



Klohn Crippen Berger

Teck Coal Limited Elkview Operations

West Fork Tailings Facility and Lagoons A, B, C, and D

2019 Dam Safety Inspection



Platinum
member

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March 23, 2020

Teck Coal Limited - Elkview Operations
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VOB 2G1

Mr. Arthur Yeomans
Senior Tailings Specialist

Dear Mr. Yeomans:

West Fork Tailings Facility and Lagoons A, B, C, and D
2019 Dam Safety Inspection

Please find enclosed our “West Fork Tailings Facility and Lagoons A, B, C, and D 2019 Dam Safety Inspection” report from September 2018 to December 2019.

Yours truly,

KLOHN CRIPPEN BERGER LTD.



Michael Cyr, P.Eng.
Senior Geotechnical Engineer / Project Manager

MC/AS/MT:dl

Teck Coal Limited Elkview Operations

West Fork Tailings Facility and Lagoons A, B, C, and D

2019 Dam Safety Inspection

EXECUTIVE SUMMARY

This summary is provided solely for purposes of overview. Any party who relies on this report must read the full report. The summary omits details, any one of which could be crucial to the proper application of this report.

This report presents the 2019 Dam Safety Inspection (DSI) of the Teck Elkview Operations (EVO) West Fork Tailings Facility (WFTF) and the Lagoon Tailings Area, comprising Lagoons A, B, C, and D.

This report has been prepared in accordance with the requirements of the British Columbia Ministry of Energy, Mines and Petroleum Resources (BCMEMP) Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (“the Code”) (BCMEMP 2017). The 2019 DSI was completed on July 8 and 9, 2019 by Mr. Michael Cyr, P.Eng. and Mr. David Willms, P.Eng. as representatives of Klohn Crippen Berger (KCB). The Tailings Storage Facility (TSF) Qualified Person (as defined by the Code) at the time of inspection was Mr. Jason Garwood, P.Eng., who was also on site during the DSI. The current TSF Qualified Person is now Mr. Arthur Yeomans. The Engineer of Record (EoR) for the tailings facilities is Mr. Andy Small, P. Eng., of KCB.

Summary of Facility Description

Fine refuse materials are deposited sub-aerially at the WFTF which is the primary fine tailings storage facility. Tailings is also deposited into Lagoon D intermittently when the WFTF GEHO pipeline that routes tailings to the WFTF is under maintenance. The WFTF embankment was constructed using rock fill overlying bedrock foundations and is approximately 35 m high, containing an estimated 8,800,000 m³ of tailings.

The Lagoon Tailings Area, comprising Lagoons A, B, C and D is located on the western perimeter of the site, immediately west of the plant. Lagoons A, B and C were constructed as ring-dyke embankments and are no longer receiving tailings from the plant. Lagoons A, B and C were primarily constructed using silty sand, and sand and gravel fill materials. The Lagoon D starter embankment comprised similar fill materials, and subsequent embankment raises comprised coarse coal rejects (CCR) material.

Lagoons A and B are inactive tailings storage facilities. Lagoon A is approximately 4 m in height and contains an estimated 185,000 m³ of tailings. A riprap armoured spillway is located at the west side of the lagoon. Lagoon B is also approximately 4 m in height and contains an estimated 295,000 m³ of tailings.

Lagoon C no longer receives tailings; however, it is used intermittently to store sediments that have been excavated from several site sumps and ponds. Lagoon C has a maximum height of approximately 19.5 m and contains an estimated 4,660,000 m³ of tailings.

Lagoon D is an active ring-dyke tailings storage facility, with tailings deposition commencing in the early 1970's. Since the commissioning of the WFTF in 2006, Lagoon D has become the secondary tailings storage location when deposition to the WFTF is not possible, typically during maintenance periods. Lagoon D has been raised using the upstream raise method to a maximum dam height of 59 m, containing approximately 22,380,000 m³ of tailings.

Summary of Key Hazards

The key external hazards for the WFTF and Lagoon Tailings Area are seismic and meteorological hazards. Slope erosion due to flooding of the Elk River is also a key hazard for Lagoon C. A summary of the Earthquake Design Ground Motion (EDGM) criteria for each facility is presented below:

- **WFTF:** The WFTF has been designed to withstand a Earthquake Design Ground Motion (EDGM) equivalent to a 1 in 2,475-year event which exceeds the required Annual Exceedance Probability (AEP) based on the assigned "Low" consequence classification as per CDA guidelines (CDA, 2013).
- **Lagoons A and B:** The 2018 Dam Safety Review (DSR) report (SRK, 2019) states that EVO has adopted a 1 in 2,475-year AEP for seismic EDGM for both Lagoons A and B. This exceeds the requirement for "Low" consequence category dams (CDA, 2013). The stability of the dams containing these lagoons will be assessed in 2020, pending the outcomes of the 2019 Lagoon Site Investigation.
- **Lagoon C:** Lagoon C was designed to withstand a seismic EDGM equivalent to a 1 in 2,475-year event as per the CDA guidelines (2013) for this "High" consequence facility. The Lagoon C dam is drained (phreatic surface is near or below the base of the dams) and is not prone to failure during a seismic event.
- **Lagoon D:** Lagoon D was designed to withstand a seismic EDGM equivalent to a 1 in 5,000-year event which achieves the requirements of the CDA guidelines (2013) for a "Very High" consequence category dam. Similar to Lagoon C, the dam is drained and is not prone to failure during a seismic event.

With respect to meteorological hazards, the dams for WFTF, Lagoon C, and Lagoon D are all designed to contain the 72-hour probable maximum precipitation (PMP), as per regulatory requirements. Lagoon A is a flow-through facility, and is in compliance with regulatory requirements to safely manage its Inflow Design Flood (IDF). In 2019 an overtopping study for Lagoon B was conducted by Wood, which determined that Lagoon B does not have adequate storage to contain the IDF (Wood, 2019). EVO is considering options to enhance Lagoon B by either increasing the storage capacity or constructing a spillway to bring the facility into compliance with regulatory requirements.

Consequence Classification

The consequence category for the facilities is summarised in Table E-1.

Table E-1 Facility Consequence Category

Facility	Consequence Category
WFTF	Low
Lagoon A	Low
Lagoon B	Low
Lagoon C	High
Lagoon D	Very High

There have been no significant changes in 2019 to warrant amending the classifications for the WFTF and Lagoons A, B, C, and D.

A routine review and update of the dam break inundation study for Lagoon D was initiated during 2019, and is in progress at the time of writing. The consequence classification for Lagoon D will be reviewed and updated as appropriate during 2020, based on the pending results of the updated inundation study.

Summary of Significant Changes in 2019

No significant dam safety changes have occurred at the WFTF and Lagoon Tailings Area during 2019. Tailings have continued to be deposited into the Lagoon D and WFTF storage facilities in accordance with the Operations, Maintenance, and Surveillance (OMS) Manual. The Lagoon D inner ring road has been raised to an elevation of El. 1,168.0 m, with a tailings elevation of approximately El. 1,165.0 m based on the 2019 LiDAR provided by EVO.

A site investigation of Lagoons A, B, C, and D was completed during September and October of 2019 with the purpose of updating and continuously improving the characterisation of the dam fill, tailings, and foundation units. The investigation specifically focused on further characterising previously identified glaciolacustrine foundation units below the Lagoon dams and obtaining information on the current properties of the tailings to inform an updated liquefaction triggering analysis as part of the initial work for closure planning and design for this facility. The site investigation report is in progress at the time of writing, and the results will be applied to update the Lagoon D stability analysis during 2020.

Significant Changes in Instrumentation and/or Visual Monitoring Records

There were no significant changes in the instrumentation or visual monitoring records during 2019, with the dams performing in accordance with the anticipated trends.

Two additional Vibrating Wire Piezometers (VWPs) were installed at each of the Lagoon A, C, and D dams as part of the 2019 Lagoon Site Investigation program. Three additional inclinometers were also installed at Lagoon D during the same program.

Significant Changes to Stability and / or Surface Water Control

No significant changes to the WFTF, Lagoon A, B, C and D were observed that would affect embankment stability. No signs of cracking, wet spots, or deformations were observed during the 2019 inspections. However, minor erosion was observed in several areas and these areas should be monitored as an ongoing maintenance item.

The glaciolacustrine clay foundations units at Lagoons A, C and D were further defined during the 2019 Lagoon Site Investigation program. Interpretation of the data from the investigation is in progress and stability analyses updates are planned for 2020.

Summary of Review of OMS Manual

EVO has three separate OMS Manuals, encompassing inactive Lagoons A, B, and C, Lagoon D and the WFTF. The OMS Manual for the inactive lagoons was updated in 2019 and submitted to EMPR. The OMS Manuals for Lagoon D and the WFTF were revised in 2019 and submitted to EMPR. The OMS manuals will be updated and restructured in 2020 to be consistent with the Mining Association of Canada (MAC) OMS guidelines (MAC 2019).

Summary of Review of EPRP

An Emergency Preparedness and Response Plan (EPRP) was prepared for the WFTF in 2020 and is an adequate action plan in the event of a dam safety emergency at the WFTF.

An EPRP was prepared for Lagoon D in October 2014 and was tabletop tested in late 2018 to assess effectiveness. The Lagoon D EPRP will be updated in 2020 with consideration of the results of the inundation study and consistency with the Mine Emergency Response Plan (MERP).

EPRP documents for Lagoons A, B, and C were up to date for 2019.

Scheduled Date for next DSR

A DSR was conducted by SRK Consulting in 2018 and the final report was delivered in March 2019. The next DSR is scheduled for 2023 as required by the Code.

Summary of Recommendations

A summary of the DSI recommendations for the WFTF and Lagoons A, B, C, and D is presented in Table E-2, with 2019 recommendations shown in bold text and actions noted as completed or closed in this report are greyed out and will be removed from the register in subsequent reports.

Refer to Section 9 for additional details regarding the recommended actions. EVO also tracks additional recommendations made during the 2018 DSR (SRK, 2019) that are not included in the summary below.

Table E-2 Summary of Recommendations

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
Previous DSI Items							
2015-01	Lagoon B	Assess the potential for overtopping the dam containing Lagoon B and determine if remedial measures are required.	N/A	N/A	Closed	2019	Lagoon inundation memo and spillway design was completed in 2018 and was finalized in 2019.
2013-02	Lagoon C	Investigate possible removal of overhead pipelines located in the southeast corner of the Lagoon as identified in the risk assessment.	3	Deficiency	Closed	End 2019	The pipelines are no longer being used and were assessed to not be a threat to dam safety.
2013-03	Lagoon C	Along the shoreline of the Elk River, the grading, riprap material weathering, soil erosion and the existence of a filter zone under riprap needs to be assessed in the design evaluations.	4	N/A	In Progress	End of 2020	The assessment was completed in 2020.
2013-08	Lagoon C	Per 2013 CDA guidelines, the next DSR for Lagoon C will be in seven years (2020).	4	N/A	Complete	2020	DSR completed in 2018
2013-13	Lagoon D	Per 2013 CDA guidelines, the next DSR for Lagoon D should be performed in five years.	4	N/A	Complete	2020	DSR completed in 2018
2017-01	WFTF	The current water balance model should be upgraded to include the increases of the tailings surface and dam crest over time up to the ultimate configuration.	3	Non-Conformance	Complete	2020	Water balance was revised in 2019.

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
2019 DSI Items							
2019-01	Lagoon B	Lagoon B requires an increase in storage capacity to manage the IDF (72-hr Probable Maximum Precipitation), or requires the construction of a spillway to meet regulatory requirements.	2	Deficiency	New Action / Not Complete	2020 Freshet	N/A
2019-02	Lagoon D	GPS survey monuments H Lower and C Lower pins were destroyed. These monuments should be replaced.	3	Potential Deficiency	New Action / Not Complete	2020	N/A
2019-03	Lagoon D	The pipes that allow the cells to drain into the central area of Lagoon D appeared to have inconsistent elevations that may possibly be higher than the outer walls of the cells. It is recommended that the pipe elevations be visually checked and corrected as required. This procedure should be implemented in the OMS Manual and training should be given to staff assigned to moving the pipes.	3	Potential Deficiency	New Action / Not Complete	2020	N/A
2019-04	WFTF	Possible signs of tailings migration into the abutment was observed during the 2019 inspection. The next stage of the design to El. 1,710 m should include measures to minimize the risk of tailings migration through WFTF embankment.	3	Potential Deficiency	New Action / Not Complete	End of 2020	N/A
2019-05	WFTF	The freeboard requirements for the WFTF should be stated in the OMS manual.	3	Potential Non-Conformance	New Action / Not Complete	End of 2020	N/A

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
2019-06	Lagoons A, B, C and D	The stability analyses for these facilities should be reviewed based on the 2019 Lagoon Site Investigation data, and potentially revised, pending the outcomes.	3	N/A	New Action / Not Complete	End of 2020	N/A
2019-07	All Facilities	The OMS Manual should be updated to include maintenance items described in Section 4.6, and to repair minor erosion as required.	3	Potential Non-Conformance	New Action / Not Complete	End of 2020	N/A

Notes: Recommendation priority guidelines specified in the HSRC Guidance Document (BCMCM, 2016) and assigned by KCB.

Priority 1: A high probability or actual dam safety issue considered dangerous to life, health or the environment, or a significant risk of regulatory enforcement.

Priority 2: If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.

Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.

Priority 4: Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risk.

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1 INTRODUCTION

1.1 General

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Coal Limited to perform an annual Dam Safety Inspection (DSI) of the West Fork Tailings Facility (WFTF) and the Lagoon Tailings Area (Lagoon A, B, C, and D) at the Elkview Operations (EVO) site. This report presents the results of the 2019 DSI and a review of available monitoring data from the beginning of September 2018 to the end of December 2019. This report has been prepared in accordance with the requirements of the British Columbia Ministry of Energy, Mines and Petroleum Resources (BCMEMP) Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (“the Code”) (BCMEMP 2017).

The site inspection for the WFTF and Lagoons A, B, C, and D was conducted from July 8 to 9, 2019, by Mr. Michael Cyr, P.Eng. and Mr. David Willms, P.Eng. of KCB.

The previous site inspection for these structures was conducted from June 17 to 19, 2018, by Mr. Andy Small, P.Eng. and Mr. Michael Cyr, P.Eng. of KCB. At the time of the previous inspection, Mr. Small and Mr. Cyr were employed with Wood PLC (previously Amec Foster Wheeler).

This report is organized as follows:

- Section 2: an overview of the project background and facility description as it relates to the DSI;
- Section 3: a summary of activities since the last DSI;
- Section 4: a review of 2019 inspection observations;
- Section 5: a review of monitoring records;
- Section 6: a summary of 2019 climate aspects;
- Section 7: a summary of water management aspects;
- Section 8: a review of documentation and relevant failure modes to support the dam safety assessment; and
- Section 9: recommendations for ongoing operations, maintenance, and surveillance of the facility.

1.2 Engineer of Record and Tailings Storage Facility Qualified Person

Mr. Andy Small, P.Eng. has filled the role of Engineer of Record (EoR) for the EVO Tailings Storage Facilities (TSFs) since 2014 while working with Wood PLC (previously Amec Foster Wheeler). Mr. Small joined KCB in August 2018 and on November 8, 2018, submitted a letter to EVO confirming that KCB will support Mr. Small in continuing as the EoR for the EVO TSFs. He visited the site twice in 2019 and was involved in the preparation of this report.

Jason Garwood, P.Geo., was the TSF qualified person at the site at the time of the inspection. Mr. Arthur Yeomans is the current TSF qualified person.

1.3 Regulatory Requirements

This report reviews the operation and performance of the TSF dams relative to the following:

- “Health, Safety and Reclamation Code for Mines in British Columbia”, by the Ministry of Energy, Mines, & Petroleum Resources (BCMEMP 2017);
- “Guidance Document – Health, Safety and Reclamation Code for Mines in British Columbia”, Version 1.0, Updated in July 2016 by the BC Ministry of Energy and Mines (BCMEMP 2016);
- “Dam Safety Guidelines 2007 (revised in 2013)” Canadian Dam Association (CDA 2007 and 2013);
- “Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams” Canadian Dam Association (CDA 2014); and
- “Developing an Operation, Maintenance, and Surveillance Manual for Tailings and Water Management Facilities” 3rd Edition, Mining Association of Canada (MAC 2019).

2 BACKGROUND

2.1 General

The EVO coal mine site is located approximately 3 km east of the town of Sparwood, in southeastern British Columbia. Underground coal mining at the site began in the late 1890's, with open pit mining operated since 1969. The site has a remaining life of mine (LOM) of approximately 30 years. The site comprises several key facilities as follows:

- Coarse Coal Refuse (CCR) Dump
- Lagoon Tailings Area (Lagoons A, B, C and D)
- West Fork Tailings Facility (WFTF)
- Process Plant
- Harmer Dam
- Erickson Dam

The focus of this report is on the WFTF and Lagoons A, B, C, and D. The DSI for the other dams and the CCR Dump have been reported separately. An overview of the WFTF and Lagoons A, B, C and D is presented in the following section.

2.2 Facility Description

2.2.1 Lagoons Tailings Area

The Lagoon Tailings Area, comprising Lagoons A, B, C, and D is located on the western perimeter of the site, immediately west of the plant. The arrangement of the lagoon dams is presented in Figure 2.1. The majority of the fine refuse material separated during the coal washing process has historically been deposited in Lagoons A, B, C, and D, and is now deposited into the WFTF. The general information and the current configuration for these facilities is presented in Table 2.1, with additional details provided in the following sections.

Lagoons A, B, C, and D have been constructed on the floodplains of the Elk River. A review of the Elk Valley late Quaternary geology and geomorphology indicated this area was previously covered by a glacial lake that deposited glaciolacustrine silts and clays along with areas of alluvial sediments (SRK 2019).

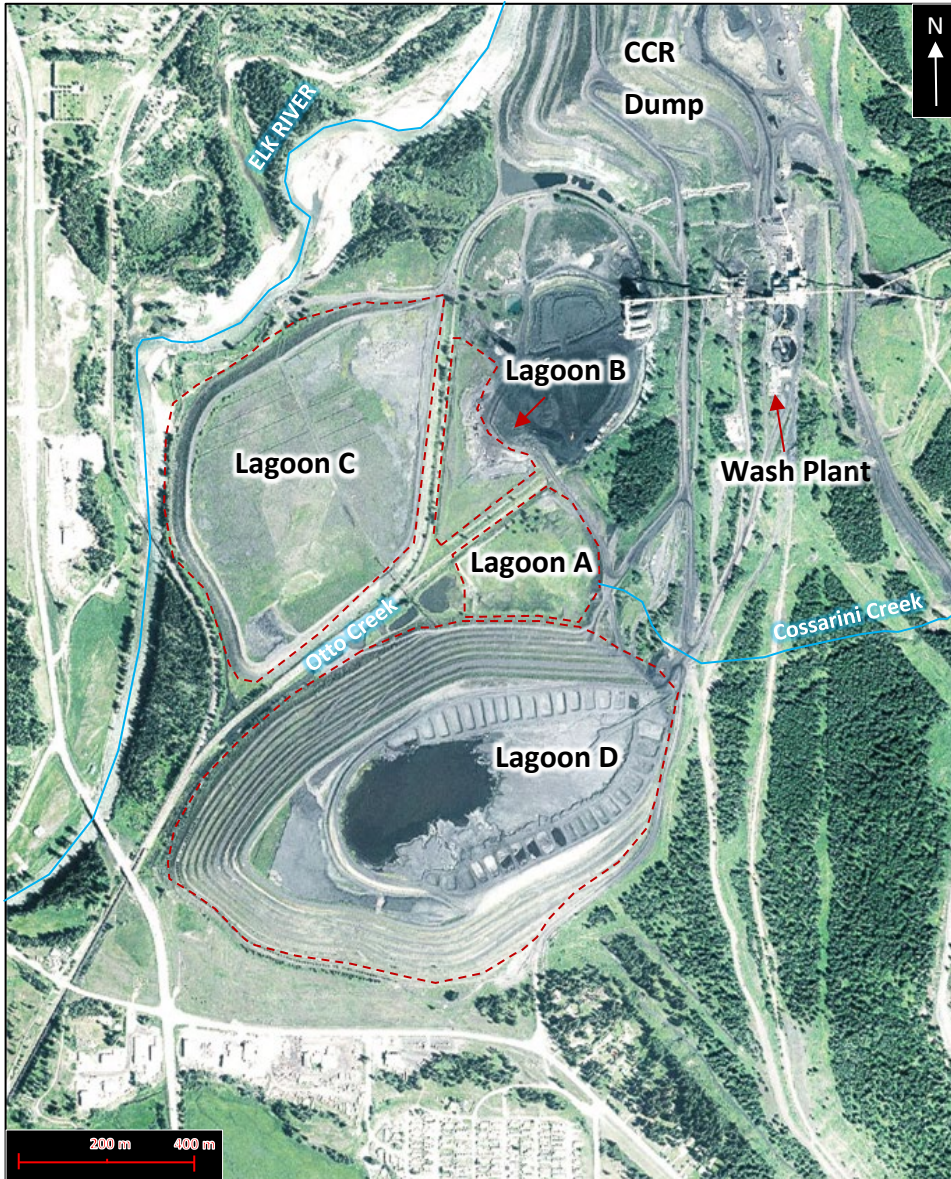
Table 2.1 Lagoon Tailings Area General Information and Configuration

Key Parameters	Lagoon A	Lagoon B	Lagoon C	Lagoon D
CDA Consequence Classification	Low	Low	High	Very High
Tailings Deposition in 2019 ⁽¹⁾	None	None	None	Yes (58,300 t)
Impounded Tailings Volume (m ³)	185,000	295,000	4,658,600	22,695,000
Maximum operating pond volume (m ³)	550	0	0	288,000
Approximate Footprint (ha)	5.8	4.5	32.6	61
Crest Length (m)	1,100	800	2,000	2,226
Crest Width (m)	6	6	6	6 to 10
Crest Elevation (m)	1,119.0	1,118.5	1,129.3	1,168 (West) 1,172 (East)
Maximum Dam Height (m)	4	4	19.5	59
Raise Method	N/A	N/A	Upstream for East embankment Downstream for all other embankments	Upstream
Overall Downstream Slope Grade	1.8H:1V	1.75H:1V	1.75H:1V	2.7H:1V to 3.4H:1V
Inter-berm side slope	N/A	N/A	N/A	2H:1V (typical)
Spillway Elevation (El. M)	1118.3	1118.2	N/A	N/A
Spillway Width (m)	5	3	N/A	N/A

Source: Elkview Operations – 2018 TSF Dam Safety Review (SRK 2019) and 2018 Dam Safety Inspection (Wood 2019)

Note: 1. Tailings deposition quantity is approximate only.

Figure 2.1 Lagoon Tailings Area Locality Plan



Note: Imagery provided by EVO (dated April 2018)

Lagoon A

Lagoon A was used as a tailings storage facility during the mine start-up period in the 1960's. The facility is currently inactive. The tailings in this facility are impounded by embankments approximately 4 m in height at the north, west, and south perimeter of the storage. The eastern perimeter of the storage is confined by Harmer Ridge and the Lagoon D embankment confines the southern side of the storage. There are no construction records available for Lagoon A, however site investigations indicate the starter embankment was primarily constructed using silty sand, and sand and gravel glacial till materials.

The foundations comprise coarse-grained gravelly sand glacial till followed by glaciofluvial sands and sandy silts. Foundation glaciolacustrine clay was identified under the western portion of Lagoon A.

Water from Cossarini Creek flows directly through Lagoon A and discharges out of the spillway at the western perimeter of the Lagoon into a series of check dam ponds (Otto Ponds). Lagoon A is in the “active care” phase of closure.

Lagoon B

Lagoon B is an inactive tailings storage facility and was used for initial tailings storage at the commencement of mining and processing in the 1960’s. Similar to Lagoon A, the facility is impounded by 4 m high embankments, coal stockpiles to the east and Harmer Ridge. The current purpose of Lagoon B is to receive emergency overflow process water when required. EVO have limited the quantity of plant water discharge to Lagoon B to reduce the risk of overtopping. The facility requires a storage capacity increase or construction of a spillway to meet regulatory requirements. Retained water within Lagoon B is left to infiltrate through the tailings into the ground surface. There are no construction records available for Lagoon B, however site investigations indicate the starter embankment was primarily constructed using silty sand, and sand and gravel glacial till materials. The foundations comprise coarse-grained gravelly sand glacial till, underlain by glaciofluvial sands, sandy silts, and interbedded glaciolacustrine clays.

Lagoon C

Lagoon C is an inactive tailings storage facility and was operated from 1970 to 1996, with tailings deposition to this facility ceasing in 1987. From 1987 to 1996 the facility was used to temporarily retain excess decant water from Lagoon D, and its current purpose is to store sediments excavated from several sedimentation ponds and sumps that require routine maintenance. The facility starter dam was constructed in 1970 using sand and gravel fill, with two subsequent raises completed in 1985 and 1986 using CCR. The upstream raise method was utilised on the eastern embankment due site infrastructure constraints and the north, south and west embankments were raised using the downstream method. Lagoon C is currently used as a disposal location for sediments excavated from various sumps and sedimentation ponds. The foundation comprises coarse-grained gravelly sand glacial till underlain by interbedded glaciofluvial silty sands, and glaciolacustrine clays and silts.

Additional infrastructure at Lagoon C includes an out-of-service pipeline which enabled Lagoon D decant water to be discharged to Lagoon C. Lagoon C also has wind fencing to manage dust, power line infrastructure along the western embankment crest, and a natural gas pipeline buried beneath the western perimeter of the dam. Lagoon C has sufficient capacity to safely manage its IDF without a spillway, and ponded water infiltrates through the tailings to the natural ground.

A summary of the raise construction history for Lagoon C is presented in Table 2.2.

Table 2.2 Lagoon C Raise Construction History

Year	Crest Elevation (El. m)	Construction Material	Comments
1970	1,120	Sands and gravels	Stater Dam construction.
1982	1,120	Sands and gravels and Coarse Coal Rejects	South extension dam was constructed with sands and gravels to elevation El. 1,114 m and to elevation El. 1,120.4 m using Coarse Coal Rejects.
1985	1,125	Coarse Coal Rejects	4.6 m dam raise. Upstream raise method used for the east embankment and the downstream raise method was used for all other embankments.
1986	1,129	Coarse Coal Rejects	4.3 m dam raise using same raise method as 1985.
1987	1,129	N/A	Tailings deposition to Lagoon C ceased.

Note: The above table is a summary for embankment raises only. Additional activities were undertaken on the dam other than the raises listed.

Lagoon D

Lagoon D is an active ring-dyke tailings storage facility, with tailings deposition commencing in the early 1970's. Since the commissioning of the WFTF in 2006, Lagoon D has become the secondary tailings storage location. The facility was constructed in 1972 with a sand and gravel starter dam, with consecutive upstream raises constructed using CCR. The north, south and west embankments were raised using the upstream method and the eastern perimeter is confined by the natural hillside. Lagoon D is underlain by sand and gravel alluvial deposits overlying glaciolacustrine clays and silts.

