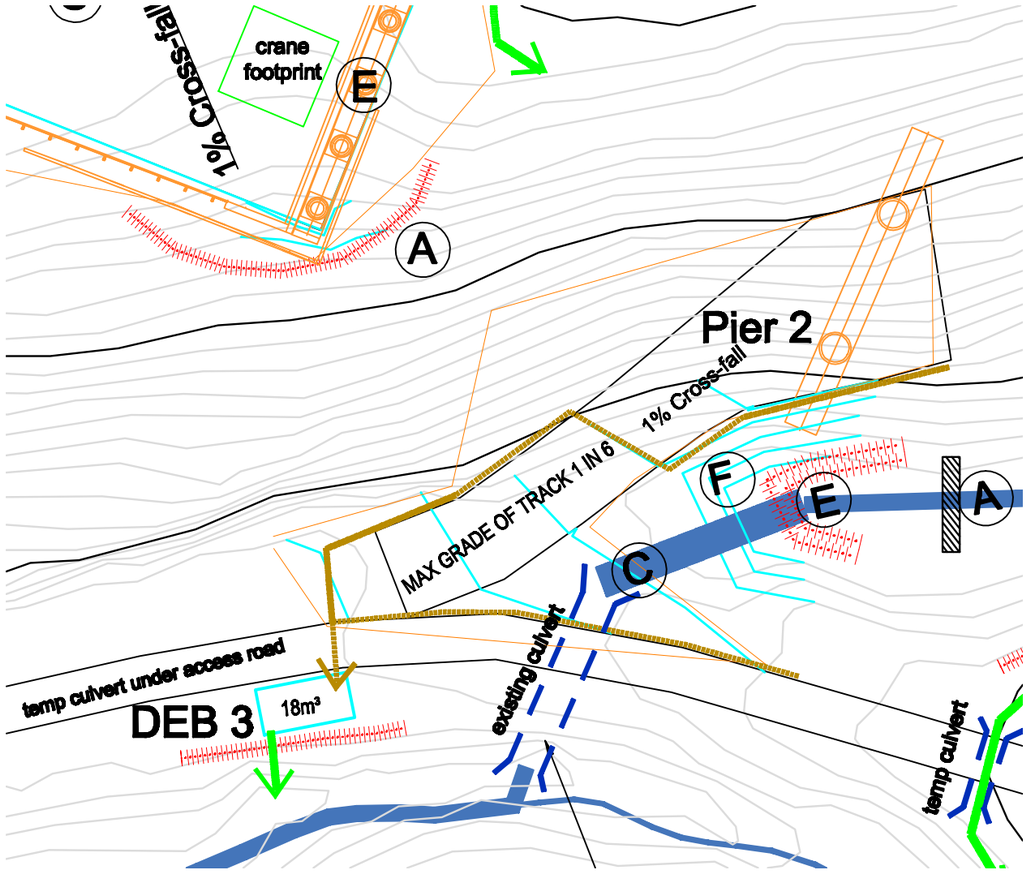
Title. Site Environmental Management Plan
Duck Creek Bridge
Abutment 1 Access

Status. For Consenting

Sheet. No. SSEMP/E25

Version No. A

Plot Date 29.07.2011 P:\projects\65-C1091.00 Transmission Gully Phase2\000 Technical\WCad\Drawings for AEE\Section 9\Indexl\Index_SSEMP_P12.dwg



STAGE 1 - EXTEND CULVERT

METHODOLOGY

A. INSTALL COFFER DAM.

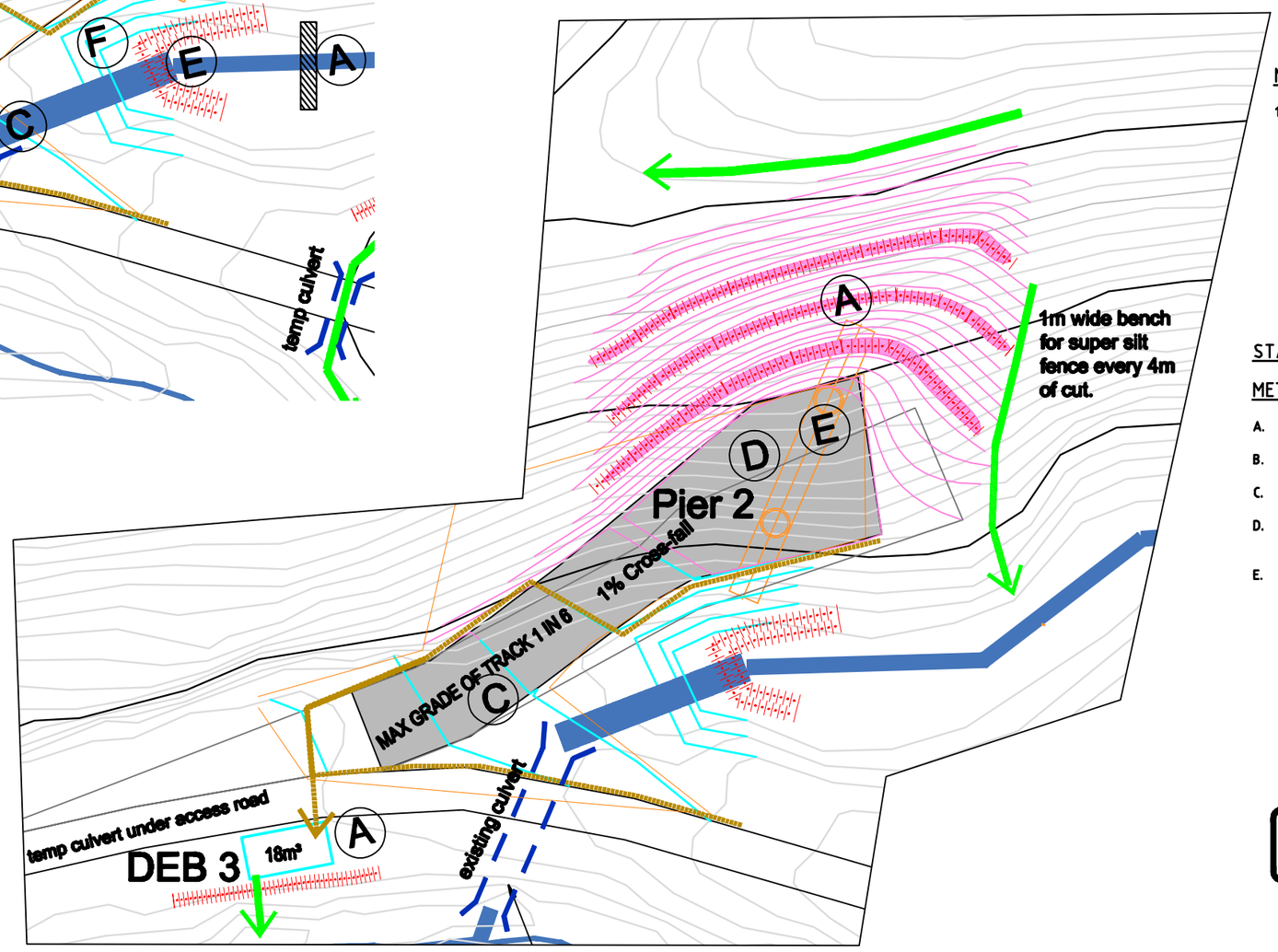
B. INSTALL TEMPORARY DIVERSION/PUMP OVER.

C. EXCAVATE AND PLACE CULVERT.

D. CLEAN-UP, REMOVE COFFER DAM AND COMMISSION EXTENDED CULVERT

E. INSTALL EROSION CONTROL AND SEDIMENT FENCES

F. PLACE FILL OVER CULVERT



NORTH

LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

STAGE 2 - PIER 2

METHODOLOGY

A. INSTALL EROSION AND SEDIMENT CONTROLS.

B. REMOVE TOPSOIL TO BUND.

C. CONSTRUCT AND STABILISE ACCESS TRACK.

D. CUT AND STABILISE PLATFORM FOR DRILL RIG AND CRAWLER CRANE.

E. CONSTRUCT PIER.

CONCEPT DESIGN

1:200 @ A1

Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AB	19.8.13

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

Title. Site Environmental Management Plan
Duck Creek Bridge
Pier 2 Access

Status. For Consenting

Sheet No. SSEMP/E26

Version No. A

Plot Date 29.07.2013 P:\projects\65-C1091.00 Transmission Gully Phase\2000 Technical\9Cad\Drawings for AEE\Section 6\Indiv\Under_SSEMP_P12.dwg

