

Site Number	Location	Name	Hwy
SH016	HWY 49:12	Little Smoky River, West Bank Instability	49:12
Legal Description:		UTM Co-ordinates	
10-33-74-21 W5		11U E 489600	N 6145512

Current Monitoring:	17-May-2024	Previous Monitoring	08-Oct-2023
Instruments Read By:	Mr. Niraj Regmi, G.I.T., and Mr. Nixson Mationg, Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs): N/A	Pneumatic Piezometers (PN): N/A	Vibration Wire Piezometers (VW): VW21-7 ^a VW21-7B, VW21-8 ^a VW21-8B VW21-9 ^a VW21-9B	Standpipe Piezometers (SP): N/A
Load Cell (LC): N/A	Strain Gauges: N/A	SAAs: N/A	Others:

Readout Equipment Used			
Slope Inclinometers:	Pneumatic Piezometers:	Vibration Wire Piezometers: Three RST DT2055 dataloggers	Standpipe Piezometers:
Load Cell:	Strain Gauges:	SAAs:	Others:
Note: Dataloggers were installed in January 2023 with the intention of gaining a better understanding of seasonal or cyclical trends tied to longer term climatic triggers.			

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	<p>Vibrating wire piezometers VW21-7A showed an increase in groundwater level of 0.01 m, while VW21-7B showed a decrease in groundwater level of 0.03 m since the fall of 2023 readings. VW21-7A and VW21-7B recorded ground water levels of 490.23 m and 489.67 m on April 17, 2024. These are the highest groundwater levels in the instruments since initialization</p> <p>Vibrating wires VW21-8A and VW21-9A showed decreases in groundwater levels of 0.15 m and 0.13 m, respectively, since the fall of 2023 readings. VW21-8B and VW21-9B showed increases in groundwater level of 0.60 m, and 0.17 m, respectively, since the fall of 2023 readings. VW21-9B, registered all-time high groundwater level of 492.28 m on April 18, 2024.</p> <p>VW21-8A had initially shown a trend of slowly increasing groundwater levels since datalogger readings began in January 2023, but has appeared to have plateaued or slightly decreased since the spring of 2023 readings. VW21-8B had shown a similar trend but since July 2021 (shortly after installation) and has continued increasing to current date. The remaining piezometers have shown relatively little change in groundwater level since they were initialized. Additional readings will be required to understand the annual cycle of the piezometers. The</p>

	annual variation in groundwater level (based on one year's data) was relatively minimal.
Future Work:	The instruments should be read again in the fall of 2024.
Instrumentation Repairs:	No instrument repairs are required at this time.
Additional Comments:	The University of Alberta assessed the fibre optic cables continuity in Fall 2023. If the cables are still intact, another set of readings may be arranged. A program involving precise surveying of monitoring points installed at various locations on the bridge and bridge foundations was proposed to TEC's bridge group to assist in tracking bridge movements and timing for adjustments to the foundations. If this program is conducted, the tops of the three sheared SI's could also be monitored to gauge ground movements at those locations.

Attachments:	<ul style="list-style-type: none"> • Table SH016-1 Spring 2024 – HWY 49:12 Little Smoky River Bridge, Slope Inclinator Instrumentation Reading Summary • Table SH016-2 Spring 2024 – HWY 49:12 Little Smoky River Bridge, Vibrating Wire Piezometer Instrumentation Reading Summary • Statement of Limitations and Conditions • APPENDIX A – SH016 SPRING 2024 <ul style="list-style-type: none"> ○ Field Inspector's report ○ Site Plan Showing Approximate Instrument Locations (Drawing No. 32121 SH016-1) ○ Figure SH016-1 (Vibrating Wire Piezometer Elevations) ○ Figure SH016-2 (Vibrating Wire Piezometer Depths)
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We trust this report meets your requirements at present. If you have any questions, please contact the undersigned at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, M.Eng., P. Eng.
Partner | Senior Geotechnical Engineer

Lucas Green, P.Eng.
Geotechnical Engineer



Table SH016-1 Spring 2024 – Hwy 49:12, Little Smoky River Bridge Slope Inclinometer Instrumentation Reading Summary

Date Monitored: Not Monitored

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	AVERAGE RATE OF MOVEMENT OVER MONITORING PERIOD (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
<i>SI21-7</i>	<i>June 14, 2021</i>	<i>7.2 mm over 11.6 m to 13.5 m in 91° direction</i>	<i>25.7 in July 2021</i>	<i>Sheared at 13.4 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>SI21-8</i>	<i>June 14, 2021</i>	<i>7.5 mm over 9.3 m to 11.1 m in 86° direction</i>	<i>35.6 in July 2021</i>	<i>Sheared at 11.0 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>SI21-9</i>	<i>June 14, 2021</i>	<i>9.3 mm over 15.3 m to 16.5 m in 61° direction</i>	<i>32.0 in July 2021</i>	<i>Sheared at 16.5 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>

