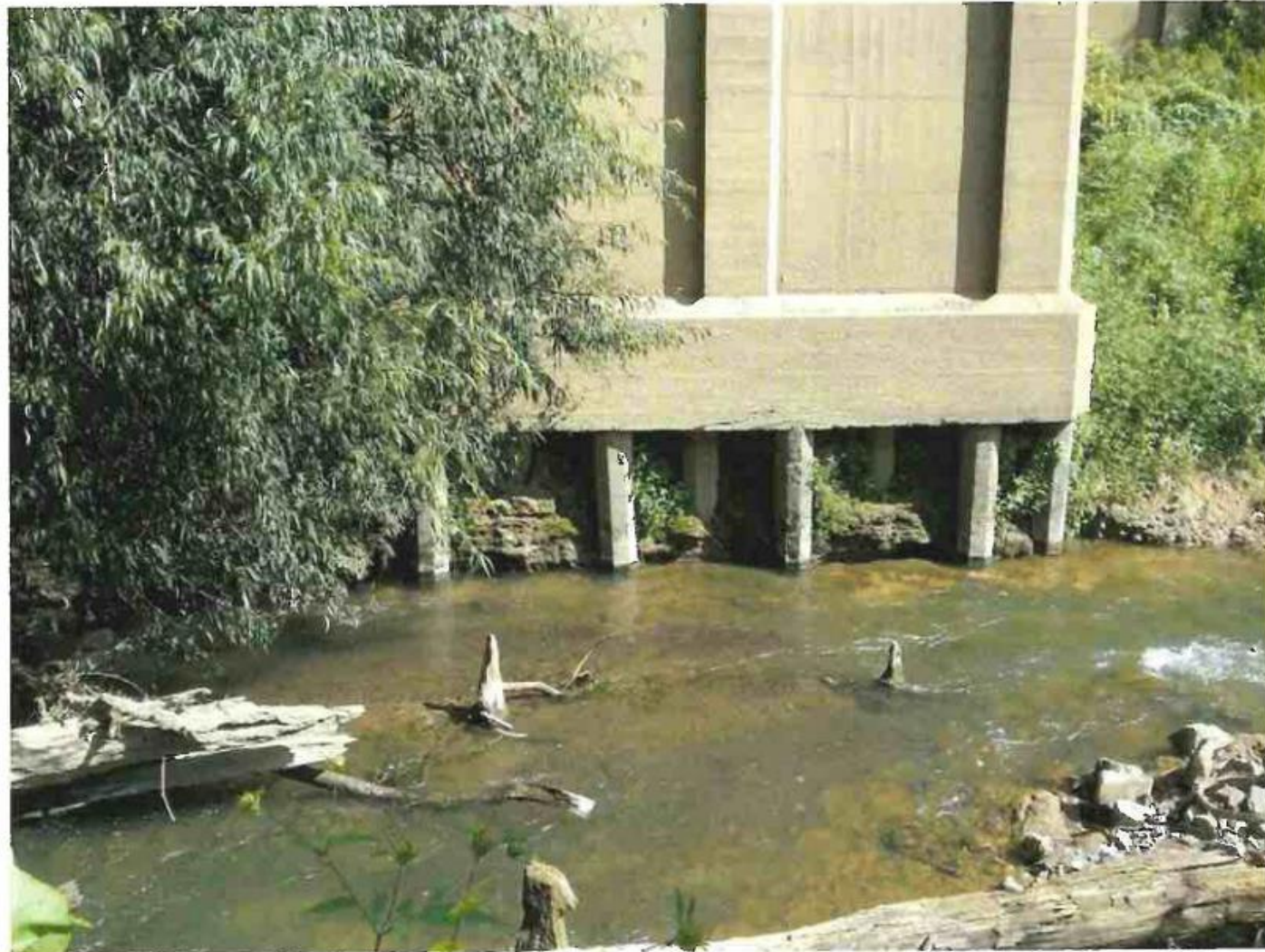


Te Pahu Road Bridge Pier Stabilisation

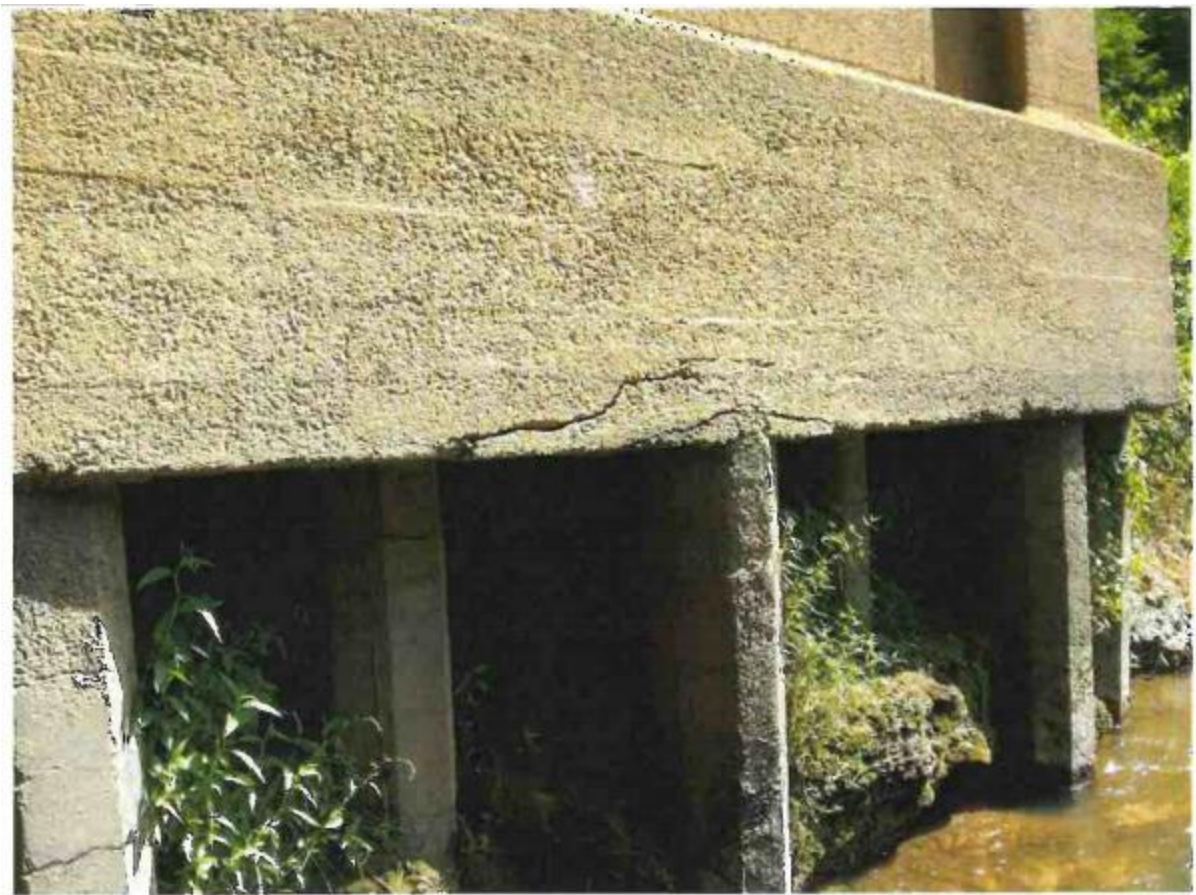


Photos from 2013, Access wasn't great.



Pier / Column: Piles at piers C & D are exposed up to 1.5m.

Photos from 2015, We struck very low flows and noticed that the bed was lower than it had been.



Pier / Column: Spall to lower pier above pile.



Pier / Column: Large horizontal cracks to most piles of Pier D up to 5mm.

Photos from 2017, We targeted the low flows, and had a really close look at those piles. Note the arch shaped cracks in the pile cap too.

Background

Bridge Inspection Report				Page 1 of 9
Waipa		Bridge name: TE PAHU RD 17236 Bridge	Road name: TE PAHU RD	RP: 17236 Bridge ID: 49
Bridge type: Comp Beam and Slab		Inspection type: General	Longitude: 175.1364601	
Marking code: 0 - Not inspected		Deck width (m): 6.2	Latitude: -37.83667905	
1 - Satisfactory		Total bridge length (m): 45	Span lengths (m):	
2 - Monitor next inspection				
R - Routine maintenance (provide comment)				
S - Structural maintenance (provide comment)				
N - Not applicable				
Inspector: C Bennett	Next inspection type: General			
Date: 16 March 2016	Next inspection date: 2017/2018			
Element	No	Description	Mark	Brief description of defect and comments
Superstructure Elements	1	Primary load carrying element	1	
	2	Transverse beams	N	
	3	Other (incl. deck)	2	Fine transverse cracking some with efflorescence to deck soffit up to 0.2mm wide.
	4	Half joints	N	
	5	Seismic linkages/holding down bolts	N	
Load-bearing Substructure	6	Parapet beam or cantilever	S	Several spalls some with exposed steel to cantilever soffit & edges.
