THURBER ENGINEERING LTD.

April 5, 2024 File No.: 32079

Revision 0

Associated Engineering (B.C.) Ltd.
#500 – 2889 East 12th Avenue
Vancouver, B.C
V5M 4T5

Attention: Priscilla Tsang, M.Eng., P.Eng.

HIGHWAY 1 WIDENING – 264TH STREET TO WHATCOM ROAD
UTILITY CROSSINGS – SEGMENT 2, MT. LEHMAN
GEOTECHNICAL ASSESSMENT FOR TENDER SUBMISSION

Dear Priscilla,

At the request of Associated Engineering (B.C.) Ltd. (AE), Thurber has prepared this letter summarizing our geotechnical assessment of utilities crossing Highway 1 within Segment 2, Mt. Lehman for tender submission. A description of the overall project and Thurber's scope is provided in our Geotechnical Report for Tender Submission for Segment 2, Mt. Lehman (Geotechnical Report for Tender Submission).

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

Thurber summarized our previous geotechnical assessment for the 50% Detailed Design of utilities crossing Highway 1 within Segment 2 in our letter dated June 01, 2023. The project extents for Segment 2, Mt. Lehman are approximately between Sta. 2012+00 and about Sta. 2047+00. This is between the west limit of Segment 2 to about Townline Road.

AE provided plan and profiles of ten utilities within Segment 2, Mt. Lehman showing the proposed cuts and fills for the proposed highway widening and multi-use path (MUP). Four of the utilities are proposed to be relocated. A summary of the utilities is provided in Table 1 attached.

At the time of this letter, the civil design to relocate Profile 1 was ongoing. Geotechnical input for Profile 1 will be provided under a separate cover once the civil design is available. Plan view drawings of the subject utilities are appended to this letter.

2. GEOTECHNICAL ASSESSMENT

Our assessment included review of the proposed utility profiles and estimating the settled profile of the utility at different time periods up to 25 years after construction.

Subsurface conditions at each utility location were estimated based on current and available historic geotechnical investigation information. Further description on the subsurface conditions is included in our Geotechnical Report for Tender Submission and Factual Geotechnical Report for Segment 2.

Settlement analyses were completed using the Settle3 by Rocscience and considered the following:

- Analyses were completed based on the proposed fill thickness and utility depth as presented on the profile drawings.
- Settlement estimates are based on the projected settlement near the utility depth.
- The assumed unit weight for all new sand and gravel fill is 22 kN/m^3.
- The assumed unit weight of light-weight fill (LWF) is 11 kN/m^3 to represent a pumice fill. LWF was only considered in utility Profile C.
- Settlement models did not consider unloading effects above the utilities.

Typical geotechnical parameters used in the settlement analyses are described in Section 7.2 of our Geotechnical Report for Tender Submission. Site-specific subsurface conditions near each utility were considered based on nearby test hole information.

3. RESULTS AND DISCUSSION

3.1 Settlement

The results of the settlement analyses are summarized in Table 1. The estimated settlement magnitudes and patterns near the utility profiles are provided in Appendix A and Appendix B. Appendix A profiles are based on utility drawings provided at 50% Detailed Design. Appendix B profiles were updated based on draft 100% Detailed Design and draft Issued for Tender drawings, as noted on Table 1.

Estimating ground settlement to an accuracy of more than 25 mm is extremely difficult given the variability of ground conditions. Accordingly, the settlement magnitudes in Table 1 and settlement outputs in Appendix A and Appendix B should be used as a relative comparison.

3.2 Settlement Monitoring

AE has identified utilities that will require settlement monitoring during construction. Recommendations for settlement monitoring are provided in our Geotechnical Report for Tender

Submission. The report also provides recommendations on a settlement monitoring framework that AE can discuss and coordinate with the utility owner.

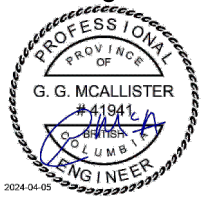
3.3 New Utility Backfill

Trench backfill between pipe bedding and pavement subbase should comply with the requirements of the jurisdiction in which the utility is being constructed. Where utilities are within the Ministry's jurisdiction, we recommend trench backfill consist of Select Granular Subbase per Ministry Standard Specification (SS) 202 compacted to 100% Standard Proctor Maximum Dry Density. Where utilities are within the City of Abbotsford's jurisdiction, we recommend trench backfill consist of Select Granular Subbase per MMCD 31 05 17, compacted to at least 95% Modified Proctor Maximum Dry Density.

4. CLOSURE

We trust this information meets your present needs. Further assessment will be carried out, as required, based on further guidance from AE based on their discussions with the utility owners. If you have any questions, please contact the undersigned at your convenience.

Yours truly,
Thurber Engineering Ltd.
Denny Ma, M.Eng., P.Eng.
Review Engineer



Thurber Engineering Ltd.
Permit to Practice #1001319

Graeme McAllister, MASc., P.Eng.
Geotechnical Engineer

Attachments:
Statement of Limitations and Conditions
Table 1: Summary of Settlement Analyses
Appendix A: Settlement Plots and Utility Profiles Based on 50% Detailed Design Drawings
Appendix B: Settlement Plots and Utility Profiles Based on draft 100% Detailed Design Drawings and draft Issued for Tender Drawings
Appendix C: Utility Plan View Drawings

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STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client, the BC Ministry of Transportation and Infrastructure (MoTI) and Authorized Users as defined in the MoTI Special Conditions Form H0461d. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Any use which an unauthorized third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any unauthorized third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Table 1: Summary of Settlement Analyses
Highway 1 Widening – 264th Street to Whatcom Road
Utility Crossings – Segment 2, Mt. Lehman
Geotechnical Assessment for Tender Submission – Rev. 0

PROFILE	LOCATION	UTILITY	STAGE OF HIGHWAY DESIGN FOR SETTLEMENT ANALYSIS[a]	MAXIMUM SETTLEMENT ESTIMATE[c] (mm)	ESTIMATED SETTLEMENT PROFILE FIGURE NO.	NOTE
A	2015+00	Telus Fibre Optic (size unknown)	N/A	N/A	N/A	50% DD removed fill over MUP. No additional settlement impact from proposed widening.
B	2024+20	Telus Fibre Optic (size unknown)	50% DD	50	A1	
1	2026+43	250 PVC San w/ Steel Casing	-	-	B1 (figure not include - to be included with future memo)	Proposed new utility. Geotechnical assessment to be provided under separate cover pending relocation design for utility.
C	2027+02	114 Steel DP	Draft IFT	65	B4	LWF[b] for embankment construction
2	2027+02	114 Steel DP	Draft IFT	60	B4	
3	2027+89	300 DI Water w/ Steel Casing	Draft 100% DD	<25	B2 (Proposed Profile)	Proposed new utility
4	2027+93	600 DI Water w/ Steel Casing	Draft 100% DD	<25	B2 (Proposed Profile)	Proposed new utility
5	2036+35	Telus Fibre Optic (size unknown)	50% DD	40	A2	
6	2038+39	600 PVC SAN w/ Steel Casing	Draft IFT	35	B3 (Proposed Profile)	Proposed new utility
7	2038+75	600 PVC San w/ Steel Casing	50% DD	25	A3	

Notes:

a. DD = Detailed Design
b. LWF = Light Weight Fill
c. Estimated maximum settlement corresponds to 25 years after construction.