NORTH

LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

Pier 3

A

14m³

DEB 4

temp culvert

1% Cross-fall

crane footprint

D

E

C Max Grade 1:6

temp culvert

existing access track

temp culvert under

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

PIER 3

METHODOLOGY

A. INSTALL EROSION AND SEDIMENT CONTROLS.

B. REMOVE TOPSOIL TO BUND.

C. CONSTRUCT AND STABILISE ACCESS TRACK.

D. CUT AND STABILISE PLATFORM FOR DRILL RIG AND CRAWLER CRANE.

E. CONSTRUCT PIER.

CONCEPT DESIGN

1:100 @ A1

Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AB	13.2.12

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

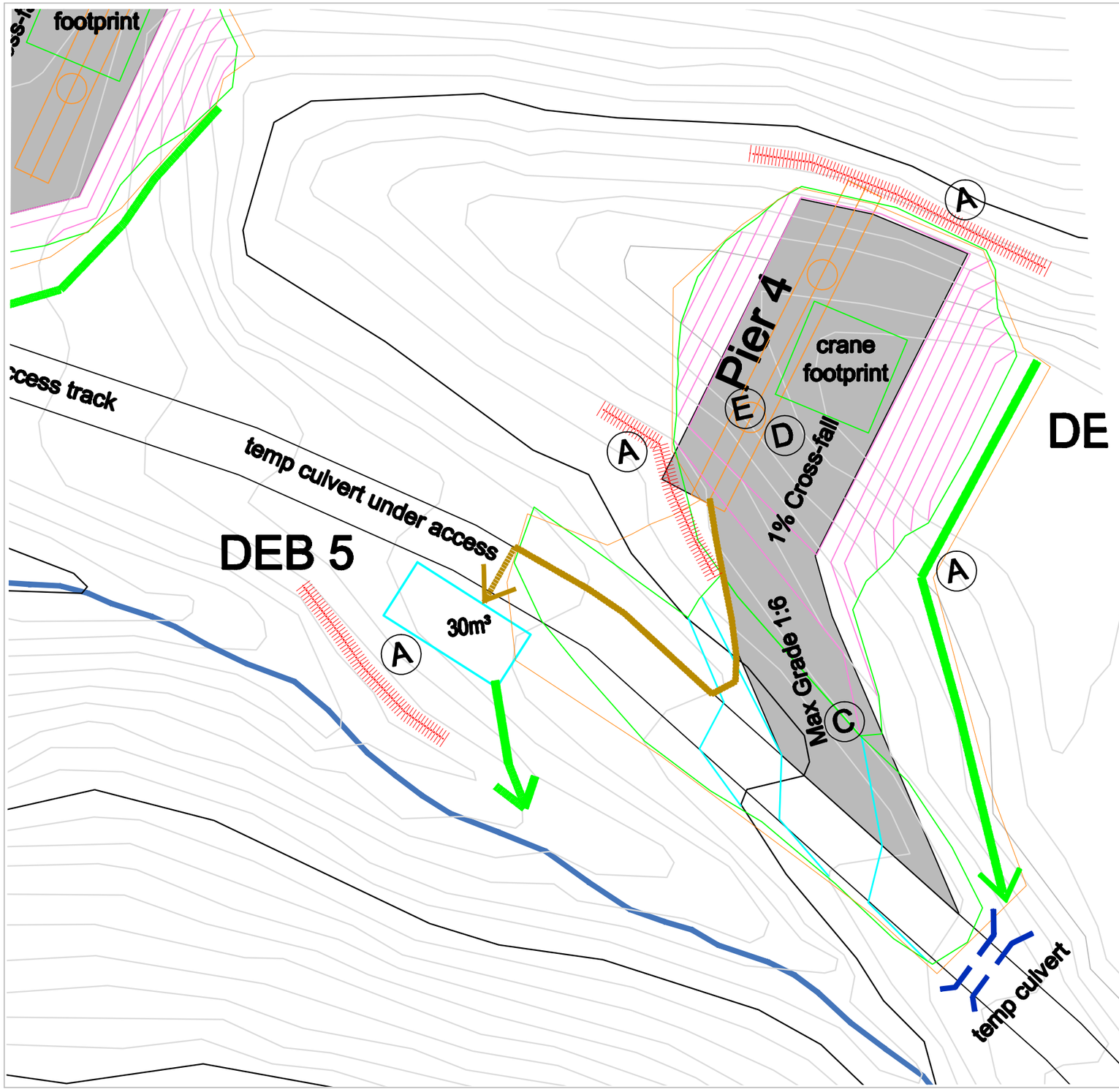
Title. Site Environmental Management Plan
Duck Creek Bridge
Pier 3 Access

Status. For Consenting

Sheet. No. SSEMP/E27

Version No. A

Plot Date 23.07.2011 P:\projects\65-C1691.00 Transmission Gully Phase2\999 Technical\4Cad\Drawings for AEE\Section 9\Lindsay\Index_SSEMP_P12.dwg



NORTH

LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

PIER 4

METHODOLOGY

A. INSTALL EROSION AND SEDIMENT CONTROLS.

B. REMOVE TOPSOIL TO BUND.

C. CONSTRUCT AND STABILISE ACCESS TRACK.

D. CUT AND STABILISE PLATFORM FOR DRILL RIG AND CRAWLER CRANE.

E. CONSTRUCT PIER.

CONCEPT DESIGN

1:150 @ A1

Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AB	19.8.13

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

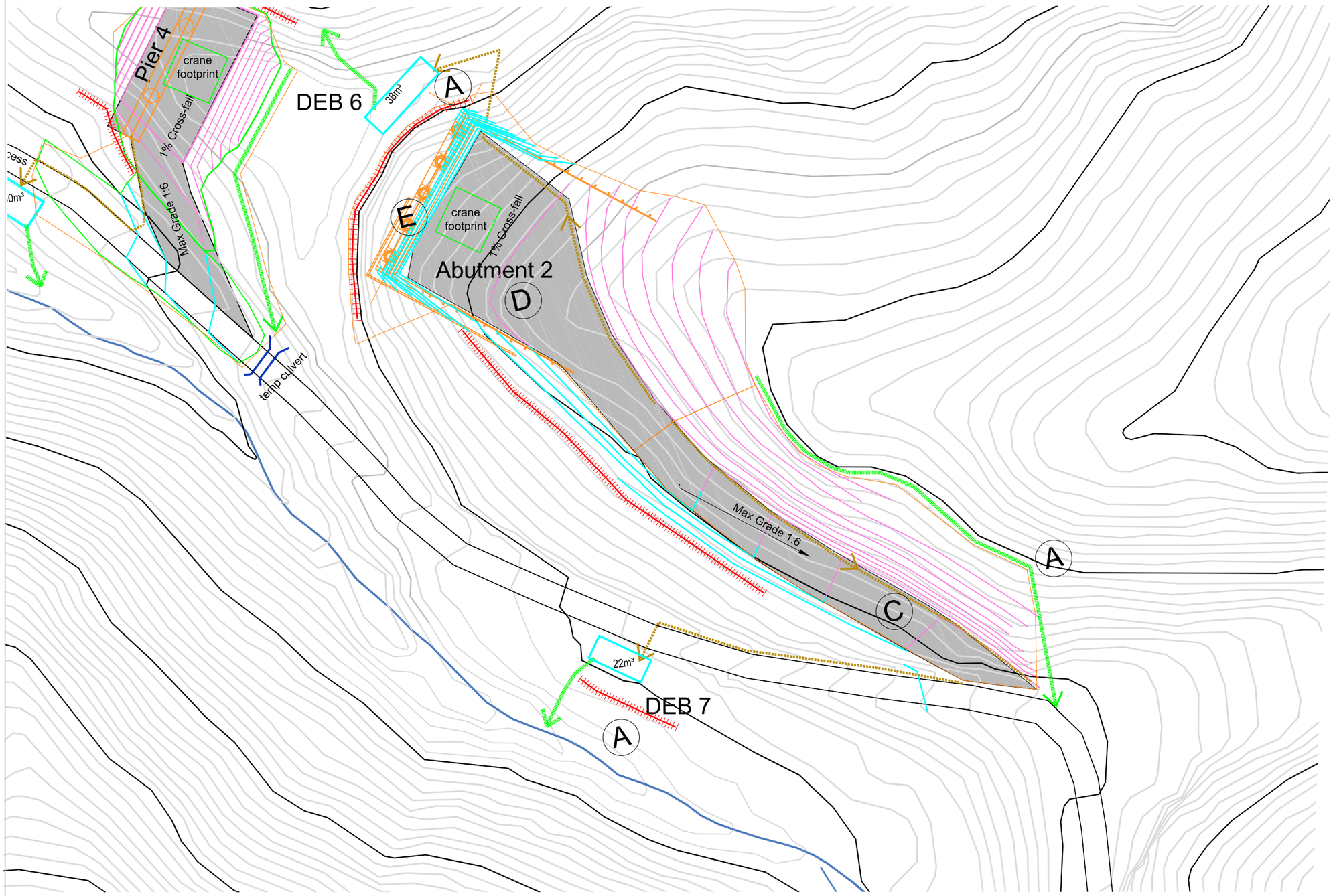
Title. Site Environmental Management Plan
Duck Creek Bridge
Pier 4 Access

Status. For Consenting

Sheet No. SSEMP/E28

Version No. A

Plot Date 29.07.2013 P:\projects\65-C1091.00 Transmission Gully Phase\2009 Technical\PCad\Drawings for AEE\Section 9\Indexf\Index_SSEMP_P12.dwg



LEGEND

- CUT
- FILL
- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- SEDIMENT FENCE
- WATERCOURSE
- PROPOSED CULVERT
- INTERMEDIATE CONTOURS
- DECANTING EARTH BUND

NOTES:

1. THIS SERIES OF DRAWINGS DEMONSTRATES THE METHODOLOGY FOR CONSTRUCTION OF MULTI SPAN BRIDGE STRUCTURES. FINAL LEVELS, LAND AREAS, POND VOLUMES AND DIVERSION PIPE DIAMETERS ARE PRELIMINARY AND ARE TO BE CONFIRMED BY DETAILED DESIGN.

Abutment 2

METHODOLOGY

A. INSTALL EROSION AND SEDIMENT CONTROLS.

B. REMOVE TOPSOIL TO BUND

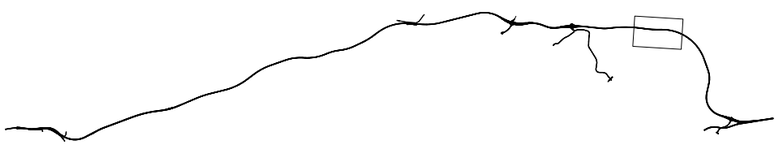
C. CONSTRUCT ACCESS TRACK AND LAYDOWN.