Since 2005, tailings have been deposited into shallow cells on the northeastern and southeastern perimeter of the ring-dyke. The cells vary in length and width, however typical cell dimensions are 60 m long x 15 m wide, with cell depths ranging from 1.8 m to 4.1 m. This tailings management system enables faster consolidation of the tailings in individual cells while allowing bleed water to drain towards the centre of Lagoon D via solid pipes that connect individual cells to the centre of the storage.

In 2018, the crest elevation of the active area of Lagoon D was raised to elevation 1,168 m. Along the north and south sides of Lagoon D, the dam raise was from 0 m to 2 m. The Inner Ring Road was raised 2 m.

Lagoon D has sufficient capacity to effectively manage the pond and IDF without a spillway. Water from the pond can also be pumped to and from the wash plant.

A summary of the raise construction history for Lagoon D is presented in Table 2.3.

Table 2.3 Lagoon D Raise Construction History

Year	Crest Elevation (El. M)	Construction Material	Comments
1972	1,123	Sand and gravel from inside lagoon	Starter embankment.
1979	1,130	Coarse Coal Rejects	7 m upstream raise.
1986–1887	1,133	Compacted tailings with a CCR exterior	3 m upstream raise.
1993	1,142 (west) 1,146 (east)	Coarse Coal Rejects	North Embankment construction only. Portions of compacted tailings was removed and replaced with compacted Coarse Coal Rejects.
	1,140	Coarse Coal Rejects and coarse tailings	West Embankment construction only.
	1,143 (west) 1,146 (east)	Coarse Coal Rejects	South Embankment construction.
1995-2001	1,151 (west) 1,155 (east)	Coarse Coal Rejects	Embankments were raised in approximate annual increments of 0.6 m to 2.5 m.
2002	1,156 (west) 1,158 (east)	Coarse Coal Rejects	Cell construction was adopted to enhance beach development.
2004–2005	1,160.5 (west) 1,162.5 (east)	Coarse Coal Rejects	Incremental 1 m embankment raises each year.
2006	Nominal 1,161.5	Coarse Coal Rejects	Nominal 1 m raise of the embankment. WFTF becomes operational this year.
2009–2011	1,166	Coarse Coal Rejects	Lagoon D constructed to the permitted elevation of El. 1,166 m. Internal ring road was constructed to elevation El. 1,164 m.
2012	1,166	Coarse Coal Rejects	Additional compacted 2 m lift on internal dike. Internal ring road was raised to the same elevation as the perimeter embankment
2018	1,168	Coarse Coal Rejects	Internal ring road dyke and portions of the Lagoon D dam (eastern side) was raised to elevation El. 1,168 m to increase the available freeboard.

Note: The above table is a summary for embankment raises only. Additional activities were undertaken on the dam other than the raises listed.

2.2.2 WFTF

The WFTF was commissioned in 2006 with the purpose of serving as the primary fine tailings storage facility on site. The facility is located on the eastern perimeter of the site, approximately 1 km from the Adit Pit and is confined by the Adit Waste Dump, West Fork Dump, Adit Ridge and Cowboy Ridge. Fine refuse material is deposited into the WFTF via six spigots located along the embankment. Tailings deposition is managed to keep ponded water at the northern extent of the WFTF, away from the embankment. Limited information is available on the surficial soils within the vicinity of the WFTF, however George et al. (1986) indicates that the area comprised bare rock surfaces, colluvial fans and mass-wasting debris (SRK 2019).

The Adit Toe Berm road is also progressively raised ahead of tailings deposition to minimise the filtration of tailings fines into the Adit Waste Dump. The tailings surface elevation within the WFTF rises at an approximate rate of 4 m per year. The WFTF embankment will require progressive raises as the tailings level increases. The general information and the current configuration for the WFTF is presented in Table 2.4 and the location of the WFTF is presented in Figure 2.2.

Table 2.4 WFTF General Information and Configuration

Key Parameters	WFTF
CDA Consequence Classification	Low
Tailings Deposition in 2019 ⁽¹⁾	1,163,000 t
Estimated Impounded Tailings Volume (m ³)	8,800,000
Estimated Impounded water volume (m ³)	300,000
Approximate Footprint (ha)	28.5
Crest Length (m)	480
Crest Elevation (m)	1,680
Crest Width (m)	50
Maximum Dam Embankment Height (m)	35
Maximum Facility Storage Depth (m) ⁽²⁾	80
Raise Method	Downstream
Overall Downstream Slope Grade	2.5H:1V
Adit Toe Berm Slope Grade	37° (angle of repose)
Maximum allowable tailings deposition rate (m ³ /day)	6,500 (normal operations) 13,100 (periodic emergencies)

Source: Elkview Operations – 2018 TSF Dam Safety Review (SRK 2019) and the 2018 DSI (Wood 2019)

Note: 1. Tailings deposition quantity is approximate only.

2. Maximum facility storage depth estimated from WFTF crest elevation to lowest elevation of tailings placement (Wood 2019).

Figure 2.2 WFTF Locality Plan



Note: Imagery from Google Earth (dated June 29, 2013)

2.3 2019 Lagoon Site Investigation

The 2019 Lagoon Site Investigation was undertaken in September and October of 2019 and focused on further characterizing the dam fill, tailings and foundations of Lagoons A, B, C, and D. Sampling was undertaken, and field and laboratory index testing was conducted for all lagoons. Reporting of the site investigation is underway at the time of writing; however a summary of the 2019 Lagoon Site Investigation program and outcomes is presented below:

2.3.1 Lagoon A

- Three drill holes and two seismic cone penetration tests (SCPT) were located along the northern perimeter of Lagoon A.
- Lagoon A overlies coarse-grained gravelly sand glacial till followed by glaciofluvial sands and silty sands. Glaciolacustrine clays were encountered 8.8 m below the crest of the dam at the western extent of the lagoon. Bedrock was not encountered.
- Two vibrating wire piezometers (VWP) were installed to monitor pore-water pressures in glacial till foundations and the tailings strata.

2.3.2 Lagoon B

- One drill hole and two SCPTs were located along the northern perimeter of Lagoon B.
- Lagoon B overlies coarse-grained gravelly sand glacial till followed by glaciofluvial sands and silty sands. Glaciolacustrine clays were encountered in discrete layers ranging from 0.1 m to 0.5 m thick and observed to be 10 m below the crest of the dam. Bedrock was not encountered.

2.3.3 Lagoon C

- Six drill holes and two CPTs were conducted in Lagoon C.
- Lagoon C typically overlies 3 to 6 m of alluvial sands and gravels, underlain by 20 m of glaciolacustrine clay and silt (SRK 2019).
- Two VWP's were installed to monitor pore-water pressures in glaciolacustrine clay foundations.

2.3.4 Lagoon D

- Seven drill holes and three CPTs and three SCPTs were conducted at the northern and western sections of Lagoon D.
- Two VWP's were installed to monitor pore-water pressures in glaciolacustrine clay foundations.
- Three inclinometers were installed into glacial till foundations to monitor potential movement and settlement in the dam and foundation strata.
- Lagoon D is underlain by sand and gravel alluvial deposits overlying glaciolacustrine clays and silts in the northern section of the lagoon. The glaciolacustrine units can extend beyond 15 m in thickness in some areas. The western portion of Lagoon D is typically underlain by alluvial sediments and glaciolacustrine units were not encountered.
- Similarly, the southern portion of Lagoon D is underlain by alluvial sediments, with the toe of the dam constructed against former terraced exposed clay, sand and gravel (SRK 2019).

2.4 Design Basis

The WFTF and Lagoon Tailings Area structures achieve the minimum criteria according to the HSRC regulations (BCMEMP 2017), the HSRC Guidance Document (BCMEMP, 2016) and CDA guidelines (2013, 2014). However, it is noted that the current configuration of Lagoon B does not meet the regulatory requirements for containment of the IDF. The design basis for the facilities is summarized in Table 2.5 and Table 2.6.

Table 2.5 Design Basis – Summary for WFTF and Lagoon Tailings Area

Structure	CDA (2013) Consequence Classification ⁽¹⁾	Inflow Design Flood (IDF)		EDGM		Freeboard Requirements
		Minimum Design Flood (AEP) ⁽³⁾	Design ⁽⁴⁾	Minimum Design (AEP) ⁽³⁾	Design ⁽⁴⁾	
WFTF	Low	1:100	72-hr PMF	1:100	1:2,475 (PGA = 0.128 g)	Not reported due to the current WFTF having >10 m of freeboard in 2019
Lagoon A	Low	1:100	24-hr 1:200yr (spillway)	1:100	1:2,475 (PGA = 0.128 g)	0.33 m
Lagoon B	Low	1:100	24-hr PMF	1:100	1:2,475 (PGA = 0.128 g)	0.33 m
Lagoon C	High	1/3 between 1,000yr and PMF	72-hr PMF	1:2,475	1:2,475 (PGA = 0.128 g)	2 m minimum freeboard
Lagoon D	Very High	2/3 between 1,000yr and PMF	72-hr PMF	1/2 between 1:2,475 and 1:10,000 (or MCE)	1:5,000 (PGA = 0.18 g)	1.25 m minimum freeboard and 60 m wide beach maintained

Notes:

1. CDA 2013 Dam Safety Guidelines categories: Low, Significant, High, Very High, and Extreme.
2. Minimum freeboard above maximum operating pond level and pond setback distance, reproduced from the OMS manual.
3. Based on HSRC Guidance Document (BCMEMP, 2016) a minimum event duration of 72-hours is required for IDF containment for impoundments with no spillway. The minimum IDF for the WFTF and Lagoons A and B is based on CDA guidelines (CDA 2013).
4. Current design capacity.

Table 2.6 Design Basis – Minimum Factor of Safety Criteria for Slope Stability

Loading Condition	Minimum Factor of Safety (CDA 2013)	Minimum Factor of Safety (BCMEMP 2017)
		Tailings Dams
Static – Long Term Steady State	1.5	1.5
Seismic – Post-earthquake	1.2	-
Seismic – Pseudo-static	1.0	-

3 ACTIVITIES IN 2019 RELATED TO DAM SAFETY

The following activities relating to dam safety were undertaken in 2019.

3.1 WFTF

- Tailings deposition from an elevation of El. 1,665 m to El. 1,669 m (measured from the spigot location at the east end of the storage). The tailings elevation is surveyed at three-month intervals.
- The WFTF embankment crest elevation was El. 1,679.5 m as at July 2019.
- The Adit Toe Berm roadway was raised ahead of tailings deposition to an approximate elevation of El. 1,671.5 m. An engineered arrangement for future Adit Toe Berm raises was designed by KCB to minimize the risk of fines migration from the WFTF into the Adit Waste Dam (KCB 2019b). The design enables to site personnel to continue raising the Adit Toe Berm under the supervision of EVO engineers.

3.2 Lagoon A

- Two VVPs were installed in Lagoon A (refer Section 2.3 for summary).

3.3 Lagoon B

- Routine discharge of plant washdown water to the southeast corner of Lagoon B continued through the 2018 to 2019 period under written approval from both the EVO Geotechnical Department and the Environment Department. The requirement to obtain internal written approval is due to the minimal freeboard available for storing water on the surface of the Lagoon.
- Wood (2019) conducted a hydrotechnical study of Lagoon B that concluded the Lagoon B Dam can contain the 1 in 200-year, 24 hour storm event with a remaining freeboard of 0.37 m to the crest of the dam, but about 0.07 m to a low spot in the crest on the west segment of the Lagoon B Dam. However, the facility is unable to contain the minimum required 72-hour IDF, and EVO is considering options to either increase the storage capacity of Lagoon B, or construct a spillway.

3.4 Lagoon C

- Sediment excavated from several sumps and ponds outside of the EVO site were dumped at Lagoon C and tracked rolled with a dozer. This is expected to continue as a routine operation to effectively maintain ponds and sumps.
- Two VVPs were installed in Lagoon C (refer Section 2.3 for summary).

3.5 Lagoon D

- Intermittent tailings deposition occurred at the Lagoon D cells from September 2018 to December 2019.
- Routine maintenance was carried out on the cells and roads as required.
- Tailings from the cells was excavated and transported to the Reclamation Area.
- Two VWPs and three inclinometers were installed in Lagoon D (refer Section 2.3 for summary).
- It is noted that no additional raises are planned for Lagoon D, with all future tailings to be deposited into the WFTF.
- December 2019 LiDAR was completed by EVO to track the progress of tailings deposition at Lagoon D. An updated plan layout and representative cross sections based on the most current survey are presented in Appendix III.

4 SITE OBSERVATIONS / RESULTS OF SITE INSPECTION

The visual inspections conducted by Mr. Cyr and Mr. Willms included observing the condition of the facilities to identify deficiencies and other potential concerns regarding the geotechnical stability of the landforms. All dams were in satisfactory physical condition. No signs of structural distress were observed during the inspections of the crest, upstream beach, downstream slope, abutments and toe area. Structural distress that would be of concern includes tension cracks, settlement, sloughs, slumps or excessive erosion.

The following general comments and observations were noted during the inspection.

4.1 Lagoon A

- Lagoon A appeared to be in a satisfactory condition, with no evidence of deformations, slumps or wet spots.

4.2 Lagoon B

- Lagoon B appeared to be in a satisfactory condition, with no evidence of deformations, slumps or wet spots.
- Minor slumping of the lagoon into the marsh was observed. **(Photo IB-4)**

4.3 Lagoon C

- Lagoon C was observed to generally be in good condition, however localised erosion was observed. **(Photo IC-5, IC-8)**
- Local ponding of water on the crest was observed. **(Photo IC-6)**
- Changes in vegetation on the downstream slope adjacent to Elk River may indicate that wet spots occasionally form in these areas. **(Photo IC-7)**
- Erosion on the upstream side of the crest was observed at the north section of the Lagoon near the pumphouse. **(Photo IC-8)**

4.4 Lagoon D

- The pipes draining the cells into the central area of Lagoon D appeared to have inconsistent elevations that may possibly be higher than the outer walls of the cells. This could result in flow over the crest of the cells or sidewalls if they were filled and hence the available freeboard would not be acceptable. **(Photo ID-3, ID-11)**
- Minor upstream erosion of the crest was visible. **(Photo ID-8, ID-9)**
- Minor downstream erosion was observed a several locations around the Lagoon D facility. **(Photo ID-10, ID-18, ID-19)**

- EVO has sprayed a tackifier and it appears to be effective in controlling majority of the erosion on the downstream face. **(Photo ID-10)**

4.5 WFTF

- Possible signs of tailings migration into the abutment was observed (at each abutment). The material grading in this area is likely too coarse to serve as an appropriate filter. **(Photo IW-3 and IW-4)**
- The coarse material appears to be preferentially located at the abutments. A design and reconfiguration of the WFTF embankment to include an appropriate filter is required to facilitate a dam raise.

4.6 Maintenance Items

Routine maintenance was conducted on the following infrastructure during the 2019 period:

- GEHO pipeline maintenance;
- Repairs to the Lagoon B sump;
- Removal of sediment from sedimentation basins and sumps, and placement of sediments into Lagoon C;
- Lagoon D tailings cell and pipe elevation adjustments;
- General road maintenance; and
- Repairs to various minor erosion gullies.

A summary of items requiring monitoring and/or maintenance is presented in Table 4.1.

Table 4.1 Summary of Maintenance Items

Maintenance Item ID	Date Logged	Facility	Observation	Status	Notes (as at time of report issue)
2019-MI-01	2019	Lagoon B	Minor slumping of the Lagoon B embankment into the marsh. This area should be monitored as part of routine visual inspections and noted in the OMS Manual as a known issue, to be repaired by EVO.	New Item	N/A
2019-MI-02	2019	Lagoon C	Localized ponding at a low spot located near the pipe crossing was observed. This area should be monitored as part of routine visual inspections and noted in the OMS Manual as a known issue, to be repaired by EVO.	New Item	N/A
2019-MI-03	2019	Lagoon C	Localized erosion of the upstream portion of Lagoon C was observed. The erosion is located opposite the pumphouse. This area should be monitored as part of routine visual inspections and noted in the OMS Manual as a known issue, to be repaired by EVO.	New Item	N/A
2019-MI-04	2019	Lagoon D	Minor erosion was observed on the crest and should be monitored as part of the regular inspections performed by EVO personnel. The erosion should be repaired during crest placement works.	New Item	N/A
2019-MI-05	2019	Lagoon D	Minor erosion was observed at several locations on the downstream slope and should be monitored and tracked as part of the routine visual inspections performed by EVO personnel. The OMS Manual should be updated to include provisions for repairing minor erosion as required.	New Item	N/A

5 MONITORING AND INSTRUMENTATION REVIEW

A review of monitoring and instrumentation data was completed for the WFTF and Lagoon Tailings Area by KCB. The monitoring instrumentation at site comprises a network of VWPs, standpipe piezometers, GPS survey monuments and inclinometers. Measurements are collected by the EVO tailings geotechnical team, with the data evaluated against the Quantifiable Performance Objectives (QPOs) for the WFTF and Lagoon Tailings Area. The data review is escalated to the EoR where there is an exceedance of a trigger level for any of the monitoring instruments. The current monitoring program is sufficient to assess the performance of the dams against dam safety targets. A review of the monitoring and instrumentation data and procedures at site is presented below, with the location of each monitoring instrument and data shown in Appendix IV.

5.1 Piezometric Data and Phreatic Surfaces

The measured phreatic surface level within the standpipe piezometers and VWPs is consistent for all dams and within the expected ranges for each dam. There were no trigger level exceedances over the September 2018 to July 2019 period and there are no dam safety concerns for the WFTF and lagoons.

5.1.1 Lagoon A and B

- There were no monitoring instruments installed in Lagoon A or Lagoon B at the time of the inspection.
- Two VWPs were installed in Lagoon A as summarised in Section 2.3. Initial readings from the two VWPs indicate the phreatic surface elevation is approximately El. 1,116 m at both the eastern and western extent of Lagoon A, generally being approximately 1 m above the base of the tailings, equivalent to 4 m below the dam crest.
- The performance of Lagoon B is likely to be similar to Lagoon A due to the similar dam configuration and proximity to Lagoon A. Due to the low consequence of failure, it is judged that no monitoring instrumentation is necessary to maintain the dam safety of Lagoon B.

5.1.2 Lagoon C

The following instruments were previously installed for performance monitoring of Lagoon C:

- 15 VWPs (including two additional instruments installed as part of the 2019 Lagoon Site Investigation program).
- 6 standpipe piezometers (excludes broken OW-C1 and OW-C4 piezometers).

Piezometer data for the 2018 to 2019 period indicates that the phreatic surface within Lagoon C generally remains consistent with previous trends. A summary of the piezometer measurements is presented below.

- Standpipe piezometers 99-01, C88-1, C88-2 and OW-C2 were dry.

- Standpipe piezometers GT-9703A and GT-9703B measured water levels were approximately 1.4 m below the ground surface elevation, indicating 0.14 m and 0.23 m respective increases over the previous year.
- All standpipes showed a peak water level around May which likely correlates with a higher Elk River water level during freshet.
- Negative readings were measured throughout the September 2018 to July 2019 period in the three pairs of nested VWP (VW23238/23242, VW23239/23243 and VW23244/23240) and VW23241. These VWPs are installed in gravel foundations and CCR dam fill.
- VW23245 measured a phreatic surface level approximately 14.6 m below ground surface level, which is generally consistent with the measurements from last year.

5.1.3 Lagoon D

The following instruments were previously installed to facilitate monitoring of Lagoon D:

- 30 VWPs (including two additional instruments installed as part of the 2019 Lagoon Site Investigation program).
- 46 standpipe piezometers (excludes broken D1, OW9432, 99-02 and V01-01 piezometers).

Piezometer data for the 2018 to 2019 period indicates that the phreatic surface within Lagoon D generally remains consistent with previous trends. A summary of the piezometer measurements is presented below.

- The phreatic surface measured from sections C-C to F-F was measured approximately 25 m below the crest elevation, indicating the system is draining competently.
- All other pairs of piezometers indicate a downward gradient, suggesting drainage also occurs through the gravel foundations below the Lagoon D dam. This downward gradient has been observed since 2012 and the trend continued throughout the 2018 to 2019 period.
- The change in phreatic surface measurements during the 2018 to 2019 period were typically in the order of ± 0.3 m from the June 2018 measurements. Based on the long term downward gradient trend, the phreatic surface within Lagoon D appears to be decreasing at a gradual rate.

5.1.4 WFTF

The following instruments have previously been installed to enable monitoring of the WFTF:

- 10 Vibrating Wire Piezometers (VWPs).
- 2 standpipe piezometers (groundwater wells).

The VWP data indicates that the pore water pressures measured at these instruments were slightly above the tip of the VWPs and did not significantly fluctuate during the September 2018 to July 2019 period. In some cases, the conditions at the tip of the VWP were dry and the measurements were generally consistent with the measurements from the previous year.

The VWP's were not installed as part of the dam safety monitoring program. They were installed to monitor the pore-water pressures in the tailings due to the concern for tailings migration into the toe of the Adit Waste Rock Dump. The piezometers indicate negative pore-pressure measurements, and only VWP29159 indicated a phreatic surface approximately 1 m above the tip of the VWP. The results indicate the tailings are draining.

The water levels within two groundwater monitoring wells (WF-2 South and WF-3 North) have gradually increased with the deposition of tailings in the WFTF since commissioning in 2006. It is noted that the two groundwater monitoring wells are located downstream of the WFTF facility and are not representative of the phreatic surface at the location of the WFTF embankment itself. The water levels measured at each of the groundwater monitoring wells is within the expected range during WFTF operations and hence there are no concerns regarding dam safety.

5.2 Settlement and Lateral Movement

The no significant movements or displacements were measured for Lagoons C and D during the September 2018 to July 2019 period, and there are no dam safety concerns. GPS data for Lagoons C and D did not show any concerns, and is being used for due diligence monitoring with respect to credible but very low probability embankment or foundation instability. A summary for each facility is presented below.

5.2.1 Lagoon A and B

There are no settlement or lateral movement monitoring instruments installed in Lagoons A or B.

5.2.1 Lagoon C

GPS Survey Monuments

- Eight GPS survey monuments (four pairs at the crest and dam toe along sections A-A, B-B, C-C and D-D) were monitored on a quarterly basis.
- C-A Upper and C-B Upper measured horizontal displacements of approximately 25 mm and 35 mm respectively. These measurements are beyond the survey tolerance levels, however the movements are not significant.
- C-D Upper pin was missing and hence this measurement was not recorded.

5.2.2 Lagoon D

Two inclinometers are installed in Lagoon D (North "LD_N" and South "LD_S") and extend through to the foundations. Cumulative displacements are measured for the A-Axis and B-Axis, with negative readings assigned for the upslope movement. The baseline readings for the LD_N and LD_S inclinometers were recorded on February 20, 2013 and March 19, 2013 respectively. The inclinometers were most recently measured on June 25, 2019.

LD_N

- The cumulative displacement from the June 2019 measurements is consistent with previous measurements, with less than 5 mm of displacement in the downstream direction of Lagoon D. The cumulative displacement increases to 33 mm towards the top of casing, in the upstream direction. This trend is consistent with the Lagoon D tailings consolidating under self-weight, with tailings at the top of casing settling towards the upstream direction.
- Incremental displacement measurements indicate downstream and upstream movements of less than 2.5 mm. The B-Axis indicated similar movements for the same period, indicating tailings settlement along the casing.
- No significant discrete displacements or localised shear planes were recorded during the September 2018 to June 2019 period.
- Since the 2013 baseline reading, no indications of discrete zones of movement have been observed, and the cumulative displacement trend is typical of tailings settlement adjacent to the inclinometer casing.

LD_S

- Measurements from 12.8 m below the top of casing to the surface recorded displacements of approximately 7 mm, trending towards the upstream (northward) direction. This trend is consistent with the Lagoon D tailings consolidating under self-weight, with tailings at the top of casing settling towards the upstream direction.
- At approximately 12.8 m below the top of casing, at the interface between CCR dam fill and fine tailings, the displacement direction changes from the upstream to downstream direction, with a maximum cumulative displacement of approximately 4.2 mm measured. This is an increase of approximately 1.5 mm when comparing the June 2018 and April 2019 measurements. However, there was a negligible change in the displacement from April 2019 to June 2019, and the rate of displacement over time is not a concern at this time. The cumulative displacement in the B-axis is typically less than 1 mm, and a maximum of 2 mm of displacement was measured towards the top of casing.
- The incremental displacement for both the A-axis and B-axis was typically less than 1 mm below the top of casing, with a maximum incremental displacement of 1.3 mm recorded.
- No significant discrete displacements or localised shear planes were recorded during the September 2018 to June 2019 period.
- Since the 2013 baseline reading, no indications of discrete zones of movement have been observed, and the cumulative displacement trend is typically of tailings settlement adjacent to the inclinometer casing.

At the time of writing, there were no measurements for the new inclinometers installed during the 2019 Lagoon SI.

GPS Survey Monuments

- Eight sets of GPS survey monuments are installed along each section of Lagoon D for a total of 23 GPS survey monuments (as shown in Appendix IV).
- All cross sections except H-H, have three survey monuments, typically located at the crest, midslope and toe of the dam.
- Cross section H-H has two survey monuments, one located at the crest and the other is located at the toe of the dam.
- Some survey monuments have recorded displacements outside of the survey tolerance (15 mm), but within the 50 mm threshold.
- The H-Upper survey monument recorded a horizontal displacement of approximately 60 mm. This appears to follow the trend from previous measurements. It is noted that there may be some discrepancy in the GPS data due to the previous method of processing GPS survey measurements. This system involved using a GPS control point to make corrections to Northing and Easting measurements, and it was noted that movement of the control point may cause errors in the measurements.
- EVO is in the process of revising the standard operating procedures for measuring GPS survey monuments and recording data.
- GPS survey pins for H Lower and C Lower monuments were destroyed and need to be replaced.

5.2.3 WFTF

The WFTF was constructed using rock fill overlying competent bedrock foundations, and therefore foundation instability is not a credible failure mode; hence it is judged that no instrumentation is required at the WFTF to monitor settlement or lateral movement at this time.

