Highway 2:60 km 33.8
PH70 East Hill Retaining Wall Site
2016-2017 Landslide Repair

by
Don Proudfoot/Shawn Russell

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Peace River
Grande Prairie
Cold Lake
St. Albert
Fort Saskatchewan
Spruce Grove
Edmonton
Leduc
Lloydminster
Wetaskiwin
Camrose
Lacombe
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge

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PH70 East Hill Retaining Wall Site Location

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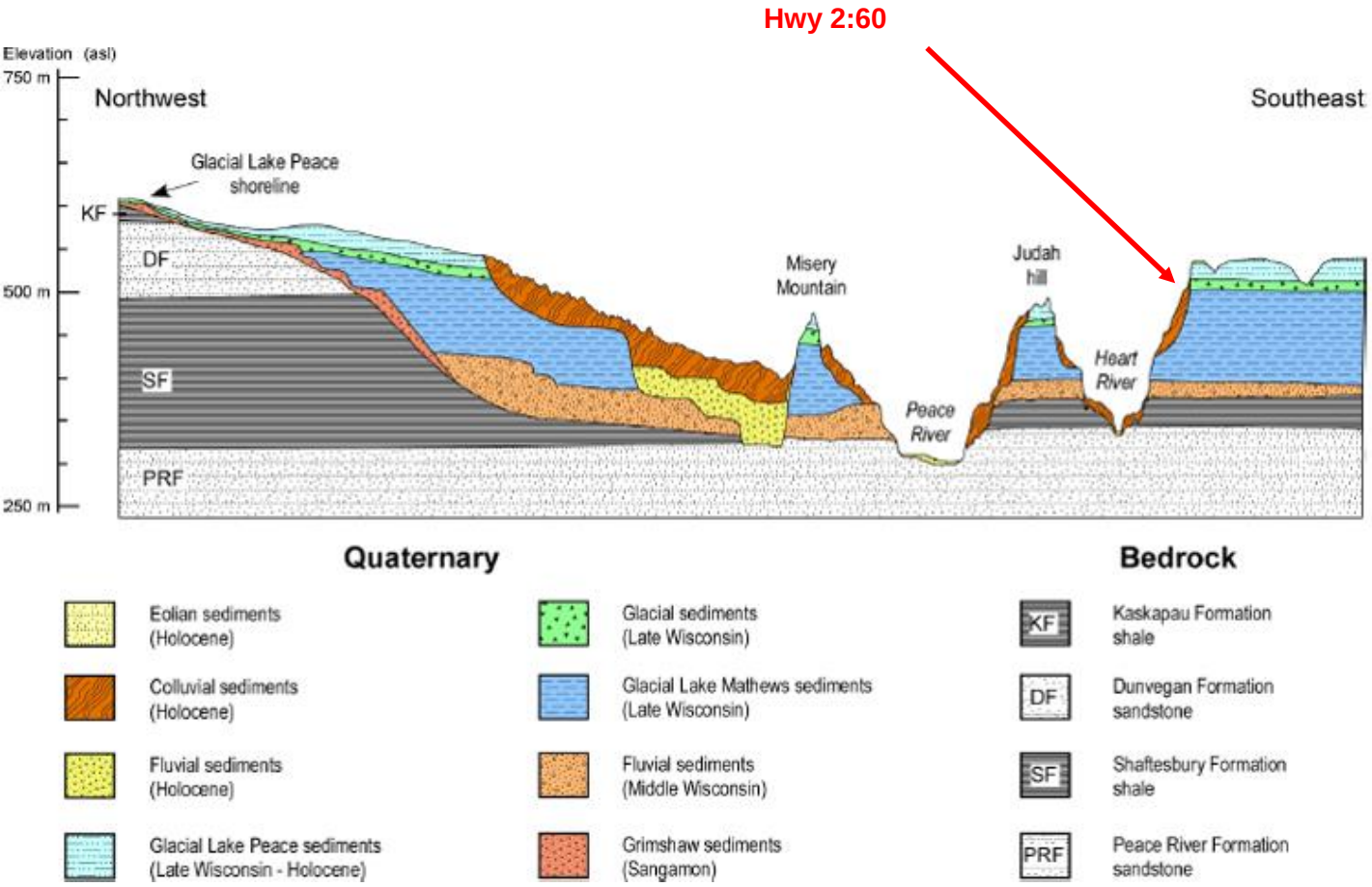

Image Source: ERCB "Geological Setting for Large Landslides at the Town of Peace River, Alberta(NTS 84C)", April 2012