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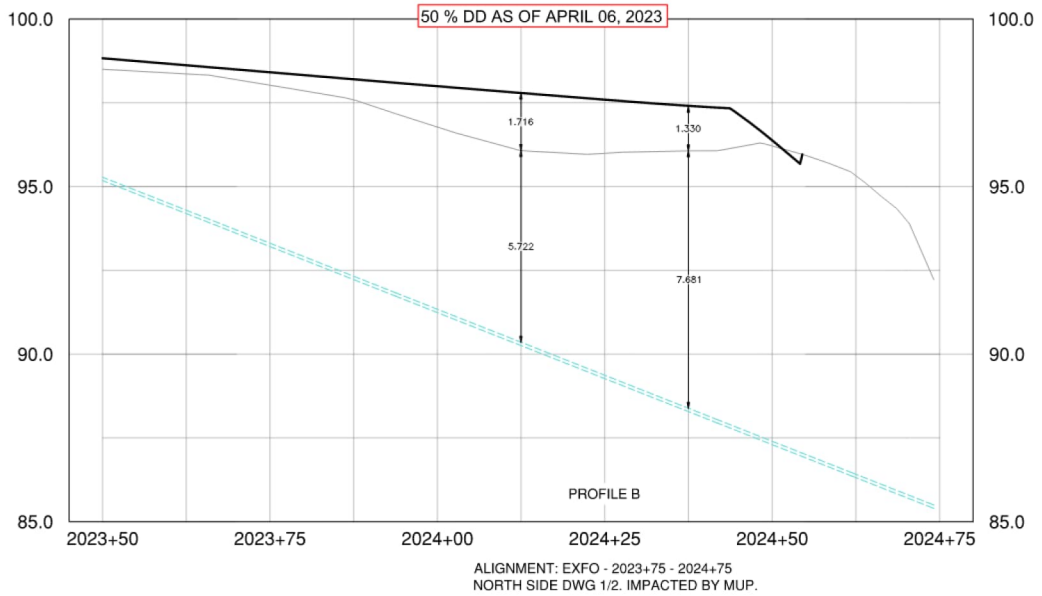
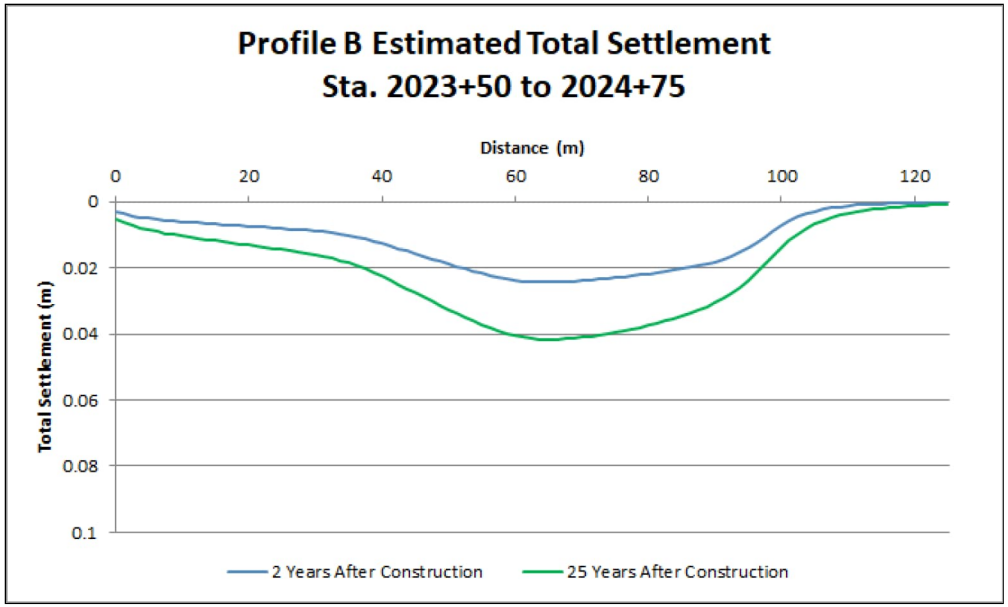
APPENDIX A: SETTLEMENT PLOTS AND UTILITY PROFILES BASED ON 50% DETAILED DESIGN DRAWINGS





LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE	DRAWN BY: GGM	DATE: 2023-05-26	
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE B	DESIGNED BY: GGM	SCALE: -	
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079	
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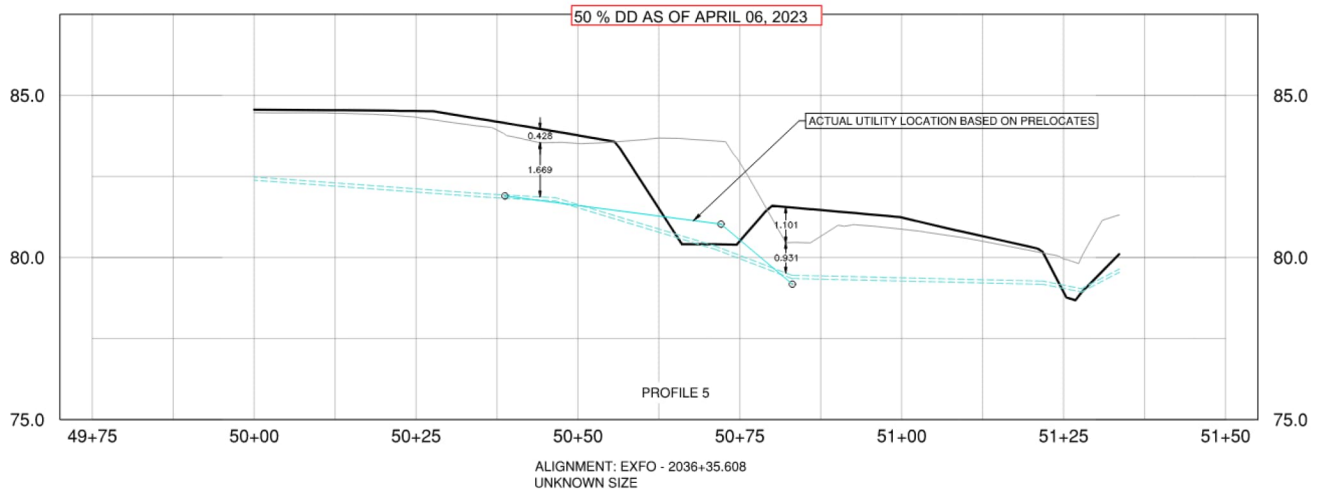

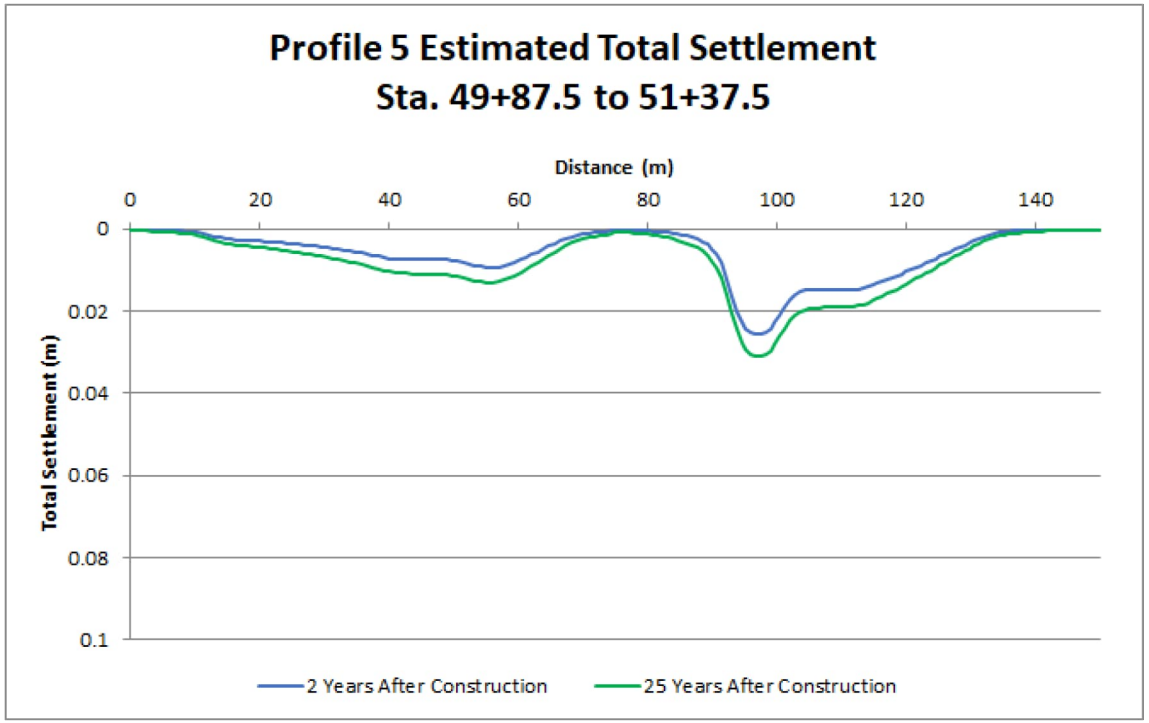

LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

Assessment doesn't consider rebound effects from fill removal.