	7	Cross bracing/diaphragms	N	
	8	Foundations	1	
	9	Abutments	1	
	10	Head wall	N	
	11	Pier/column	S	Large horizontal cracks to most piles of Pier D up to 5mm, also spall to lower pier above pile. Small shallow spalls to edge of Pier C & E. Diagonal crack to Pier B at A face LHS up to 0.4mm, also CJ cracks at top of pier walls. Piles at piers C & D are exposed up to 1.5m.
	12	Cross-head/capping beam	1	
	13	Bearings	N	
	14	Bearing pin/insert	N	
	15	Superstructure drainage	R	Detritus & vegetation in kerbs.
Durability Elements	16	Substructure drainage	N	
	17	Movement/expansion joints	1	
	18	Painting: superstructure elements	N	
Safety Elements	19	Painting: substructure elements	N	
	20	Painting: barriers/guardrails	1	
	21	Access/walkways/gantries	N	
	22	Guardrail/handrail/safety fences	1	
	23	Carnage/way surfacing	2	Early signs of flushing & shear failure to bridge surfacing.
Waterway Elements	24	Footway/verge/footbridge surfacing	N	
	25	Invert/river bed	1	
	26	Aprons	N	
	27	River bed upstream	1	
Retaining Elements	28	River bed downstream	1	
	29	Scour	1	
	30	River banks	1	
	31	Revetment/batter slope paving	1	
Other	32	Wing walls	1	
	33	Retaining walls	1	
	34	Embankments	N	
	35	Approach rails/barriers/walls	1	
	36	Approach adequacy	1	
	37	Signs	1	
	38	Lighting	N	
39	Services	N		
40	Appearance	1		

Large horizontal cracks to most piles of Pier D up to 5mm, also spall to lower pier above pile. Small shallow spalls to edge of Pier C & E. Diagonal crack to Pier B at A face LHS up to 0.4mm, also CJ cracks at top of pier walls. Piles at piers C & D are exposed up to 1.5m.