D. CUT AND STABLISE PLATFORM FOR DRILL RIG AND CRAWLER CRANE.

E. CONSTRUCT ABUTMENT.

CONCEPT DESIGN

1:250 @ A1 — 0 4 8 12 16 20 24 m



Revision	Amendment	Approved	Date
A	CONCEPT DESIGN	AG	13.2.12

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

Title. Site Environmental Management Plan
Duck Creek Bridge
Abutment 2 Access

Status. For Consenting

Sheet. No. SSEMP/E29

Version No. A

Plot Date 29.07.2011 P:\projects\5-C1591.00 Transmission Gully Phase2\500 Technical\#Cad\Drawings for AEE\Section 5\Linden\Linden_SSEMP_F12.dwg

ADDENDUM TO SITE SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN (SSEMP)

Te Puka Focus Area
(from Chainage 3700 to 4900)

This Document describes the more detailed design for steam diversion at the southern end of the Te Puka stream. It updates the methodology described in the Te Puka SSEMP dated July 2011.

This addendum addresses the following issues:

- Temporary diversion of stream flows along the eastern side of the Te Puka stream
- Associated erosion and sediment control measures

The works that follow establishment of the eastern diversion are generally as described in the SSEMP.

February 2012
Version 3.

1 INTRODUCTION

In the original Te Puka SSEMP, the focus of the work described for the upper (southern) end of the Te Puka stream was to identify a staged methodology for constructing this section of TGP, including diversion of the existing stream and construction of culverts and discharge structures along the route. That methodology did not analyse details of initial diversion of side streams in any detail, nor describe the E&SC measures that would be used in making such diversions.

The issues of initial diversions and of the E&SC measures associated with the diversions have been examined in greater detail to address issues raised in the evidence of Mr Handyside for Department of Conservation, Mr Mclean in his Section 42 report and in expert conferencing 7/8 December 2011 and 20 January 2012.

Note that the following terms are used in this document:

- Eastern Diversion – a diversion channel formed along the eastern side of the valley above the existing stream.
- Existing Stream – the current Te Puka Stream alignment
- Realigned Stream – the proposed new alignment of the existing stream, including the base fill for the bulk filled highway embankment. This is shown on the sections on SSEMP drawings A5 to A7.

This addendum is accompanied by Drawing SK-110 shows the proposed alignment of the new Eastern Diversion channel and Drawings SK-111 to -114 (inclusive) shows a number of cross-sections along the alignment. Preliminary details of the fluming and excavated channel are shown on drawings SK-120 to -122.

2 OVERVIEW

In summary, the construction of the section of the Te Puka stream from ch 3700 – 5000 shall be constructed in three phases, with each phase being broken down into a series of stages.

- Phase A – Construct the Eastern Diversion, progressively working upstream from north (ch 3700) to south (ch 4950), in stages with an earthworks corridor located to the east of existing stream
- Phase B – Construct the Realigned Stream, progressively working downstream from south (ch 4950 to ch 3700) to north to construct the realigned stream in stages, diverting flows from the side streams to the Eastern Diversion as the work reaches each side stream entry. The work corridor will be approximately 25 – 30 m wide.
- Phase C – Construction of the highway embankment, including culverts and cascade discharge structures.

The size of each stage is governed by the size of the sub catchment of the stage and the space that is available to construct erosion and sediment control measures clear of both the existing stream and realigned stream works.

3 STREAMWORKS

The eastern diversion is proposed to run up the eastern side of the Te Puka stream, clear of the proposed new permanent alignment of the stream. Construction would begin at about ch 3700 and following construction and commissioning of a small pond (P1) and associated E&SC measures, a bench is cut along the proposed alignment, up to the first side stream at about ch 3940. The bench is progressively stabilised and the fluming is installed when the benching is complete. Following completion of the fluming, the pond is decommissioned and a channel is then extended north (across the site of the pond) for approximately 30 m using small scale E&SC measures, to form the discharge channel from the first stage of the eastern diversion, back to the existing stream bed. Once this is completed, the fluming is installed along the bench and the side stream at ch 3940 is diverted into the eastern diversion channel.

The process continues southwards to the next sidestream, with the construction and commissioning of a Decanting Earth Bund (DEB) as the primary form of sediment control for bench construction from ch 3940 to about 3980. At 3980, there is sufficient space to construct another pond (P2). This has sufficient capacity to provide the required level of sediment control for the bench to be constructed up to the next side stream at about ch 4190. Once the bench reaches the next sidestream, the fluming is installed and when completed, the steam is diverted into the new flume channel.

The process continues with the construction of ponds P3 at about ch 4200 and P4 at 4480, while the eastern diversion flume is constructed up to ch 4500. The final section up to the entry of the upper Te Puka stream at ch 4900 can probably be formed as a cut channel, as shown on the attached drawings.

Once the diversion of the upper Te Puka into the new diversion is completed, three small streams at the head of the Te Puka valley between ch 4850 and 4950 are also diverted into the new diversion channel/flume.

It is proposed that construction of the realigned stream then progress downstream from 4900, as described in the SSEMP. All of the eastern slope stream flows and those at the head of the valley are conveyed in the eastern diversion, while the stream realignment works are undertaken above the existing stream. Approximately 84% of the stream flow is diverted, leaving four side stream flows from the western slopes requiring temporary connection to the eastern diversion while the re-aligned stream is reconstructed. Following completion of realigned stream, all side streams will be progressively diverted to the new alignment (starting at the northern end) by constructing short lengths of stabilised channel. The fluming will be removed and the cut bench and temporary channel will be backfilled and reinstated using material previous excavated during construction of the eastern diversion.

4 E&SC MEASURES

All of the works described below would only be undertaken in suitable weather conditions. For example, side stream diversions will be made using a temporary dam and pumping over while the new side channel connection is formed (expected to take 2 – 3 days). This work can only be carried out in dry conditions and when stream flows are relatively low.

It is assumed that the Enabling Works are completed by others prior to commencement of the eastern diversion/realigned stream works. This will include relocation of Transpower towers and upgrading/minor realignment of the existing track.

Excavated spoil will be carted to temporary disposal areas sited on the western side of the access track around ch 2700 – 3000. The material will be stockpiled in stabilised bunds, then reused in the fill forming non-structural benches on the eastern side of the new stream realignment, including reinstatement of the de-commissioned diversion channel. The total volume of material removed and then replaced in the upper Te Puka valley is estimated to be about 12,000 – 15,000 cubic metres.

Prior to stockpiling any material, clean water diversions will be constructed above and around the stockpile sites and super silt fences constructed below the stockpiles. Clean gravel ramps will be formed at truck entry and exit points, to minimise sediment leakage around the ends of the silt fences. Existing pasture below the stockpiles will be preserved as filter strips below the silt fences.

4.1 Eastern Diversion Channel ch 3700 - 3920

Drawing SK-121 shows details of construction and methodology for the eastern diversion from ch 3700 to 3920.

Clean water diversions are used above each section of the work, while super silt fences are installed below the alignment to minimise the amount of sediment from the excavation works entering the stream.

Construction of each pond is undertaken with clean water diversions, silt fences, temporary silt sock bunds (bio socks) in place. The outfall is to be protected with riprap apron placed on geotextile, to reduce discharge velocities and minimise erosion.

Once the pond is commissioned, the excavated bench is cut out and progressively stabilised as the final profile on a section is achieved. The bench is sloped in to the cut face and surfaced with aggregate, forming a vee channel that directs water from the open work area down to the sediment pond. A series of small rock dams will be used to control velocity in the vee channel. If required, side cuts are to be stabilised with mesh netting over the face.

When the cut bench reaches ch 3920 and fully stabilised, pond P1 is to be decommissioned, with sediment controls in place during that work. Super silt fences and bio socks are used during this work to minimise loss of sediment from the site. While perimeter controls remain in place, the discharge channel from the diversion back to the existing stream alignment is to be formed, and protected with a riprap discharge apron on geotextile, to minimise flow erosion.

When the formed and stabilised diversion channel reaches the side stream at ch 3920, the stream will be dammed using temporary "sandbags". The side stream flow is pumped over to the existing stream channel, while the new side stream channel into the diversion channel is formed and stabilised. Once this is completed, the pumping is stopped and dam removed, completing the diversion of the side stream.

It is proposed that temporary clean water diversions and super silt fences remain in place and are maintained along the diversion channel alignment, until the realigned stream works are completed and the diversion is backfilled and stabilised.

4.2 Eastern Diversion Channel ch 3920 - 4950

Construction of the eastern diversion continues in stages to just below the entry of the upper Te Puka stream into the Te Puka valley using the same sequence of construction as described above.

There is insufficient space to construct a sediment pond of the required size at ch 3920, so a Decanting Earth Bund (DEB) is proposed to provide effective sediment control while the first 60 m of the next stage of diversion is constructed from ch 3920 to ch 3980. Once this relatively short stage is completed and stabilised, pond P2 is then constructed at ch 3980, and the diversion can then be constructed up to the next side streams at ch 4200. Work then continues with two further stages to reach ch 4950, with each stage including a dedicated and appropriately sized sediment pond.

4.3 Southern end of Eastern Diversion (ch 4900)

Drawing SK-122 shows details of progressive diversions of two small streams into the Eastern Diversion channel. In each case temporary dams and over-pumping is used to separately re-align the streams one at a time. Super silt fences and bio-sock bunds are to be used on the downstream side of the diversion works to minimise sediment loss to the stream. I anticipate that each diversion would be made within a single day.

4.4 Te Puka Stream Realignment

Once the eastern diversion is commissioned, work will then commence on the realigned stream works. This will be undertaken in stages, expected to be around 150 – 200 m long, with the actual length governed by the availability of locations to construct ponds in the existing stream channel. Refer to Drawing SK-122 for the first stage of these works.