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: GGM	DATE: 2023-05-26
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE 5		DESIGNED BY: GGM	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
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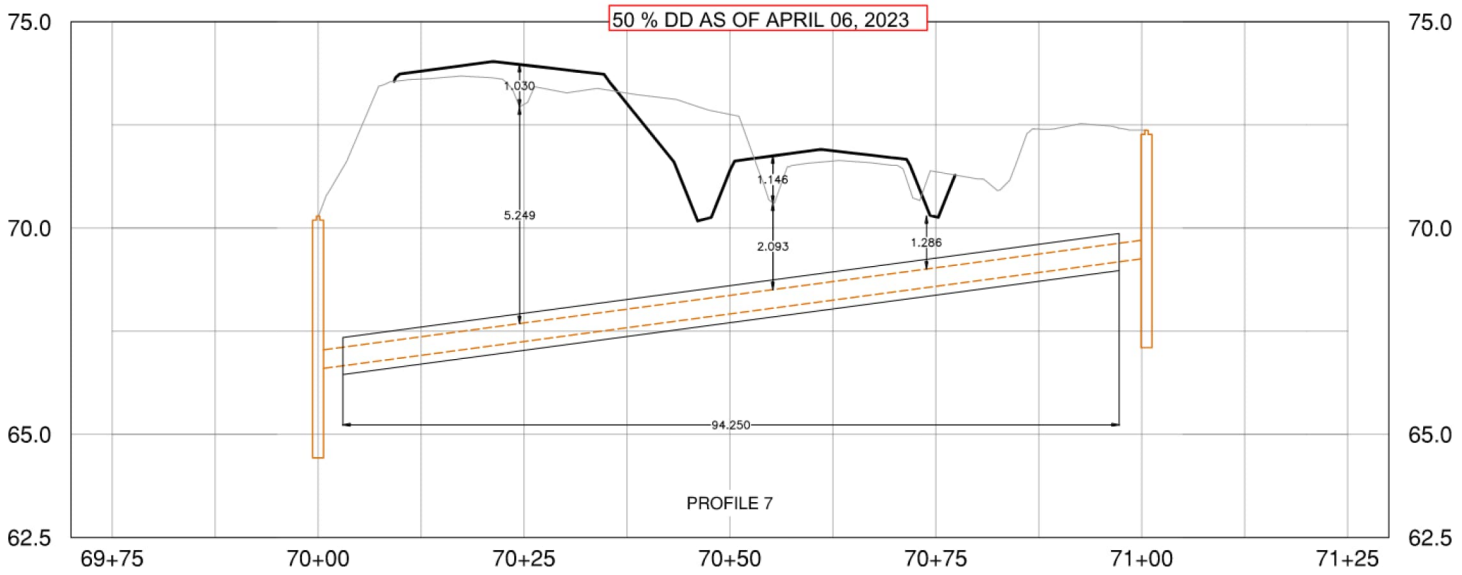
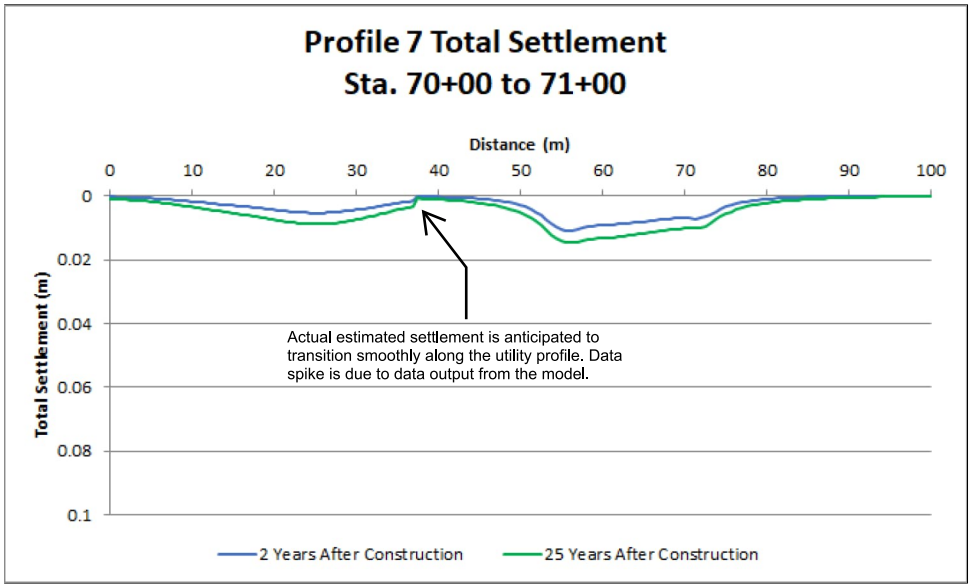


ALIGNMENT: EXSAN - 2038+75.160
600 mm PVC WITH 900 mm STEEL CASING



LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

Assessment doesn't consider rebound effects from fill removal.

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: GGM	DATE: 2023-05-26
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE 7		DESIGNED BY: GGM	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
		DRAWING / FIGURE No.: A3	REV.: 0

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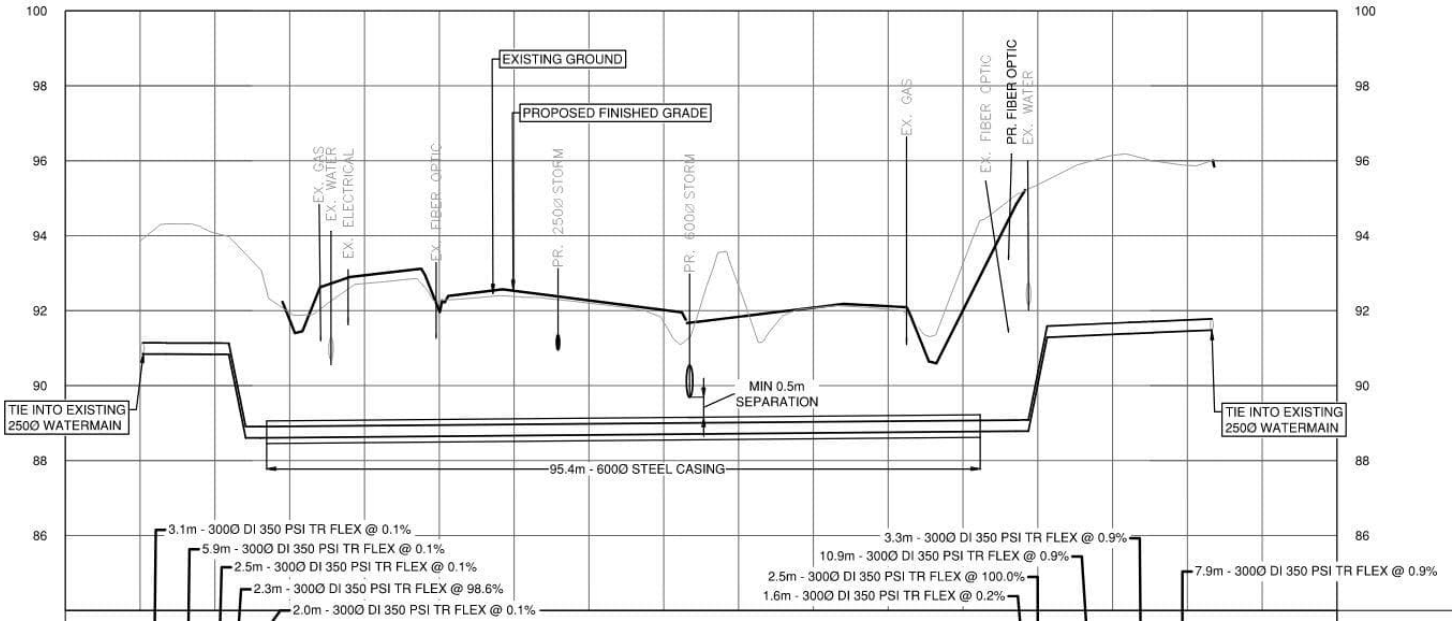
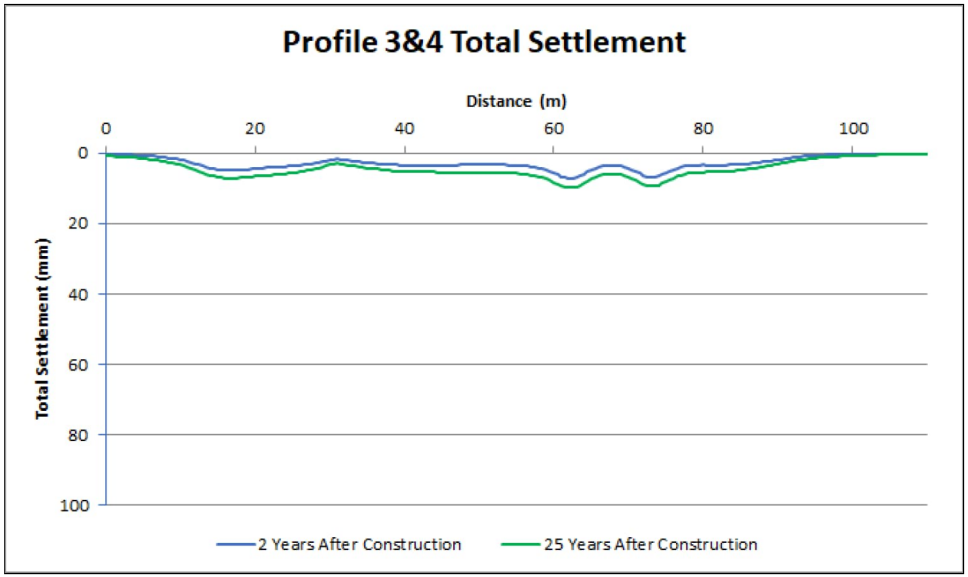
APPENDIX B: SETTLEMENT PLOTS AND UTILITY PROFILES BASED ON 100% DETAILED DESIGN AND IFT DRAFT DRAWINGS





LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

Assessment doesn't consider rebound effects from fill removal

Grade increase at south end Profile 4 not considered

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: GGM	DATE: 2023-08-10
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE 3 & 4		DESIGNED BY: GGM	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
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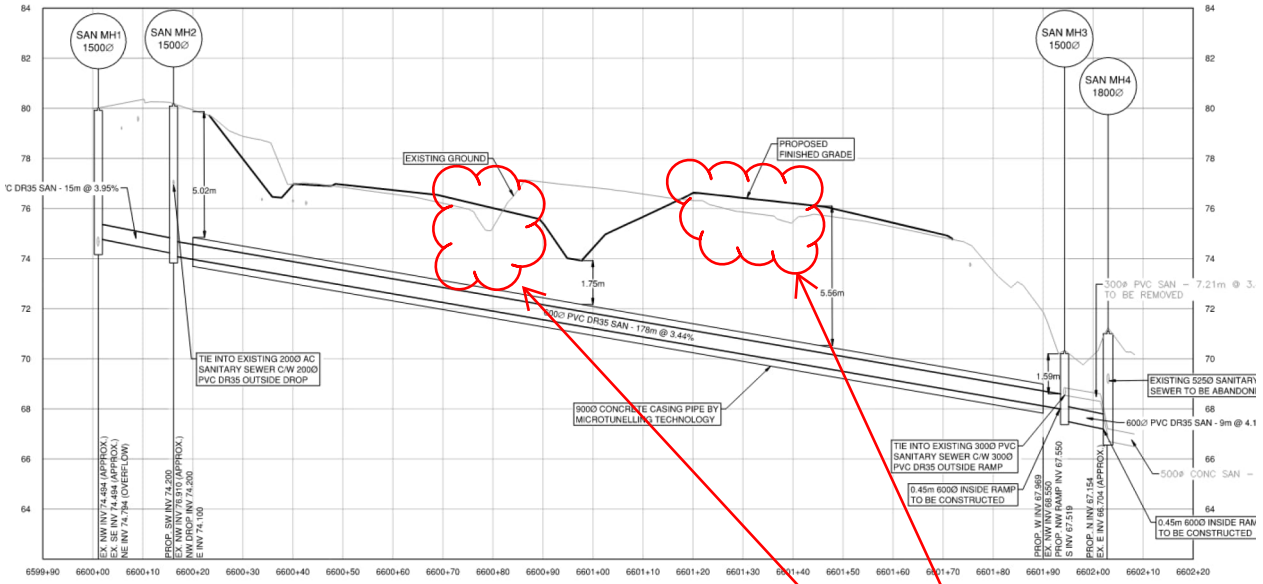

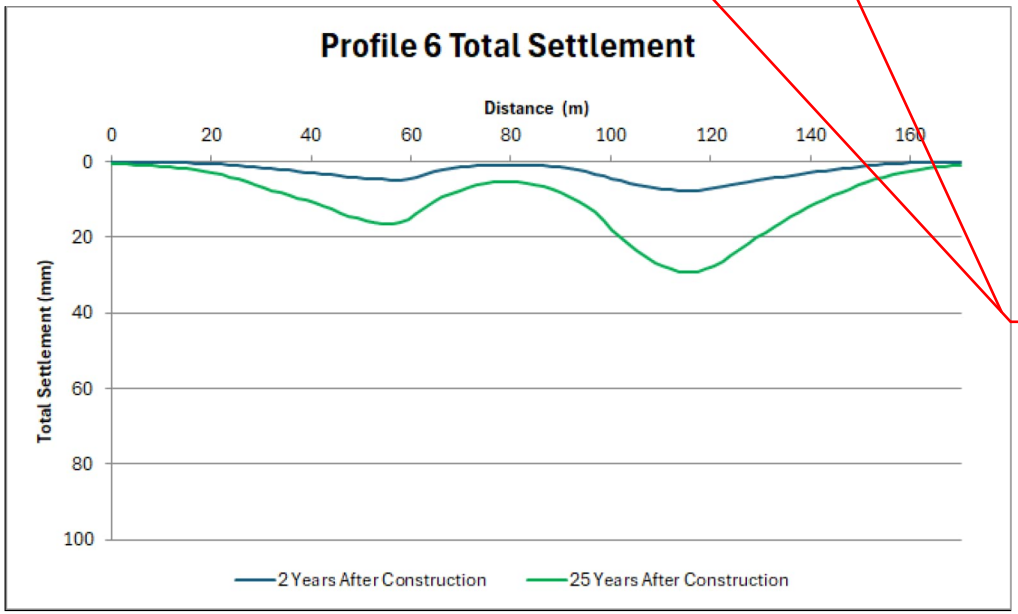

Assessment assumes fill increases >0.3 m placed to design grade at least 4 months prior to installation of sewer. Early fill placement should extend at least 12 m east & west of sewer (24 m total centered on sewer).

LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

Assessment doesn't consider rebound effects from fill removal

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: GGM	DATE: 2024-03-21
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE 6 - REVISED ALIGNMENT		DESIGNED BY: GGM	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
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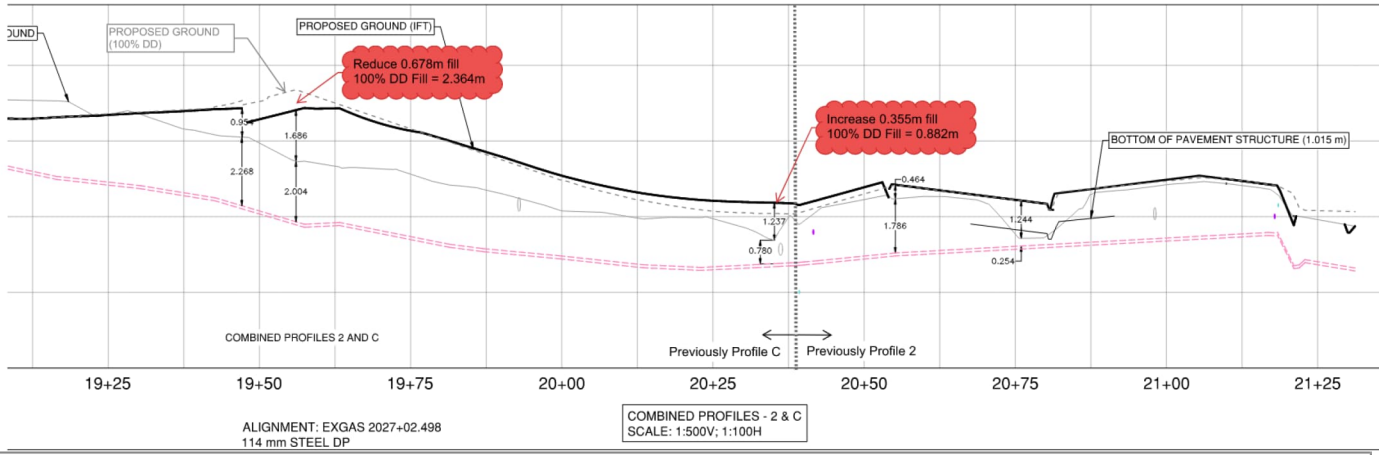