Drawing 32121-SH016 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



Table SH016-2 Spring 2024 – Hwy 49:12, Little Smoky River Bridge Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: May 17, 2024

INSTRUMENT	DATE INITIALIZED	GROUND ELEVATION (m)	TIP DEPTH (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEVATION (m)	CURRENT GROUNDWATER ELEVATION (m)	PREVIOUS GROUNDWATER ELEVATION* (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
VW21-7A	June 10, 2021	492.42	5.00	Operational	490.23 on April 17, 2024	489.65	489.64	0.01
VW21-7B	June 20, 2021	492.42	12.00	Operational	489.67 on April 17, 2024	489.13	489.16	-0.03
VW21-8A	June 16, 2021	493.89	5.00	Operational	492.46 on July 11, 2023	491.71	491.86	-0.15
VW21-8B	June 16, 2021	493.89	14.00	Operational	482.46 on August 2, 2023	482.39	481.79	0.60
VW21-9A	June 16, 2021	500.36	9.80	Operational	494.13 on August 25, 2023	493.46	493.59	-0.13
VW21-9B	June 16, 2021	500.36	19.04	Operational	492.28 on April 18, 2024	492.06	491.89	0.17

Drawing 32121-SH016 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site

* Previous groundwater elevation on June 10, 2023



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.

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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.

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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

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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

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THURBER ENGINEERING LTD.

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2024

**APPENDIX A
DATA PRESENTATION**

SITE SH016: HWY 49:12, LITTLE SMOKY RIVER BRIDGE

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (SH016)
SPRING 2024**

Location: HWY 49:12 LITTLE SMOKY RIVER WEST BANK INSTABILITY	Read Out: Downloaded
File Number: 32121	Temp: 5/Rain
	Read by: NKR/NRM

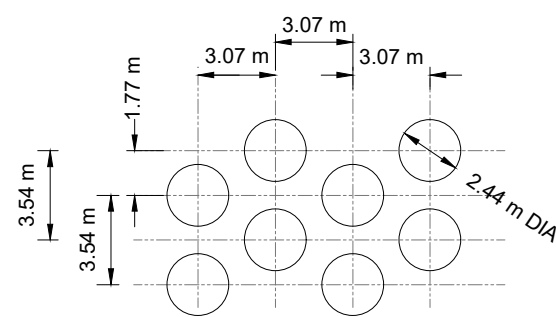
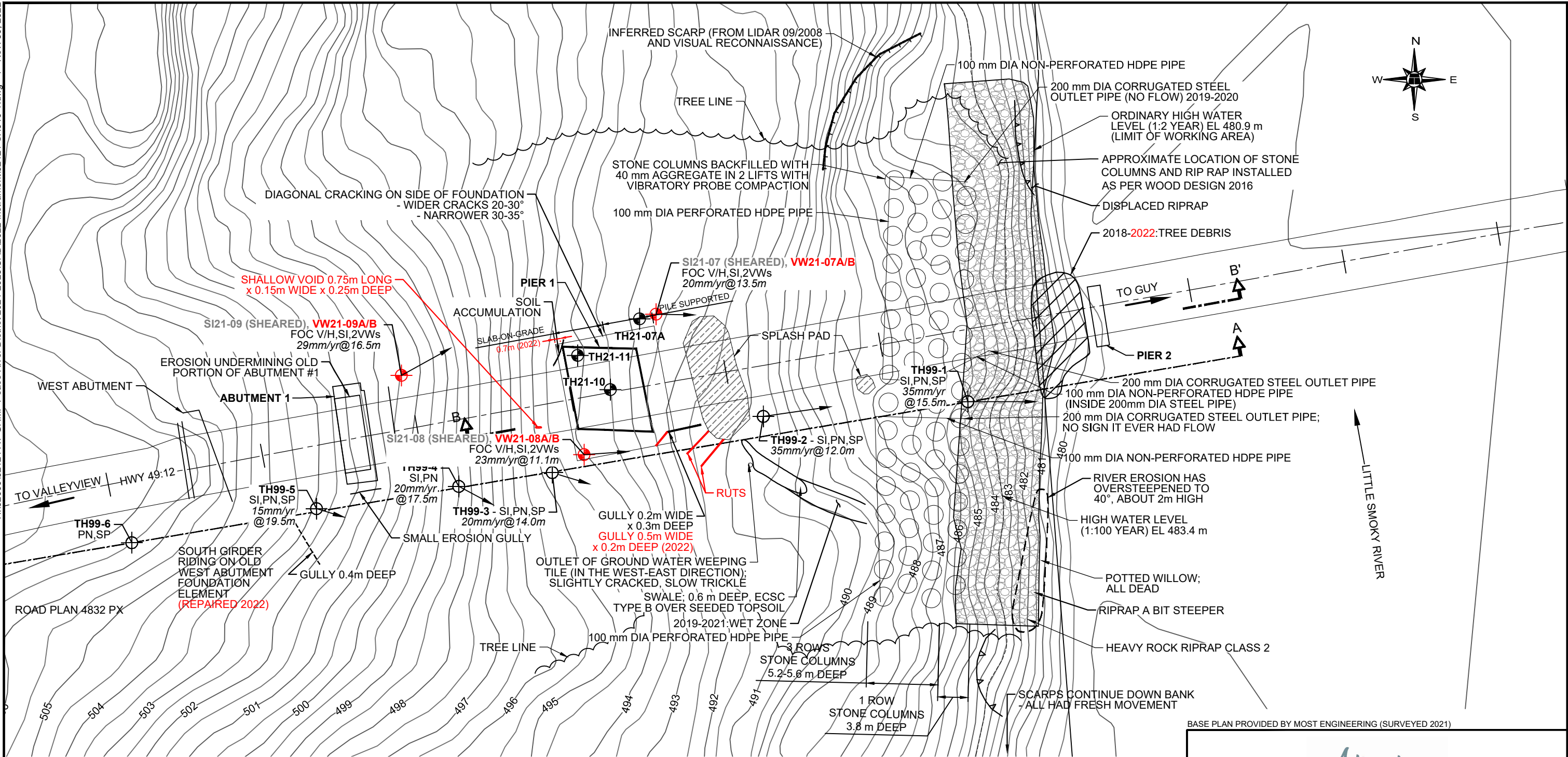
VIBRATING WIRE PIEZOMETER (VW) READINGS