Hwy 2:60 in Peace River Valley Geology

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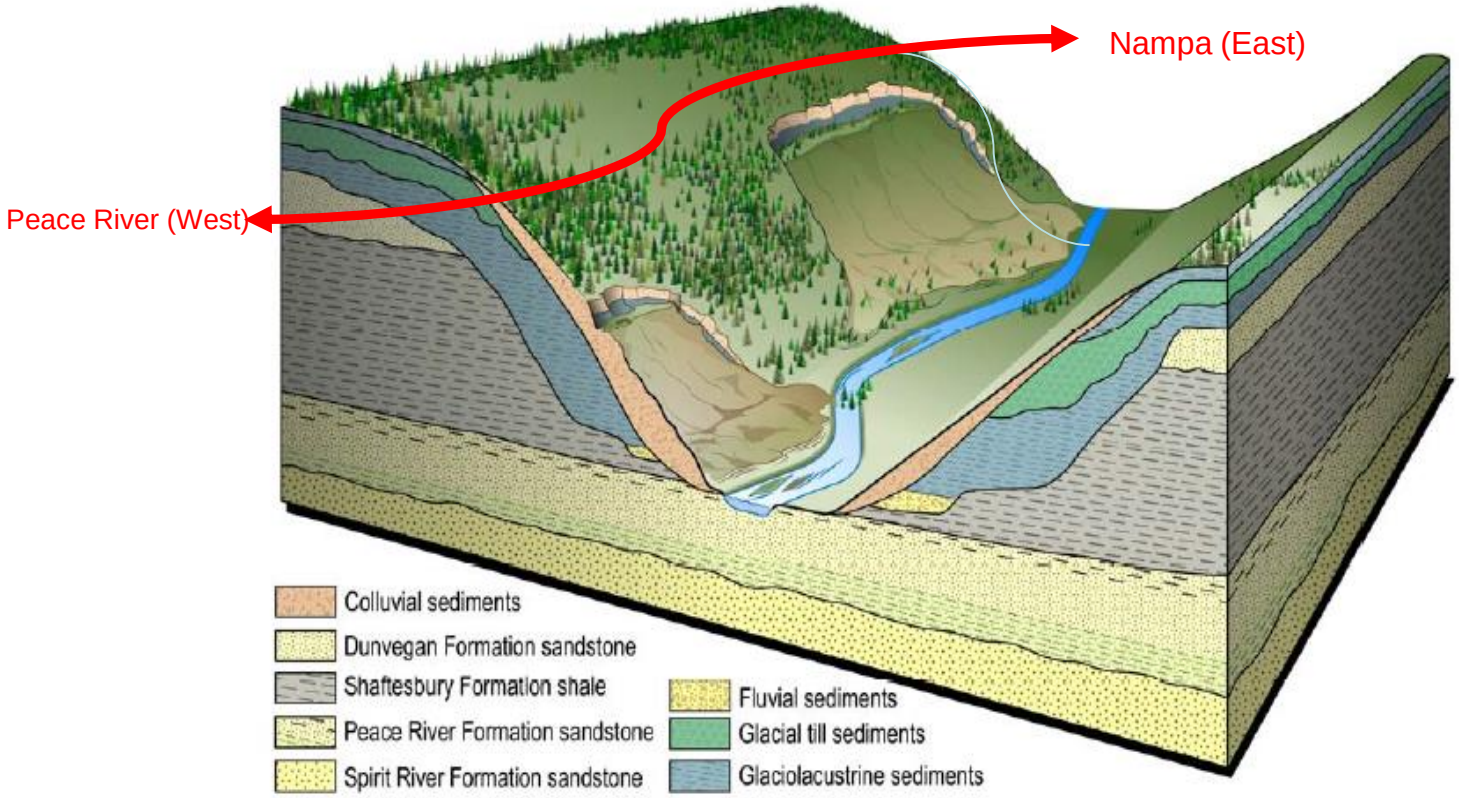

Image Source: ERCB "Geological Setting for Large Landslides at the Town of Peace River, Alberta (NTS 84C)", April 2012

Hwy 2:60 Through North Heart River Valley Geology

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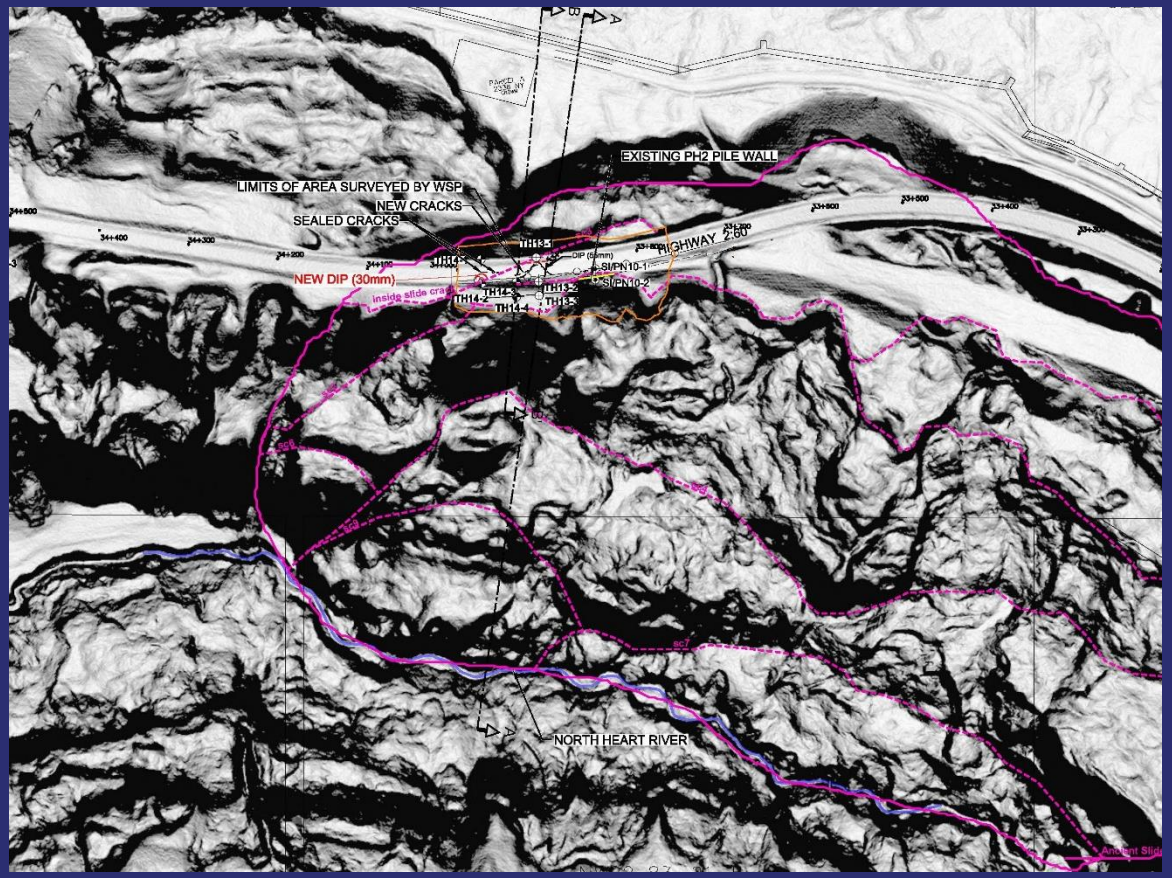