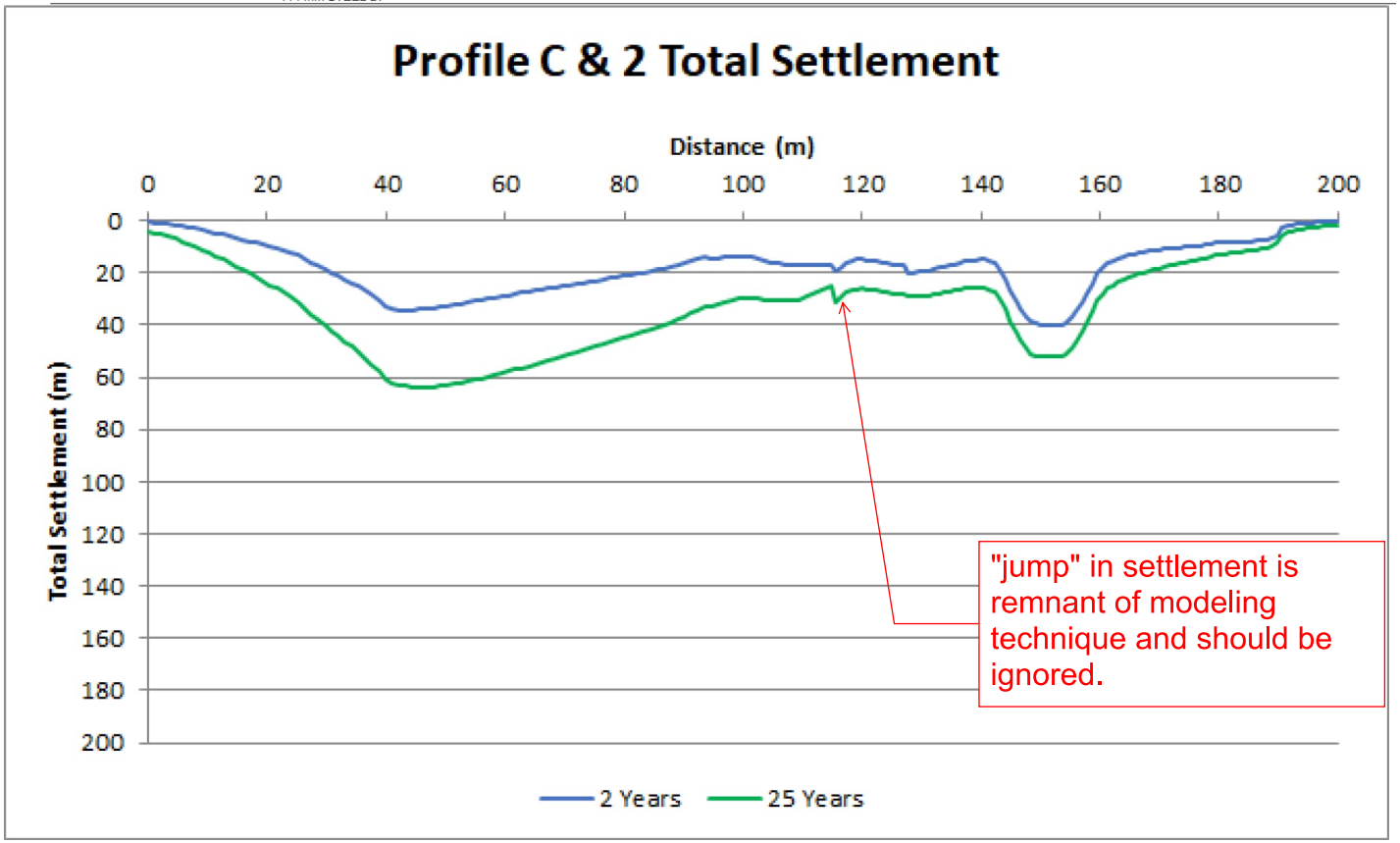

LEGEND / NOTES

Settlement estimates are based on the projected settlement near the utility depth

Analysis based on light-weight fill (unit weight 11 kN/m3) for Profile C embankment construction to underside of MUP gravel base course

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: GGM	DATE: 2024-04-04
DRAWING TITLE: ESTIMATED SETTLEMENT AT UTILITY PROFILE C & 2		DESIGNED BY: GGM	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
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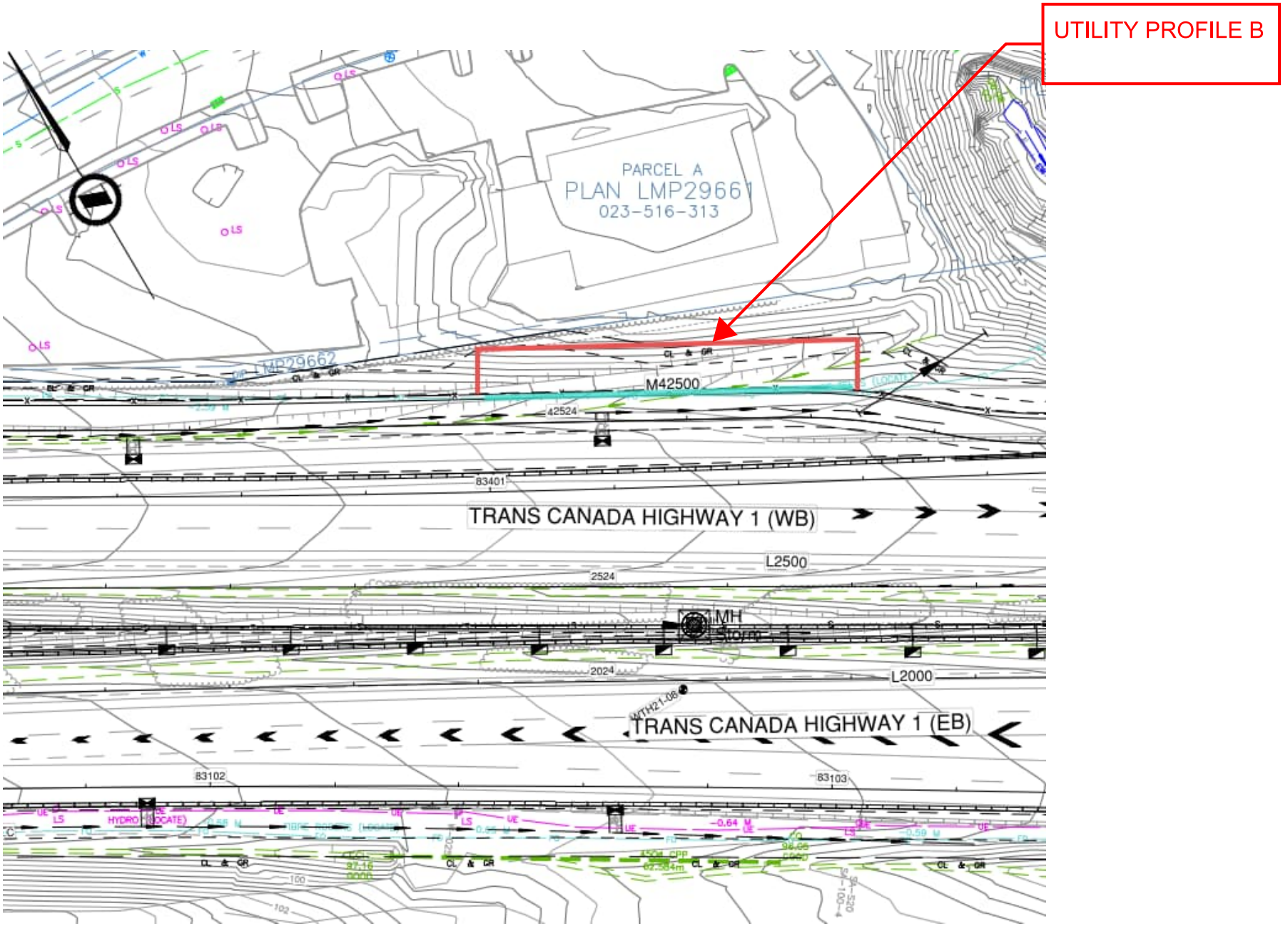
APPENDIX C: UTILITY PLAN VIEW DRAWINGS