Options for diversion of the five side streams along the western bank include the installation of a sump tank at the base of the valley, with a "lay-flat" flexible pipe laid in the channel past the downstream sediment pond. The flexible tube can be relocated along the stream alignment as required to fit in with construction activities, until the section of work is completed.

Ponds will be constructed in the existing (now dry) stream bed, complete with downstream super silt fence; riprap protection at the outfall of each pond and sized to comply with the 3% catchment within the

stream floor. As far as is practical, clean water cutoff drains will divert side slope runoff past the pond, but there may be places where it is impractical to construct such drains. Some of this runoff is likely to soak into the ground and run as subsurface flow down the valley but where this does not ocur and the flows are significant, the pond size will need to be adjusted accordingly.

5 SUMMARY

The construction of a eastern diversion along the eastern side of the Te Puka valley can be undertaken in stages using erosion control measures and 3% sediment ponds as the primary means of sediment control, with some small areas of work being undertaken using other sediment control measures or offering additional protection (e.g. super silt fences along the edge of the existing stream floodplain).

The use of relatively small stages of work significantly reduces the risk of adverse environmental effects arising during a storm event, as the area of active work at any time is limited to 0.5 ha with the above methodology.

The proposed channel is designed for the Q20 catchment flow.

Once the eastern diversion is completed, the realigned stream channel and associated base fill platform can be constructed, with the streams on the western bank being initially diverted downstream and then to the Eastern Diversion channel, as the staged construction works proceed downstream.

It is expected that the formation of the highway embankment would not commence until the realigned stream between ch 3700 and ch 4950 is completed.

The details described above will be developed and tested against design options and updated for inclusion in the SSEMPs, as described in draft condition of consent G12 and G15A. Consent condition G15.A.(d) has specific requirements for detailed diversion plans to be included in the SSEMP. Fully detailed Erosion and Sediment Control Plans are required to be completed prior to commencement of construction, as described in draft condition E5.

Variations to the methodology described above may include undertaking the eastern diversion and realigned stream works in shorter sections of 500 – 700 m long, to allow reuse of fluming and other materials during the work. In that case the methodology for each section would be the same sequence as described above: Construct and commission the eastern diversion first, then work downstream to construct the realigned stream and associated channel filling. This cycle would be repeated 2 or 3 times in accordance with the Contractor's methodology, to complete the entire section of work between ch 3700 to ch 4950.

6 APPENDIX - DETAILS

6.1 Chemically Treated Sediment Retention Ponds

The sediment retention pond size has been calculated on the basis of 3% of the contributing catchment.

CHAINAGE	CATCHMENT AREA (m^2)	INDICATIVE POND SIZE (m^3)	POND NUMBER
3720	3000	100	P1
3970	4000	150	P2
4200	4500	200	P3
4480	6600	300	P4

6.2 Diversion Flows

The capacity of the Eastern diversion channel has been designed using HEC-RAS to convey the Q20 flow.

Using inlet control and HW/D ratio of 2, the capacity of a 750 mm dia culvert is approximately 1.25 m^3/s. The largest side stream on the western side of the valley has a Q20 flow of approximately 2 m^3/s and would require a coffer dam or tank and two 750 mm diameter flumes to convey this flow. The other four side streams on the western slopes have maximum Q20 flows of about 1.1 m^3/s and a single flexible flume would be sufficient. The minimum grade for the flumes is 1%.

POND 1 APPROXIMATE VOLUME 100 m³

FUTURE REALIGNED STREAM

EXISTING STREAM ALIGNMENTS

EASTERN DIVERSION

DEB DECANTING EARTH BUND AS NEEDED

POND 2 APPROXIMATE VOLUME 150 m³

POND 3 APPROXIMATE VOLUME 200 m³

JOIN LINE

POND 2 APPROXIMATE VOLUME 300 m³

FUTURE REALIGNED STREAM

EXISTING STREAM ALIGNMENTS

EASTERN DIVERSION

JOIN LINE

UPPER TE-PUKA

ATTACHED XREF FILES

- AE04101 SECTION LOCATIONS.DWG
- XR 6504 EX TOPO-FEATURES.DWG
- XR 6504 PROPOSED SERVICES.DWG
- XR 6504 PROPOSED LANDSCAPING.DWG
- XR 6504 PROPOSED DESIGNATION.DWG
- XR 6504 EX SERVICES UPDATED.DWG
- XR 6504 EX GEOLOGY.DWG
- XR 6504 EX CADASTRAL BOUNDARIES.DWG
- XR 6504 ALL WETLANDS.DWG
- AE04101 TE PUKA STREAM PLAN2.DWG
- AE04101 ROAD STRINGS.DWG
- AE04101 ROAD ACCESS STRINGS.DWG
- AE04101 CONTOURS EXISTING.DWG

KEY

- EX BOUNDARY
- EX DESIGNATION BOUNDARY
- PROP DESIGNATION BOUNDARY
- EXISTING STREAMS
- GEOTECH INVESTIGATIONS
- EX FAULT LINE
- ELECTRICITY
- PROP ELECTRICITY
- TELECOM
- GAS
- PROPOSED ROAD AND REALIGNED STREAM
- EX TRACK
- CENTRE OF EASTERN DIVERSION
- SEDIMENT PONDS
- DECANTING EARTH BUNDS

ORIGINAL STREAM OVERALL PLAN

1:1000 @ A1

NOTE:

1. TRANSMISSION TOWERS WILL BE RELOCATED BEFORE CONSTRUCTION COMMENCES

SCALE 1:1000 (A1) 0 20 40 60 80 100m / 20 10

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

Sinclair Knight Merz Ltd
Carlaw Park Commercial
12-16 Nicholls Lane
Parnell, Auckland
NEW ZEALAND
Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.skmconsulting.com

CLIENT: NEW ZEALAND TRANSPORT AGENCY

PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: STREAM DIVERSION EAST OPTION OVERALL PLAN

SCALE	PROJECT No	DRAWING No	AMDT
1:1000 (A1)	AE04101	SK-110	A

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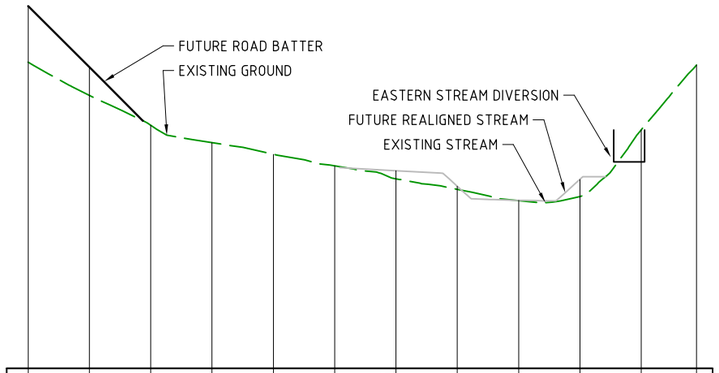

DATUM RL 93.0

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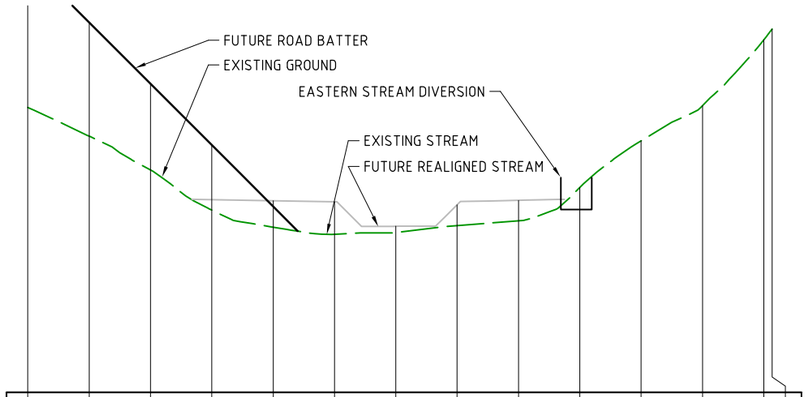
EXISTING SURFACE LEVEL	117.956	115.248	112.816	111.392	110.447	109.496	108.445	107.591	106.673	106.989	112.440	117.711

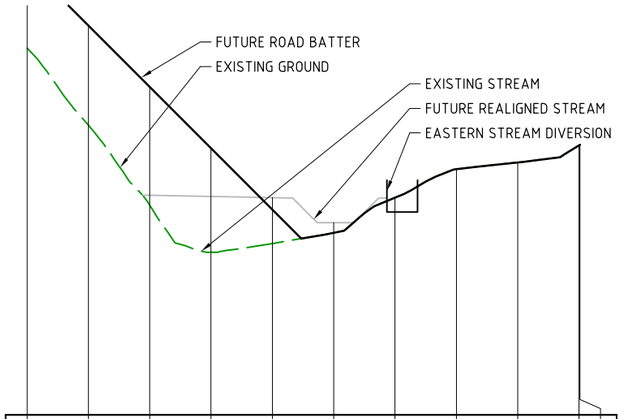
SECTION 1
SCALE 1:250 (A1) SK-110



DATUM RL 100.0

CHAINAGE	0.000	5.000	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000	55.000	60.000	60.675
EXISTING SURFACE LEVEL	123.220	120.870	118.119	114.844	113.460	112.871	113.030	113.589	113.969	116.702	120.495	123.359	128.738	129.610