Location	Serial	GPS Location (UTM 11)		Location	Date	Reading		Comments
		Easting (m)	Northing (m)			B Units	Temp °C	
VW21-7A	133742	489600	6145512	Stand Alone Location	17-May-24	Downloaded	Downloaded	
VW21-7A	133747	489600	6145512	Stand Alone Location	17-May-24	Downloaded	Downloaded	
VW27-8A	133715	489593	6145503	Attached to SI21-08	17-May-24	Downloaded	Downloaded	
VW21-8B	133476	489593	6145503	Attached to SI21-08	17-May-24	Downloaded	Downloaded	
VW27-9A	133478	489570	6145510	Attached to SI21-09	17-May-24	Downloaded	Downloaded	
VW21-9B	133492	489570	6145510	Attached to SI21-09	17-May-24	Downloaded	Downloaded	

INSPECTOR REPORT

- Dataloggers are connected to RST DT2055 dataloggers at their respective locations - download data at each station

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2022 Instrument\32121 SH016-1.dwg - 1 - Nov. 30, 2022



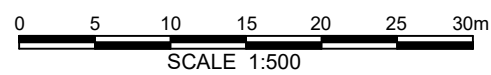
TYPICAL DETAIL OF STONE COLUMN SPACING
SCALE 1:300

LEGEND

- APPROXIMATE INSTRUMENTATION LOCATION
- APPROXIMATE TEST HOLE LOCATION (THURBER, 2021)
- APPROXIMATE TEST HOLE LOCATION (THURBER, 1999)
- SI SLOPE INCLINOMETER
- FOC V/H FIBRE OPTIC CABLE: VERTICAL / HELICAL ORIENTATION
- PN PNEUMATIC PIEZOMETER
- SP STANDPIPE PIEZOMETER
- VW VIBRATING WIRE PIEZOMETER
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 0.5m)
- MOVEMENT VECTOR AND DEPTH (SCALED BY OVERALL MOVEMENT RATE)

NOTES

1. MAY 2022 OBSERVATIONS SHOWN IN RED.
2. DETAILS OF REPAIR BELOW PIER 1 PROVIDED BY AMEC FOSTER WHEELER.
3. HIGHWAY RIGHT OF WAY BOUNDARY IS 91 m FROM THE HIGHWAY CENTERLINE (OUTSIDE OF DRAWING LIMITS)