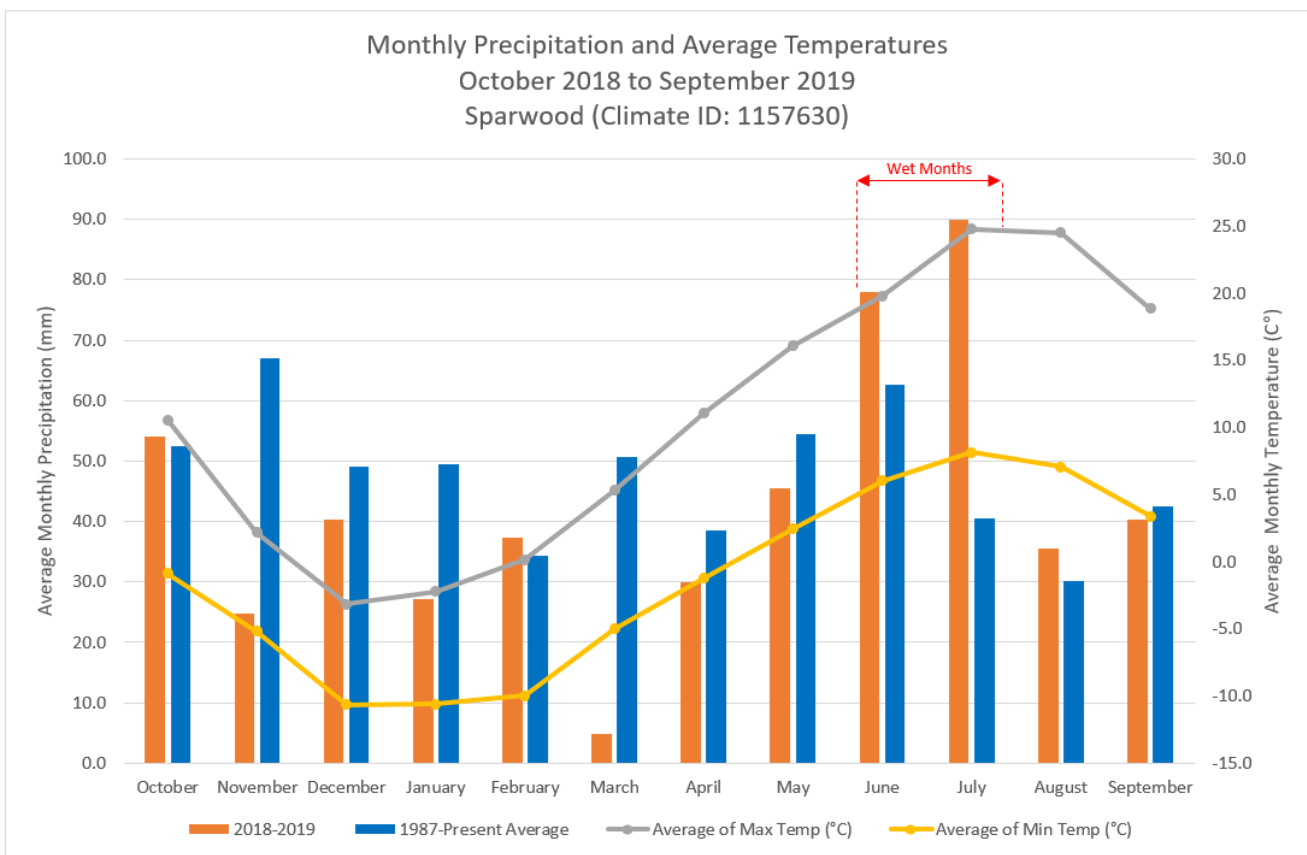
6 CLIMATE

The Elk Valley is semi-arid due to the lack of moisture that reaches eastern British Columbia. Both the amount of precipitation and the temperature are highly influenced by elevation in this area, causing more accumulation of snowpack at higher elevations.

Figure 6.1 presents the climate averages for Sparwood based on the Sparwood climate station (climate ID 1157630). The total recorded precipitation from the October 2018 to September 2019 period was approximately 507.9 mm, compared to a historical average of 572 mm. During this period there were approximately 154 days without precipitation, equivalent to 42 % of the 12 month period.

Precipitation during October 2018 and from June to August of 2019 was higher than the historical average. The precipitation for the 2018 to 2019 period has been lower in comparison the historical average. March 2019 had the lowest precipitation of the period with an average temperature of approximately zero degrees Celsius, during which most of the precipitation occurs as snowfall.

Figure 6.1 Climate Averages for Sparwood



Note: 1. Source: Environment Canada Sparwood climate station (Climate ID 1157630; El. 1138 m).

7 WATER MANAGEMENT

The water balance model for Lagoon C and D, and the WFTF was updated in 2019. The water balance model and report are currently in draft status, and the document will be finalized 2020. The recommendations made in the water balance update have been reported separately (KCB 2019c). The following sections provide a summary of the water management strategies used at each facility.

7.1 Lagoon A

Lagoon A does not receive any pumped tailings or water discharge, and rainfall typically infiltrates the tailings and discharges into the glacial till foundations or ponds on the surface of the lagoon and discharges through the spillway. The spillway was designed to accommodate the 1 in 200-year event. The water management at Lagoon A is managed passively and does not require any actions from site personnel.

7.2 Lagoon B

Lagoon B is similar to Lagoon A with water managed passively, with rainfall expected to infiltrate the tailings to the ground surface. EVO is able to utilize the storage capacity of Lagoon B to receive overflow process water in emergency situations, although this did not occur during the September 2018 to July 2019 period. The hydrotechnical assessment by Wood (2019) recommended upgrading the facility to meet regulatory requirements. EVO is considering increasing the storage capacity of the facility to accommodate the 72-hour IDF, or construction of a spillway to meet these regulatory requirements.

7.3 Lagoon C

Tailings deposition to Lagoon C has ceased since the late 1980's and the structure was designed to accommodate the 72-hour PMP event and maintain a 2 m minimum freeboard. Lagoon C is currently utilized as a sediment disposal location for sediments excavated from various sumps and ponds. Poned water typically infiltrates through the tailings and discharges at ground surface level where the tailings is in contact with glacial till foundations. Lagoon C has sufficient capacity to safely manage its IDF without a spillway, and ponded water infiltrates through the tailings to the natural ground.

7.4 Lagoon D

Tailings deposition to Lagoon D is managed using shallow cells to enable faster consolidation of tailings, with bleed water draining towards the center of the structure via temporary solid pipes through the pipe walls. Lagoon D does not possess an emergency spillway. The central decant pond is managed to maintain a 1.25 m minimum freeboard and 60 m wide beach to the ring-dyke embankments. The decant pond can accommodate the 72-hour PMP event. Overflow from the decant pond can be transferred to the plant site by pumping. The freeboard for Lagoon D is measured with a staff gauge on the east side of the internal splitter dyke.

7.5 WFTF

Tailings discharge is managed from six spigots located along the WFTF embankment. The decant pond is subsequently formed at the northern portion of the facility, confined by the Adit Ridge and the Cowboy Ridge. The decant pond in the WFTF is pumped to the plant for use in processing. The WFTF has sufficient freeboard to accommodate the IDF, and it is recommended that the OMS manual be updated to include the WFTF freeboard requirements.

7.6 Seepage

WFTF

- The seepage observed at the toe of the WFTF during the 2018 DSI was not observed during the 2019 DSI.

Lagoon A and B

- Seepage was not apparent at the toe of Lagoons A and B due to ponding at the between the facilities and the railway tracks.

Lagoon C

- Localized changes in vegetation on the downstream slope of Lagoon C potentially indicate periodic seepage spots.

Lagoon D

- Seepage was not apparent at the toe of Lagoon D due to ponding at toe.
- No wet spots or changes in vegetation were observed on the downstream slopes of the facility.

7.7 Discharge Quantities and Quality

Rainfall infiltrating through the surface of the Lagoons typically drains to the ground surface level. The original ground comprises layers of sand and gravel, glaciolacustrine clay, and till. The sand and gravel layers act as drains, draining the water from the lagoons into the ground water system. Infiltration into the ground water system is not measured. Seepage from the WFTF is expected to report to shallow bedrock sequences below the dam. To date, seepage from the Lagoon Tailings Area and the WFTF have not resulted in water quality exceedances. Typically, the infiltration of rainfall or ponded water through the tailings occurs slowly, with no observed seepage recovery points. Water quality samples collected from the WFTF South Monitoring Well indicated the turbidity levels have decreased since the 2018 period to a negligible level, as measured from field and lab values. It is noted that EVO reports water quality data directly to the Ministry of Environment.

8 DAM SAFETY ASSESSMENT

Lagoons A, B, C, and D, and the WFTF appeared to be in good physical condition with no signs of structural distress based on observations during the 2019 DSI. At the time of inspection tailings deposition to the Lagoon D cells was occurring and the structure was being raised in accordance with normal operating procedures.

The following sections provide additional detail on specific dam safety categories and detail deficiencies where applicable.

8.1 Dam Classification Review

The WFTF, Lagoon A and Lagoon B have been classified as “Low” consequence structures in accordance with the CDA guidelines (Wood 2019). Lagoon C and D and have been classified as “High” (Amec 2014) and “Very High” consequence structures respectively due to the potential impacts to the downstream environment and population at risk (Wood 2018). A routine review and update of the dam break inundation study for Lagoon D was initiated during 2019, and is in progress at the time of writing. The consequence classification for Lagoon D will be reviewed and updated if appropriate during 2020 based on the upcoming results of the updated inundation study. The current consequence classifications for the WFTF and Lagoons A, B, C, and D are appropriate.

8.2 Failure Modes Review

Formal Failure Mode and Effects Analyses (FMEA) are currently in progress for a several tailings dams at the EVO site. Risk assessments for Lagoons C and D were completed in 2017. Assessments for the WFTF, Lagoons A and B are in progress.

8.2.1 Overtopping

Overtopping is a credible failure mode for the current Lagoons A, B, and C. It is not credible for Lagoon D given the storage capacity that is available.

The passive water management strategy for Lagoons A, B, and C is to allow ponded water to infiltrate through the tailings and discharge into the glacial till foundations at ground surface level. The freeboard and flood routing analyses completed for Lagoon B, determined that Lagoon B does not have adequate storage to contain the IDF (Wood 2019). EVO is considering options to enhance Lagoon B by either increasing the storage capacity or constructing a spillway to bring the facility into compliance with regulatory requirements. The risk of overtopping for Lagoons A, C, and D is managed through appropriately designed storage capacity and minimum freeboards (refer Table 2.5).

Overtopping is a credible failure mode for the WFTF however, the available freeboard during the 2019 DSI was approximately 10 m and therefore the facility is unlikely to overtop during a rare rainfall event. The freeboard requirement for the WFTF should be assessed in 2020 and reported in the OMS Manual.

8.2.2 Internal Erosion and Piping

Internal erosion and piping are credible failure modes for Lagoon D and the WFTF only. Lagoons A, B, and C do not maintain a pond, and therefore failure due to internal erosion and piping is not credible. Monitoring instruments within the Lagoons typically indicates a downward gradient to the glacial till foundation level. No piping of embankments or tailings material was observed during the 2019 DSI or routine inspections by EVO personnel.

Design and construction modifications were made to the WFTF Adit Toe Berm in 2019 to address the risk of tailings migration into the Adit Dump. The Adit Toe Berm design includes a specification for material particle size to function as a filter for the tailings. No piping of the WFTF embankment was observed during the 2019 DSI, however a single point of erosion was observed at each of the WFTF abutments. Tailings was observed to be eroding into the WFTF abutment where the filter material may be too coarse. This should be addressed during the design phase for additional raises to the WFTF.

Monitoring the dam slopes and toes for seepage and erosion is part of the scheduled surveillance during routine inspections.

8.2.3 Slope Instability

Slope instability is a credible failure mode for many dams. No signs of slope instability were observed for Lagoons A, B, C, and D, and the WFTF during the 2019 DSI. All structures meet the minimum target Factor of Safety (FoS) for stability as described in Section 2.4. Based on previous geotechnical investigations, glaciolacustrine clay foundation units underlie Lagoon A, C and D. The stability analyses for these structures should be reviewed based on the 2019 Lagoon Site Investigation data and potentially revised, pending the outcomes.

8.2.4 Surface Erosion

EVO personnel conduct routine inspections of the tailings dams and monitor the downstream and upstream slopes for surface erosion caused by snow melt or rainfall runoff. Surface erosion was observed on Lagoon C at several locations, including upstream erosion at a point near the pumphouse which should be repaired as part of closure works. Minor surface erosion was also observed on Lagoon D at several upstream and downstream slope locations. The upstream erosion should be repaired as part of placement works on the crest and the downstream minor erosion should be monitored, tracked and repaired .

The magnitude of surface erosion for Lagoons A, B, C and D, and the WFTF is not a concern to dam safety. EVO has been utilizing a tackifier to effectively control most of the erosion on the downstream face of the structures.

8.2.5 Earthquake

The 2018 DSI report states that Lagoons A and B are not susceptible to seismic ground motions because of the low design seismicity (less than 0.1 g) and the small size of the dams. The 2018 DSI report also states that the WFTF is not susceptible to seismic ground motions because the embankment was constructed using rockfill overlying competent bedrock foundations.

EVO has adopted a 1 in 2,475-year return period seismic event for these structures which is above the minimum CDA requirement of a 1 in 100-year return period.

Lagoon C and D have been designed to a 1 in 2,475-year and 1 in 5,000-year return period seismic event respectively. The stability models for Lagoon D are in the process of being revised to include the additional characterization of glaciolacustrine clay foundations undertaken as part of the 2019 Lagoon Site Investigation.

8.3 OMS Manual and EPRP

EVO have three separate OMS Manuals, encompassing inactive Lagoons A, B and C, Lagoon D and the WFTF. The OMS Manual for the inactive lagoons was updated in 2019 and the documents are current. The OMS Manuals for Lagoon D and the WFTF were also revised in 2019, and additional updates and restructuring will occur in 2020 to make the documents consistent with the MAC OMS guidelines (MAC 2019).

An EPRP was been prepared for Lagoon D in October 2014 which is a combined emergency preparedness plan and emergency response plan and has been subject to a tabletop test in 2018. The EPRP document will be updated in 2020 with consideration of the results of the dam break inundation study. The EPRP document for Lagoons A, B and C is up to date for 2019, with revisions required. No significant changes have occurred for Lagoons A, B and C since 2014, however the EPRP should be revised as necessary to include current emergency contact information.

An EPRP was prepared for the WFTF in 2020 and is an adequate action plan in the event of a dam safety emergency at the WFTF.

8.4 Previous Dam Safety Review

The last DSR completed for the EVO site was in 2018, which covered Lagoons A, B, C, and D and the WFTF. DSRs are conducted at five-yearly intervals, and the next DSR will be undertaken in 2023.

9 RECOMMENDATIONS

Recommendations are prioritized based on the scheme recommended in BCMEM (2016), as shown in Table 9.1.

Table 9.1 Prioritization of Action Items

Priority	Description
1	A high probability or actual dam safety issues considered dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice – further improvements are necessary to meet best practices or reduce potential risks.

The outstanding 2018 DSI recommended actions (Wood, 2019) and 2019 DSI recommended actions for Lagoons A, B, C, and D, and the WFTF are presented in Table 9.2. Each recommendation is assigned a number with the prefix based on the year that item was recommended. 2019 recommended actions are presented in bold text and actions noted as completed or closed in this report are greyed out and will be removed from the register in subsequent reports. Each item is defined as a dam safety deficiency or a non-conformance, with the CDA (2016) definitions as follows:

- Deficiency: “an inadequacy, or uncertainty in the adequacy, of the dam system to meet its performance goals in accordance with good dam safety practices”.
- Non-conformance: “an inadequacy in the non-physical controls (procedures, processes and management systems) necessary to maintain the safety of the dam”.

Table 9.2 Summary of Recommendations

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
Previous DSI Items							
2015-01	Lagoon B	Assess the potential for overtopping the dam containing Lagoon B and determine if remedial measures are required.	N/A	N/A	Closed	2019	Lagoon Inundation memo and spillway design was completed in 2018 and was finalized in 2019.
2013-02	Lagoon C	Investigate possible removal of overhead pipelines located in the southeast corner of the Lagoon as identified in the risk assessment. The wood structure could deteriorate over time creating voids in the embankment.	3	Deficiency	Closed	End 2019	The pipelines are no longer being used and were assessed to not be a threat to dam safety.
2013-03	Lagoon C	Along the shoreline of the Elk River, the grading, riprap material weathering, soil erosion and the existence of a filter zone under riprap needs to be assessed in the design evaluations.	4	N/A	In Progress	End of 2020	The assessment was completed in 2019.
2013-08	Lagoon C	Per 2007 CDA guidelines, the next DSR for Lagoon C will be in seven years (2020).	4	N/A	Complete	2020	DSR completed in 2018
2013-13	Lagoon D	Per 2007 CDA guidelines, the next DSR for Lagoon D should be performed in five years.	4	N/A	Complete	2020	DSR completed in 2018
2017-01	WFTF	The current water balance model should be upgraded to include the increases of the tailings surface and dam crest over time up to the ultimate configuration.	2	Non-Conformance	Complete	2020	Water balance has been revised in 2019.

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
2019 DSI Items							
2019-01	Lagoon B	Lagoon B requires an increase in storage capacity to manage the IDF (72-hr PMP), or requires the construction of a spillway to meet regulatory requirements.	2	Deficiency	New Action / Not Complete	2020	N/A
2019-02	Lagoon D	GPS survey monuments H Lower and C Lower were destroyed. It is recommended that these monuments be replaced.	3	Potential Deficiency	New Action / Not Complete	2020	N/A
2019-03	Lagoon D	The pipes that allow the cells to drain into the central area of Lagoon D appeared to have inconsistent elevations that may possibly be higher than the outer walls of the cells. It is recommended that the pipe elevations be visually checked and corrected as required. This procedure should be implemented in the OMS manual and training should be given to staff assigned to moving the pipes.	3	Potential Deficiency	New Action / Not Complete	2020	N/A
2019-04	WFTF	Possible signs of tailings migration into the abutment was observed during the 2019 inspection. The next stage of the design to El. 1,710 m should include measures to minimize the risk of tailings migration through WFTF embankment.	3	Potential Deficiency	New Action / Not Complete	Prior to next raise	N/A
2019-05	WFTF	The freeboard requirements for the WFTF should be stated in the OMS manual.	3	Potential Non-Conformance	New Action / Not Complete	End of 2020	N/A

Action ID	Facility	Action Description	Priority	Deficiency / Non-conformance	Status	Recommended Deadline	Notes (as at time of report issue)
2019-06	Lagoons A, B, C and D	The stability analyses for these facilities should be reviewed based on the 2019 Lagoon Site Investigation data, and potentially revised, pending the outcomes.	3	N/A	New Action / Not Complete	End of 2020	N/A
2019-07	All Facilities	The OMS Manual should be updated to include maintenance items described in Section 4.6, and to repair minor erosion as required.	3	Potential Non-Conformance	New Action / Not Complete	End of 2020	N/A

Notes: Recommendation priority guidelines specified in the HSRC Guidance Document (BCMCM, 2016) and assigned by KCB.

Priority 1: A high probability or actual dam safety issue considered dangerous to life, health or the environment, or a significant risk of regulatory enforcement.

Priority 2: If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.

Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.

Priority 4: Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks.

10 CLOSING

Based on the site inspections noted and data reviewed, Lagoons A, B, C, and D, and the WFTF are in an adequate condition and continues to perform satisfactorily.

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Teck Coal Limited (Client) for the specific application to the West Fork Tailings Facility, Lagoons A, B, C and D, and it may not be relied upon by any other party without KCB's written consent. KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

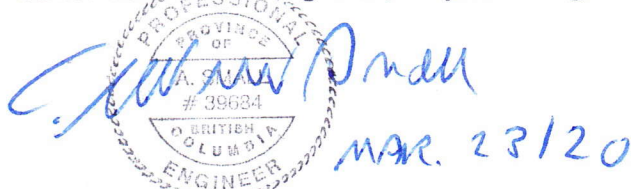
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APPENDIX I

Inspection Photographs

Lagoon A
Lagoon B
Lagoon C
Lagoon D
WFTF

Appendix I
Inspection Photographs
(Taken on July 8 and 9, 2019 during DSI)

I-1.1 Lagoon A

Photo IA-0 Lagoon A photograph plan layout



Notes:

1. Excludes helicopter photographs
2. Selected photo locations and direction taken are approximate only

Photo IA-1 Lagoon A overview. (looking west)



Helicopter photo

Photo IA-2 Crest and downstream slope. (looking east)



Latitude: 49°45'11.65"N. Longitude: 114°52'25.48"W

Photo IA-3 Typical surface conditions. (looking south)



Latitude: 49°45'10.71"N. Longitude: 114°52'29.05"W

Photo IA-4 Rockfill armoured spillway. (looking north)



Latitude: 49°45'7.31"N. Longitude: 114°52'25.51"W

I-1.2 Lagoon B

Photo IB-0 Lagoon B photograph plan layout



Notes:

1. Excludes helicopter photographs
2. Selected photo locations and direction taken are approximate only

Photo IB-1 Lagoon B overview. (looking west)



Helicopter photo

Photo IB-2 Crest and typical surface conditions. (looking southwest)



Latitude: 49°45'15.60"N. Longitude: 114°52'21.46"W

Photo IB-3 Typical surface conditions. (looking northeast)



Latitude: 49°45'13.02"N. Longitude: 114°52'30.25"W

Photo IB-4 Minor slumping of Lagoon B. (looking northeast)



Latitude: 49°45'12.25"N. Longitude: 114°52'31.43"W

Photo IB-5 Typical downstream slope condition. (looking southwest)



Latitude: 49°45'23.21"N. Longitude: 114°52'28.41"W

I-1.3 Lagoon C

Photo IC-0 Lagoon B photograph plan layout



Notes:

1. Excludes helicopter photographs
2. Selected photo locations and direction taken are approximate only

Photo IC-1 Lagoon C overview. (looking west)



Helicopter photo

Photo IC-2 Typical surface conditions. (looking north)



Latitude: 49°45'3.38"N. Longitude: 114°52'49.23"W

Photo IC-3 Typical crest and surface conditions. (looking southwest)



Latitude: 49°45'19.34"N. Longitude: 114°52'31.70"W

Photo IC-4 Typical downstream slope condition. (looking north)



Latitude: 49°45'4.17"N. Longitude: 114°52'51.09"W

Photo IC-5 Local erosion and sparse vegetation. (looking southwest)



Latitude: 49°45'13.16"N. Longitude: 114°52'31.44"W

Photo IC-6 Local low spot on crest. (looking east)



Latitude: 49°45'8.18"N. Longitude: 114°52'39.04"W

Photo IC-7 Changes in vegetation potentially indicating seepage or wet spots. (looking west)



Latitude: 49°45'16.91"N. Longitude: 114°52'57.82"W

Photo IC-8 Erosion on the upstream side near the pumphouse. (looking south)



Latitude: 49°45'24.88"N. Longitude: 114°52'45.30"W

Photo IC-9 Decant Pond transfer pipeline from Lagoon D to Lagoon C. (looking west)



Latitude: 49°45'10.55"N. Longitude: 114°52'34.39"W

Photo IC-10 Ponding between the toe of Lagoon C and the railroad tracks. (looking west)



Latitude: 49°45'19.96"N. Longitude: 114°52'29.99"W

Photo IC-11 Riprap on at the toe of Lagoon C, adjacent to the Elk River. (looking North)



Latitude: 49°45'15.07"N. Longitude: 114°52'59.32"W

I-1.4 Lagoon D

Photo ID-0 Lagoon D photograph plan layout



Notes:

1. Excludes helicopter photographs
2. Selected photo locations and direction taken are approximate only

Photo ID-1 Lagoon D overview. (looking west)



Helicopter photo

Photo ID-2 Lagoon D overview. (looking east)



Helicopter photo

Photo ID-3 Internal pipes that drain cells to the central area appear to have inconsistent elevations. (looking north)



Helicopter photo

Photo ID-4 Typical crest conditions. (looking east)



Latitude: 49°44'56.27"N. Longitude: 114°52'44.66"W

Photo ID-5 Typical crest conditions. (looking west)



Latitude: 49°45'1.58"N. Longitude: 114°52'24.49"W

Photo ID-6 Typical bench conditions. (looking west)



Latitude: 49°44'59.89"N. Longitude: 114°52'42.70"W

Photo ID-7 Minor rockfall from the crest onto the second bench and application of tackifier to vegetate slopes. (looking west)



Latitude: 49°45'1.94"N. Longitude: 114°52'11.24"W

Photo ID-8 Upstream crest erosion 1. (looking west)



Latitude: 49°45'1.80"N. Longitude: 114°52'5.56"W

Photo ID-9 Upstream crest erosion 2. (looking west)



Latitude: 49°44'45.63"N. Longitude: 114°52'34.28"W

Photo ID-10 Minor bench erosion. (looking south)



Latitude: 49°45'5.84"N. Longitude: 114°52'22.83"W

Photo ID-11 Typical internal cell on crest. (looking south)



Latitude: 49°45'1.69"N. Longitude: 114°52'23.01"W

Photo ID-12 Reclamation area condition. (looking south)



Latitude: 49°44'56.20"N. Longitude: 114°52'44.44"W

Photo ID-13 Discharge line to central decant. (looking west)



Latitude: 49°44'59.16"N. Longitude: 114°52'11.13"W

Photo ID-14 Wind fence conditions. (looking west)



Latitude: 49°44'45.65"N. Longitude: 114°52'26.41"W

Photo ID-15 Typical vegetation and tree spacing at the western benches. (looking northwest)



Latitude: 49°44'42.87"N. Longitude: 114°52'41.77"W

Photo ID-16 Transfer pipeline from Lagoon D to Lagoon C. (looking north)



Latitude: 49°45'2.61"N. Longitude: 114°52'27.97"W

Photo ID-17 Decant Pond and upstream slope conditions. (looking west)



Latitude: 49°44'48.99"N. Longitude: 114°52'31.57"W

Photo ID-18 Downstream erosion and sparse vegetation. (looking west)



Latitude: 49°44'48.13"N. Longitude: 114°52'15.88"W

Photo ID-19 Minor gully erosion on the southern portion of the lagoon. (looking south)



Latitude: 49°44'43.31"N. Longitude: 114°52'29.56"W

I-1.5 West Fork Tailings Facility (WFTF)

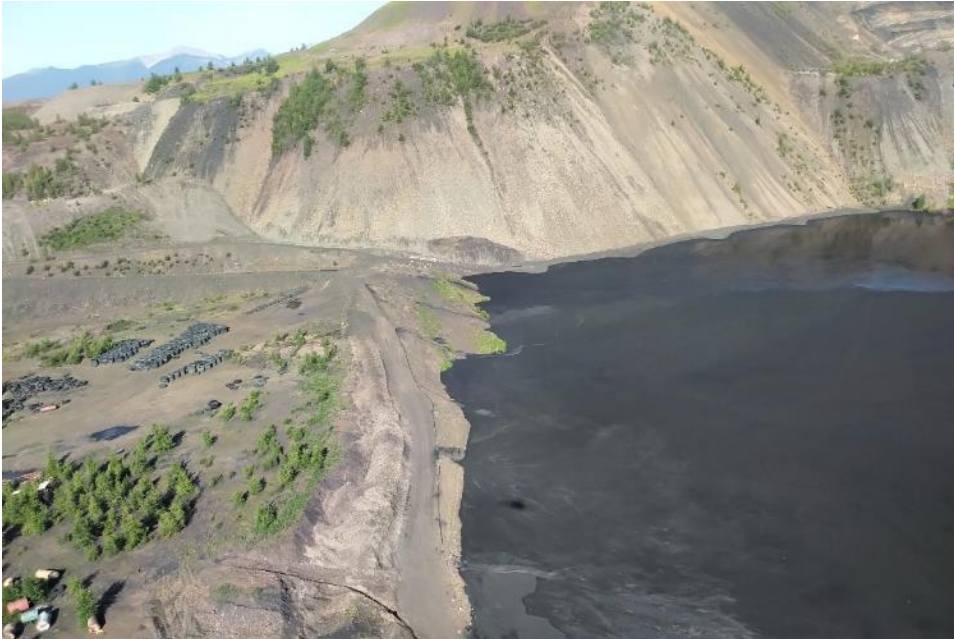
Photo IW-0 WFTF photograph plan layout



Notes:

1. Excludes helicopter photographs
2. Selected photo locations and direction taken are approximate only

Photo IW-1 WFTF embankment overview. (looking west)



Helicopter photo

Photo IW-2 WFTF storage area overview. (looking south)



Helicopter photo

Photo IW-3 Adit Toe Berm and tailings infiltration into west abutment. (looking north)



Latitude: 49°45'1.59"N. Longitude: 114°47'36.07"W

Photo IW-4 Tailings infiltration into east abutment. (looking north)



Latitude: 49°45'4.30"N. Longitude: 114°47'36.53"W

Photo IW-5 Upstream slope erosion protection at spigot 1. (looking northwest)



Latitude: 49°45'3.41"N. Longitude: 114°47'19.94"W

Photo IW-6 Upstream slope erosion protection at spigot 2. (looking south)



Latitude: 49°45'5.36"N. Longitude: 114°47'34.72"W

Photo IW-7 Crest typical conditions 1. (looking east)



Latitude: 49°45'1.82"N. Longitude: 114°47'16.96"W

Photo IW-8 Crest typical conditions 2. (looking east)



Latitude: 49°45'2.91"N. Longitude: 114°47'26.61"W

APPENDIX II

Inspection Checklist

Lagoon A
Lagoon B
Lagoon C
Lagoon D
WFTF

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon A		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,119.0 m
Accompanied by	-	Spillway Invert El.	1,118.3 m
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Slopes/Toe/Crest Surface	Available Freeboard	0.33 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
1.0 Upstream Dam Slope and Tailings Surface					
1.1	Concern with Current or Previous Water Level		X		
1.2	Evidence of Wave or Other Erosion/Gullyng		X		
1.3	Evidence of Sloughing/Sliding		X		
1.4	Evidence of Cracking		X		
1.5	Evidence of Movement		X		
1.6	Other Deformation/Settlement/Sinkholes		X		
1.7	Other Unusual Conditions		X		
1.8	Repairs Required		X		
2.0 Dam Crest					
2.1	Evidence of Shoulder/Erosion		X		
2.2	Evidence of Cracking		X		
2.3	Evidence of Movement		X		
2.4	Other Deformation/Settlement/Sinkholes		X		
2.5	Concerns with Low Areas on the Crest		X		
2.6	Concerns with crest width		X		
2.7	Other Unusual Conditions		X		
2.8	Repairs Required		X		
3.0 Downstream Dam Slope					
3.1	Evidence of Erosion		X		
3.2	Evidence of Sloughing/Sliding		X		
3.3	Evidence of Cracking		X		
3.4	Evidence of Movement		X		
3.5	Any Other Deformation		X		
3.6	Signs of Phreatic Surface/Seepage		X		
3.7	Seepages Observed		X		
3.8	Is Seepage (if any) Turbid		X		
3.9	Other Unusual Conditions		X		
3.10	Repairs Required		X		
4.0 Dam Abutments					
4.1	Seepages Observed			X	
4.2	Is Seepage (if any) Turbid			X	
4.3	Evidence of Erosion			X	
4.4	Evidence of Cracking			X	
4.5	Evidence of Movement			X	
4.6	Other Deformation/Settlement/Sinkholes			X	
4.7	Other Unusual Conditions			X	
4.8	Repairs Required			X	

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon A		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,119.0 m
Accompanied by	-	Spillway Invert El.	1,118.3 m
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Toe/Surface	Available Freeboard	0.33 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	Photo	Comments
5.0 Downstream Toe					
5.1	Seepages Observed		X		
5.2	Is Seepage (if any) Turbid		X		
5.3	Evidence of Soft Toe Condition		X		
5.4	Evidence of Sloughing/Sliding		X		
5.5	Evidence of Boils		X		
5.6	Evidence of Contamination/Vegetation Kills		X		
5.7	Excessive Vegetation		X		
5.8	Other Unusual Conditions		X		
5.9	Repairs Required		X		
6.0 Spillway					
6.1	Obstruction by debris or vegetation		X		
6.2	Lack of Erosion Protection		X		
6.3	Slope Deterioration (Sloughing, Erosion etc...)		X		
6.4	Other Unusual Conditions		X		
6.5	Repairs Required		X		
7.0 Other					
7.1	Other Unusual Conditions		X		
7.2	Sketch (if required):				

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon B		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,118.5 m
Accompanied by	-	Spillway Invert El.	1,118.2 m
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Slopes/Toe/Crest Surface	Available Freeboard	0.37 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
1.0 Upstream Dam Slope and Tailings Surface					
1.1	Concern with Current or Previous Water Level		X		
1.2	Evidence of Wave or Other Erosion/Gullyng		X		
1.3	Evidence of Sloughing/Sliding		X		
1.4	Evidence of Cracking		X		
1.5	Evidence of Movement		X		
1.6	Other Deformation/Settlement/Sinkholes		X		
1.7	Other Unusual Conditions		X		
1.8	Repairs Required		X		
2.0 Dam Crest					
2.1	Evidence of Shoulder/Erosion		X		
2.2	Evidence of Cracking		X		
2.3	Evidence of Movement		X		
2.4	Other Deformation/Settlement/Sinkholes		X		
2.5	Concerns with Low Areas on the Crest		X		
2.6	Concerns with crest width		X		
2.7	Other Unusual Conditions		X		
2.8	Repairs Required		X		
3.0 Downstream Dam Slope					
3.1	Evidence of Erosion		X		
3.2	Evidence of Sloughing/Sliding		X		
3.3	Evidence of Cracking		X		
3.4	Evidence of Movement		X		
3.5	Any Other Deformation		X		
3.6	Signs of Phreatic Surface/Seepage		X		
3.7	Seepages Observed		X		
3.8	Is Seepage (if any) Turbid		X		
3.9	Other Unusual Conditions		X		
3.10	Repairs Required		X		
4.0 Dam Abutments					
4.1	Seepages Observed			X	N/A
4.2	Is Seepage (if any) Turbid			X	N/A
4.3	Evidence of Erosion			X	N/A
4.4	Evidence of Cracking			X	N/A
4.5	Evidence of Movement			X	N/A
4.6	Other Deformation/Settlement/Sinkholes			X	N/A
4.7	Other Unusual Conditions			X	N/A
4.8	Repairs Required			X	N/A

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon B		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,118.5 m
Accompanied by	-	Spillway Invert El.	1,118.2 m
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Toe/Surface	Available Freeboard	0.37 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
5.0 Downstream Toe					
5.1	Seepages Observed		X		
5.2	Is Seepage (if any) Turbid		X		
5.3	Evidence of Soft Toe Condition		X		
5.4	Evidence of Sloughing/Sliding	X			Minor slumping failure into marsh.
5.5	Evidence of Boils		X		
5.6	Evidence of Contamination/Vegetation Kills		X		
5.7	Excessive Vegetation		X		
5.8	Other Unusual Conditions		X		
5.9	Repairs Required		X		
6.0 Spillway					
6.1	Obstruction by debris or vegetation			X	No spillway
6.2	Lack of Erosion Protection			X	
6.3	Slope Deterioration (Sloughing, Erosion etc...)			X	
6.4	Other Unusual Conditions			X	
6.5	Repairs Required			X	
7.0 Other					
7.1	Other Unusual Conditions		X		
7.2	Sketch (if required):				

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon C		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1.129.3 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Slopes/Toe/Crest Surface	Available Freeboard	2.0 m (varies)
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
1.0 Upstream Dam Slope and Tailings Surface					
1.1	Concern with Current or Previous Water Level		X		
1.2	Evidence of Wave or Other Erosion/Gullyng	X			Upstream erosion at a point near the pumphouse. To be monitored.
1.3	Evidence of Sloughing/Sliding		X		
1.4	Evidence of Cracking		X		
1.5	Evidence of Movement		X		
1.6	Other Deformation/Settlement/Sinkholes		X		
1.7	Other Unusual Conditions		X		
1.8	Repairs Required		X		
2.0 Dam Crest					
2.1	Evidence of Shoulder/Erosion		X		
2.2	Evidence of Cracking		X		
2.3	Evidence of Movement		X		
2.4	Other Deformation/Settlement/Sinkholes		X		
2.5	Concerns with Low Areas on the Crest	X			Minor localised low area
2.6	Concerns with crest width		X		
2.7	Other Unusual Conditions		X		
2.8	Repairs Required		X		
3.0 Downstream Dam Slope					
3.1	Evidence of Erosion		X		
3.2	Evidence of Sloughing/Sliding		X		
3.3	Evidence of Cracking		X		
3.4	Evidence of Movement		X		
3.5	Any Other Deformation		X		
3.6	Signs of Phreatic Surface/Seepage		X		
3.7	Seepages Observed	X			Change in vegetation indicating occasional wet spots
3.8	Is Seepage (if any) Turbid		X		
3.9	Other Unusual Conditions		X		
3.10	Repairs Required		X		
4.0 Dam Abutments					
4.1	Seepages Observed			X	
4.2	Is Seepage (if any) Turbid			X	
4.3	Evidence of Erosion			X	
4.4	Evidence of Cracking			X	
4.5	Evidence of Movement			X	
4.6	Other Deformation/Settlement/Sinkholes			X	
4.7	Other Unusual Conditions			X	
4.8	Repairs Required			X	

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon C		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1.129.3 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	N/A
Walk Over Inspection	Crest/Toe/Surface	Available Freeboard	2.0 m (varies)
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
5.0 Downstream Toe					
5.1	Seepages Observed		X		
5.2	Is Seepage (if any) Turbid		X		
5.3	Evidence of Soft Toe Condition		X		
5.4	Evidence of Sloughing/Sliding		X		
5.5	Evidence of Boils		X		
5.6	Evidence of Contamination/Vegetation Kills		X		
5.7	Excessive Vegetation		X		
5.8	Other Unusual Conditions		X		
5.9	Repairs Required		X		
6.0 Spillway					
6.1	Obstruction by debris or vegetation			X	
6.2	Lack of Erosion Protection			X	
6.3	Slope Deterioration (Sloughing, Erosion etc...)			X	
6.4	Other Unusual Conditions			X	
6.5	Repairs Required			X	
7.0 Other					
7.1	Other Unusual Conditions			X	
7.2	Sketch (if required):				

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon D		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,168.0 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	1,165.0 m
Walk Over Inspection	Crest/Slopes/Toe/Crest Surface	Available Freeboard	N/A
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
1.0 Upstream Dam Slope and Tailings Surface					
1.1	Concern with Current or Previous Water Level		X		
1.2	Evidence of Wave or Other Erosion/Gullyng	X			
1.3	Evidence of Sloughing/Sliding		X		Minor upstream erosion.
1.4	Evidence of Cracking		X		
1.5	Evidence of Movement		X		
1.6	Other Deformation/Settlement/Sinkholes		X		
1.7	Other Unusual Conditions	X			Pipe elevations in cells are inconsistent.
1.8	Repairs Required	X			Upstream erosion to be repaired.
2.0 Dam Crest					
2.1	Evidence of Shoulder/Erosion		X		
2.2	Evidence of Cracking		X		
2.3	Evidence of Movement		X		
2.4	Other Deformation/Settlement/Sinkholes		X		
2.5	Concerns with Low Areas on the Crest		X		
2.6	Concerns with crest width		X		
2.7	Other Unusual Conditions	X			Minor animal burrows in benches.
2.8	Repairs Required		X		
3.0 Downstream Dam Slope					
3.1	Evidence of Erosion	X			Minor erosion on slope.
3.2	Evidence of Sloughing/Sliding		X		
3.3	Evidence of Cracking		X		
3.4	Evidence of Movement		X		
3.5	Any Other Deformation		X		
3.6	Signs of Phreatic Surface/Seepage		X		
3.7	Seepages Observed		X		
3.8	Is Seepage (if any) Turbid		X		
3.9	Other Unusual Conditions		X		
3.10	Repairs Required		X		
4.0 Dam Abutments					
4.1	Seepages Observed		X		
4.2	Is Seepage (if any) Turbid		X		
4.3	Evidence of Erosion		X		
4.4	Evidence of Cracking		X		
4.5	Evidence of Movement		X		
4.6	Other Deformation/Settlement/Sinkholes		X		
4.7	Other Unusual Conditions		X		
4.8	Repairs Required		X		

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	Lagoon D		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,168.0 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	1,165.0 m
Walk Over Inspection	Crest/slopes/Toe/Surface	Available Freeboard	N/A
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
5.0 Downstream Toe					
5.1	Seepages Observed		X		
5.2	Is Seepage (if any) Turbid		X		
5.3	Evidence of Soft Toe Condition		X		
5.4	Evidence of Sloughing/Sliding		X		
5.5	Evidence of Boils		X		
5.6	Evidence of Contamination/Vegetation Kills		X		
5.7	Excessive Vegetation		X		
5.8	Other Unusual Conditions		X		
5.9	Repairs Required		X		
6.0 Spillway					
6.1	Obstruction by debris or vegetation		X		
6.2	Lack of Erosion Protection		X		
6.3	Slope Deterioration (Sloughing, Erosion etc...)		X		
6.4	Other Unusual Conditions		X		
6.5	Repairs Required		X		
7.0 Other					
7.1	Other Unusual Conditions		X		
7.2	Sketch (if required):				

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	West Fork Tailings Facility		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,679.5 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	1,665.0 m
Walk Over Inspection	Crest/Slopes/Toe	Available Freeboard	10.5 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
1.0 Upstream Dam Slope					
1.1	Concern with Current or Previous Water Level		X		
1.2	Evidence of Wave or Other Erosion/Gullyng		X		
1.3	Evidence of Sloughing/Sliding		X		
1.4	Evidence of Cracking		X		
1.5	Evidence of Movement		X		
1.6	Other Deformation/Settlement/Sinkholes		X		
1.7	Other Unusual Conditions		X		
1.8	Repairs Required		X		
2.0 Dam Crest					
2.1	Evidence of Shoulder/Erosion		X		
2.2	Evidence of Cracking		X		
2.3	Evidence of Movement		X		
2.4	Other Deformation/Settlement/Sinkholes		X		
2.5	Concerns with Low Areas on the Crest		X		
2.6	Concerns with crest width		X		
2.7	Other Unusual Conditions		X		
2.8	Repairs Required		X		
3.0 Downstream Dam Slope					
3.1	Evidence of Erosion		X		
3.2	Evidence of Sloughing/Sliding		X		
3.3	Evidence of Cracking		X		
3.4	Evidence of Movement		X		
3.5	Any Other Deformation		X		
3.6	Signs of Phreatic Surface/Seepage		X		
3.7	Seepages Observed		X		
3.8	Is Seepage (if any) Turbid		X		
3.9	Other Unusual Conditions		X		
3.10	Repairs Required		X		
4.0 Dam Abutments					
4.1	Seepages Observed	X			Migration of tailings into both abutments
4.2	Is Seepage (if any) Turbid		X		
4.3	Evidence of Erosion		X		
4.4	Evidence of Cracking		X		
4.5	Evidence of Movement		X		
4.6	Other Deformation/Settlement/Sinkholes		X		
4.7	Other Unusual Conditions		X		
4.8	Repairs Required		X		

Dam Safety Inspection Checklist



Dam Site	Teck Elkview Operations		
Dam Structure	West Fork Tailings Facility		
Inspected by	Michael Cyr P.Eng / David Willms P.Eng	Crest El.	1,679.5 m
Accompanied by	-	Spillway Invert El.	N/A
Date of Inspection	July 8 and 9, 2019	Reservoir Level El.	1,665.0 m
Walk Over Inspection	Crest/slopes/Toe/Surface	Available Freeboard	10.5 m
Weather Conditions	Sunny		

ID	Observed Features	Yes	No	N/A	Comments
5.0 Downstream Toe					
5.1	Seepages Observed		X		
5.2	Is Seepage (if any) Turbid		X		
5.3	Evidence of Soft Toe Condition		X		
5.4	Evidence of Sloughing/Sliding		X		
5.5	Evidence of Boils		X		
5.6	Evidence of Contamination/Vegetation Kills		X		
5.7	Excessive Vegetation		X		
5.8	Other Unusual Conditions		X		
5.9	Repairs Required		X		
6.0 Spillway					
6.1	Obstruction by debris or vegetation			X	
6.2	Lack of Erosion Protection			X	
6.3	Slope Deterioration (Sloughing, Erosion etc...)			X	
6.4	Other Unusual Conditions			X	
6.5	Repairs Required			X	
7.0 Other					
7.1	Other Unusual Conditions		X		
7.2	Sketch (if required):				

APPENDIX III

Cross Sections (provided by EVO)

Lagoon C
Lagoon D

CROSS-SECTION

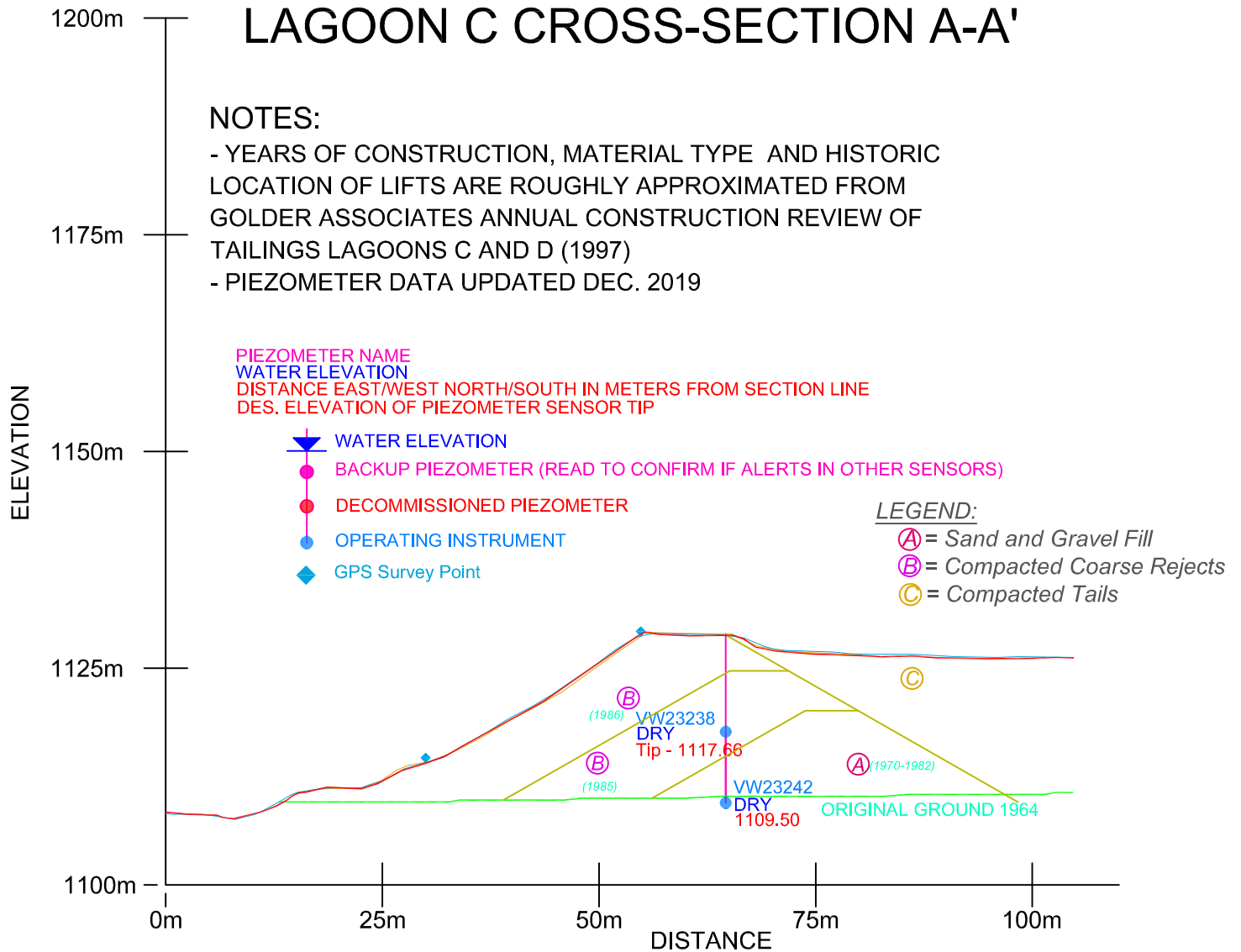
ORIGIN COORD: 14538.12E, 52909.99N

AZIMUTH: 144°50'19"

LAGOON C CROSS-SECTION A-A'

NOTES:

- YEARS OF CONSTRUCTION, MATERIAL TYPE AND HISTORIC LOCATION OF LIFTS ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1997)
- PIEZOMETER DATA UPDATED DEC. 2019



Teck	Elkview Operations	
Geotechnical Engineering		
LAGOON C CROSS-SECTION A-A'		
2019		
DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. Yeomans	REV BY:	

CROSS-SECTION
 ORIGIN COORD: 14267.12E, 52774.79N
 AZIMUTH: 115°6'0"

LAGOON C CROSS-SECTION B-B'

NOTES:

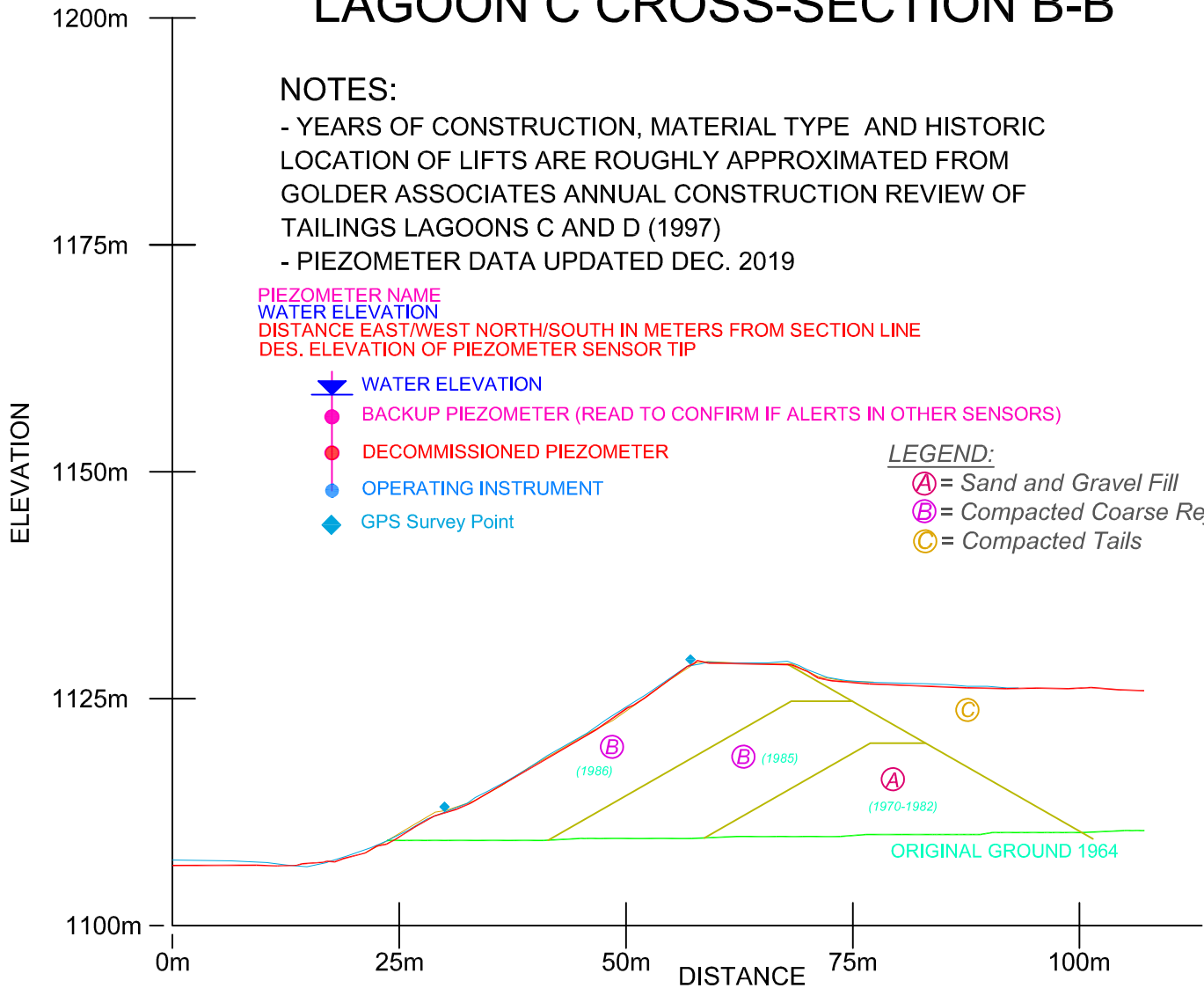
- YEARS OF CONSTRUCTION, MATERIAL TYPE AND HISTORIC LOCATION OF LIFTS ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1997)
- PIEZOMETER DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

- ▼ WATER ELEVATION
- BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
- DECOMMISSIONED PIEZOMETER
- OPERATING INSTRUMENT
- ◆ GPS Survey Point

LEGEND:

- Ⓐ = Sand and Gravel Fill
- Ⓑ = Compacted Coarse Rejects
- Ⓒ = Compacted Tails



Teck

Elkview Operations

Geotechnical Engineering

LAGOON C CROSS-SECTION B-B'
2019

DATE: Dec. 2019
 DWN BY: A. Yeomans

SCALE:
 REV BY:

DWG. NO. :

CROSS-SECTION

ORIGIN COORD: 14253.35E, 52508.06N

AZIMUTH: 82°8'31"