Comments and recommendations for maintenance/repairs		
Suggested remedial work	Priority (H/M/L)	Estimated cost
Break out & repair all spalls to cantilever.	M	\$10,000
Cracks to piles of Pier D are below water level. Cracks noted in last inspection however appear relatively recent. Investigate cause of cracks and develop a repair solution.	H	\$25,000
Remove detritus & vegetation from kerbs.	H	\$500



Photos from 2017



.... found cracks at the top of the pier too (hinging)



15 February 2017



9 April 2017

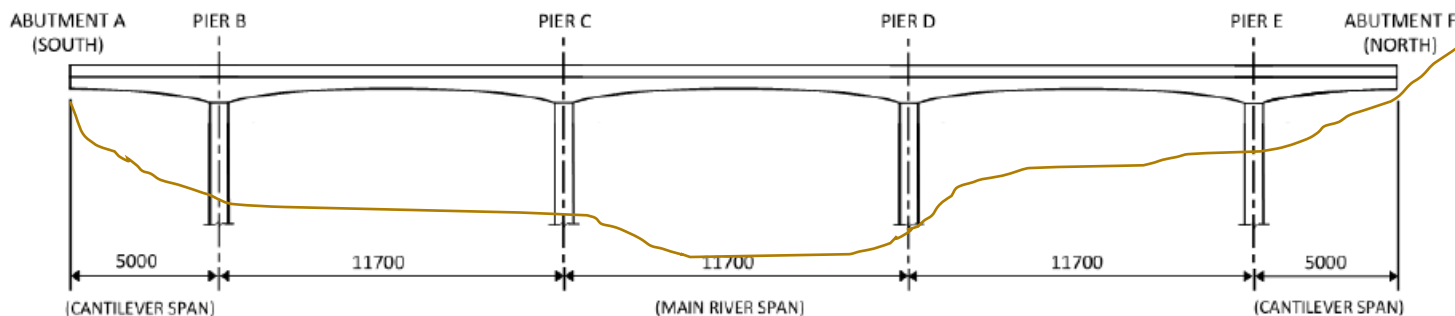
And water levels were highly variable,
shame we didn't use a boat instead of the
Bridge Inspection Unit....

Constraints

- No record drawings / asbuilts
- Slope instability
- Distressed pier (top and bottom)
- Spacial constraints including limited headroom
- Access constraints
- Highly variable stream levels
- Environmental including fish spawning
- Public
- Overhead services
- Urupa
- 40 Minute detours if bridge closed