LEGEND / NOTES

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		DRAWN BY: YS	DATE: 2023-12-08
DRAWING TITLE: UTILITY PROFILE B - PLAN VIEW		DESIGNED BY: -	SCALE: -
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC		APPROVED BY: DM	PROJECT No.: 32079
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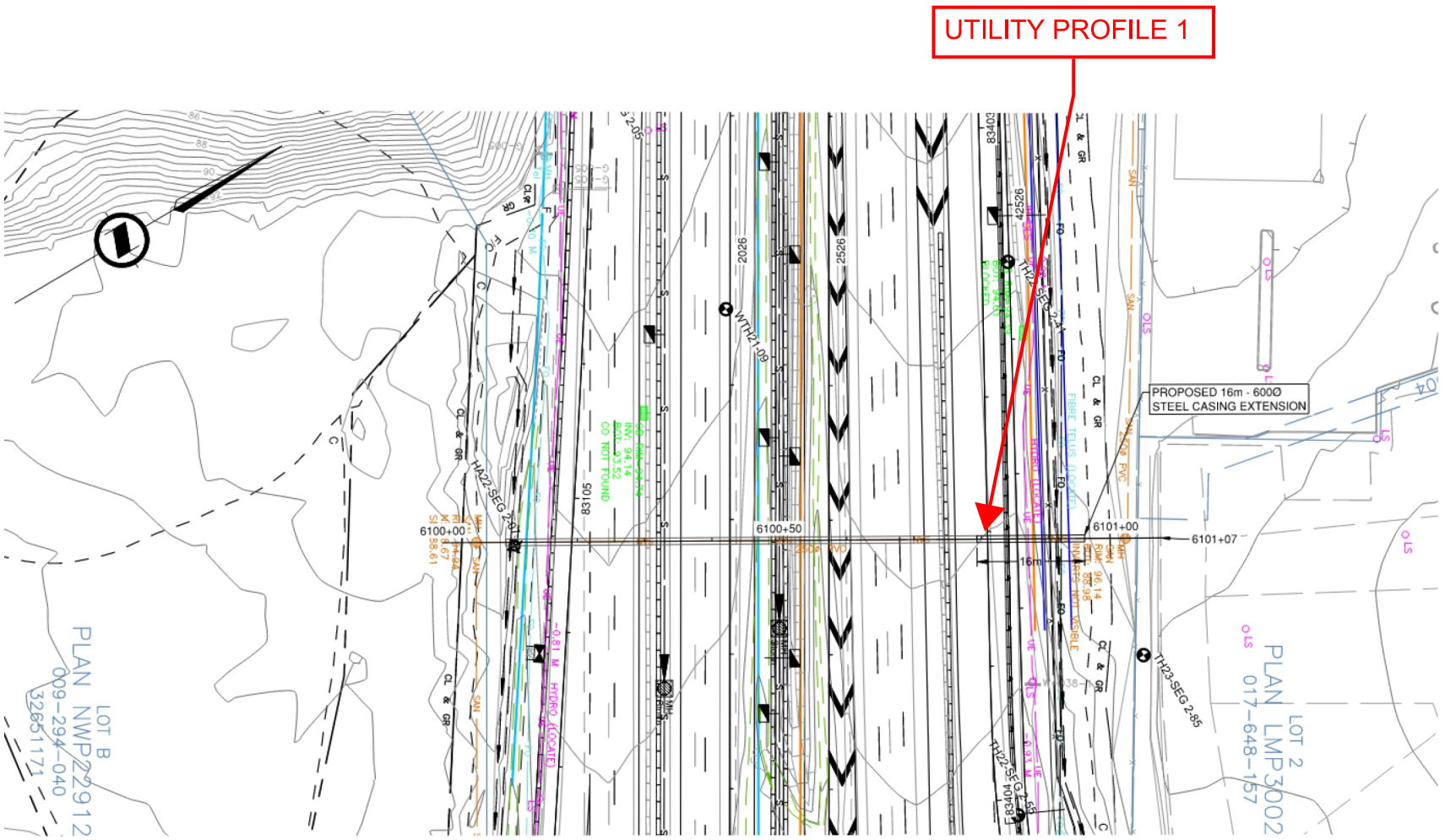

PROFILE 1 TO BE RELOCATION - PENDING CIVIL DESIGN

LEGEND / NOTES		CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE	DRAWN BY: YS	DATE: 2023-12-08
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		PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079
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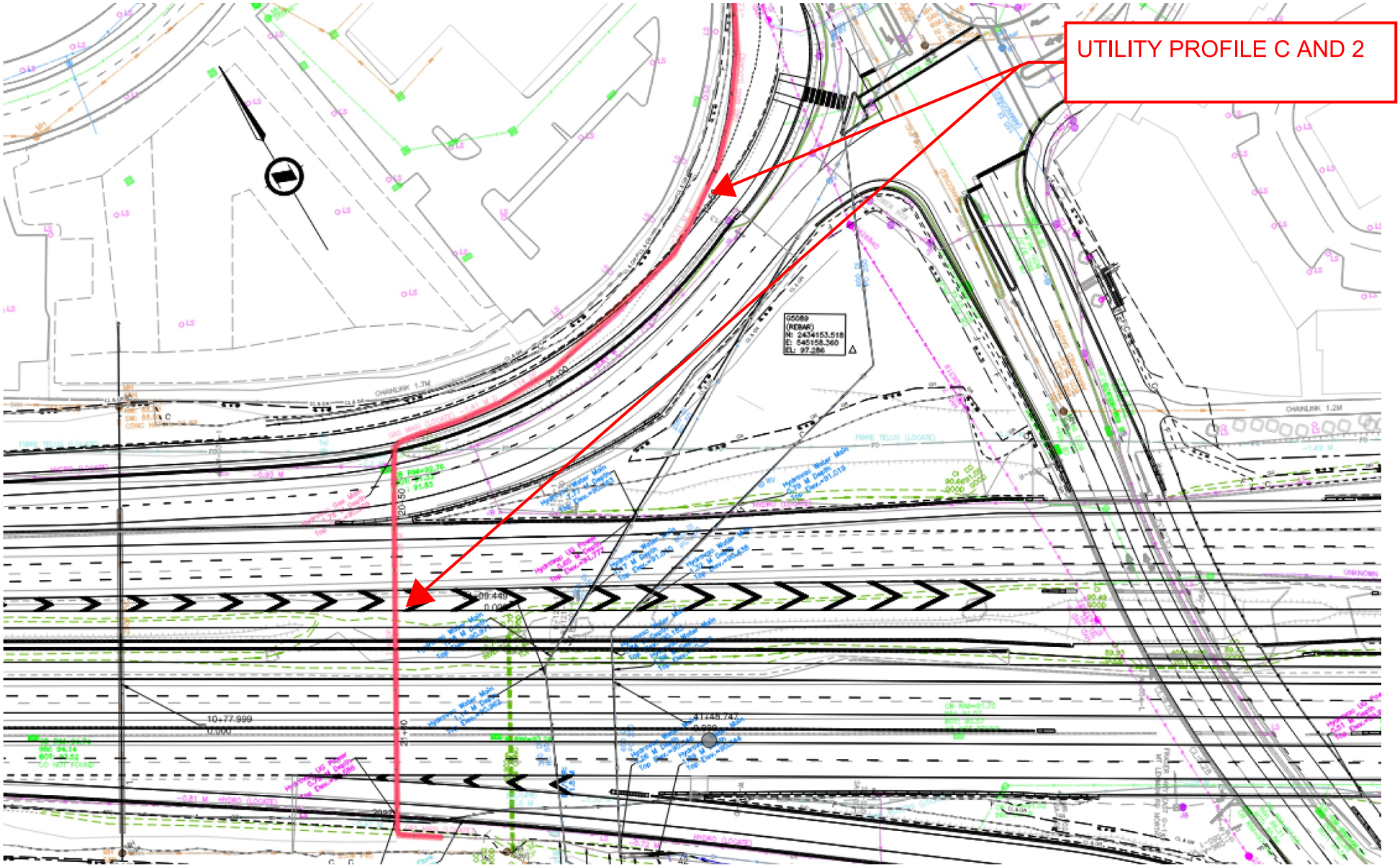