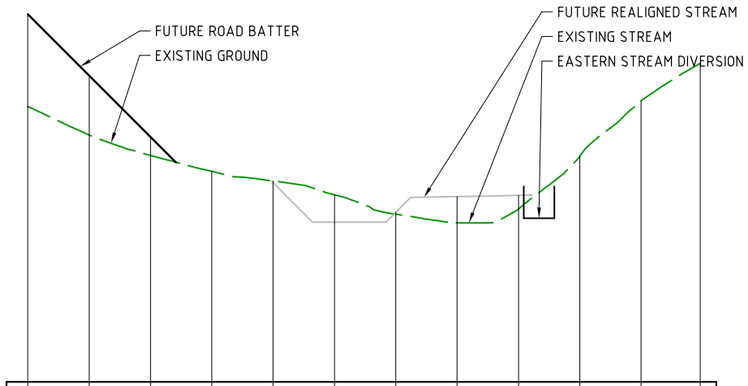
SECTION 3
SCALE 1:250 (A1) SK-110



DATUM RL 97.0

CHAINAGE	0.000	5.000	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	45.090
EXISTING SURFACE LEVEL	126.879	120.601	114.106	110.246	110.960	111.832	114.689	117.022	117.572	118.946	119.000

SECTION 2
SCALE 1:250 (A1) SK-110



DATUM RL 104.0

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EXISTING SURFACE LEVEL	126.433	124.116	122.456	121.156	120.367	119.244	117.672	116.958	118.064	122.372	126.892	129.959

SECTION 4
SCALE 1:250 (A1) SK-110

50m 40 30 20 10 0
10 8 6 4 2
SCALE 1:500 (A1)

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

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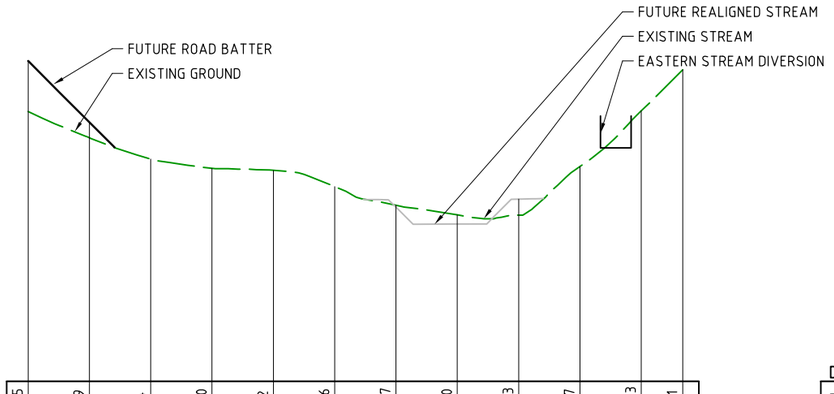
PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: STREAM DIVERSION EAST OPTION TYPICAL SECTIONS SHEET 1

SCALE	PROJECT No	DRAWING No	AMDT
1:250 (A1)	AE04101	SK-111	A

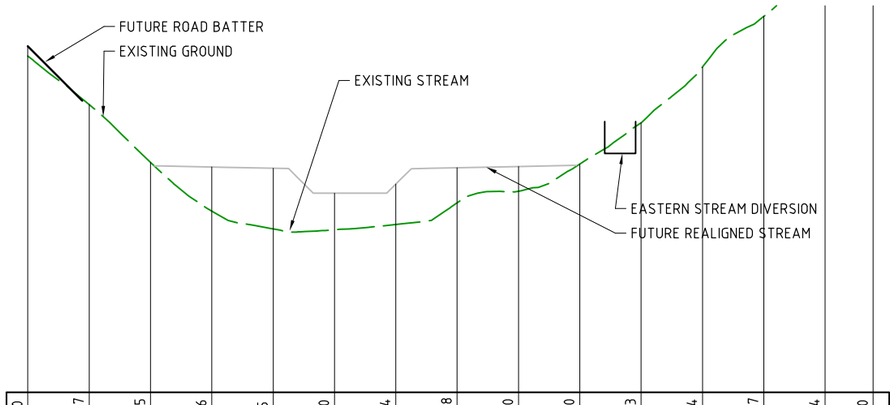
I:\AENV\A\Projects\AE04101\DELIVERABLES\DRAWINGS\SKETCHES\2012 January\AE04101_SK_111-113.dwg Plot Date: 16 February , 2012 - 8:11 AM



DATUM RL 112.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	133.985
5.000	131.849
10.000	130.114
15.000	129.360
20.000	129.192
25.000	127.866
30.000	126.347
35.000	125.560
40.000	125.543
45.000	129.507
50.000	134.043
53.386	137.391

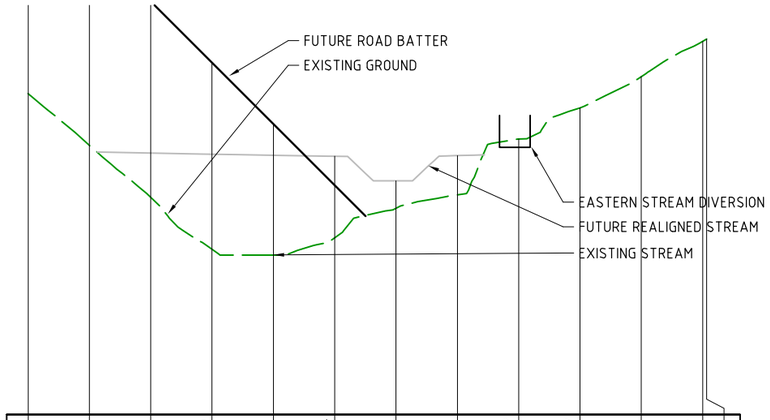
SECTION 5 SK-110
SCALE 1:250 (A1)



DATUM RL 124.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	151.400
5.000	147.457
10.000	142.735
15.000	138.766
20.000	137.315
25.000	137.250
30.000	137.684
35.000	139.448
40.000	140.390
45.000	142.600
50.000	145.963
55.000	150.504
60.000	154.647
65.000	158.774
68.915	162.000

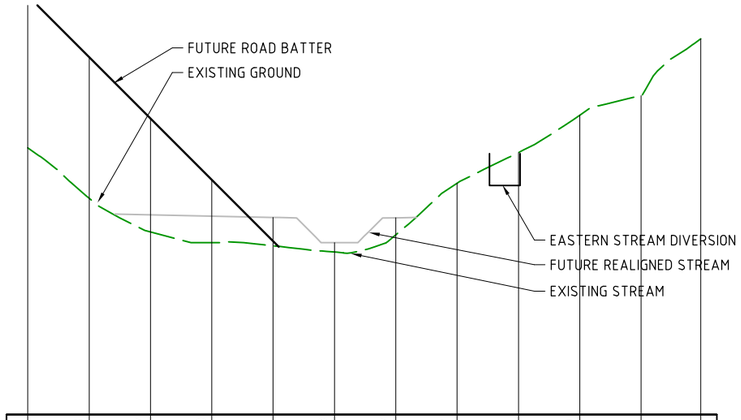
SECTION 7 SK-110
SCALE 1:250 (A1)



DATUM RL 120.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	146.157
5.000	141.928
10.000	137.700
15.000	133.466
20.000	133.000
25.000	134.404
30.000	136.813
35.000	137.893
40.000	142.452
45.000	144.997
50.000	147.541
55.000	150.407
55.328	150.595

SECTION 6 SK-110
SCALE 1:250 (A1)



DATUM RL 130.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	151.732
5.000	147.623
10.000	144.877
15.000	144.000
20.000	143.754
25.000	143.249
30.000	144.637
35.000	148.857
40.000	151.355
45.000	154.390
50.000	155.985
54.857	160.631

SECTION 8 SK-110
SCALE 1:250 (A1)

50m 40 30 20 10 0
10 8 6 4 2
SCALE 1:500 (A1)

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

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Web: www.skmconsulting.com

CLIENT: NEW ZEALAND TRANSPORT AGENCY
PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: STREAM DIVERSION EAST OPTION
TYPICAL SECTIONS
SHEET 2

SCALE	PROJECT No	DRAWING No	AMDT
1:250 (A1)	AE04101	SK-112	A

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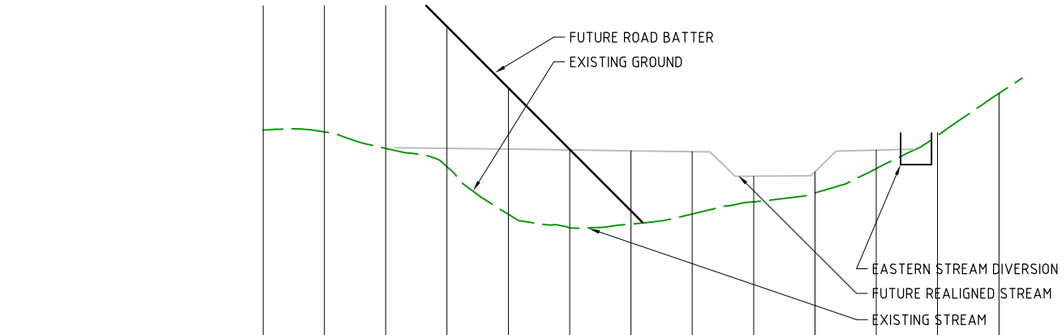
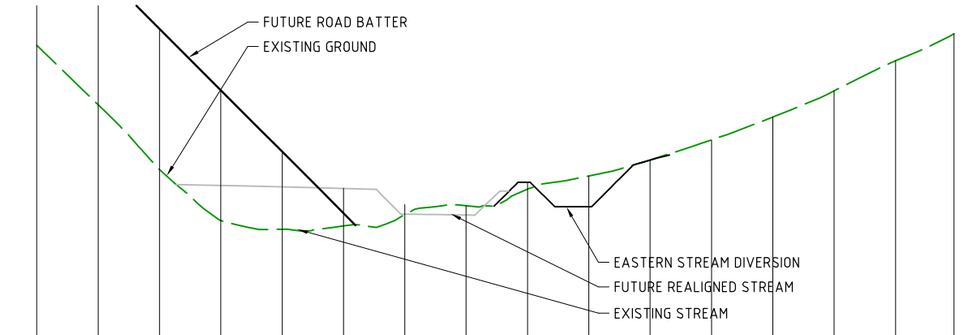