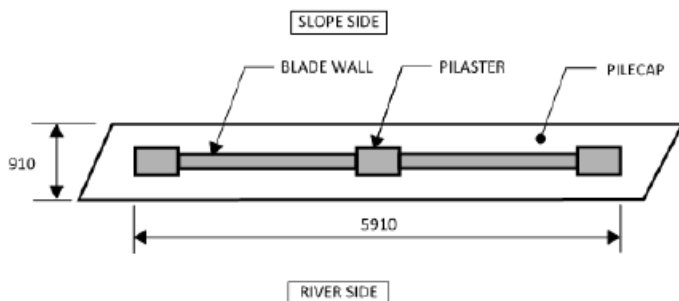


Indicative Bridge Form

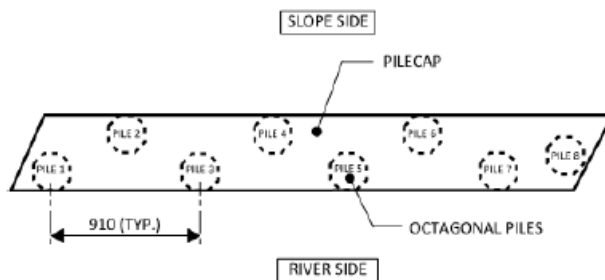


Indicative elevation of bridge

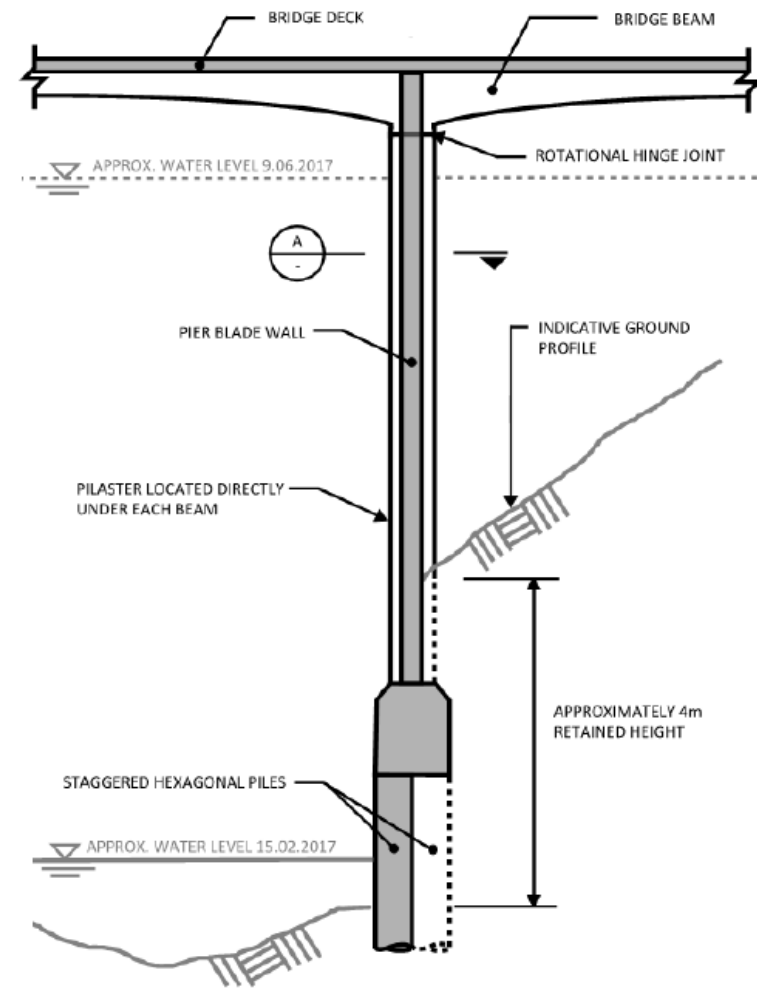
Note: Piers and abutments are skewed to the main alignment of Te Pahu Road.



Section through pier stem



Section through base of the pile cap



Elevation of pier

Design Concept and Development

- 50 year design life agreed. The design life was adopted to reflect the envisaged future life expectancy for the existing bridge structure.
- Council confirmed the stabilisation works did not require to be designed to resist earthquake loads in addition to static loads, given the existing bridge is unlikely to meet current seismic design standards for new structures.
- Assumed future scour of 1m. Potentially need to maintain instream scour protection.
- Design to NZS 3101 and NZBM

Scoping the problem

Pier D was 300mm off vertical

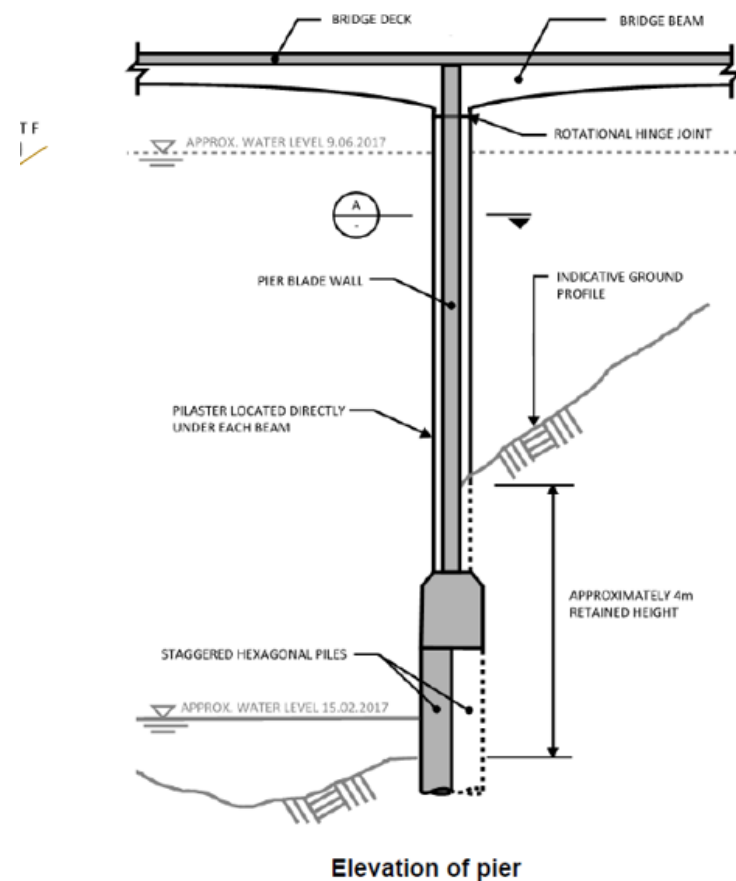
Pier D was built as a pier but now expected to do the job of a retaining wall.