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	THURBER	DRAWING TITLE: UTILITY PROFILE C AND 2 - PLAN VIEW	DESIGNED BY: -	SCALE: -
		PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079
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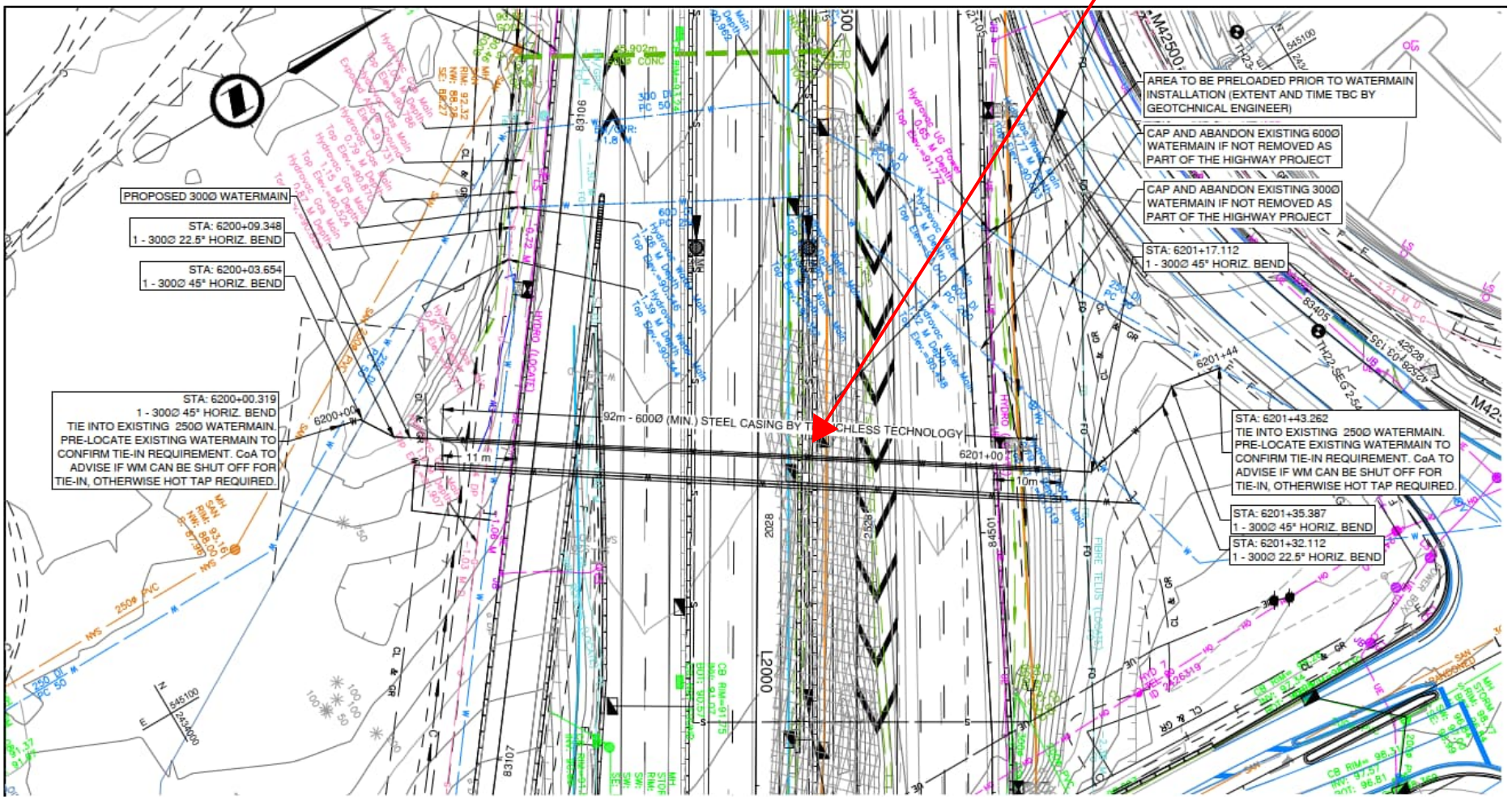
UTILITY PROFILE 3



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		PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079
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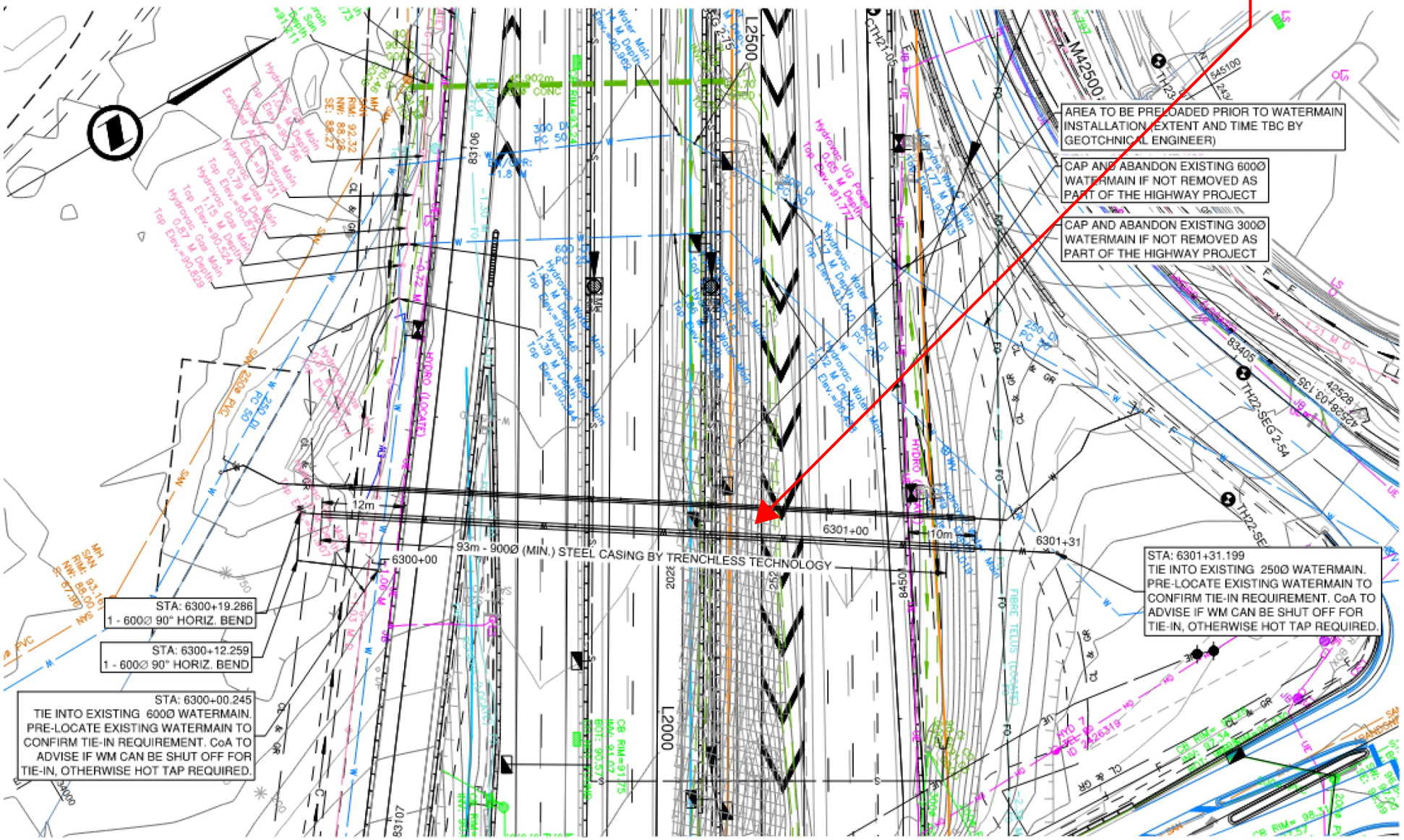
UTILITY PROFILE 4