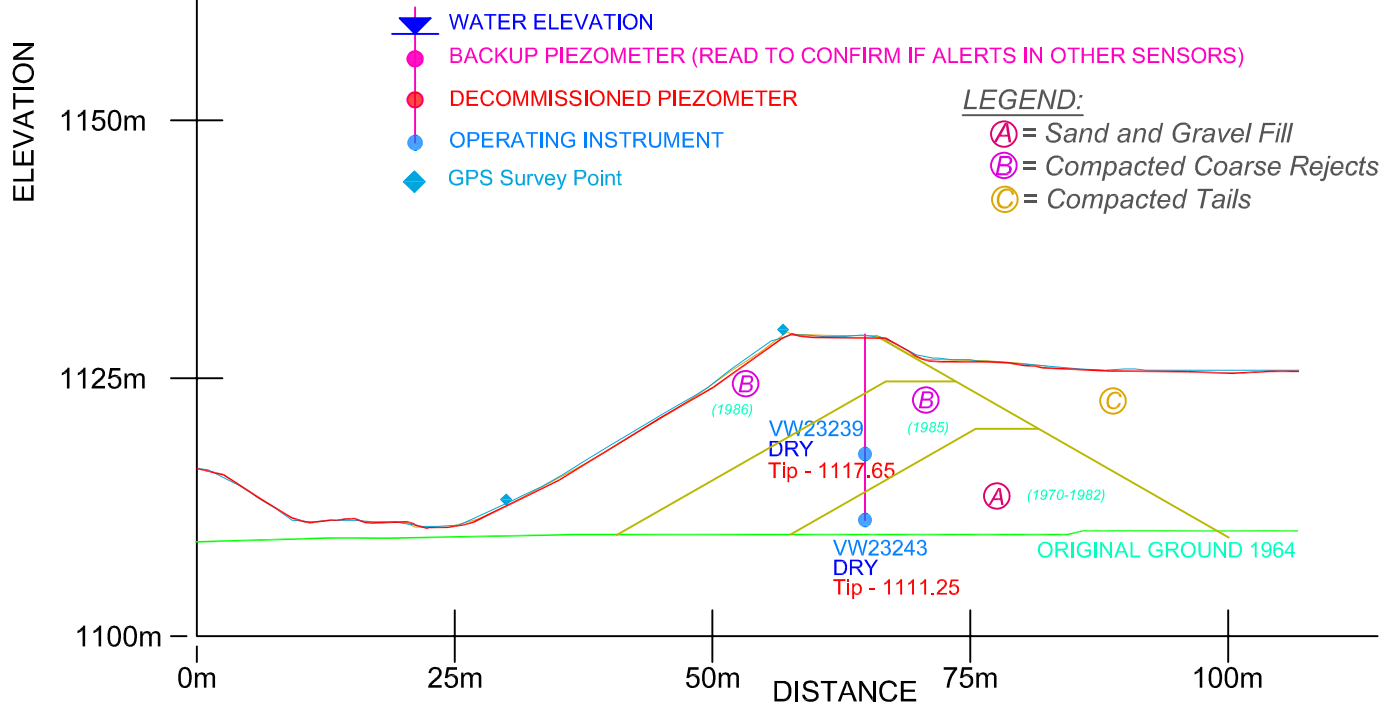
LAGOON C CROSS-SECTION C-C'

NOTES:

- YEARS OF CONSTRUCTION, MATERIAL TYPE AND HISTORIC LOCATION OF LIFTS ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1997)

- PIEZOMETER DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP



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Elkview Operations

Geotechnical Engineering

LAGOON C CROSS-SECTION C-C' 2019

DATE: Dec. 2019

SCALE:

DWG. NO. :

DWN BY: A. Yeomans

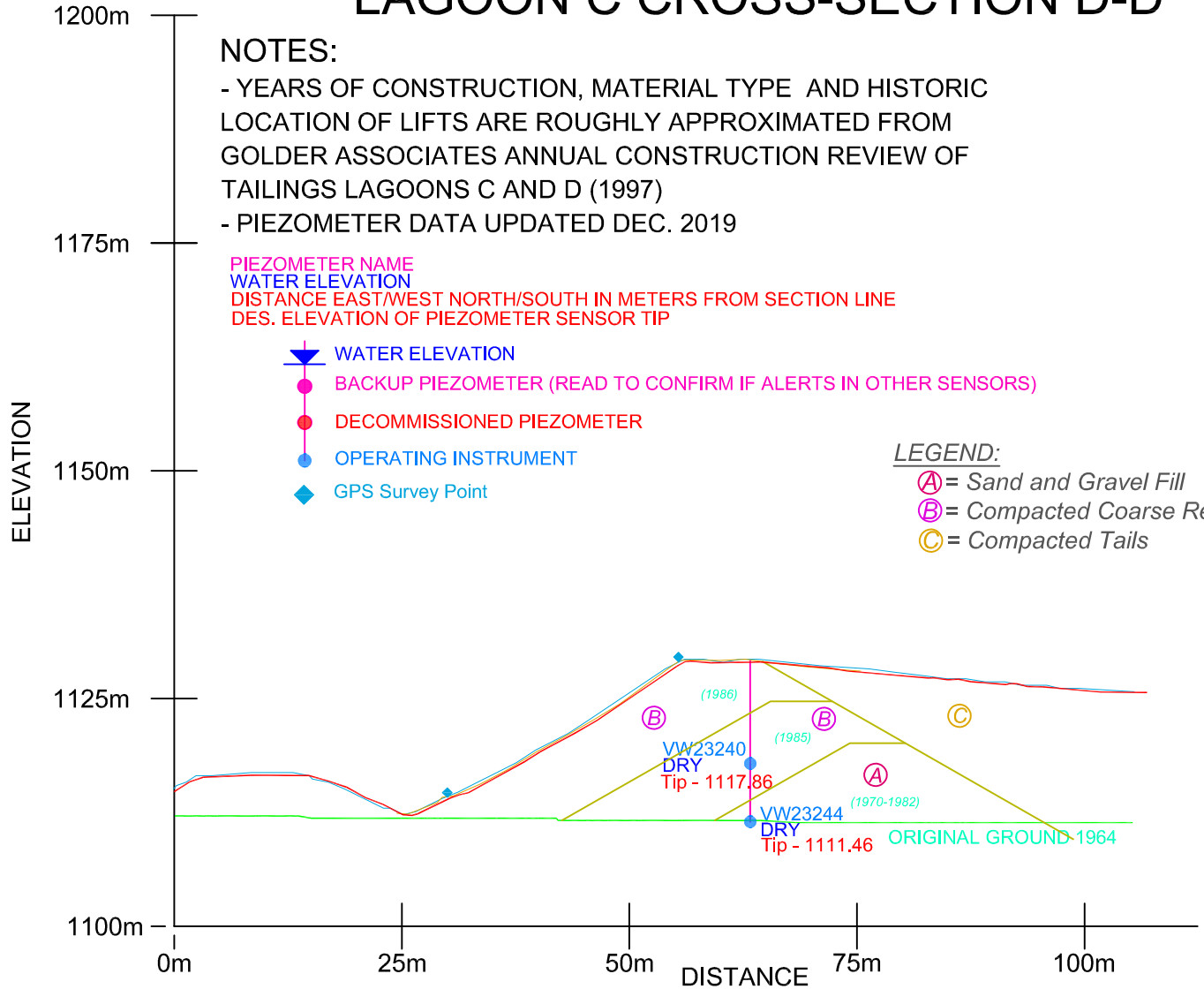
REV BY:

CROSS-SECTION

ORIGIN COORD: 14489.78E, 52319.17N

AZIMUTH: 345°37'1"

LAGOON C CROSS-SECTION D-D'



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LAGOON C CROSS-SECTION D-D'
2019

DATE: Dec. 2019

SCALE:

DWG. NO. :

DWN BY: A. Yeomans

REV BY:

CROSS-SECTION

ORIGIN COORD: 14278.06E, 52280.63N

AZIMUTH: 324°12'9"

LAGOON C CROSS-SECTION E-E'

NOTES:

- YEARS OF CONSTRUCTION, MATERIAL TYPE AND HISTORIC LOCATION OF LIFTS ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1997)

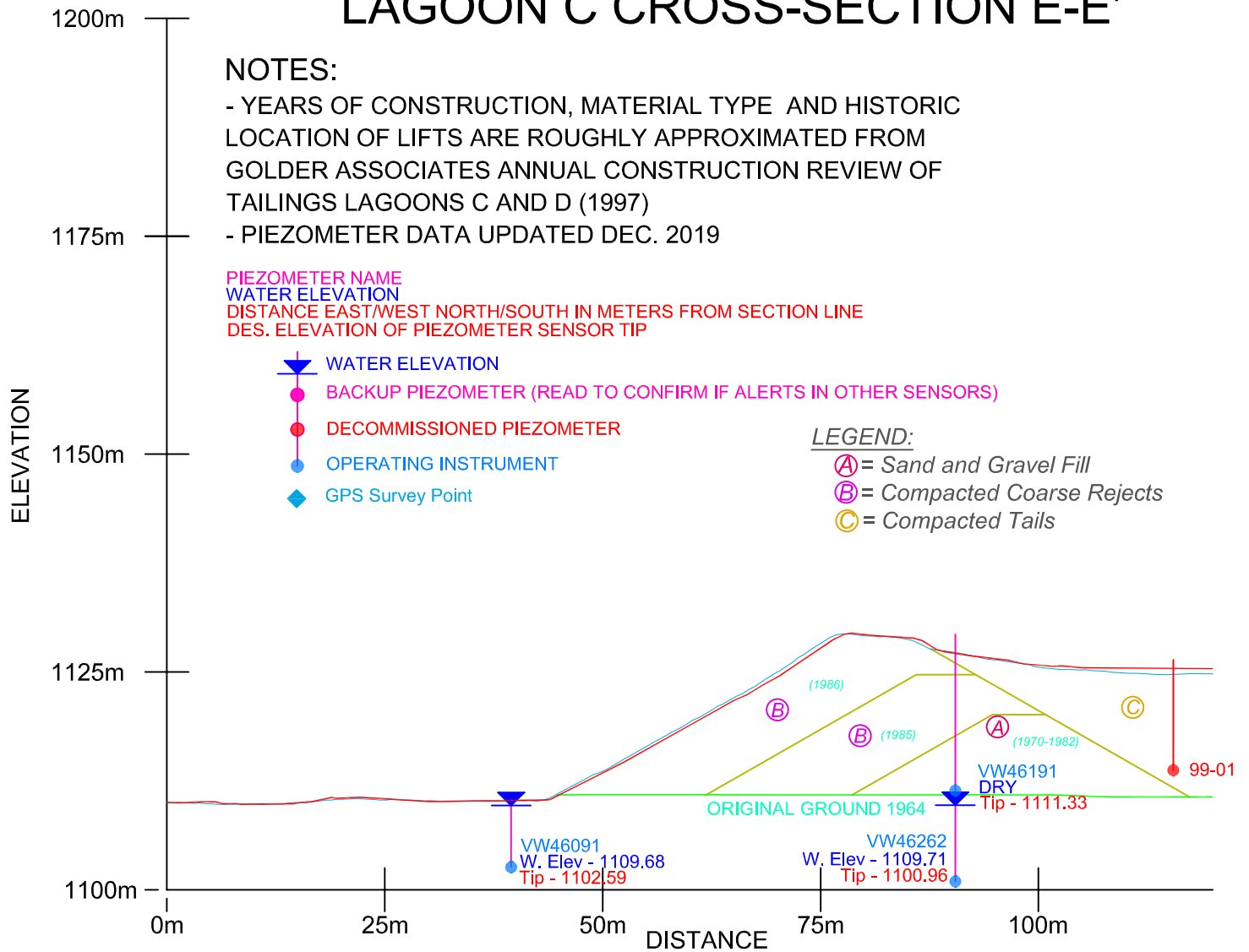
- PIEZOMETER DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

- ▼ WATER ELEVATION
- BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
- DECOMMISSIONED PIEZOMETER
- OPERATING INSTRUMENT
- ◆ GPS Survey Point

LEGEND:

- A = Sand and Gravel Fill
- B = Compacted Coarse Rejects
- C = Compacted Tails



Teck Elkview Operations

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LAGOON C CROSS-SECTION E-E'
 2019

DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. Yeomans	REV BY:	

CROSS-SECTION

ORIGIN COORD: 14538.12E, 52909.99N

AZIMUTH: 144°50'19"

LAGOON C CROSS-SECTION G-G'

NOTES:

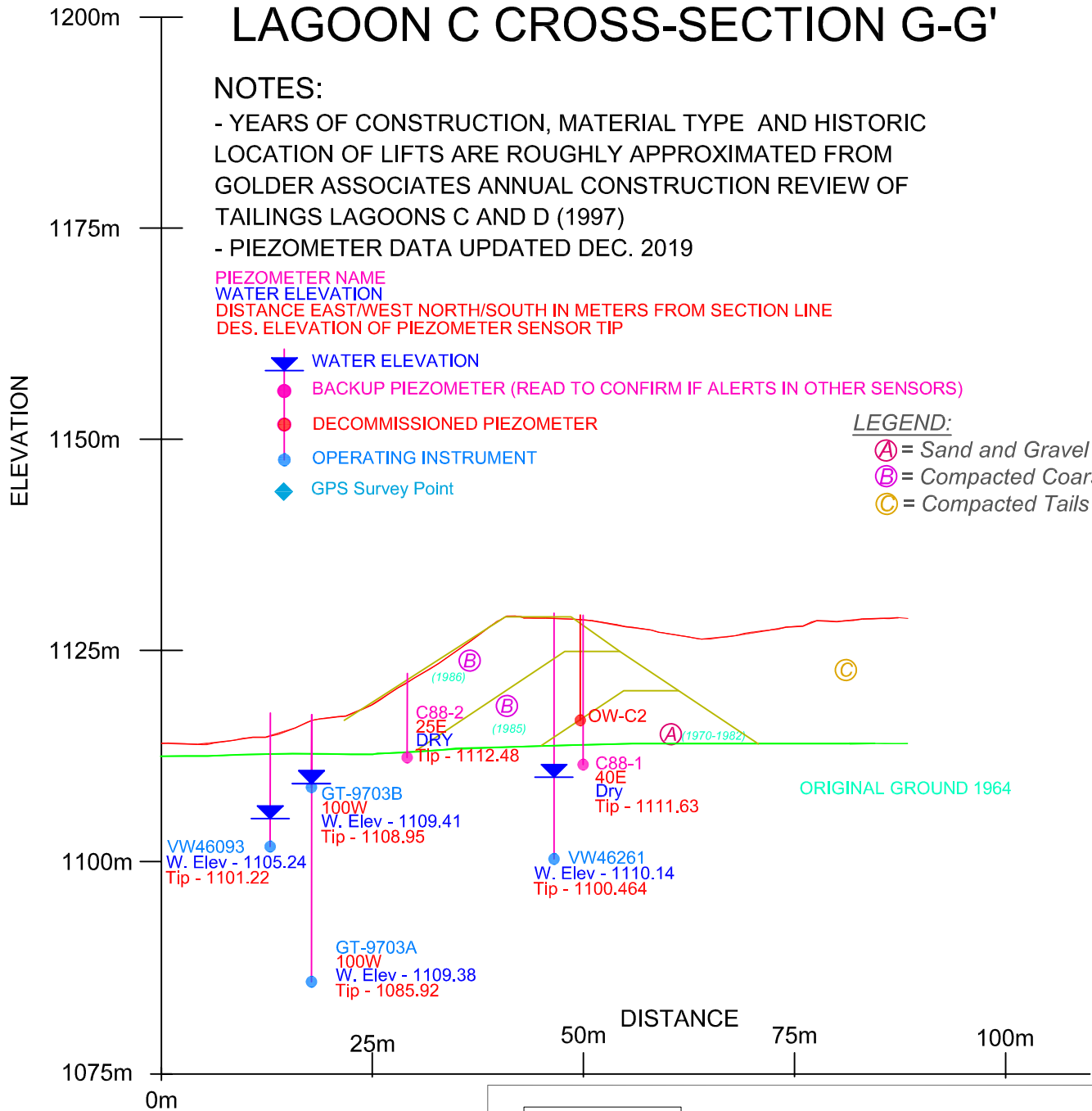
- YEARS OF CONSTRUCTION, MATERIAL TYPE AND HISTORIC LOCATION OF LIFTS ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1997)
- PIEZOMETER DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

- WATER ELEVATION
- BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
- DECOMMISSIONED PIEZOMETER
- OPERATING INSTRUMENT
- GPS Survey Point

LEGEND:

- = Sand and Gravel Fill
- = Compacted Coarse Rejects
- = Compacted Tails



Elkview Operations

Geotechnical Engineering

LAGOON C CROSS-SECTION G-G' 2019

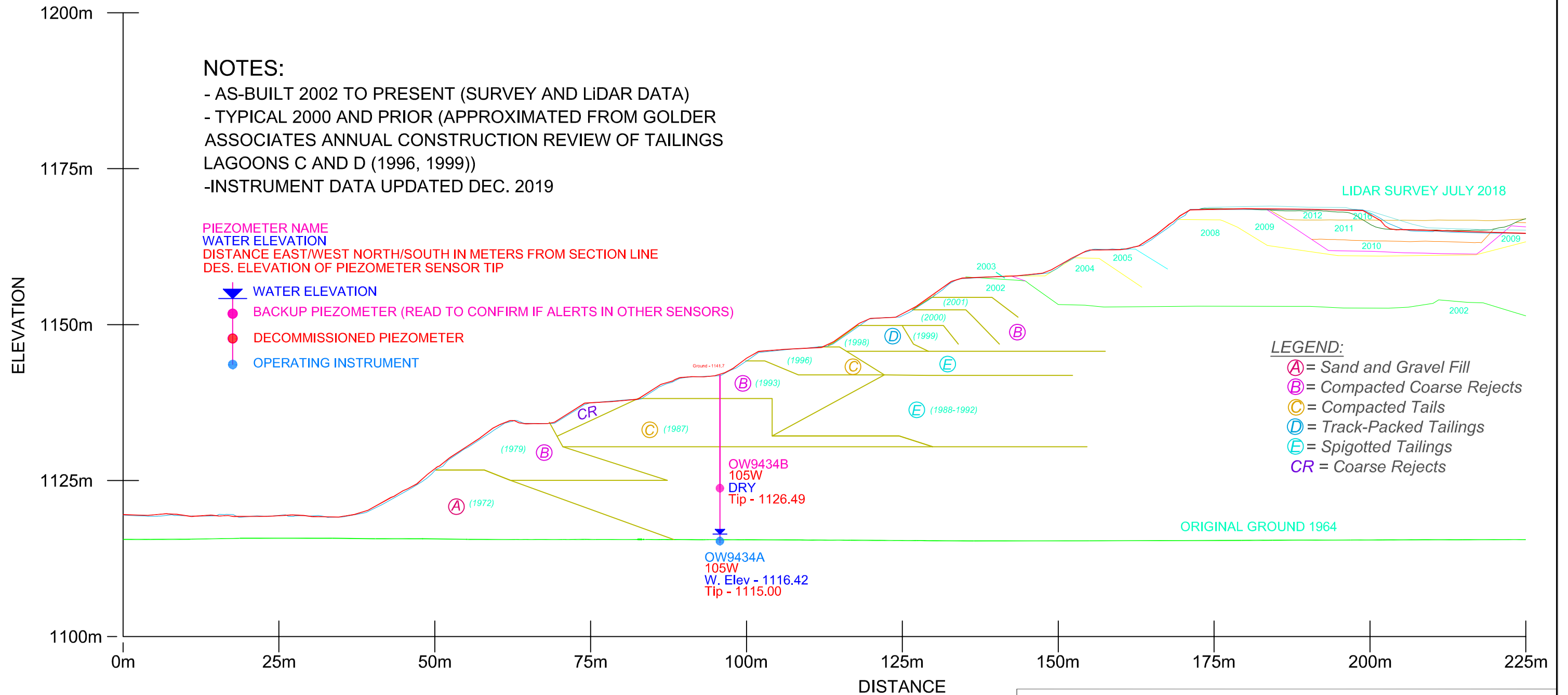
DATE: Dec. 2019
 DWN BY: A. Yeomans

SCALE:
 REV BY:

DWG. NO. :

CROSS-SECTION
 ORIGIN COORD: 14960.53E, 52265.72N
 AZIMUTH: 202°53'07"

LAGOON D CROSS-SECTION A-A'



Teck Elkview Operations

Geotechnical Engineering
LAGOON D CROSS-SECTION A-A'
2019

DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. YEOMANS	REV BY:	

CROSS-SECTION

ORIGIN COORD: 14726.30E, 52346.74N

AZIMUTH: 182°47'27"

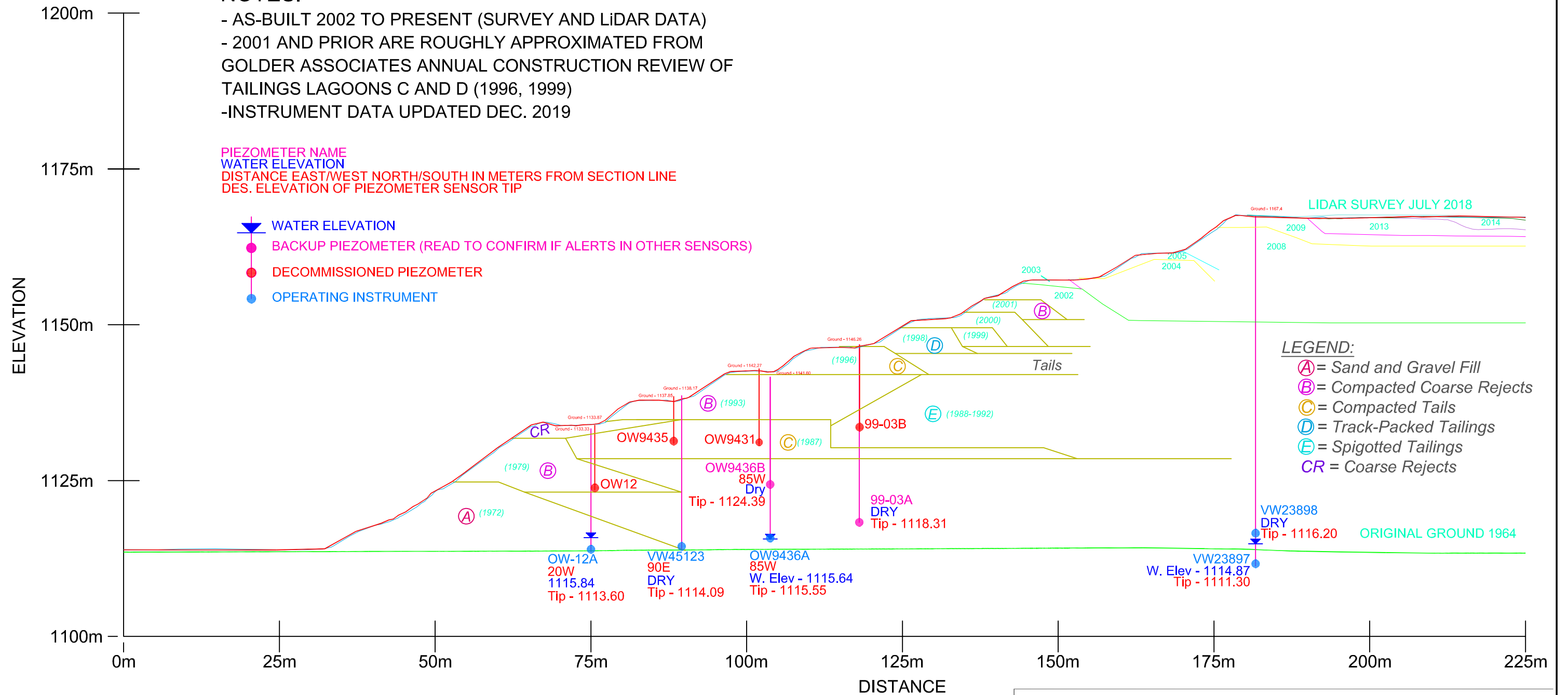
LAGOON D CROSS-SECTION B-B'

NOTES:

- AS-BUILT 2002 TO PRESENT (SURVEY AND LIDAR DATA)
- 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999)
- INSTRUMENT DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

- ▼ WATER ELEVATION
- BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
- DECOMMISSIONED PIEZOMETER
- OPERATING INSTRUMENT



Teck Elkview Operations

Geotechnical Engineering

LAGOON D CROSS-SECTION B-B'
 2019

DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. YEOMANS	REV BY:	

CROSS-SECTION
 ORIGIN COORD: 14491.89E, 52303.38N
 AZIMUTH: 168°11'50"

LAGOON D CROSS-SECTION C-C'

NOTES:

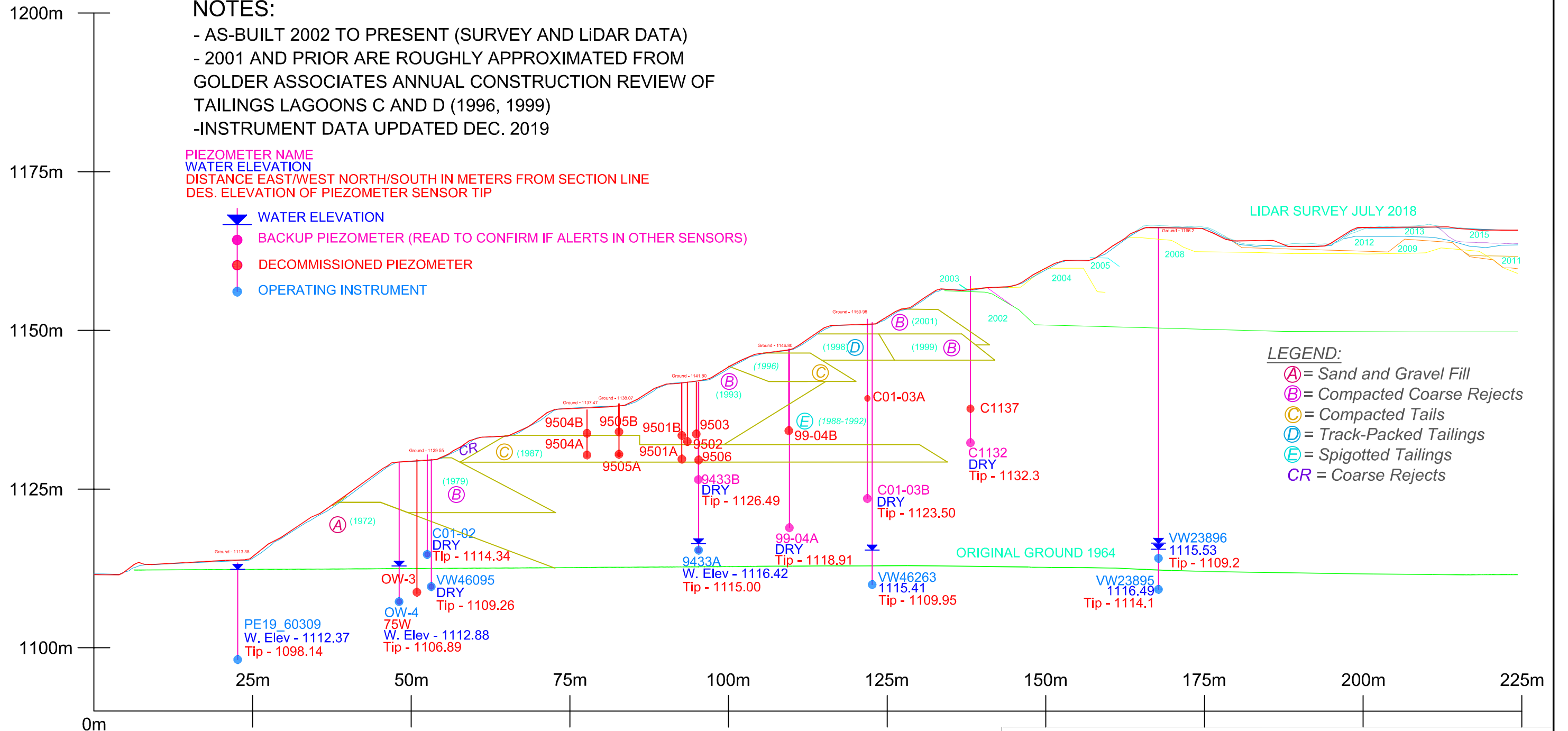
- AS-BUILT 2002 TO PRESENT (SURVEY AND LIDAR DATA)
- 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999)
- INSTRUMENT DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