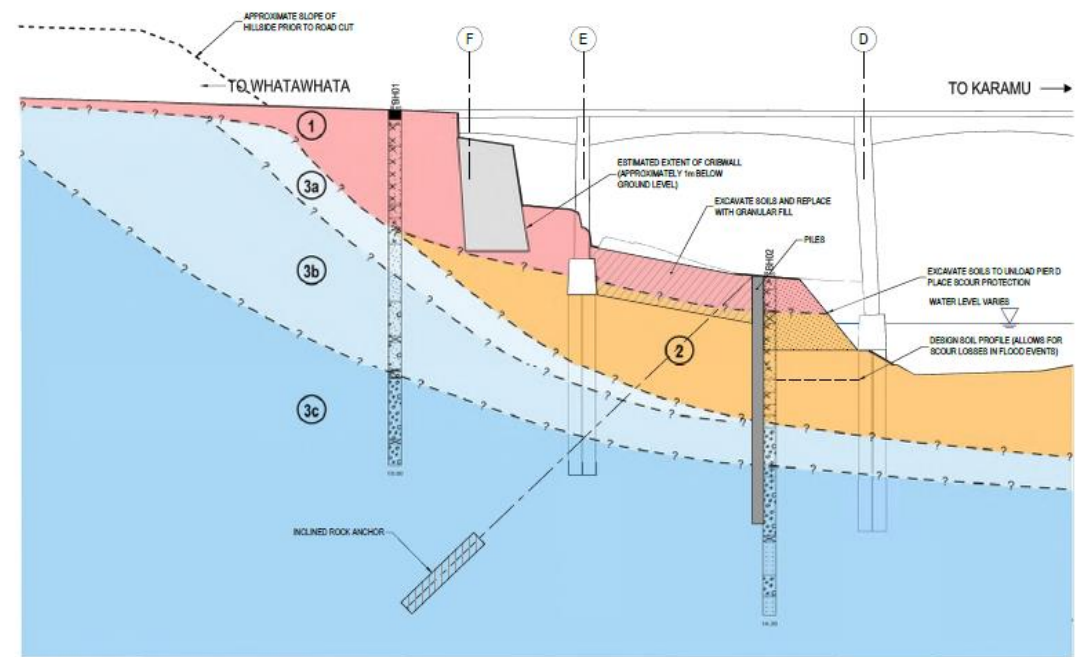
The lowering bed level was worsening.

The ground being retained was getting flooded for many days several times a year.

The ground being retained was poor quality and slowing slipping.

Good ground was a long way down.





- NOTES:**
1. REFER DRAWING CE-000 FOR GENERAL SURVEY NOTES
 2. RIVER BANK RETAINING MEASURES AND SCOUR PROTECTION INDICATIVELY SHOWN
 3. CURRENTLY ASSUMING PIER E IS FOUNDED ON PILES. CONFIRM PRIOR TO DETAILED DESIGN
 4. STREAMBED SCOUR PROTECTION WORKS NOT SHOWN
 5. FOUNDING DEPTH OF EXISTING BRIDGE PILES IS UNKNOWN

Datum 8

STREAMBED LEVEL	20.57	20.99	20.98	20.93	20.8	20.77	20.74	20.61	20.66	20.61	20.51	19.47	19.31	19.18	18.65	15.74	15.92	15.09	14.88	14.61	14.2	13.92	13.78	13.69	13.6	13.63	13.25	10.67	9.99	9.54	9.67	9.69	9.62	9.64	9.67	9.67	
EXISTING SURFACE	20.57	20.99	20.98	20.93	20.8	20.77	20.74	20.61	20.66	20.61	20.51	19.47	19.31	19.18	18.65	15.74	15.92	15.09	14.88	14.61	14.2	13.92	13.78	13.69	13.6	13.63	13.25	10.67	9.99	9.54	9.67	9.69	9.62	9.64	9.67	9.67	
DISTANCE	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00

- LONGITUDINAL SECTION 1**
SCALE - AS SHOWN
- ① FILL / COLLUVIUM
 - ② QUATERNARY ALLUVIUM (TAURANGA GROUP)
 - ③a RESIDUAL SOIL (NEWCASTLE GROUP)
 - ③b COMPLETELY WEATHERED SANDSTONE (NEWCASTLE GROUP)
 - ③c HIGHLY WEATHERED SANDSTONE (NEWCASTLE GROUP)

FOR INFORMATION NOT FOR CONSTRUCTION



Original Date: 2/1/2016	Drawn: J. LINDEN	Checked: J. LINDEN	Approved: J. LINDEN
Revised: 1/2017	Drawn: J. LINDEN	Checked: J. LINDEN	Approved: J. LINDEN