DATUM RL 136.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	157.384
5.000	157.223
10.000	155.886
15.000	154.385
20.000	150.513
25.000	149.413
30.000	149.707
35.000	150.538
40.000	151.537
45.000	152.258
50.000	154.235
55.000	156.924
60.000	160.370

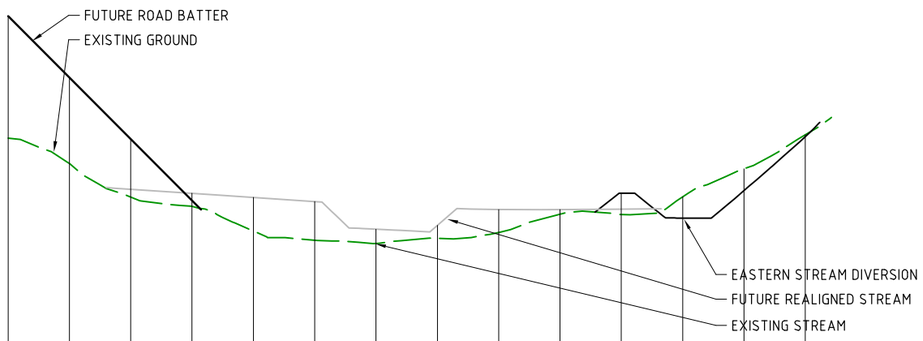
SECTION 9 SK-110
SCALE 1:250 (A1)



DATUM RL 159.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	187.274
5.000	182.430
10.000	177.171
15.000	172.990
20.000	172.285
25.000	172.570
30.000	173.479
35.000	174.212
40.000	175.560
45.000	176.628
50.000	177.938
55.000	179.578
60.000	181.439
65.000	183.564
70.000	186.025
74.770	188.227

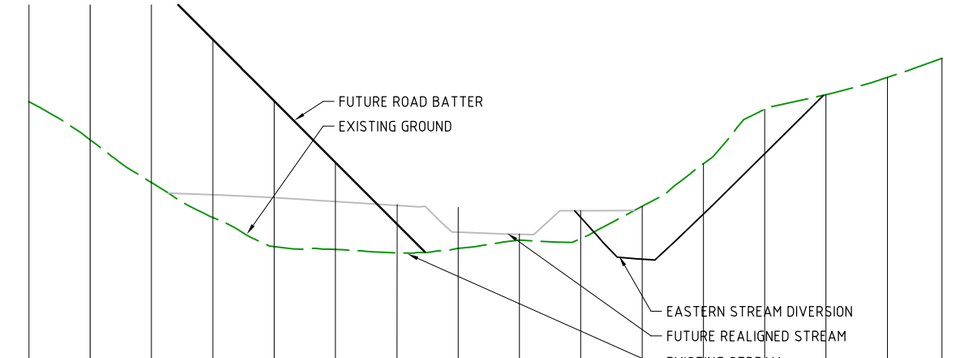
SECTION 11 SK-110
SCALE 1:250 (A1)



DATUM RL 143.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	164.092
5.000	162.024
10.000	159.286
15.000	158.548
20.000	156.526
25.000	155.768
30.000	155.512
35.000	155.934
40.000	156.403
45.000	157.899
50.000	157.871
55.000	159.311
60.000	161.601
65.000	164.378

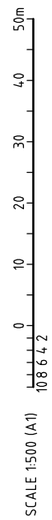
SECTION 10 SK-110
SCALE 1:250 (A1)



DATUM RL 171.0

CHAINAGE	EXISTING SURFACE LEVEL
0.000	196.458
5.000	193.334
10.000	189.862
15.000	187.018
20.000	184.644
25.000	184.420
30.000	184.138
35.000	184.496
40.000	185.173
45.000	185.295
50.000	187.933
55.000	191.404
60.000	195.850
65.000	197.022
70.000	198.432
74.450	200.000

SECTION 12 SK-110
SCALE 1:250 (A1)



SCALE 1:500 (A1)

CONCEPT DESIGN

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CLIENT: NEW ZEALAND TRANSPORT AGENCY
PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: STREAM DIVERSION EAST OPTION TYPICAL SECTIONS SHEET 3

SCALE	PROJECT No	DRAWING No	AMDT.
1:250 (A1)	AE04101	SK-113	A

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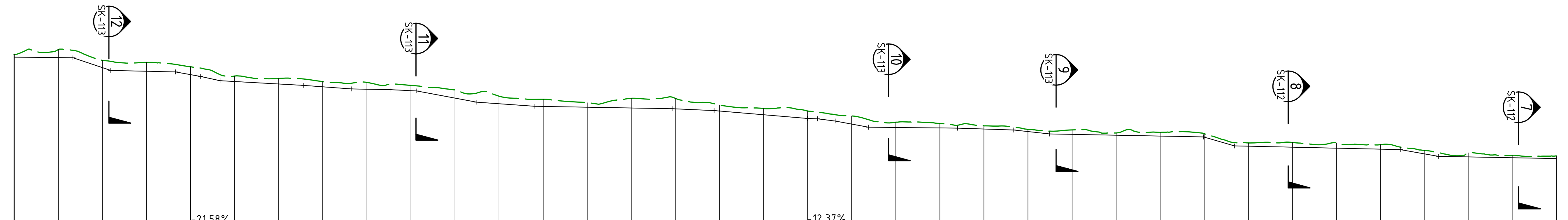


VERTICAL CURVE

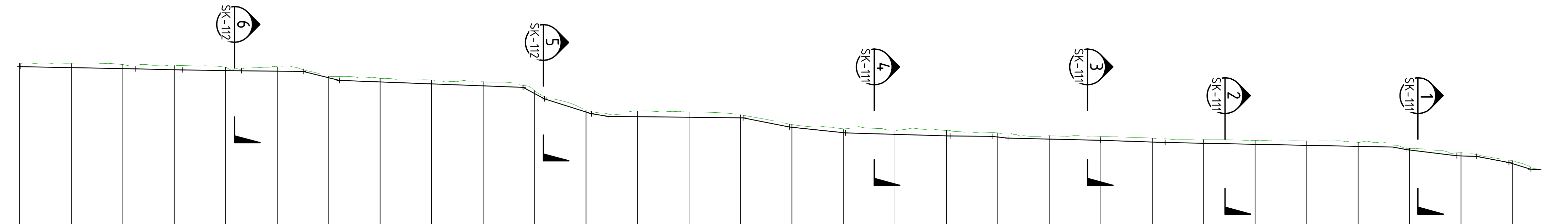
VERTICAL GRADE: -1.00% | -33.59% | -2.14% | -18.27% | -21.58% | -5.65% | -7.42% | -1.71% | -4.77% | -18.86% | -6.96% | -1.76% | -4.41% | -8.45% | -2.94% | -12.37% | -18.59% | -1.03% | -3.44% | -10.86% | -1.96% | -29.04% | -2.16% | -17.72% | -1.98%

DATUM RL 93.0

CHAINAGE	CUT - / FILL +	DESIGN SURFACE LEVEL	EXISTING SURFACE LEVEL
-0.11			190.761
0.00	-1.369	189.383	190.751
20.00	-3.663	189.182	192.845
40.00	-3.341	184.619	187.959
60.00	-4.023	183.006	187.029
80.00	-3.566	181.482	185.048
100.00	-2.468	178.360	180.828
120.00	-2.505	177.231	179.736
140.00	-2.348	175.945	178.293
160.00	-3.124	174.867	177.991
180.00	-2.383	174.236	176.619
200.00	-3.703	170.835	174.538
220.00	-3.476	168.263	171.740
240.00	-3.310	167.067	170.376
260.00	-2.068	166.714	168.782
280.00	-4.419	166.361	170.780
300.00	-4.742	165.969	170.711
320.00	-2.766	164.988	167.754
340.00	-2.867	163.299	166.166
360.00	-3.382	161.621	165.003
380.00	-3.667	159.103	162.770
400.00	-2.376	157.549	159.925
420.00	-2.053	157.344	159.396
440.00	-1.440	156.851	158.290
460.00	-0.979	155.685	156.663
480.00	-2.022	154.421	156.444
500.00	-0.987	154.030	155.017
520.00	-1.637	153.638	155.276
540.00	-1.598	153.139	154.737
560.00	-1.506	149.039	150.545
580.00	-2.158	148.607	150.765
600.00	-2.414	148.174	150.588
620.00	-2.028	147.742	149.770
640.00	-1.574	145.586	147.161
660.00	-1.833	144.217	146.050
680.00	-1.182	143.821	145.003
699.89	-1.195	143.427	144.623

LONGITUDINAL SECTION EAST STREAM DIVERSION OPTION

SCALE 1:1000H
1:1000V



VERTICAL CURVE

VERTICAL GRADE: -1.98% | -2.00% | -2.04% | -1.50% | -1.26% | -24.73% | -3.74% | -53.69% | -31.85% | -15.22% | -1.13% | -19.60% | -10.63% | -2.98% | -1.03% | -10.02% | -2.43% | -3.39% | -1.98% | -20.00% | -12.04% | -3.56% | -18.91% | -30.62% | -3.06%