PH70 Landslide (Lidar)

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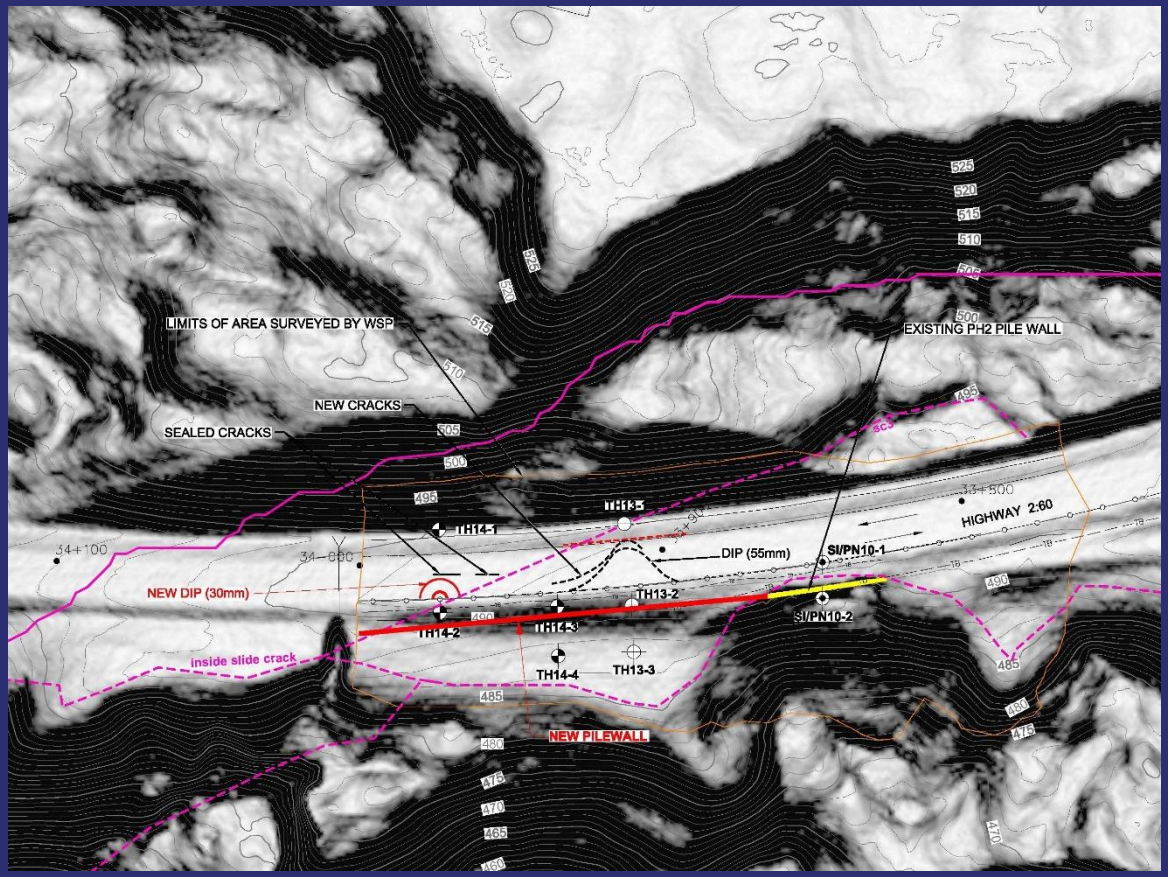

New Pile Wall Location

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Old Wall (June 2011)

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WBL west of wall (June 2015)

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SUMMARY OF MOVEMENTS IN SLOPE INCLINOMETERS

SLOPE INCLINOMETER	TIP DEPTH, m	DEPTH/ELEV. OF MOVEMENT (m)	RATE OF MOVEMENT BETWEEN May and Sept. 2015 (mm/yr)
SI10-1	32.7	5.0 / 487.5	No discernable movement
SI10-2	32.7	Sheared at 6.1/ Elev. 481.6	55 mm/yr in 2010 before it sheared off
SI13-2	28.6	17.6 / Elev. 473	16.5
SI13-3	19.5	>19.5 / <467m	?
SI14-2	30.2	4.5 / 486	7.1
SI14-3	30.2	5 to 8.5 / 486 to 482.5	12.4
SI14-4	31.7	19.5 /467	15.0