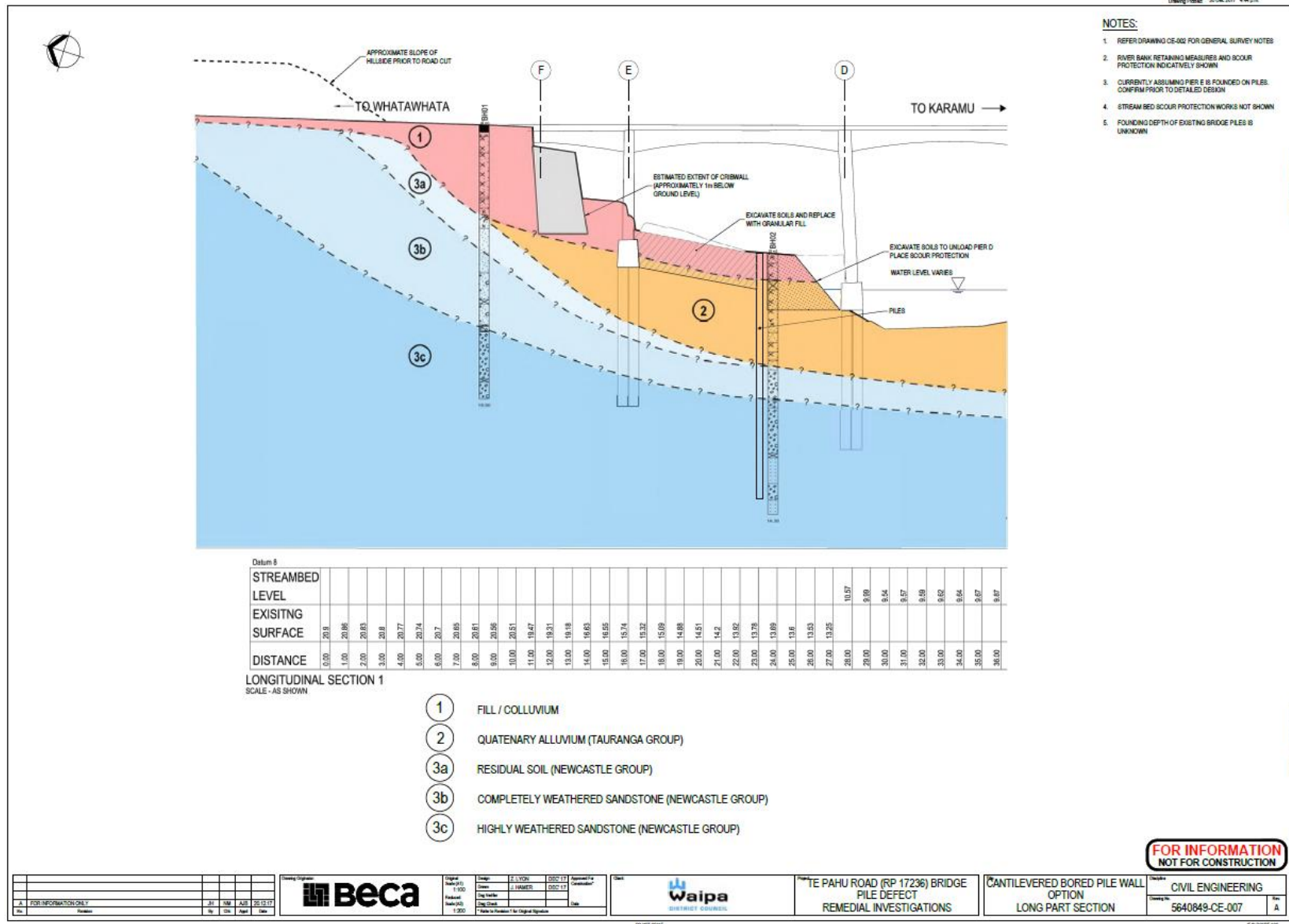


TE PAHU ROAD (RP 17236) BRIDGE PILE DEFECT REMEDIAL INVESTIGATIONS

ANCHORED SHEETPILE WALL OPTION LONG PART SECTION

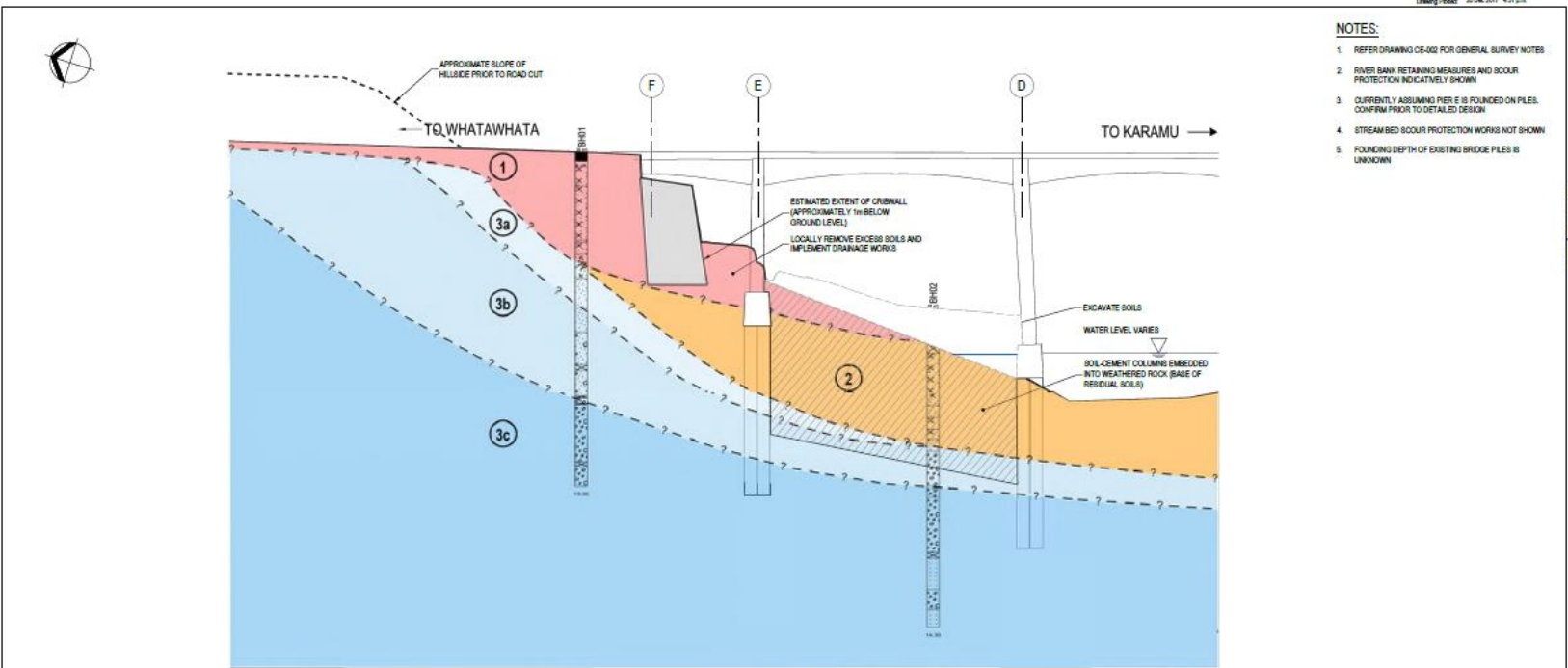
CIVIL ENGINEERING
5640849-CE-005

Anchored Sheet pile wall



				TE PAHU ROAD (RP 17236) BRIDGE PILE DEFECT REMEDIAL INVESTIGATIONS		CANTILEVERED BORED PILE WALL OPTION LONG PART SECTION		CIVIL ENGINEERING Drawing No: 5640849-CE-007 Rev: A	