BASE PLAN PROVIDED BY MOST ENGINEERING (SURVEYED 2021)



PEACE REGION (PEACE RIVER DISTRICT)

SH016: HWY 49:12 LITTLE SMOKY RIVER APPROXIMATE INSTRUMENT LOCATIONS

DWG No. 32121-SH016-1

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	RVC
SCALE	1:500
DATE	NOVEMBER 2022
FILE No.	32121



FIGURE SH016-1
HWY 49:12 LITTLE SMOKY RIVER PIEZOMETRIC ELEVATIONS

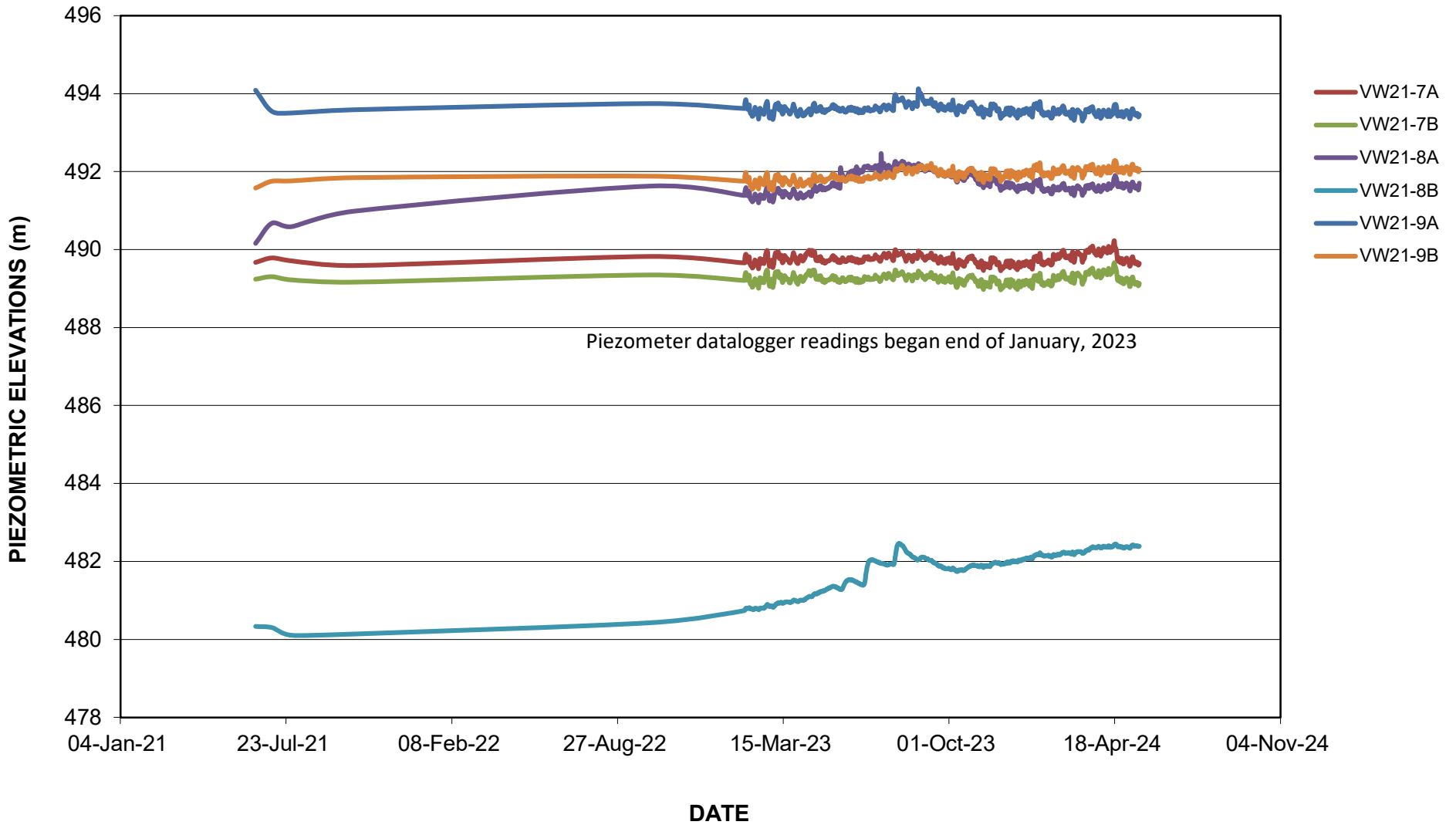


FIGURE SH016-2
HWY 49:12 LITTLE SMOKY RIVER PIEZOMETRIC DEPTHS