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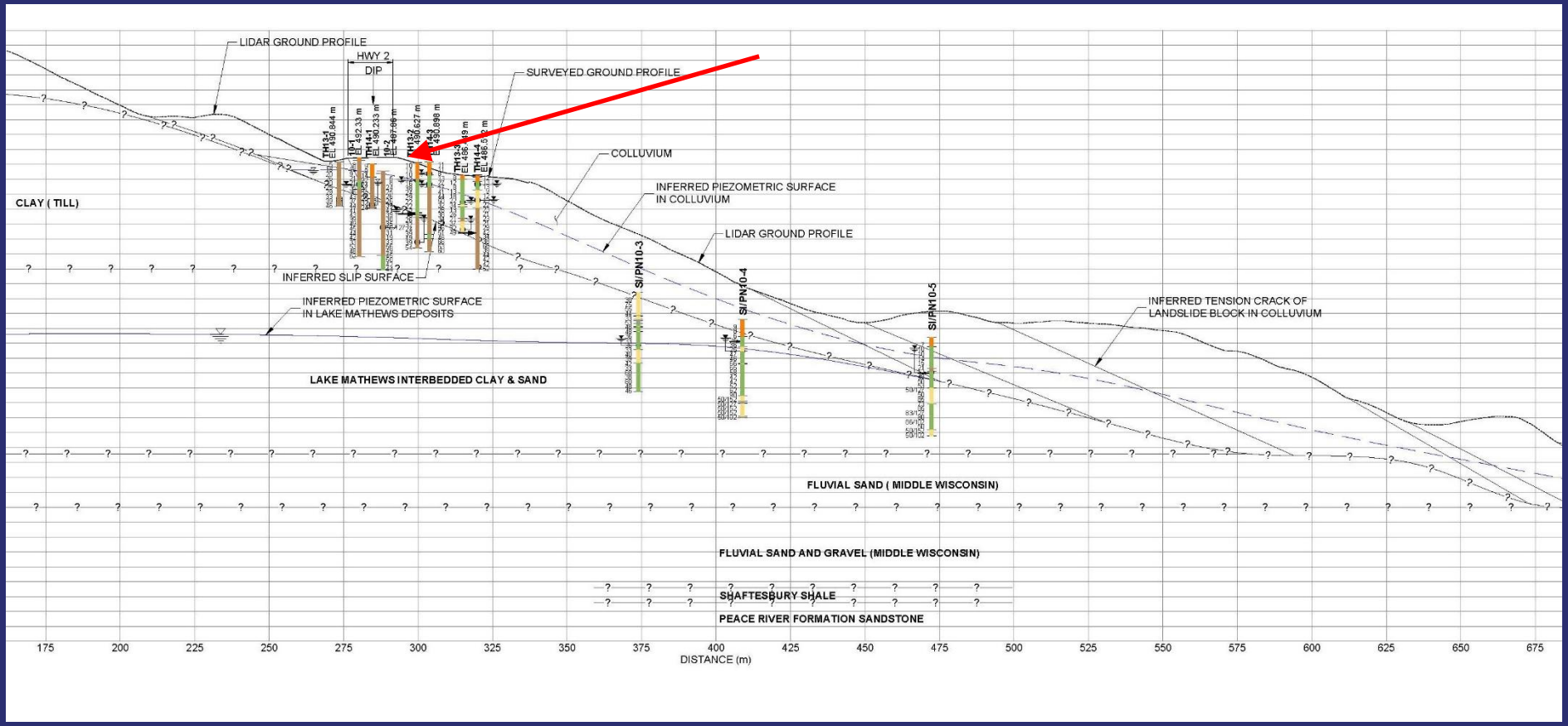

Test Hole Cross Section

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Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 18.5 kN/m³
Cohesion: 0 kPa
Phi: 25 °
Piezometric Line: 1

Name: Upper Colluvium
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 21 °
Piezometric Line: 1

Name: Colluvium - remolded
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion: 1 kPa
Phi: 15 °
Piezometric Line: 1

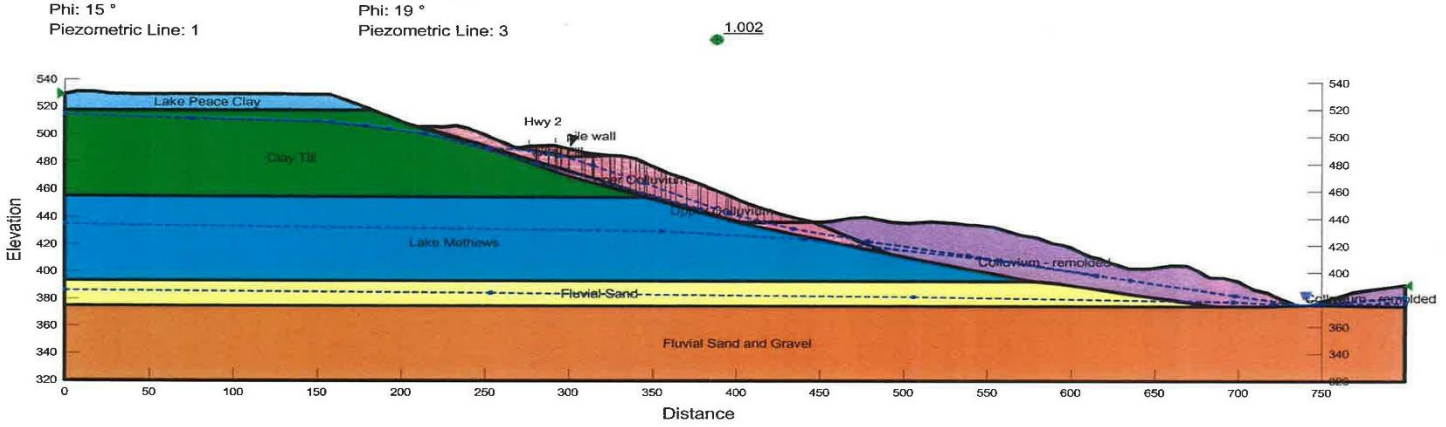
Name: Lake Peace Clay
Model: Mohr-Coulomb
Unit Weight: 18.5 kN/m³
Cohesion: 0.5 kPa
Phi: 21 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 5 kPa
Phi: 29 °
Piezometric Line: 2

Name: Lake Mathews
Model: Mohr-Coulomb
Unit Weight: 18.5 kN/m³
Cohesion: 10 kPa
Phi: 19 °
Piezometric Line: 3

Name: Fluvial Sand
Model: Bedrock (Impenetrable)
Piezometric Line: 4

Name: Fluvial Sand and Gravel
Model: Bedrock (Impenetrable)
Piezometric Line: 4



H:\15\16-357 Hwy 260 km 34 Landslide Repair- Design Tender and Construction\Calculations\Slope Stability\Figure 1 PH2 BackAnalysis fully specified dwp.gsz