- ▼ WATER ELEVATION
- BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
- DECOMMISSIONED PIEZOMETER
- OPERATING INSTRUMENT

LIDAR SURVEY JULY 2018

ELEVATION



LEGEND:

- (A) = Sand and Gravel Fill
- (B) = Compacted Coarse Rejects
- (C) = Compacted Tails
- (D) = Track-Packed Tailings
- (E) = Spigotted Tailings
- CR = Coarse Rejects

DISTANCE

Teck

Elkview Operations

Geotechnical Engineering

LAGOON D CROSS-SECTION C-C'
 2019

DATE: Dec. 2019

SCALE:

DWG. NO. :

DWN BY: A. YEOMANS

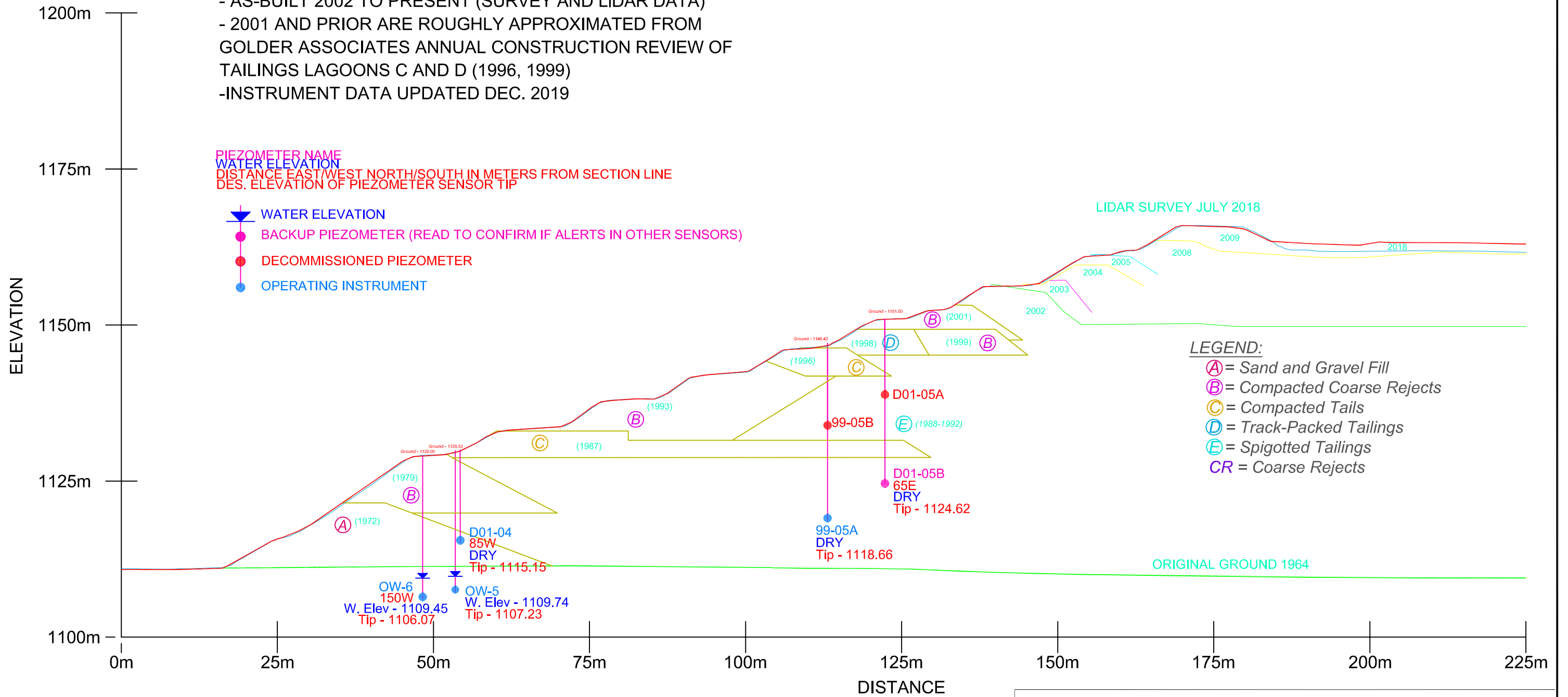
REV BY:

CROSS-SECTION
 ORIGIN COORD: 14249.70E, 52237.31N
 AZIMUTH: 155°43'21"

LAGOON D CROSS-SECTION D-D'

NOTES:

- AS-BUILT 2002 TO PRESENT (SURVEY AND LIDAR DATA)
- 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999)
- INSTRUMENT DATA UPDATED DEC. 2019



Teck		Elkview Operations	
Geotechnical Engineering			
LAGOON D CROSS-SECTION D-D'			
2019			
DATE: Dec. 2019	SCALE:	DWG. NO. :	
DWN BY: A. YEOMANS	REV BY:		

CROSS-SECTION
 ORIGIN COORD: 13974.88E, 51969.26N
 AZIMUTH: 90°31'40"

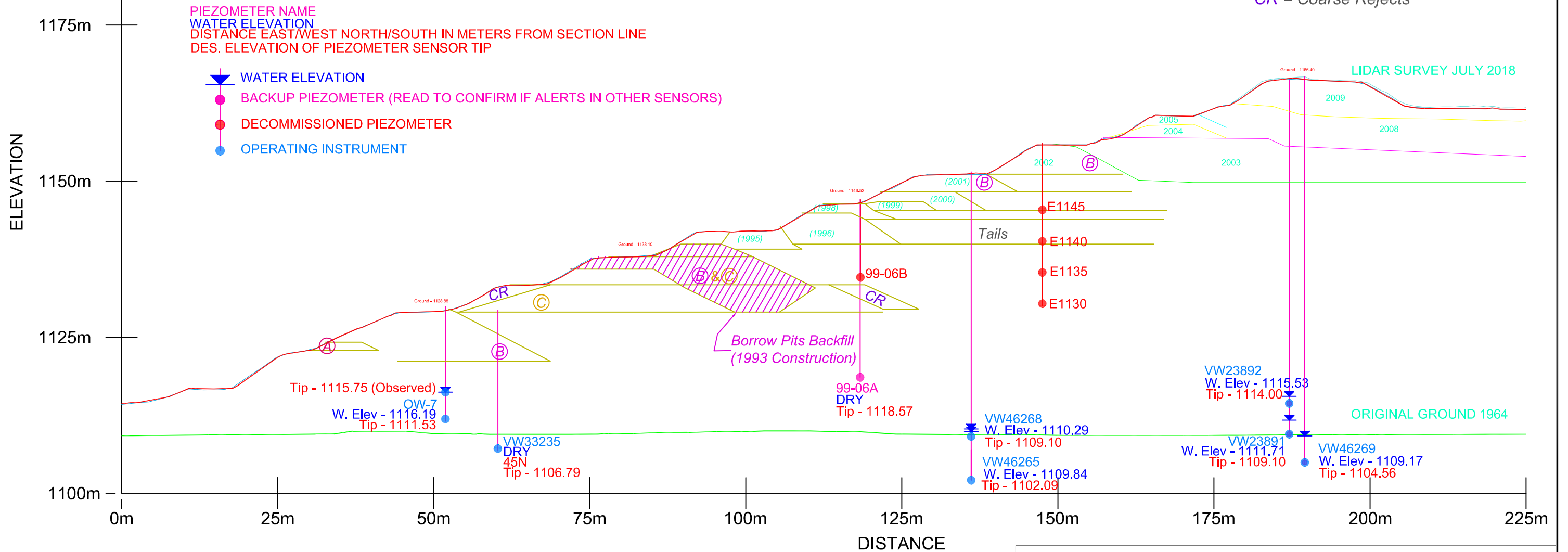
LAGOON D CROSS-SECTION E-E'

NOTES:

- AS-BUILT 2002 TO PRESENT (SURVEY AND LIDAR DATA)
- 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999)
- INSTRUMENT DATA UPDATED DEC. 2019

LEGEND:

- (A) = Sand and Gravel Fill
- (B) = Compacted Coarse Rejects
- (C) = Compacted Tails
- (D) = Track-Packed Tailings
- (E) = Spigotted Tailings
- CR = Coarse Rejects



Teck Elkview Operations

Geotechnical Engineering
LAGOON D CROSS-SECTION E-E'
2019





DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. YEOMANS	REV BY:	







CROSS-SECTION
 ORIGIN COORD: 14225.89E, 51679.04N
 AZIMUTH: 24°05'20"

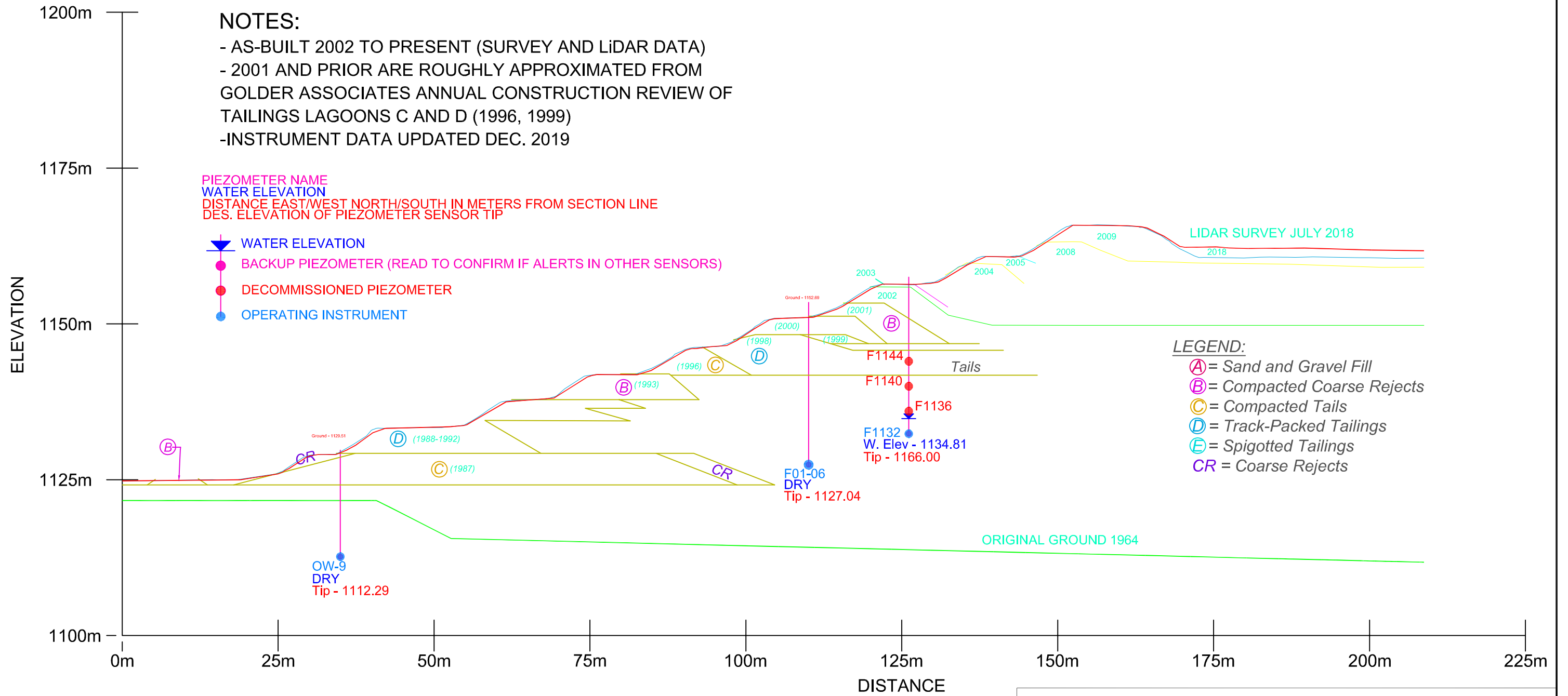
LAGOON D CROSS-SECTION F-F'


NOTES:
 - AS-BUILT 2002 TO PRESENT (SURVEY AND LiDAR DATA)
 - 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM
 GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF
 TAILINGS LAGOONS C AND D (1996, 1999)
 -INSTRUMENT DATA UPDATED DEC. 2019

PIEZOMETER NAME
 WATER ELEVATION
 DISTANCE EAST/WEST NORTH/SOUTH IN METERS FROM SECTION LINE
 DES. ELEVATION OF PIEZOMETER SENSOR TIP

-  WATER ELEVATION
-  BACKUP PIEZOMETER (READ TO CONFIRM IF ALERTS IN OTHER SENSORS)
-  DECOMMISSIONED PIEZOMETER
-  OPERATING INSTRUMENT

- LEGEND:**
-  = Sand and Gravel Fill
 -  = Compacted Coarse Rejects
 -  = Compacted Tails
 -  = Track-Packed Tailings
 -  = Spigotted Tailings
 -  = Coarse Rejects



		Elkview Operations	
Geotechnical Engineering			
LAGOON D CROSS-SECTION F-F'			
2019			
DATE: Dec. 2019	SCALE:	DWG. NO. :	
DWN BY: A. YEOMANS	REV BY:		

CROSS-SECTION

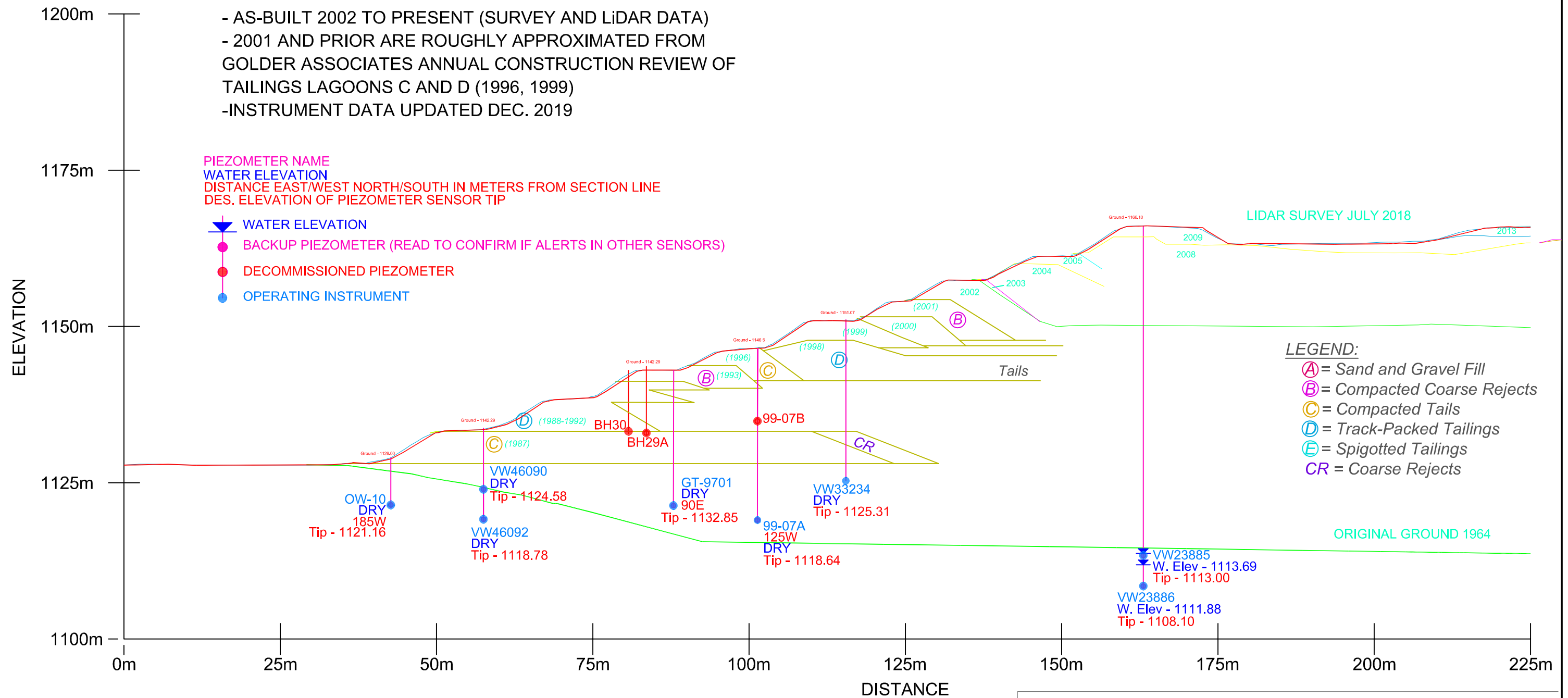
ORIGIN COORD: 14583.76E, 51528.38N

AZIMUTH: 350°18'50"

LAGOON D CROSS-SECTION G-G'

NOTES:

- AS-BUILT 2002 TO PRESENT (SURVEY AND LiDAR DATA)
- 2001 AND PRIOR ARE ROUGHLY APPROXIMATED FROM GOLDER ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999)
- INSTRUMENT DATA UPDATED DEC. 2019



Teck Elkview Operations

Geotechnical Engineering

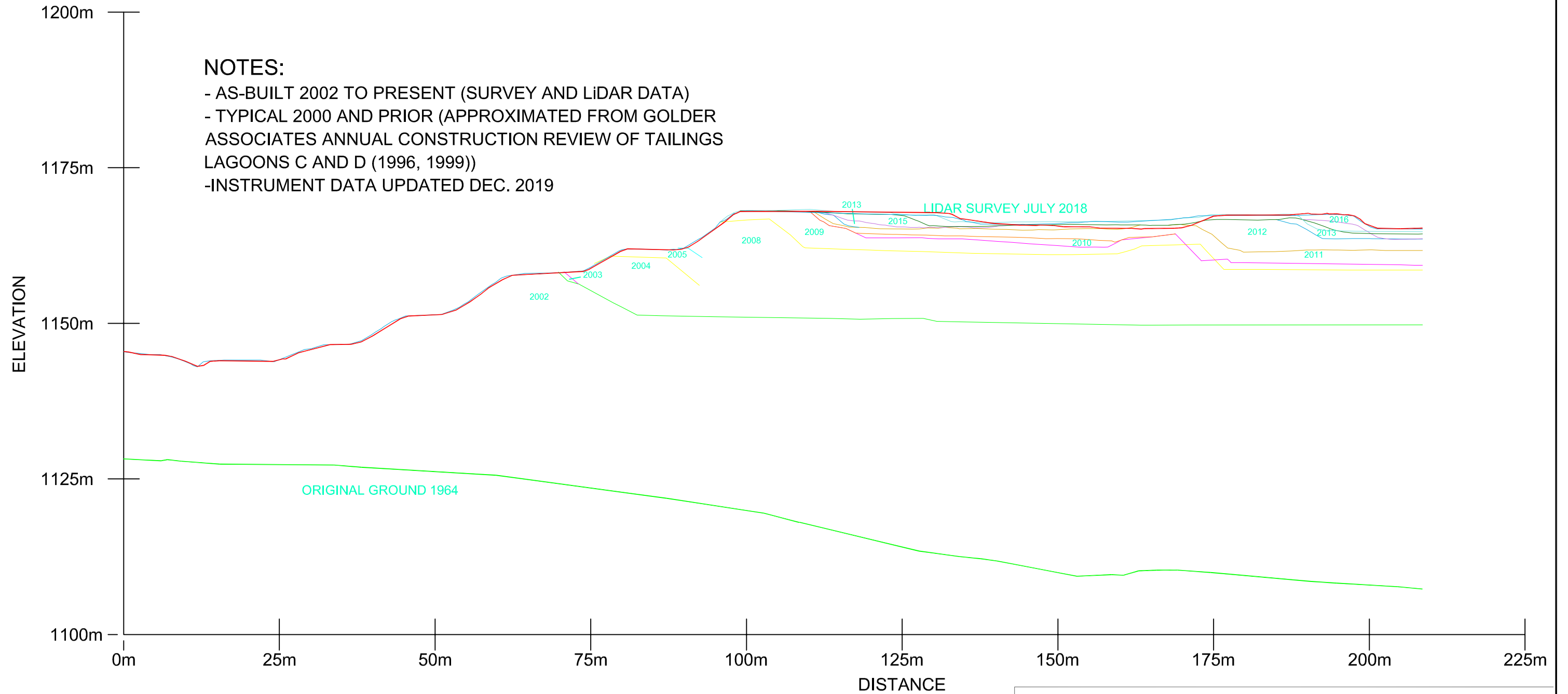
LAGOON D CROSS-SECTION G-G'

2019


DATE: Dec. 2019	SCALE:	DWG. NO. :
DWN BY: A. YEOMANS	REV BY:	

CROSS-SECTION
 ORIGIN COORD: 14865.68E, 51638.80N
 AZIMUTH: 350°43'36"

LAGOON D CROSS-SECTION H-H'



NOTES:
 - AS-BUILT 2002 TO PRESENT (SURVEY AND LIDAR DATA)
 - TYPICAL 2000 AND PRIOR (APPROXIMATED FROM GOLDR ASSOCIATES ANNUAL CONSTRUCTION REVIEW OF TAILINGS LAGOONS C AND D (1996, 1999))
 - INSTRUMENT DATA UPDATED DEC. 2019

		Elkview Operations	
Geotechnical Engineering			
LAGOON D CROSS-SECTION H-H'			
2019			
DATE: Dec. 2019	SCALE:	DWG. NO. :	
DWN BY: A. YEOMANS	REV BY:		

APPENDIX IV

Monitoring Instrument Data and Plots (provided by EVO)

Lagoon C
Lagoon D
WFTF

Appendix IV 2019 Piezometric Level Observations

Table IV-1.0 2019 Piezometric Level Observation

Dam	Piezometer ID	Stability Section	VWP Tip Elevation or Standpipe Screen Elevation (m)	Max Measured Water Table Elevation ¹ (m)	2019 Observations
WFTF	VW38582	N/A	1657.93	1657.91	Equivalent water table below VWP tip.
WFTF	VW38583	N/A	1658.87	1658.81	Equivalent water table below VWP tip.
WFTF	VW38584	N/A	1657.48	1657.28	Equivalent water table below VWP tip.
WFTF	VW38585	N/A	1657.08	1656.86	Equivalent water table below VWP tip.
WFTF	VW38586	N/A	1657.08	1656.91	Equivalent water table below VWP tip.
WFTF	VW27171	N/A	1657.08	1656.47	Equivalent water table below VWP tip.
WFTF	VW27172	N/A	1658.06	1657.23	Equivalent water table below VWP tip.
WFTF	VW29155	N/A	1657.87	1657.40	Equivalent water table below VWP tip.
WFTF	VW29158	N/A	1657.31	1655.48	Equivalent water table below VWP tip.
WFTF	VW29159	N/A	1656.62	1657.57	Steady trend. 0.33 m increase from 2018 DSI.
WFTF	WF-2 SOUTH	N/A	N/A	N/A	Not reported
WFTF	WF-3 NORTH	N/A	N/A	N/A	Not reported
Lagoon C	VW23238	A-A	1117.66	Dry	Steady trend. Dry.
Lagoon C	VW23242	A-A	1109.50	Dry	Steady trend. Dry.
Lagoon C	VW23239	C-C	1117.65	Dry	Steady trend. Dry.
Lagoon C	VW23243	C-C	1111.25	Dry	Steady trend. Dry.
Lagoon C	99-01	D-D	1113.72	Dry	Steady trend. Dry.
Lagoon C	VW46191	D-D	1111.33	Dry	Steady trend. Dry.
Lagoon C	VW46262	D-D	1100.96	1109.79	Steady trend. 0.10 m decrease from 2018 DSI.
Lagoon C	VW46091	D-D	1102.59	1109.73	Steady trend. 0.12 m decrease from 2018 DSI.
Lagoon C	VW23240	D-D	1117.86	Dry	Steady trend. Dry.
Lagoon C	VW23244	D-D	1111.46	Dry	Steady trend. Dry.
Lagoon C	VW23241	N/A	1118.60	Dry	Steady trend. Dry.
Lagoon C	VW23245	N/A	1111.03	1114.16	Steady trend. 0.03 m decrease from 2018 DSI.
Lagoon C	VW46261	G-G	1100.46	1110.39	Steady trend. 0.05 m decrease from 2018 DSI.
Lagoon C	VW46093	G-G	1101.22	1105.55	Steady trend. 0.05 m decrease from 2018 DSI.
Lagoon C	OW-C-88-1	G-G	1111.63	Dry	Steady trend. Dry.
Lagoon C	OW-C-88-2	G-G	1112.48	Dry	Steady trend. 0.23 m decrease from 2018 DSI.
Lagoon C	OW-C2	G-G	1116.87	Dry	Steady trend. Dry.
Lagoon C	GT-9703 A	G-G	1085.92	1109.88	Steady trend. 0.14 m increase from 2018 DSI.

Dam	Piezometer ID	Stability Section	VWP Tip Elevation or Standpipe Screen Elevation (m)	Max Measured Water Table Elevation ¹ (m)	2019 Observations
Lagoon C	GT-9703 B	G-G	1108.50	1110.26	Steady trend. 0.23 m increase from 2018 DSI.
Lagoon D	VW23897	B-B	1111.30	1115.16	Steady trend. 0.29 m decrease from 2018 DSI.
Lagoon D	VW23898	B-B	1116.20	1115.65	Equivalent water table below VWP tip.
Lagoon D	99-03A	B-B	1118.31	Dry	Steady trend. Dry.
Lagoon D	99-03B	B-B	1133.21	Dry	Steady trend. Dry.
Lagoon D	OW-12	B-B	1123.50	Dry	Steady trend. Dry.
Lagoon D	OW-12A	B-B	1113.60	1115.97	Steady trend. 0.54 m decrease from 2018 DSI.
Lagoon D	OW-9431	B-B	1130.79	Dry	Steady trend. Dry.
Lagoon D	OW-9435	B-B	1130.97	Dry	Steady trend. Dry.
Lagoon D	VW23895	C-C	1114.10	1116.80	Steady trend. 0.33 m decrease from 2018 DSI.
Lagoon D	VW23896	C-C	1109.20	1115.71	Steady trend. 0.41 m decrease from 2018 DSI.
Lagoon D	VW65023 (C1137)	C-C	1137.05	1137.06	Steady trend. 0.08 m increase from 2018 DSI.
Lagoon D	VW65026 (C1132)	C-C	1132.16	1132.12	Equivalent water table below VWP tip.
Lagoon D	VW46263	C-C	1109.95	1115.70	Steady trend. 0.24 m decrease from 2018 DSI.
Lagoon D	C01-03A	C-C	1138.95	1138.90	Steady trend. 0.02 m increase from 2018 DSI.
Lagoon D	C01-03B	C-C	1123.50	Dry	Steady trend. Dry.
Lagoon D	OW-9505A	C-C	1130.11	Dry	Steady trend. Dry.
Lagoon D	OW-9505B	C-C	1133.65	1133.57	Steady trend. 0.1 m increase from 2018 DSI.
Lagoon D	OW-9503	C-C	1133.33	1133.34	Steady trend. 0.02 m increase from 2018 DSI.
Lagoon D	OW-9506	C-C	1129.26	Dry	Steady trend. 0.14 m decrease from 2018 DSI.
Lagoon D	OW-9433A	C-C	1115.00	1116.94	Steady trend. 0.29 m decrease from 2018 DSI.
Lagoon D	OW-9433B	C-C	1126.49	1127.16	Steady trend. 0.27 m increase from 2018 DSI.
Lagoon D	99-04A	C-C	1118.91	Dry	Steady trend. Dry.
Lagoon D	99-04B	C-C	1133.81	Dry	Steady trend. Dry.
Lagoon D	VW46095	C-C	1109.26	1109.02	Equivalent water table below VWP tip.
Lagoon D	C01-02	C-C	1114.34	Dry	Steady trend. Dry.
Lagoon D	D01-05A	CC-DD	1138.55	1138.37	Steady trend. 0.02 m decrease from 2018 DSI.
Lagoon D	D01-05B	CC-DD	1124.62	Dry	Steady trend. Dry.
Lagoon D	OW-5	D-D	1107.23	1110.12	Steady trend. 0.18 m decrease from 2018 DSI.
Lagoon D	99-05A	D-D	1118.66	Dry	Steady trend. Dry.
Lagoon D	99-05B	D-D	1133.54	Dry	Steady trend. Dry.