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Bored pile wall



- NOTES:**
1. REFER DRAWING CE-002 FOR GENERAL SURVEY NOTES
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Datum 8

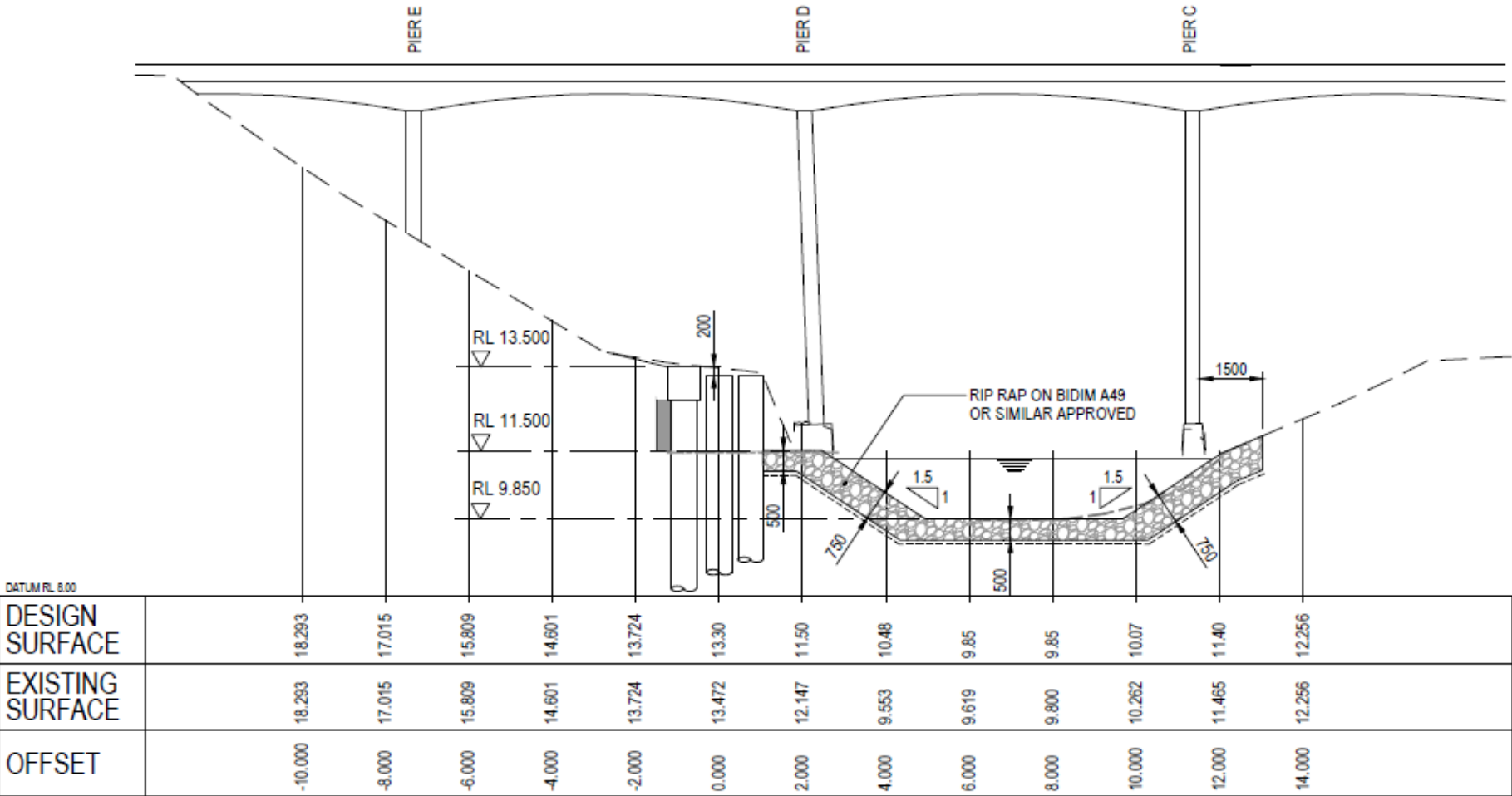
DISTANCE	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00			
STREAMBED LEVEL	2019	2018	2018	2018	2017	2017	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	
EXISTING SURFACE	2019	2018	2018	2018	2017	2017	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