2D Limit Equilibrium Model

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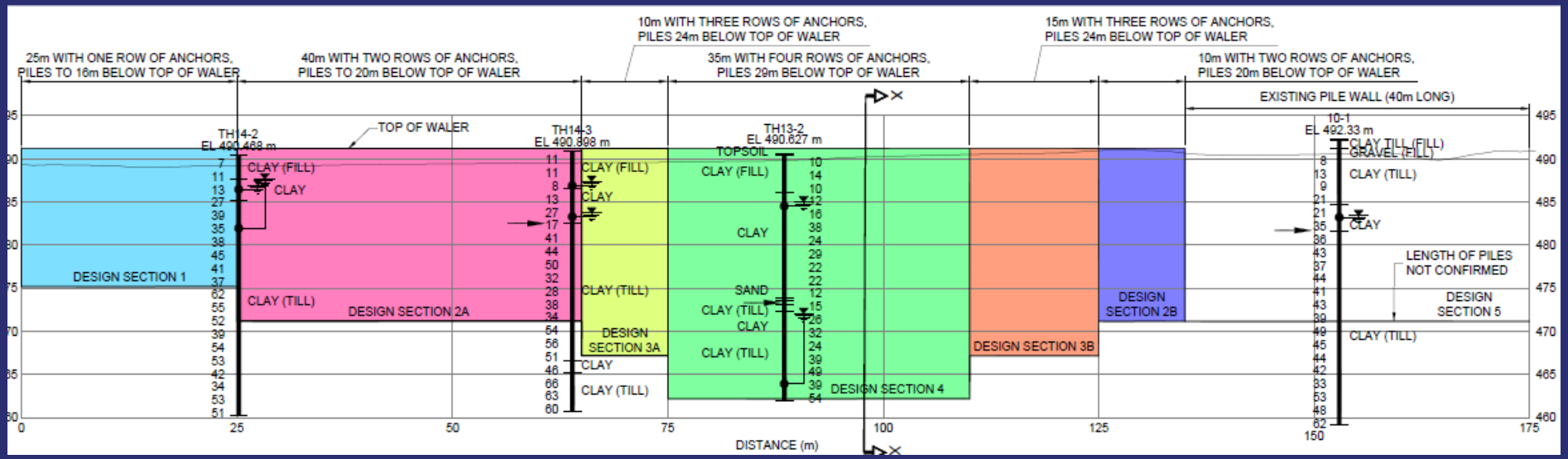

New Pile Wall Conceptual Design Section

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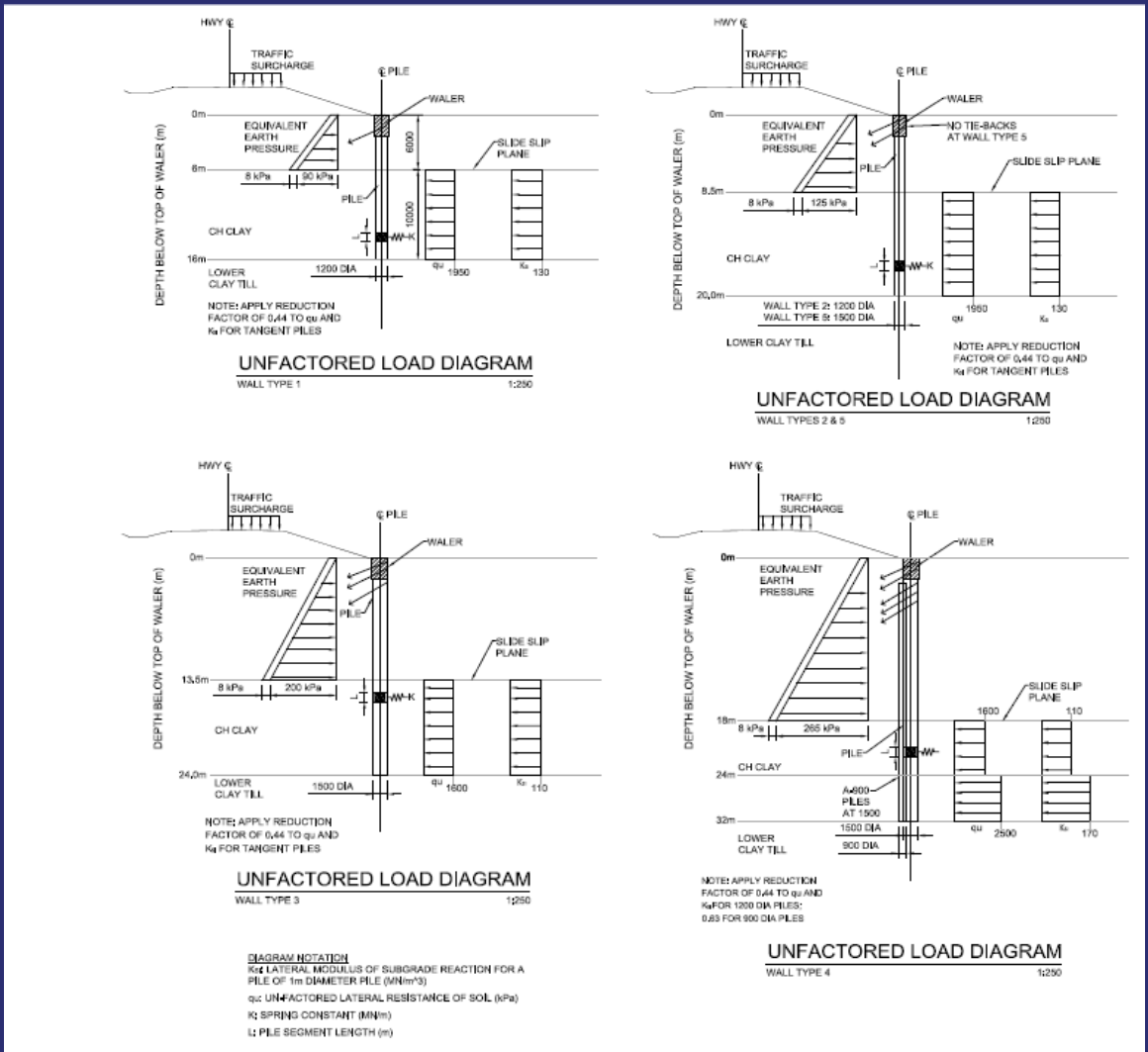