DATUM RL 53.0

CHAINAGE	CUT - / FILL +	DESIGN SURFACE LEVEL	EXISTING SURFACE LEVEL
699.89	-1.195	143.427	144.623
700.00	-1.188	143.425	144.613
720.00	-1.510	143.025	144.536
740.00	-1.608	142.625	144.233
760.00	-1.586	142.219	143.805
780.00	-1.257	141.902	143.159
800.00	-1.686	141.636	143.322
820.00	-0.586	139.069	139.655
840.00	-1.407	137.453	138.860
860.00	-1.523	136.705	138.228
880.00	-1.558	135.958	137.516
900.00	-1.075	132.992	134.067
920.00	-0.774	125.770	126.544
940.00	-2.134	123.981	126.114
960.00	-2.037	123.754	125.791
980.00	-1.116	123.527	124.643
1000.00	-1.002	119.877	120.879
1020.00	-1.469	117.751	119.220
1040.00	-1.415	117.089	118.504
1060.00	-2.083	116.494	118.577
1080.00	-1.559	116.062	117.620
1100.00	-1.264	115.273	116.538
1120.00	-1.532	114.787	116.319
1140.00	-1.444	114.110	115.553
1160.00	-1.389	113.643	115.032
1180.00	-1.420	113.247	114.667
1200.00	-1.645	112.850	114.496
1220.00	-1.502	112.454	113.956
1240.00	-0.667	110.976	111.643
1260.00	-1.267	108.704	109.971
1280.00	-1.136	105.687	106.823

LONGITUDINAL SECTION EAST STREAM DIVERSION OPTION

SCALE 1:1000H
1:1000V

SCALE 1:1000 (A1)

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

SKM
Sinclair Knight Merz Ltd
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CLIENT: NEW ZEALAND TRANSPORT AGENCY

PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED: LC	DESIGN REVIEW: AG		

TITLE: STREAM DIVERSION EAST OPTION DIVERSION LONGSECTION

SCALE	PROJECT No	DRAWING No	AMDT
1:1000 (A1)	AE04101	SK-114	A

A1

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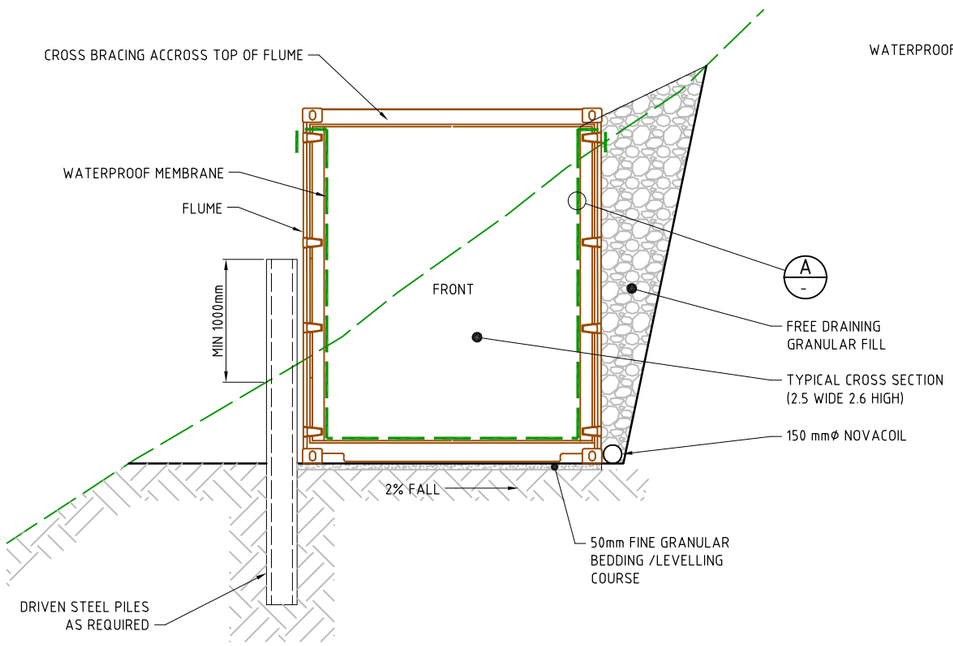
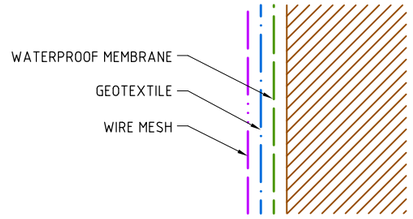


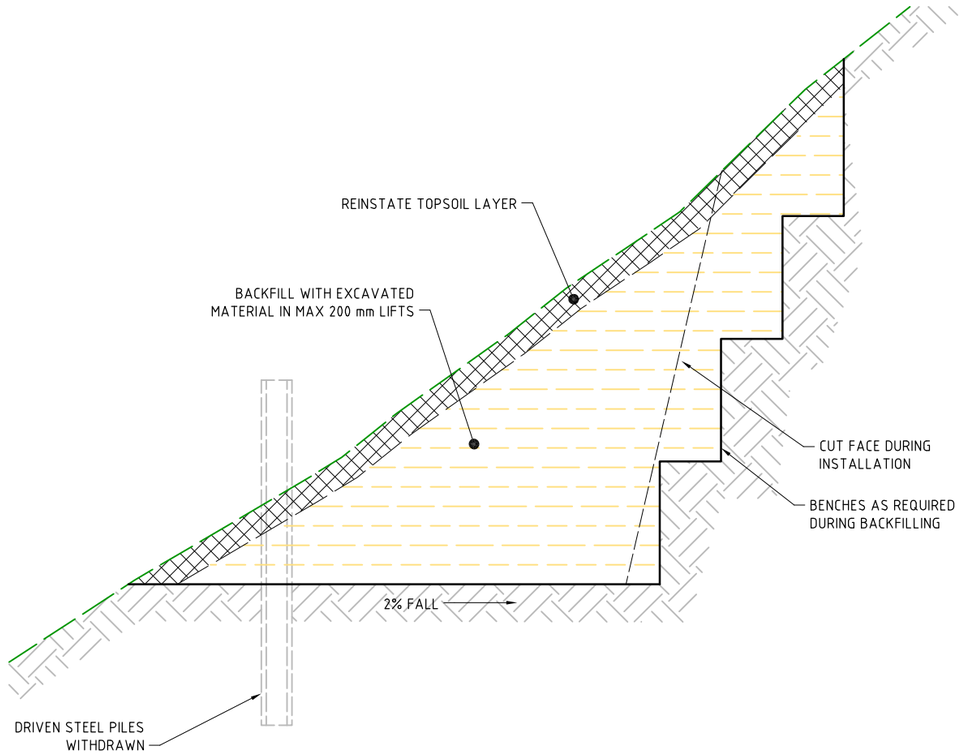
TEMPORARY FLUME INSTALLATION (EASTERN DIVERSION)

DETAIL 1 / - SCALE 1:25 (A1)



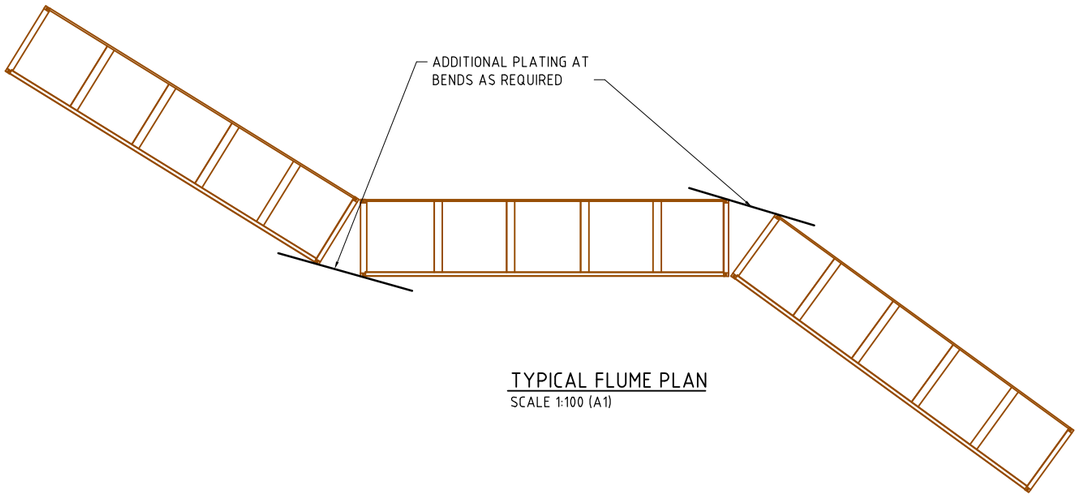
WATERPROOF MEMBRANE

DETAIL A / - SCALE N.T.S



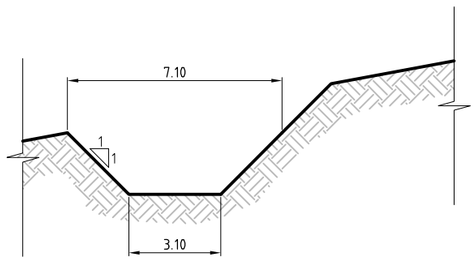
REINSTATEMENT (DURING COMPLETION OF NEW STREAM ALIGNMENT WORKS)

DETAIL 2 / - SCALE 1:25 (A1)



TYPICAL FLUME PLAN

SCALE 1:100 (A1)



TYPICAL CHANNEL PROFILE (EASTERN DIVERSION)

SCALE 1:100 (A1)

SCALE 1:500 (A1) 0 10 20 30 40 50m

NOTES

1. SEALING AND LINING OF FLUME TO BE DETAILED BY THE CONTRACTOR

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REVD P.MGR	APPD P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

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Fax: +64 9 928 5501
Web: www.skmconsulting.com

CLIENT: NEW ZEALAND TRANSPORT AGENCY
PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: STREAM DIVERSION EAST OPTION FLUME INSTALLATION AND BACKFILL DETAILS

SCALE	PROJECT No	DRAWING No	AMDT
1:250 (A1)	AE04101	SK-120	A

NOTES

1. TRANSMISSION TOWERS WILL BE RELOCATED BEFORE CONSTRUCTION COMMENCES.
2. DEB =DECANTING EARTH BUND
3. (CW) = CLEAN WATER

STAGE A

- (1) SILT FENCE AND DIVERSION CHANNEL. (CW)
- (2) CONSTRUCT POND.
- (3a) (3b) DIVERSION CHANNEL (CW) AND SILT FENCE ON DOWNHILL SIDE OF NEW STREAM DIVERSION.
- (3c) EW FOR STREAM DIVERSION. (FLUMING)
- (3d) INSTALL STREAM DIVERSION. (FLUMING) CH 1280m TO 1050m.
- (4a) DAM EXISTING STREAM AND OVER PUMP TO STREAM DIVERSION.
- (4b) NEW CHANNEL (IN DRY) TO SIDE STREAM.
- (4c) REMOVE TEMPORARY DAM DISCHARGE TO DIVERSION.