LONGITUDINAL SECTION 1
SCALE - AS SHOWN

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NOT FOR CONSTRUCTION**

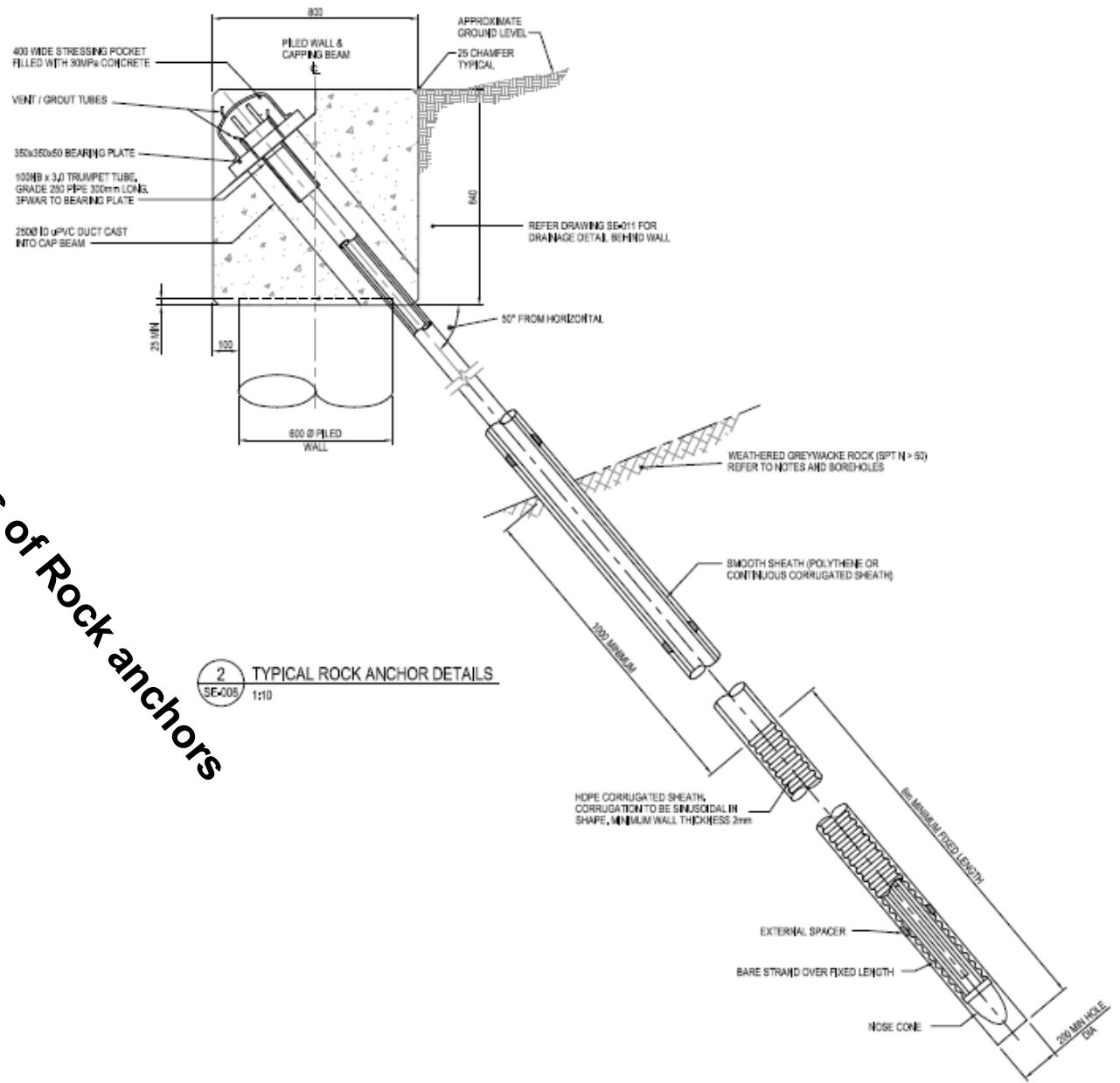
<p>Beca</p>	<p>Waipa DISTRICT COUNCIL</p>	<p>THE PAHU ROAD (RP 17236) BRIDGE PILE DEFECT REMEDIAL INVESTIGATIONS</p>	<p>GROUND IMPROVEMENT OPTION LONG PART SECTION</p>	<p>Project No: 5640849-CE-009</p>
				<p>Sheet No: A</p>



CHAINAGE 6.000

And add some stream bed protection

Details of Rock anchors



Procurement

- Early contractor involvement (great until it got “commercial but not exclusive”)
- EOI -Invited tenderers based on NZTA pre-qualification for bridge construction.
- Two tenderers received (1 declined to price)
- Engineers Estimate of \$1.4M for Pier Stabilisation works
- Bridge Replacement in order of \$8M
- Fulton Hogan awarded Pier Stabilisation works for \$2M







Pier monitoring sensors





Every 3rd pile installed to reduce vibration, 20 metres deep piles. One wet afternoon Pier D decided to move 30mm.

Pier tied to new wall, and lets have a good look at those piles.

Pier D decided to spring back a little too.

Note the bypass pipe and coffer dam





Cracks repaired, and piles strengthened (encased in concrete).





Nice neat job, just some planting to finish off

The Great Team at BECA



- Racecourse Road Bridge, Te Awamutu
- Looks familiar.



Mangauika Road
Bridge, Pirongia

The concrete
probably once went
to ground level



Invert / River Bed (Element 25): Log jam impeding flow at A.

Whitehall Road Bridge



Scour (Element 29): Failure of abutment B protection structure.