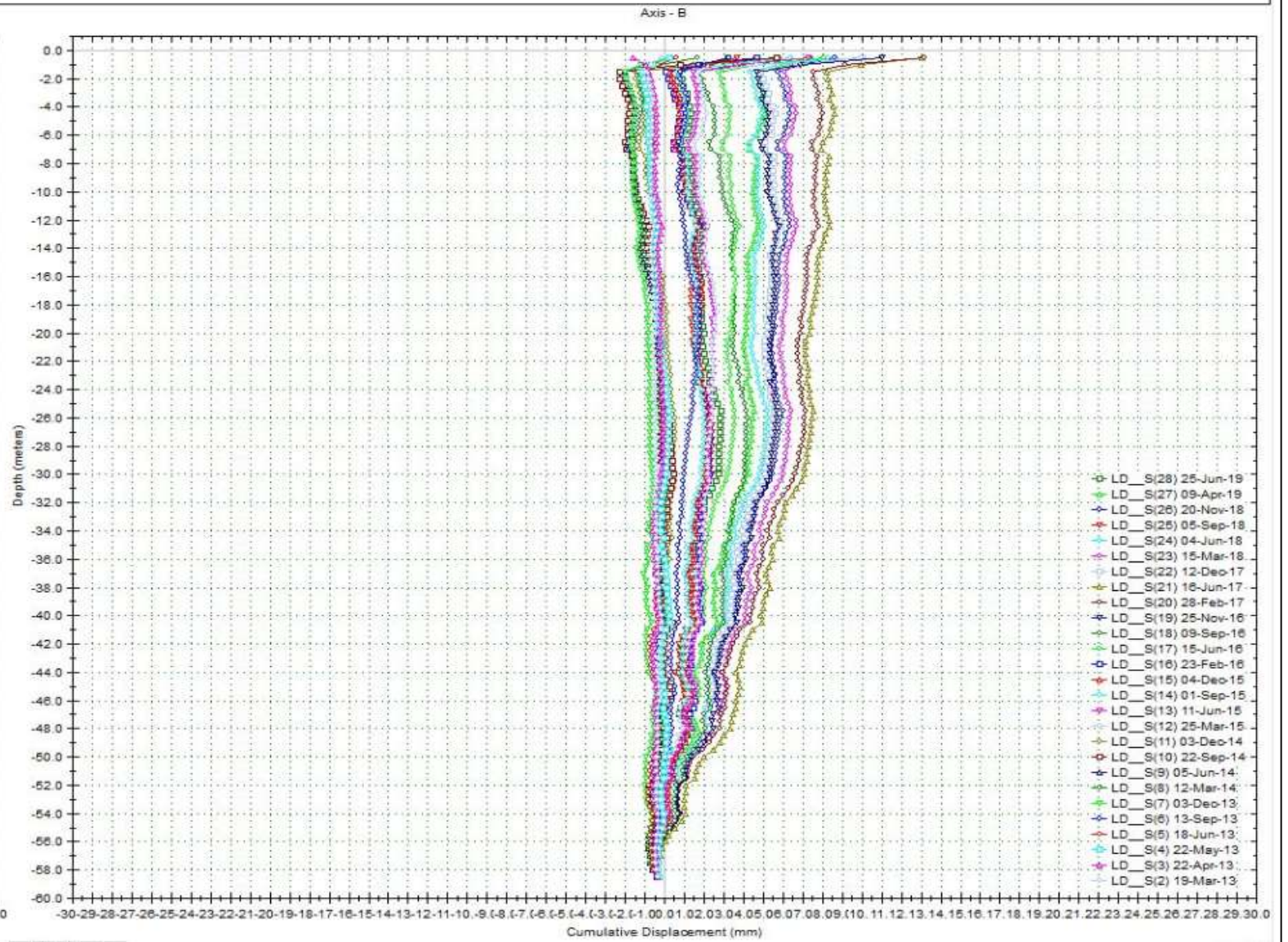
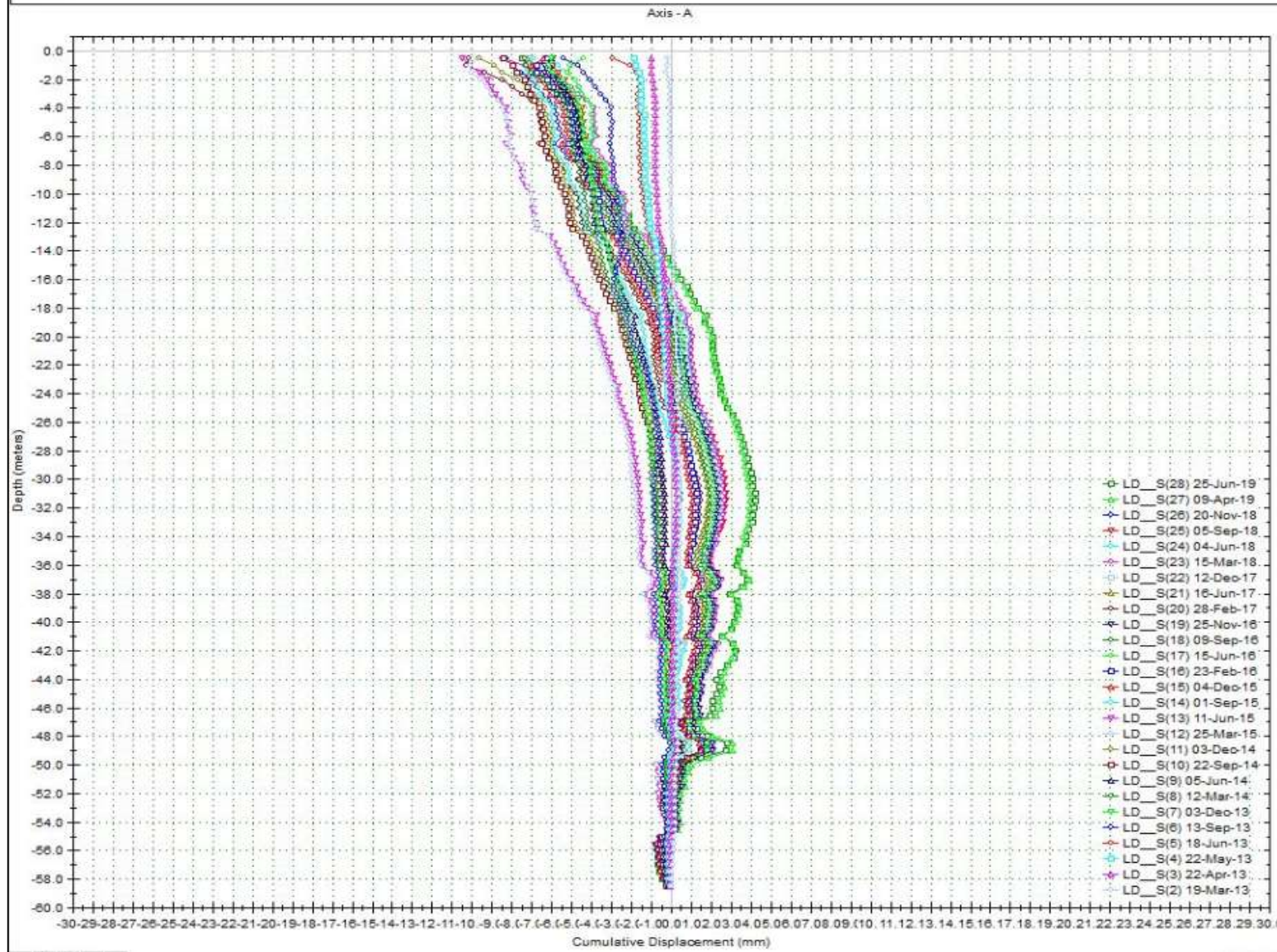
Dam	Piezometer ID	Stability Section	VWP Tip Elevation or Standpipe Screen Elevation (m)	Max Measured Water Table Elevation ¹ (m)	2019 Observations
Lagoon D	D01-04	DD-EE	1115.15	Dry	Steady trend. 0.15 m decrease from 2018 DSI.
Lagoon D	VW23891	E-E	1109.1	1112.15	Steady trend. 0.18 m decrease from 2018 DSI.
Lagoon D	VW23892	E-E	1114.0	1115.73	Steady trend. 0.15 m decrease from 2018 DSI.
Lagoon D	VW46269	E-E	1104.56	1109.44	Steady trend. 0.07 m decrease from 2018 DSI.
Lagoon D	VW46265	E-E	1102.09	1109.88	Steady trend. 0.14 m decrease from 2018 DSI.
Lagoon D	VW46268	E-E	1109.10	1110.19	Steady trend. 0.12 m decrease from 2018 DSI.
Lagoon D	99-06A	E-E	1118.57	Dry	Steady trend. Dry.
Lagoon D	99-06B	E-E	1134.22	Dry	Steady trend. Dry.
Lagoon D	OW-7	E-E	1111.53	1116.37	Steady trend. 0.03 m decrease from 2018 DSI.
Lagoon D	VW33235	E-E	1106.79	1106.56	Steady trend. 0.13 m decrease from 2018 DSI.
Lagoon D	VW 62745 (F1144)	F-F	1144.0	1143.54	Steady trend. Insignificant increase from 2018 DSI.
Lagoon D	VW 65027 (F1140)	F-F	1140.0	1139.91	Equivalent water table below VWP tip.
Lagoon D	VW 12394-134 (F1136)	F-F	1136.00	1136.91	Steady trend. 0.12 m increase from 2018 DSI. Noted that there were not readings from April 2019 to the present date.
Lagoon D	VW 66325 (F1132)	F-F	1132.00	1134.89	Steady trend. 0.21 m increase from 2018 DSI.
Lagoon D	F01-06	F-F	1127.04	Dry	Steady trend. Dry.
Lagoon D	OW-9	F-F	1112.29	1112.13	Steady trend. 0.16 m decrease from 2018 DSI.
Lagoon D	GT-9701	FF-GG	1120.97	Dry	Steady trend. Dry.
Lagoon D	VW23885	G-G	1113.00	1114.30	Steady trend. 0.54 m decrease from 2018 DSI.
Lagoon D	VW23886	G-G	1108.10	1112.24	Steady trend. 0.50 m decrease from 2018 DSI.
Lagoon D	VW33234	G-G	1125.31	1125.35	Steady trend. 0.05 m decrease from 2018 DSI.
Lagoon D	VW46090	G-G	1124.58	1124.41	Equivalent water table below VWP tip.
Lagoon D	VW46092	G-G	1118.78	1118.61	Steady trend. 0.04 m decrease from 2018 DSI.
Lagoon D	BH 30	G-G	1132.85	Dry	Steady trend. Dry.
Lagoon D	VW45123	AA-BB	1114.09	1113.47	Steady trend. 0.46 m decrease from 2018 DSI.
Lagoon D	BH 29A	GG-HH	1132.59	1133.60	Steady trend. 0.02 m increase from 2018 DSI.
Lagoon D	OW-9434A	AA-BB	1115.00	1116.18	Steady trend. 0.41 m decrease from 2018 DSI.

Dam	Piezometer ID	Stability Section	VWP Tip Elevation or Standpipe Screen Elevation (m)	Max Measured Water Table Elevation ¹ (m)	2019 Observations
Lagoon D	OW-9434B	AA-BB	1123.77	Dry	Steady trend. 0.51 m decrease from 2018 DSI.
Lagoon D	OW-9436A	BB-CC	1115.55	1115.99	Decreasing trend. 0.42 m decrease from 2018 DSI.
Lagoon D	OW-9436B	BB-CC	1124.39	Dry	Steady trend. Dry.
Lagoon D	OW-9504A	BB-CC	1130.00	Dry	Steady trend. Dry.
Lagoon D	OW-9504B	BB-CC	1133.42	1133.40	Steady trend. 0.02 m decrease from 2018 DSI.
Lagoon D	OW-9502	BB-CC	1132.14	Dry	Steady trend. Dry.
Lagoon D	OW-9501A	BB-CC	1129.37	Dry	Steady trend. Dry.
Lagoon D	OW-9501B	BB-CC	1133.09	Dry	Steady trend. Dry
Lagoon D	OW-3	BB-CC	1108.48	Dry	This standpipe was blocked in 2018.
Lagoon D	OW-4	CC-DD	1106.86	1112.91	Steady trend. 0.2 m decrease from 2018 DSI.
Lagoon D	OW-6	DD-EE	1106.70	1109.67	Steady trend. 0.07 m decrease from 2018 DSI.
Lagoon D	VW 12394-136 (E1140)	DD-EE	1142.49	1141.00	Steady trend. 0.2 m decrease from 2018 DSI.
Lagoon D	VW 12394-135 (E1145)	DD-EE	1144.61	1144.63	Equivalent water table below VWP tip.
Lagoon D	VW 65025 (E1135)	DD-EE	1135.00	1136.90	Steady trend. 0.33 m increase from 2018 DSI.
Lagoon D	VW 65024 (E1130)	DD-EE	1130.00	1130.17	Steady trend. 0.12 m increase from 2018 DSI.
Lagoon D	OW-10	FF-GG	1121.16	Dry	Steady trend. Dry.
Lagoon D	99-07A	FF-GG	1118.64	Dry	Steady trend. Dry.
Lagoon D	99-07B	FF-GG	1134.48	Dry	Steady trend. Dry.
Lagoon D	BH 29A	GG-HH	1132.59	1133.56	Steady trend. 0.02 m decrease from 2018 DSI.

Note: 1. Max measured water table elevation refers to the maximum recorded level in 2019 since the previous DSI (September 2018).

Borehole : LD__S
 Project : LagoonD
 Location :
 Northing :
 Easting :
 Collar :

Spiral Correction : N/A
 Collar Elevation : 0.0 meters
 Borehole Total Depth : 58.5 meters
 North Groove Azimuth :
 Base Reading : 2013 Feb 20 12:51
 Axis A Azimuth : 0.0 degrees



Notes: 1. Inclinometer plots provided by Teck.

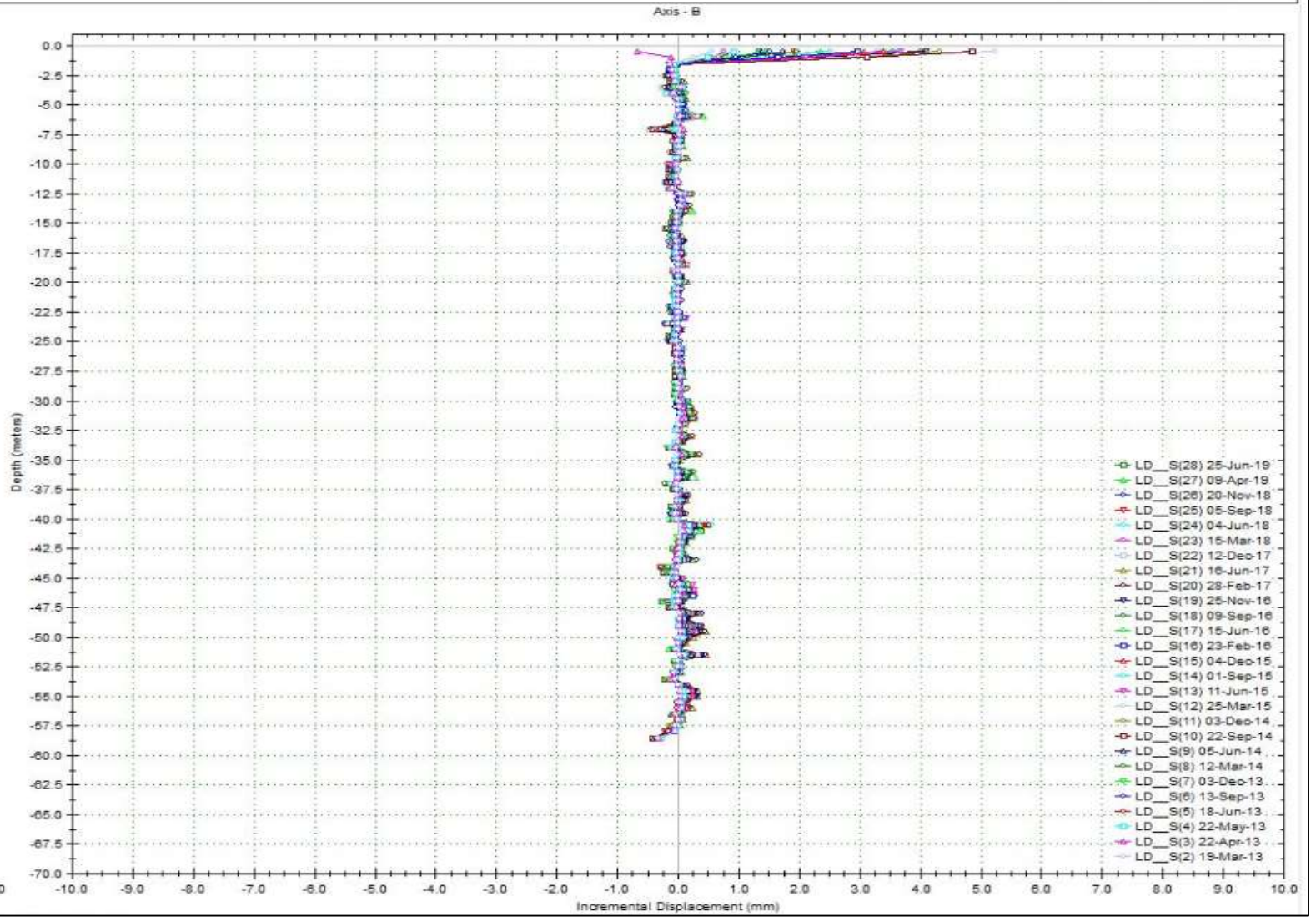
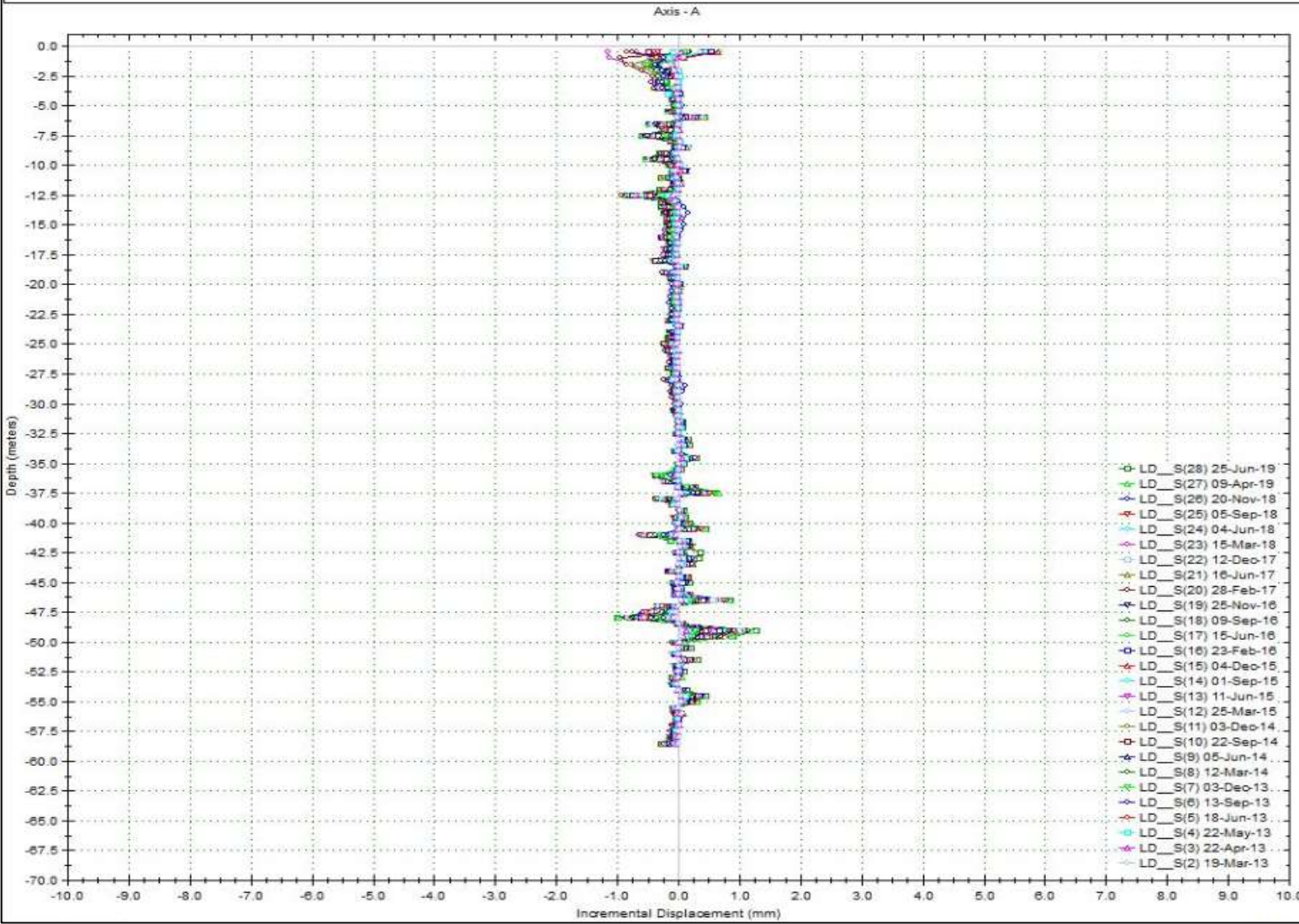
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.



CLIENT	TECK ELKVIEW OPERATIONS LTD.
PROJECT	TECK ELKVIEW OPERATIONS 2019 DAM SAFETY INSPECTION
TITLE	LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_S CUMMULATIVE DISPLACEMENT
PROJECT No.	M09963A07
FIG. No.	IV-1

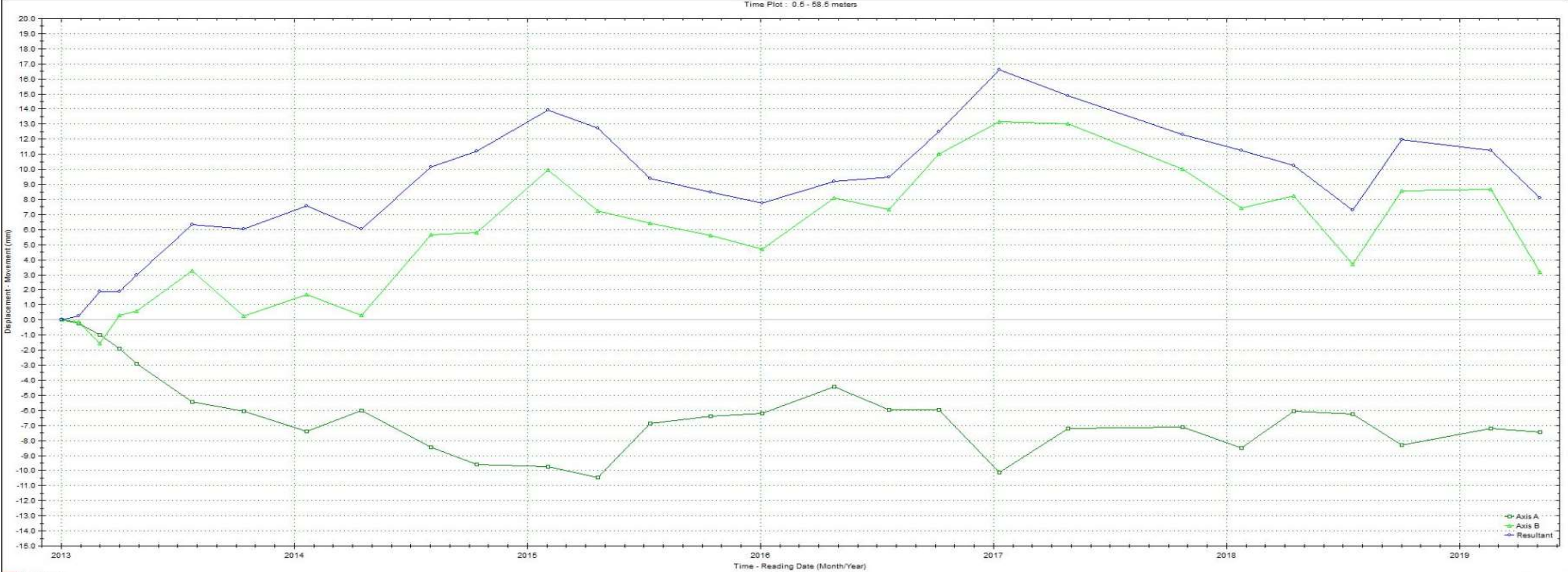
Borehole : LD_S
 Project : LagoonD
 Location :
 Northing :
 Easting :
 Collar :

Spiral Correction : N/A
 Collar Elevation : 0.0 meters
 Borehole Total Depth : 68.5 meters
 North Groove Azimuth :
 Base Reading : 2013 Feb 20 12:51
 Axis A Azimuth : 0.0 degrees



Notes: 1. Inclinometer plots provided by Teck.

<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>TECK ELKVIEW OPERATIONS LTD.</p>	<p>PROJECT</p> <p>TECK ELKVIEW OPERATIONS 2019 DAM SAFETY INSPECTION</p>
	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_S INCREMENTAL DISPLACEMENT</p>
<p>PROJECT No. M09963A07</p>		<p>FIG. No. IV-2</p>



Notes: 1. Inclinometer plots provided by Teck.