Loading Diagrams for Structural Design

LoadLoad

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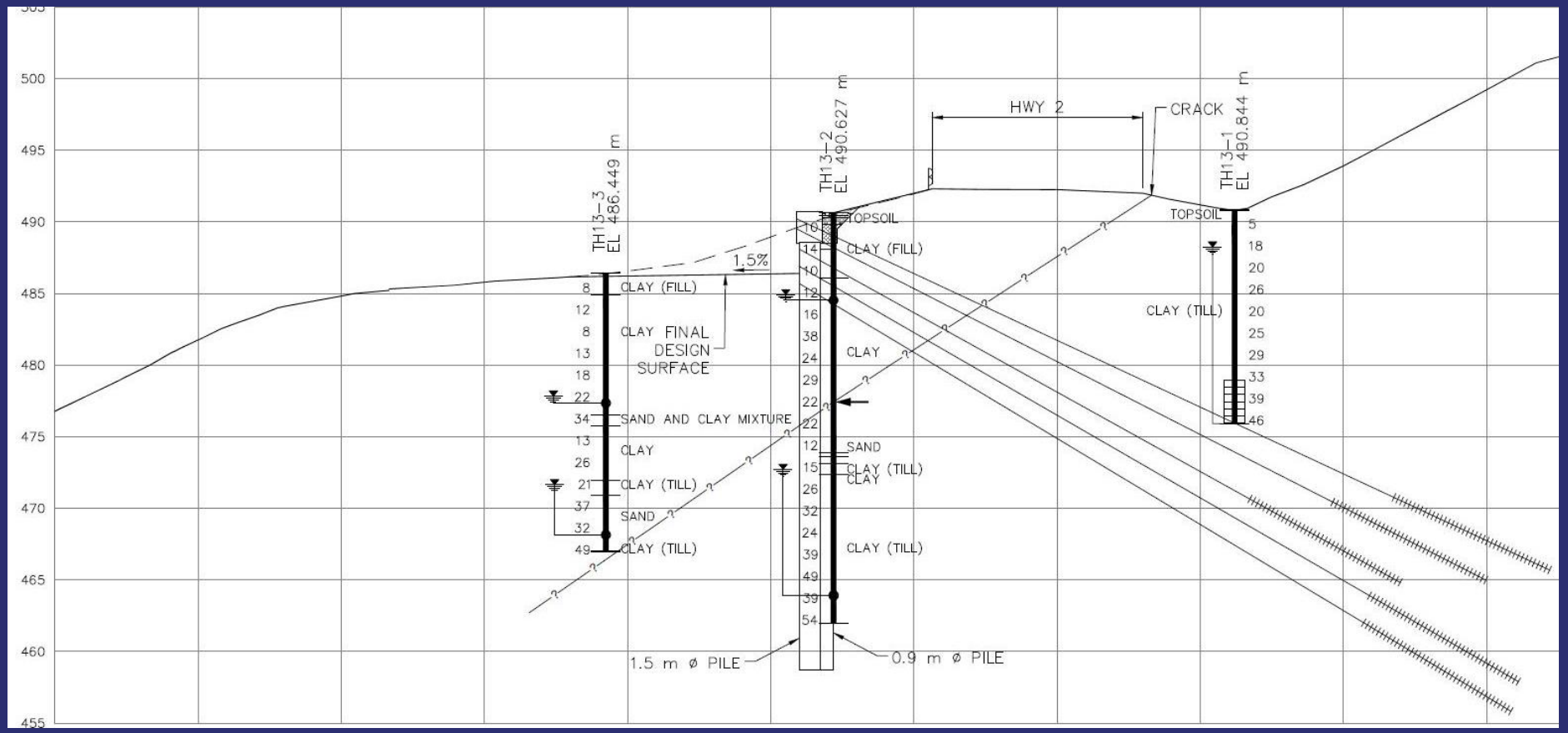