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		PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079
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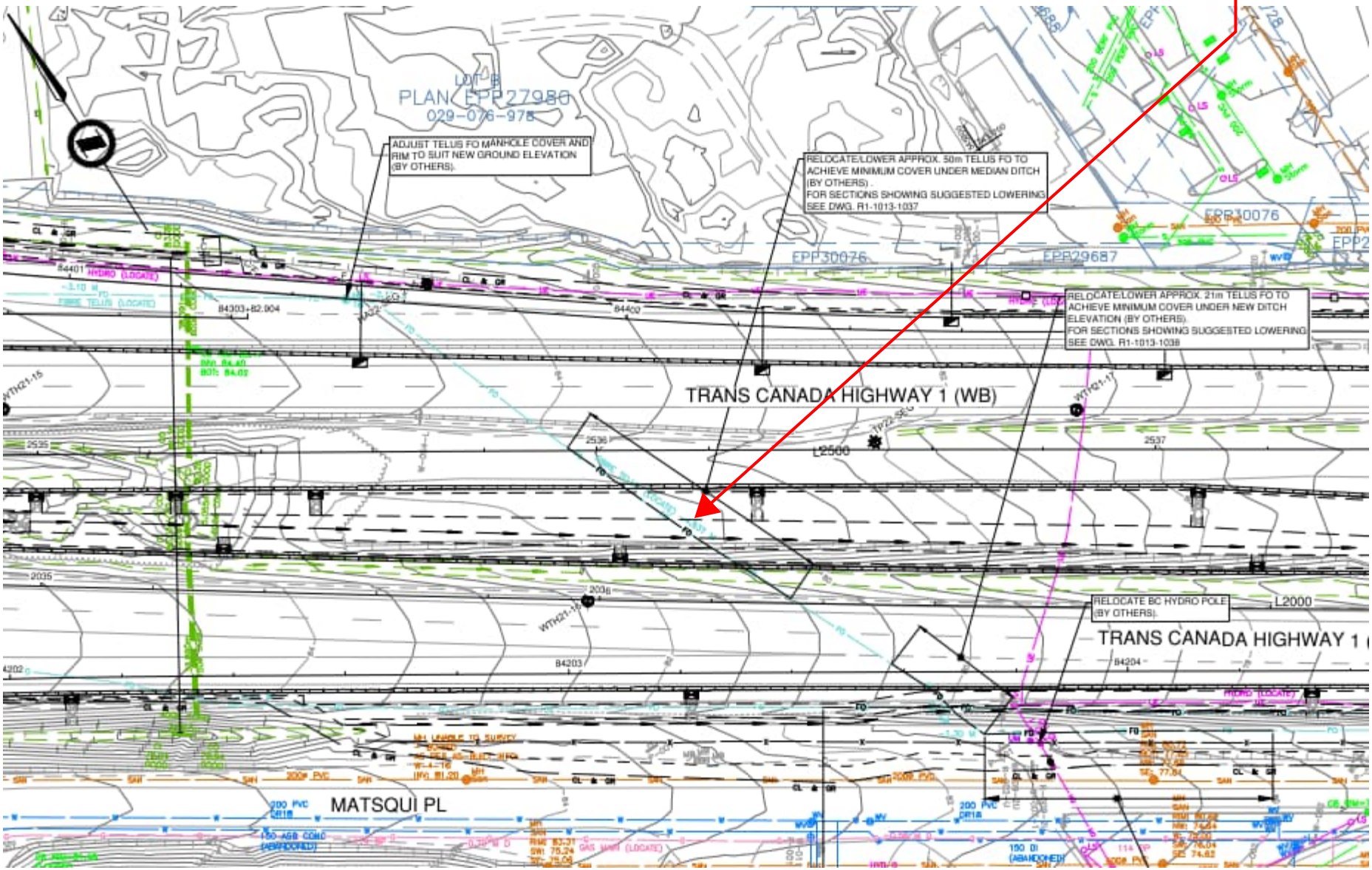
UTILITY PROFILE 5



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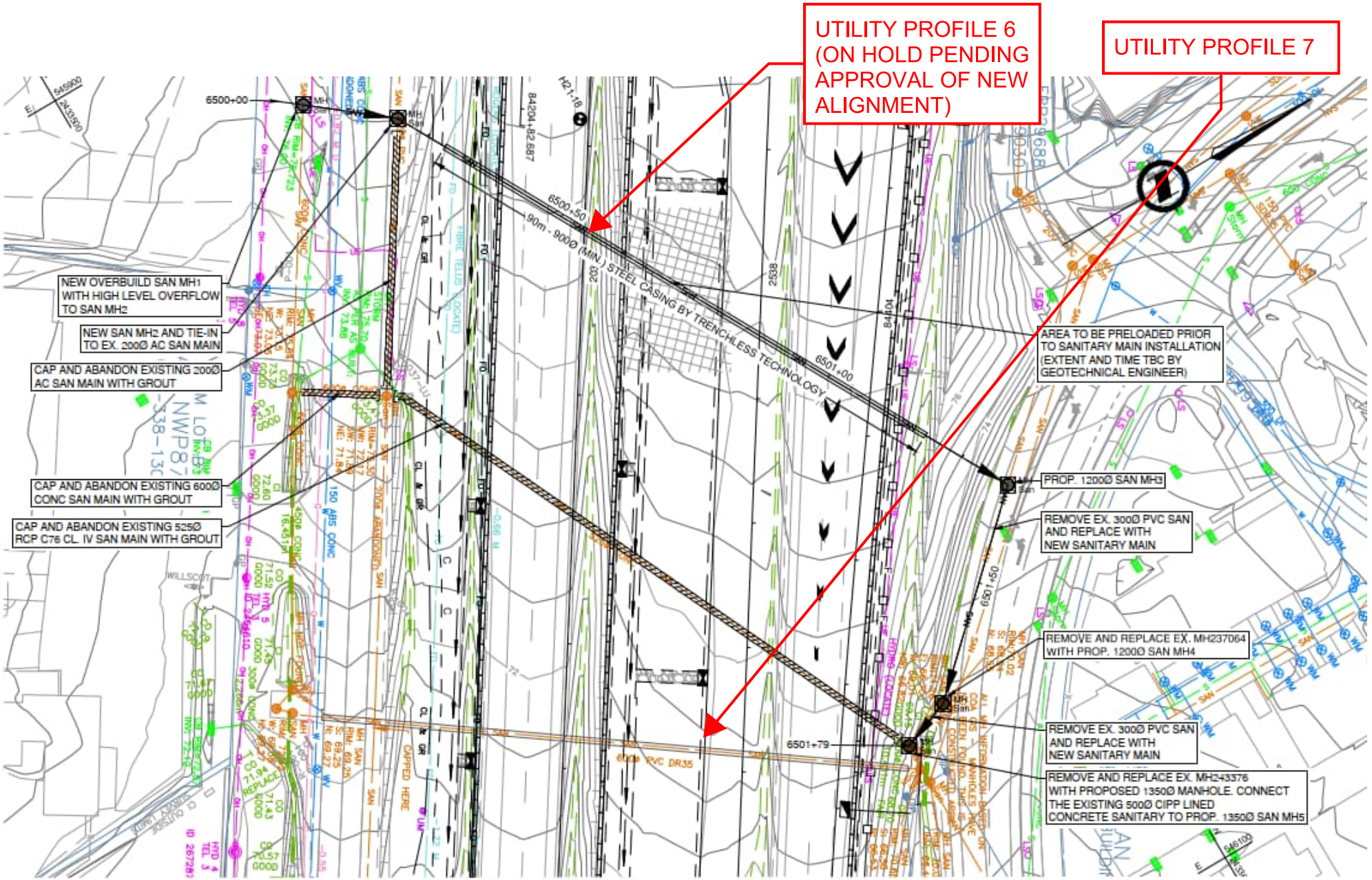
		PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079
			DRAWING / FIGURE No.: C6	REV.: 0



LEGEND / NOTES

THURBER

CLIENT NAME: BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE	DRAWN BY: YS	DATE: 2023-12-08	
DRAWING TITLE: UTILITY PROFILE 6 & 7 - PLAN VIEW	DESIGNED BY: -	SCALE: -	
PROJECT NAME AND LOCATION: HIGHWAY 1 WIDENING - 264th STREET TO WHATCOM ROAD SEGMENT 2, MT. LEHMAN, ABBOTSFORD, BC	APPROVED BY: DM	PROJECT No.: 32079	
	DRAWING / FIGURE No.: C7	REV.: 0	