STAGE B

- (5a) INSTALL SILT FENCE TO DEB.
- (5b) INSTALL DIVERSION CHANNEL. (CW)
- (6) CONSTRUCT DEB.
- (7a) EW FOR STREAM DIVERSION. (FLUMING)
- (7b) INSTALL STREAM DIVERSION. (FLUMING)

LEGEND

- DIVERSION CHANNEL
- SF SUPER SILT FENCE
- TEMPORARY DAM
- PUMP
- DEB DECANTING EARTH BUND
- P SEDIMENT POND
- EX BOUNDARY
- EX DESIGNATION BOUNDARY
- PROPERTY DESIGNATION BOUNDARY
- EXISTING STREAMS
- GEOTECH INVESTIGATIONS
- EX FAULT LINE
- ELEC ELEC EX ELECTRICITY
- OH OH PROP ELECTRICITY
- TC TC EX TELECOM
- GAS GAS EX GAS
- PROPOSED ROAD AND STREAM
- EX TRACK
- CENTRE OF EASTERN DIVERSION

EASTERN DIVERSION
FUTURE REALIGNED STREAM
EXISTING STREAM

150.0
140.0
130.0
120.0
110.0

3400
3450
3800
3850
3900
3950
4000
4050

SCALE 1:500 (A1)
0 10 20 30 40 50m
10 8 6 4 2

TYPICAL STREAM DIVERSION COMMISSIONING

1:500 @ A1

ATTACHED XREF FILES

- AE04101 SECTION LOCATIONS.DWG
- XR 6504 EX TOPO-FEATURES.DWG
- XR 6504 PROPOSED SERVICES.DWG
- XR 6504 PROPOSED LANDSCAPING.DWG
- XR 6504 PROPOSED DESIGNATION.DWG
- XR 6504 EX SERVICES UPDATED.DWG
- XR 6504 EX GEOLOGY.DWG
- XR 6504 EX CADASTRAL BOUNDARIES.DWG
- XR 6504 ALL WETLANDS.DWG
- AE04101 TE PUKA STREAM PLAN2.DWG
- AE04101 ROAD STRINGS.DWG
- AE04101 ROAD ACCESS STRINGS.DWG
- AE04101 CONTOURS EXISTING.DWG

CONCEPT DESIGN

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DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: EROSION AND SEDIMENT CONTROL
ROAD CHAINAGE 980 - 1290 m
STREAM DIVERSION

SCALE	PROJECT No	DRAWING No	AMDT
1:250 (A1)	AE04101	SK-121	A

Plot Date: 16 February - 2012 - 8:06 AM
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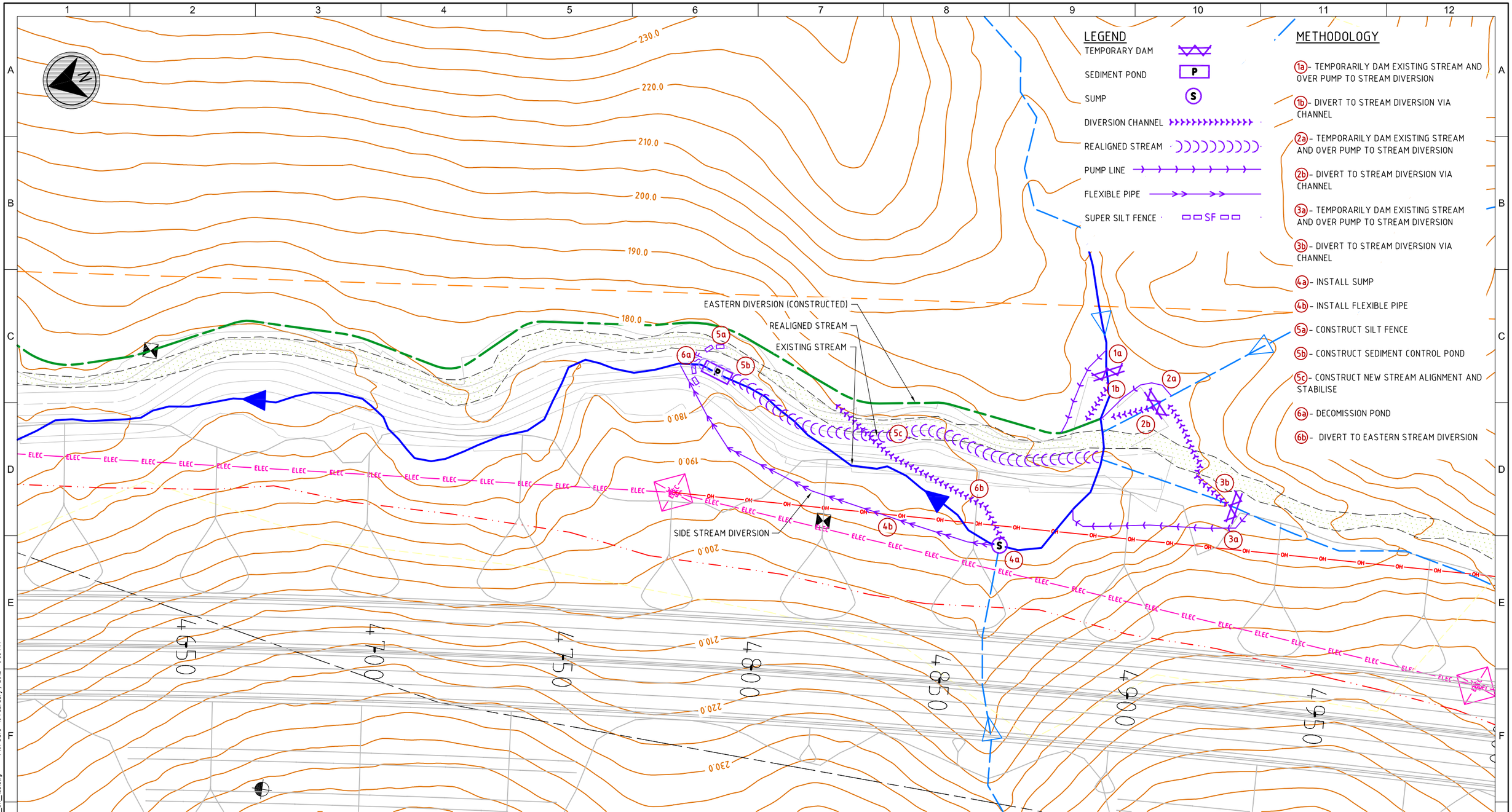

ATTACHED XREF FILES
AE04101 SECTION LOCATIONS.DWG
XR 6504 EX TOPO-FEATURES.DWG
XR 6504 PROPOSED SERVICES.DWG
XR 6504 PROPOSED LANDSCAPING.DWG
XR 6504 PROPOSED DESIGNATION.DWG
XR 6504 EX SERVICES UPDATED.DWG
XR 6504 EX GEOLOGY.DWG
XR 6504 EX CADASTRAL BOUNDARIES.DWG
XR 6504 ALL WETLANDS.DWG
AE04101 TE PUKA STREAM PLAN2.DWG
AE04101 ROAD STRINGS.DWG
AE04101 ROAD ACCESS STRINGS.DWG
AE04101 CONTOURS EXISTING.DWG

LEGEND

- EX BOUNDARY
- EX DESIGNATION BOUNDARY
- PROP DESIGNATION BOUNDARY
- EXISTING STREAMS
- GEOTECH INVESTIGATIONS
- EX FAULT LINE
- EX ELECTRICITY — ELEC
- PROP ELECTRICITY
- EX TELECOM — TC
- EX GAS — GAS
- PROPOSED ROAD AND STREAM
- EX TRACK
- CENTRE OF EASTERN DIVERSION (CONSTRUCTED)

TYPICAL STREAM REALIGNMENT COMMISSIONING

1:500 @ A1

NOTE:

1. TRANSMISSION TOWERS WILL BE RELOCATED BEFORE CONSTRUCTION COMMENCES

SCALE 1:500 (A1) 0 10 20 30 40 50m / 10 8 6 4 2

CONCEPT DESIGN

No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A	Jan 11	LC	AG		FOR CONSENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

CLIENT APPROVAL

Sinclair Knight Merz Ltd
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CLIENT: NEW ZEALAND TRANSPORT AGENCY
PROJECT: TRANSMISSION GULLY-TE PUKA STREAM WORKS

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
LC	TU		
DESIGNED	DESIGN REVIEW		
LC	AG		

TITLE: EROSION AND SEDIMENT CONTROL
ROAD CHAINAGE 4775 - 4900 m
STREAM REALIGNMENT

SCALE	PROJECT No	DRAWING No	AMDT
1:250 (A1)	AE04101	SK-122	A

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