Design Section 4

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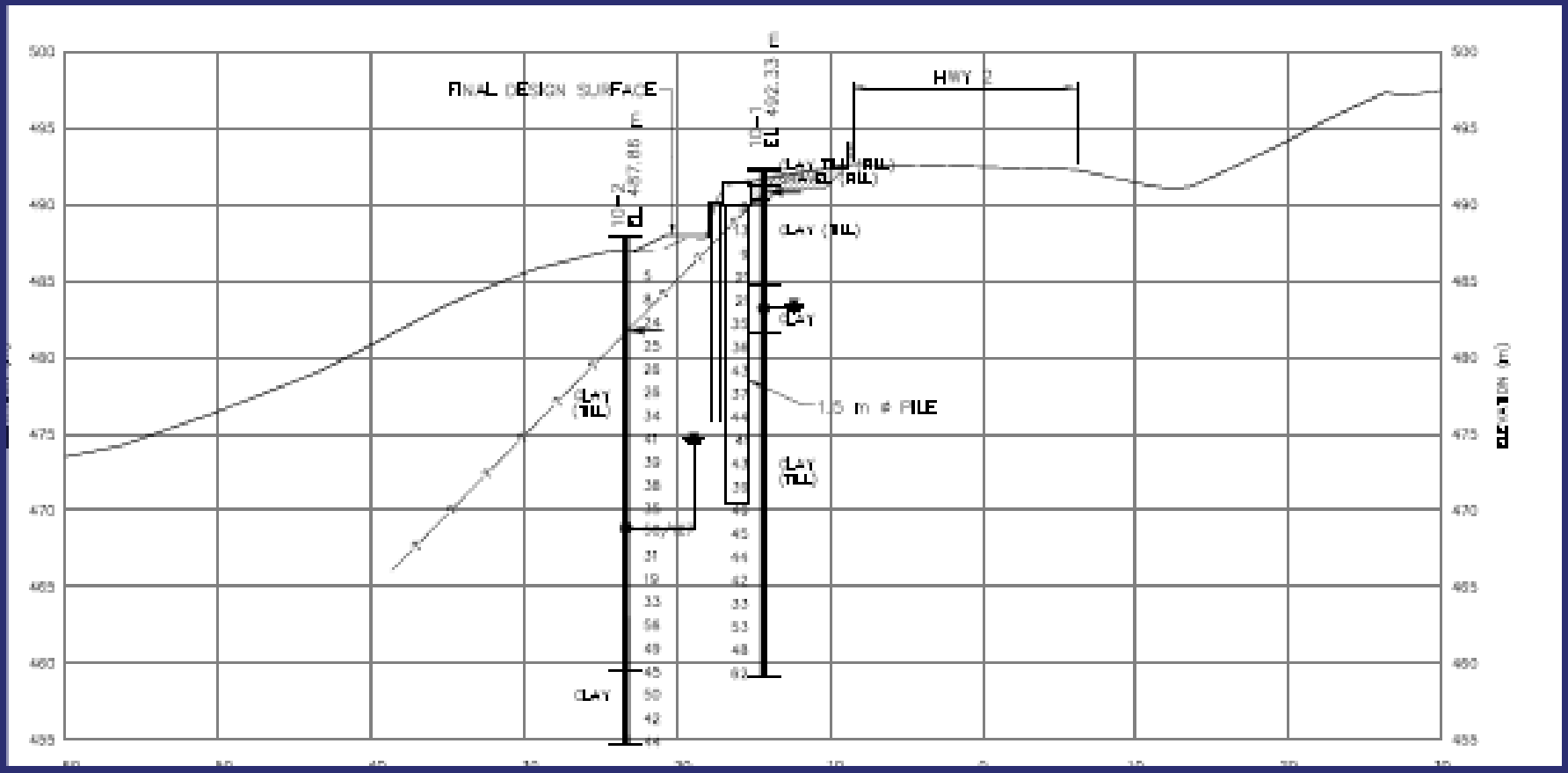

Design Section 5 for New Cantilever at Old Wall

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- 60 Weeks (Aug. ‘16 to Oct.’17)
- 7,000 m3 Earthworks
- 4,600 m3 Pile Class concrete (154 piles)
  - (67) 1,5 m diameter piles (30 m)
  - (62) 1.2 m diameter piles (14 m / 30 m)
  - (25) 0.9 m diameter piles (18 m / 30 m)
- 660 m3 Class C concrete (walers/trough)
- 610,000 kg Steel Reinforcement
- 202 tieback anchors (35 m to 68 m)
- 270 m3 of Fillcrete/Lean Concrete

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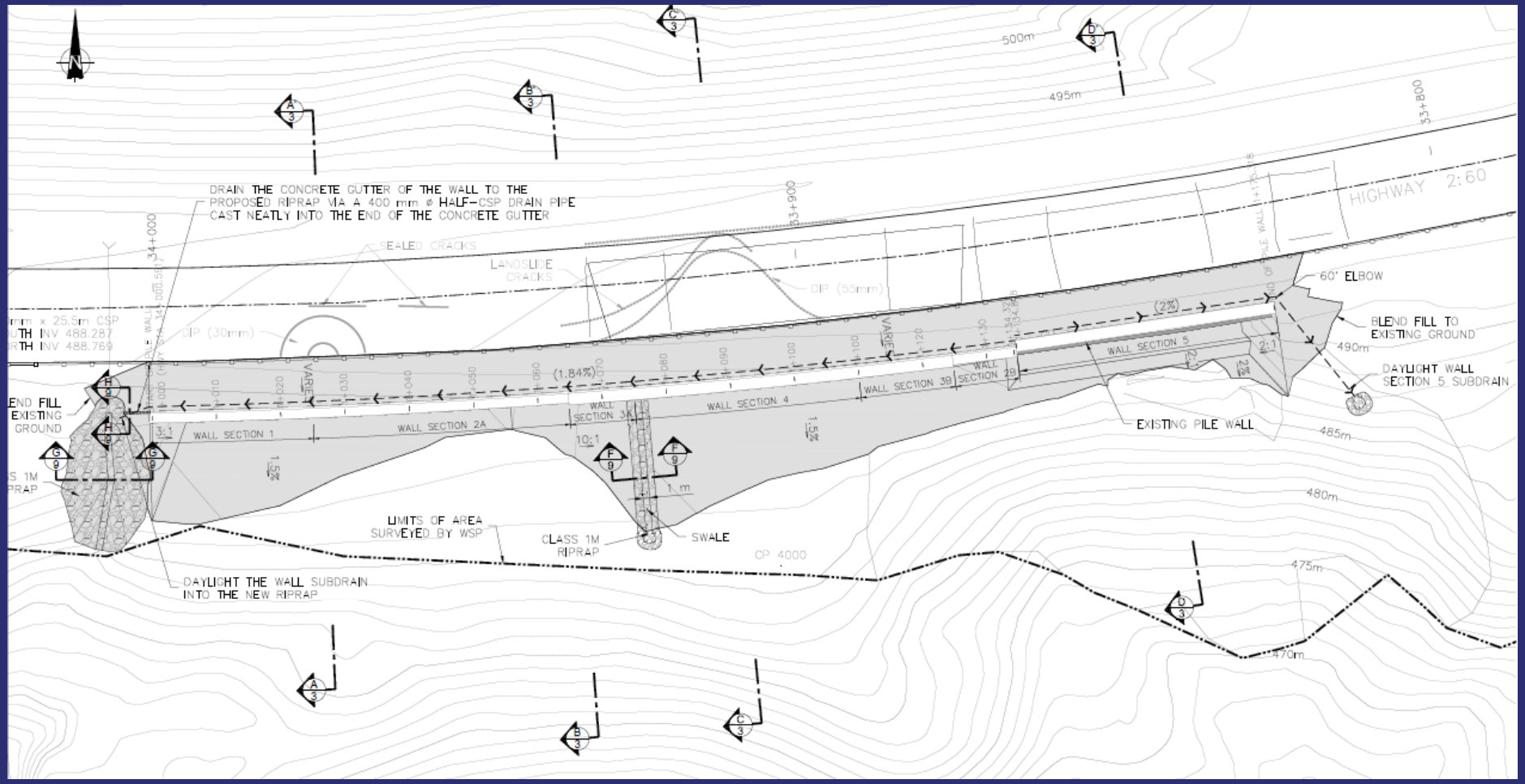

Finished Wall Design Plan

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New Pile Wall Site Prior to Construction

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Bench Preparation for Pile and Anchor Rigs

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Bauer BG-24H Piling Rig Installing Casing

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Single Lift Type 4 Steel Reinforcing Cage

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Section 1 Waler Construction with Sleeves

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Concrete Waler Transition Section 2B to 3B

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Waler Anchor fitted with VW Load Cell

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Assembled DCP Tieback anchors

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Waler Wall Section 4 Anchors Completed

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Wall Section 4 Anchor Air Rotary Rig

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Wall Section 4 Pile Anchor Proof Testing

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Wall Section 4 Anchor Auger Drilling

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Wall Section 4 Anchors Completed

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Wall Section 4 Backfill Lower Anchor Rows

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Completed Wall from East

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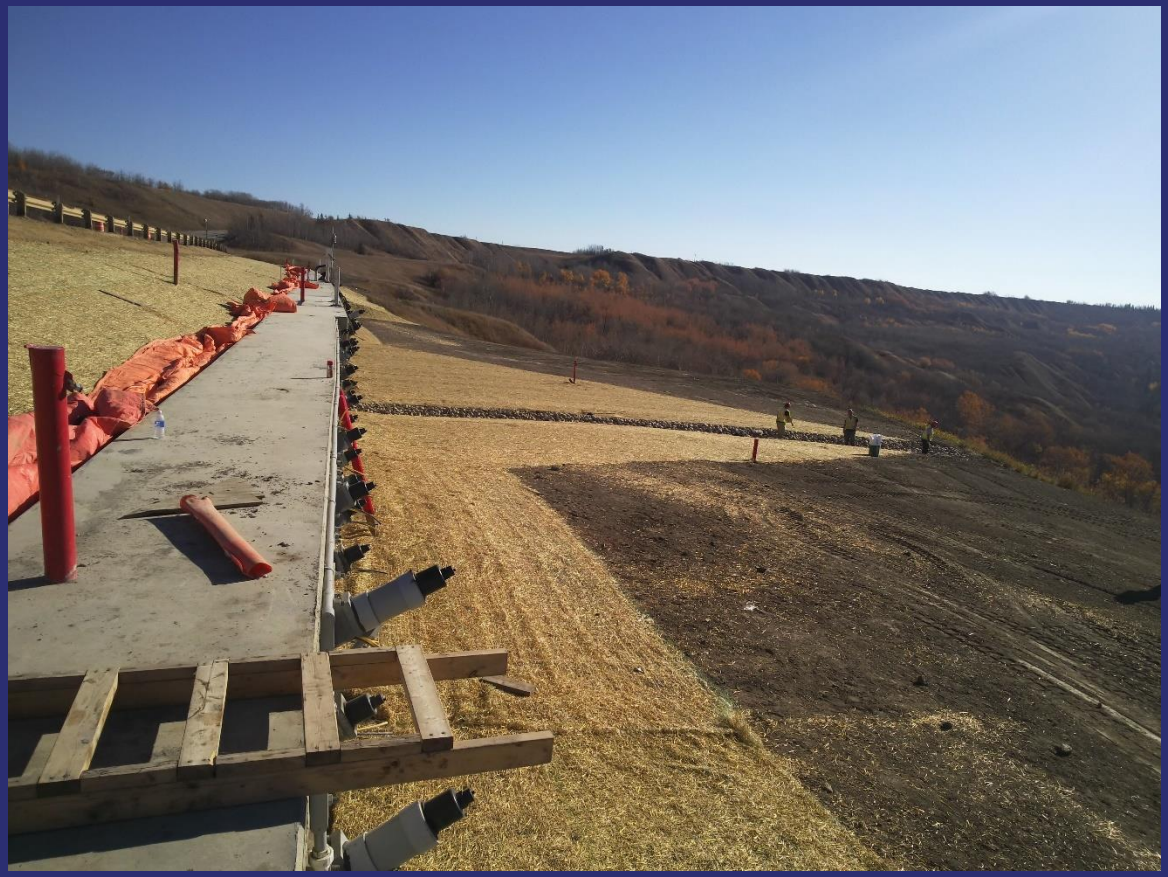

Completed Wall from West

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Completed Wall Section 4

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Acknowledgements

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Chris Dirks

Hubert Wald

Colm Hughes

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References

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Nestor, B.W., Proudfoot, D.W. & Russell, S.G.,(2018):Project Summary Report – Contract CON0017863 Hwy 2:60 km 33.84 to km 34.00 Peace River Retaining Wall Site (PH70-1) Construct Concrete Pile Wal and Other Work; Thurber Engineering Ltd., Report Number 15-16-357, March 2018.

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Questions?

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