Date & Time: 2020-02-26 16:19
Figure File: Z:\M\FRE\09963A07-TCL-EVO-2019 DSI\700 Deliverables\720 Working\WFTF Lagoon A, B, C, D\App IV - Monitoring\Plots\1. Inclinometer Plots Combined.xlsx\LD_S_Cumm

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	Klohn Crippen Berger	TITLE LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_S TIME VS. DISPLACEMENT
		PROJECT No. M09963A07 FIG. No. IV-3

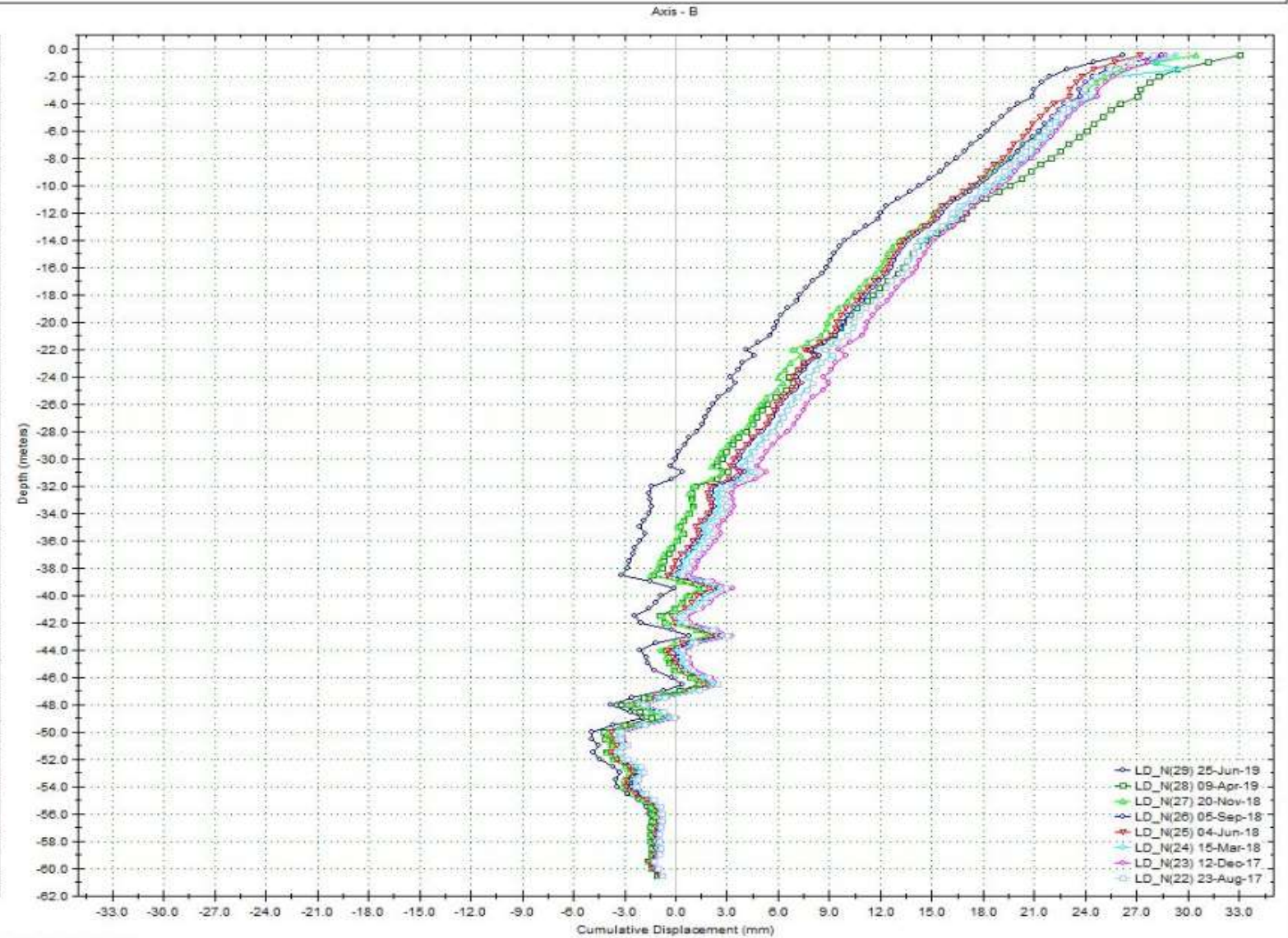
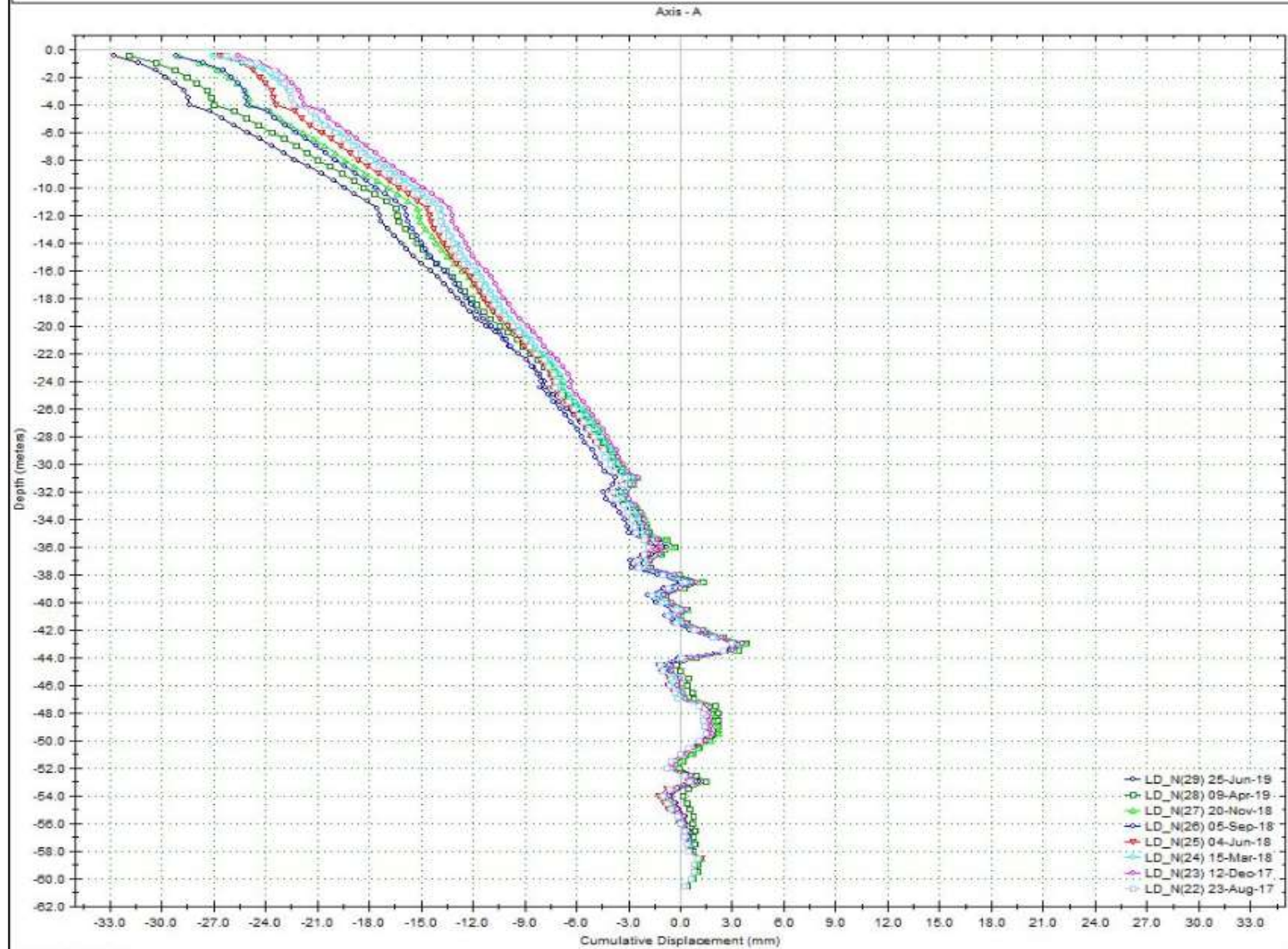
RST Instruments Ltd.

CUMULATIVE DISPLACEMENT

Inclinanalysis v.2.27

Borehole : LD_N
Project : LagoonD
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 meters
Borehole Total Depth : 60.5 meters
North Groove Azimuth :
Base Reading : 2013 Feb 20 11:27
AxisAAzimuth : 0.0 degrees



Notes: 1. Inclinometer plots provided by Teck.

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CLIENT	TECK ELKVIEW OPERATIONS LTD.
PROJECT	TECK ELKVIEW OPERATIONS 2019 DAM SAFETY INSPECTION
TITLE	LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_N CUMMULATIVE DISPLACEMENT
PROJECT No.	M09963A07
FIG. No.	IV-4

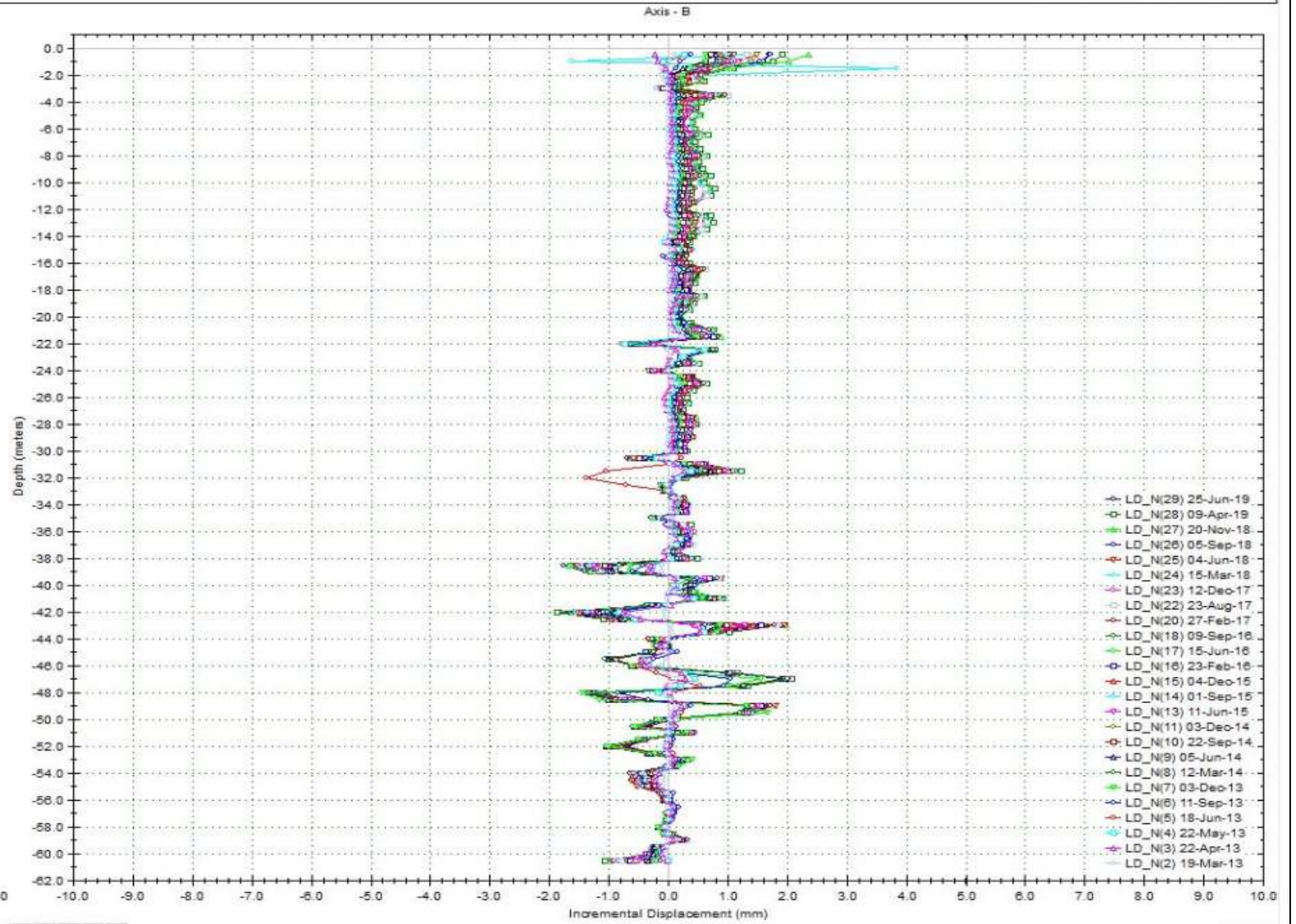
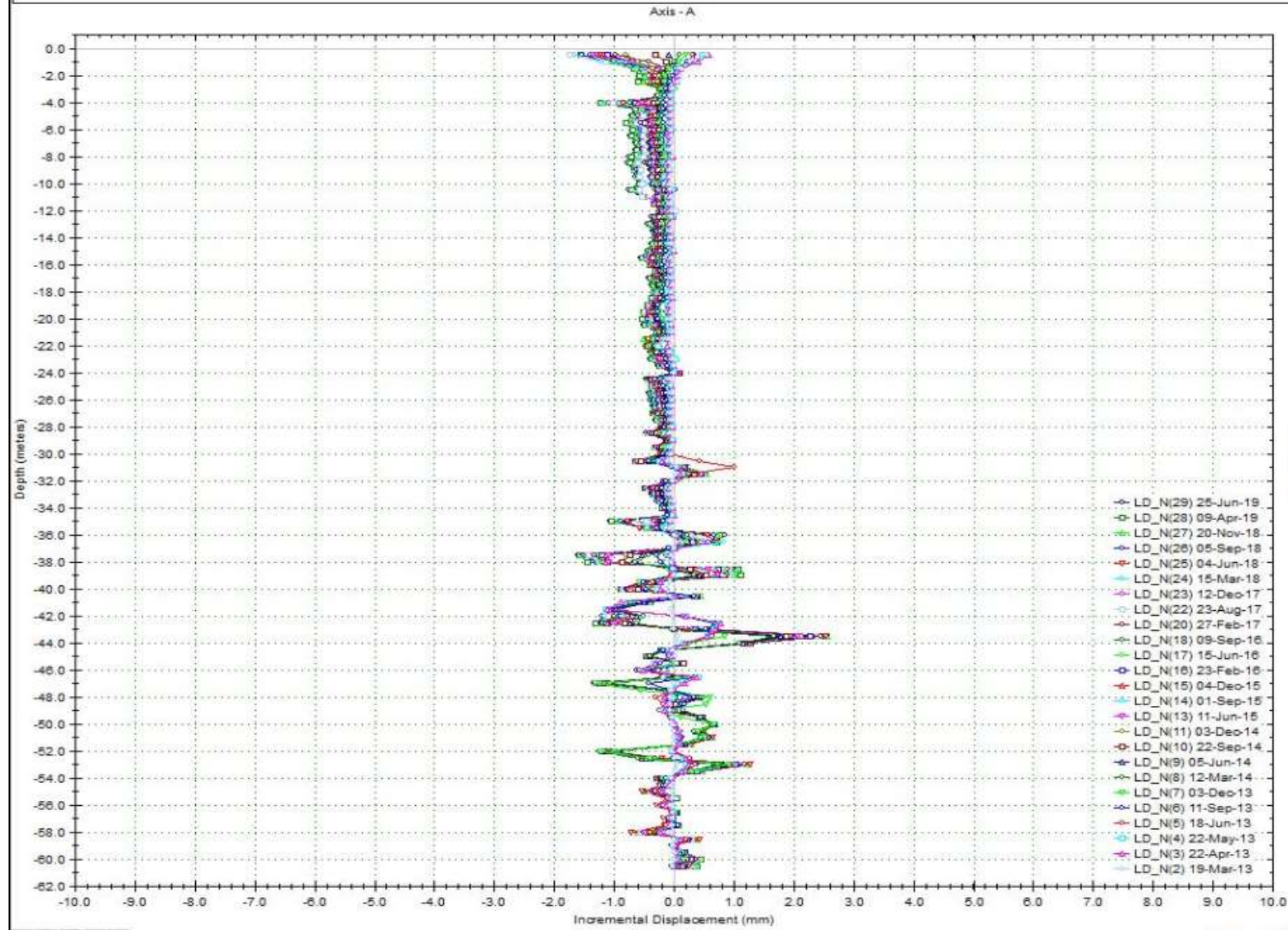
RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

Inclinanalysis v.2.27

Borehole : LD_N
Project : LagoonD
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 meters
Borehole Total Depth : 60.5 meters
North Groove Azimuth :
Base Reading : 2013 Feb 20 11:27
Axis AAzimuth : 0.0 degrees



Notes: 1. Inclinometer plots provided by Teck.

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.



CLIENT	TECK ELKVIEW OPERATIONS LTD.
PROJECT	TECK ELKVIEW OPERATIONS 2019 DAM SAFETY INSPECTION
TITLE	LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_N INCREMENTAL DISPLACEMENT
PROJECT No.	M09963A07
FIG. No.	IV-5

RST Instruments Ltd.

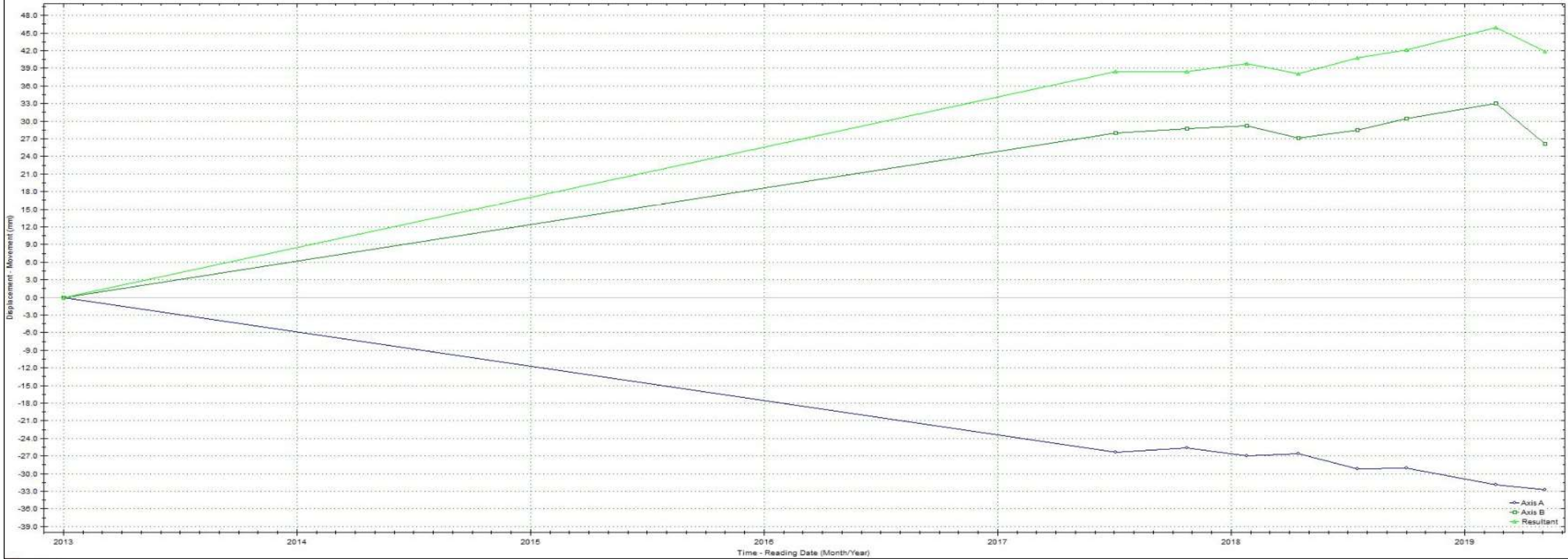
Borehole : LD_N
Project : LagoonD
Location :
Northing :
Easting :
Collar :
Collar Elev : 0.0 meters

TIME PLOT
Displacement vs. Time

Inclinanalysis v.2.27

Spiral Correction : N/A
Movement Depth : 0.5 - 60.5 meters
Borehole Total Depth : 60.5 meters
North Groove Azimuth :
Latest Reading : 2019 Jun 25 14:56
Initial Reading : 2013 Feb 20 11:27
Axis A Azimuth : 0.0 degrees

Time Plot : 0.5 - 60.5 meters



Notes: 1. Inclinometer plots provided by Teck.

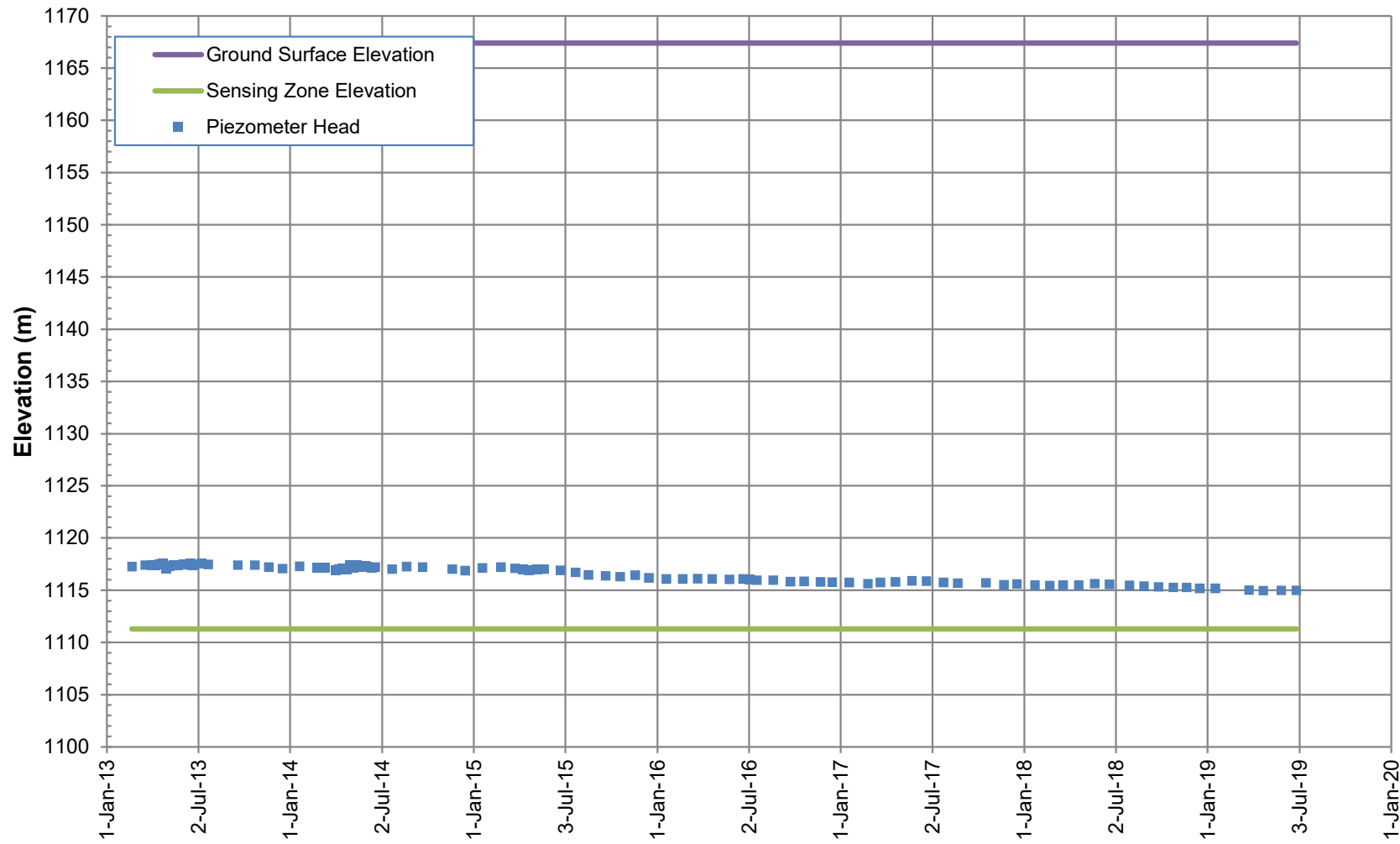
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT

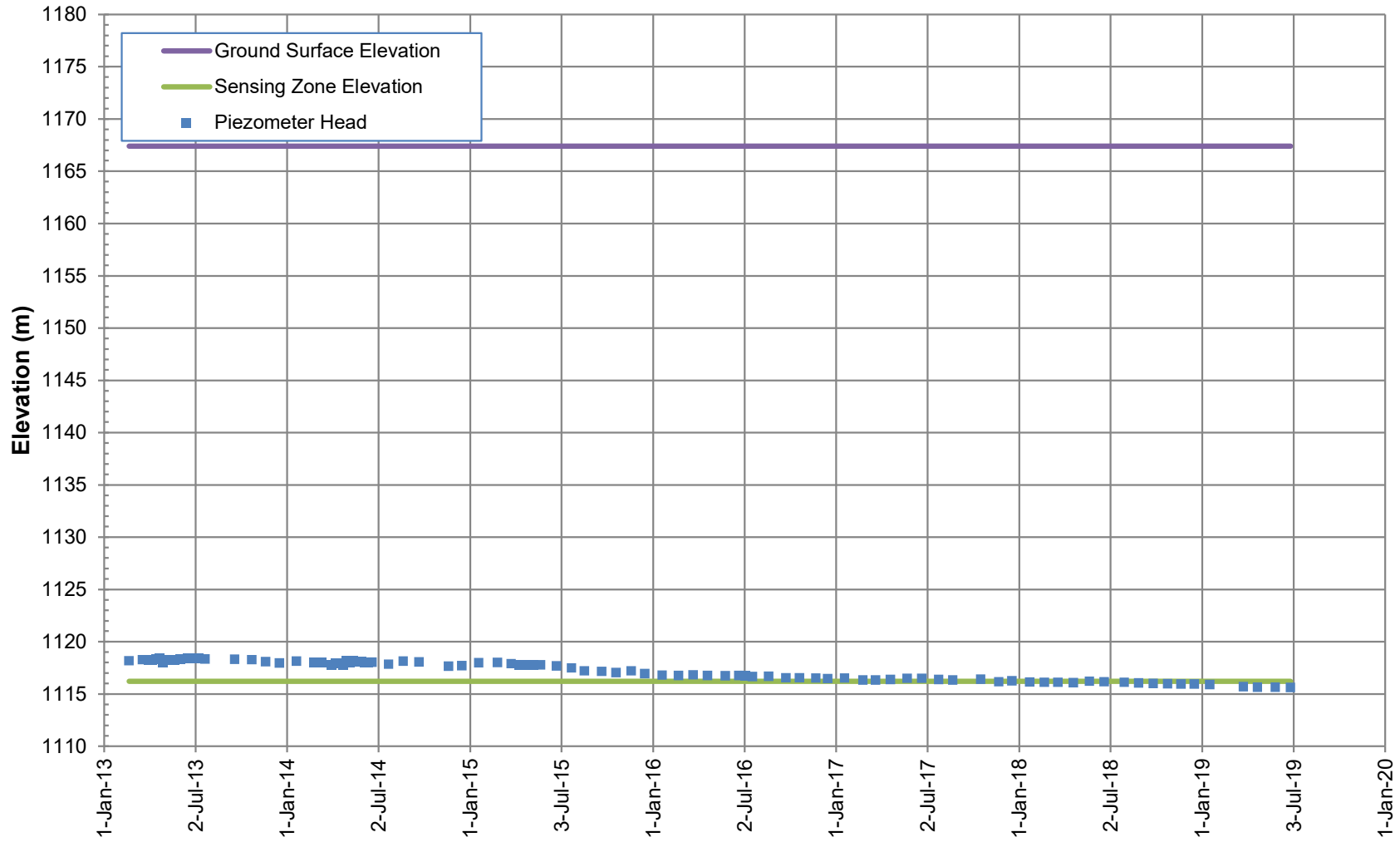
Teck TECK ELKVIEW OPERATIONS LTD.

Klohn Crippen Berger

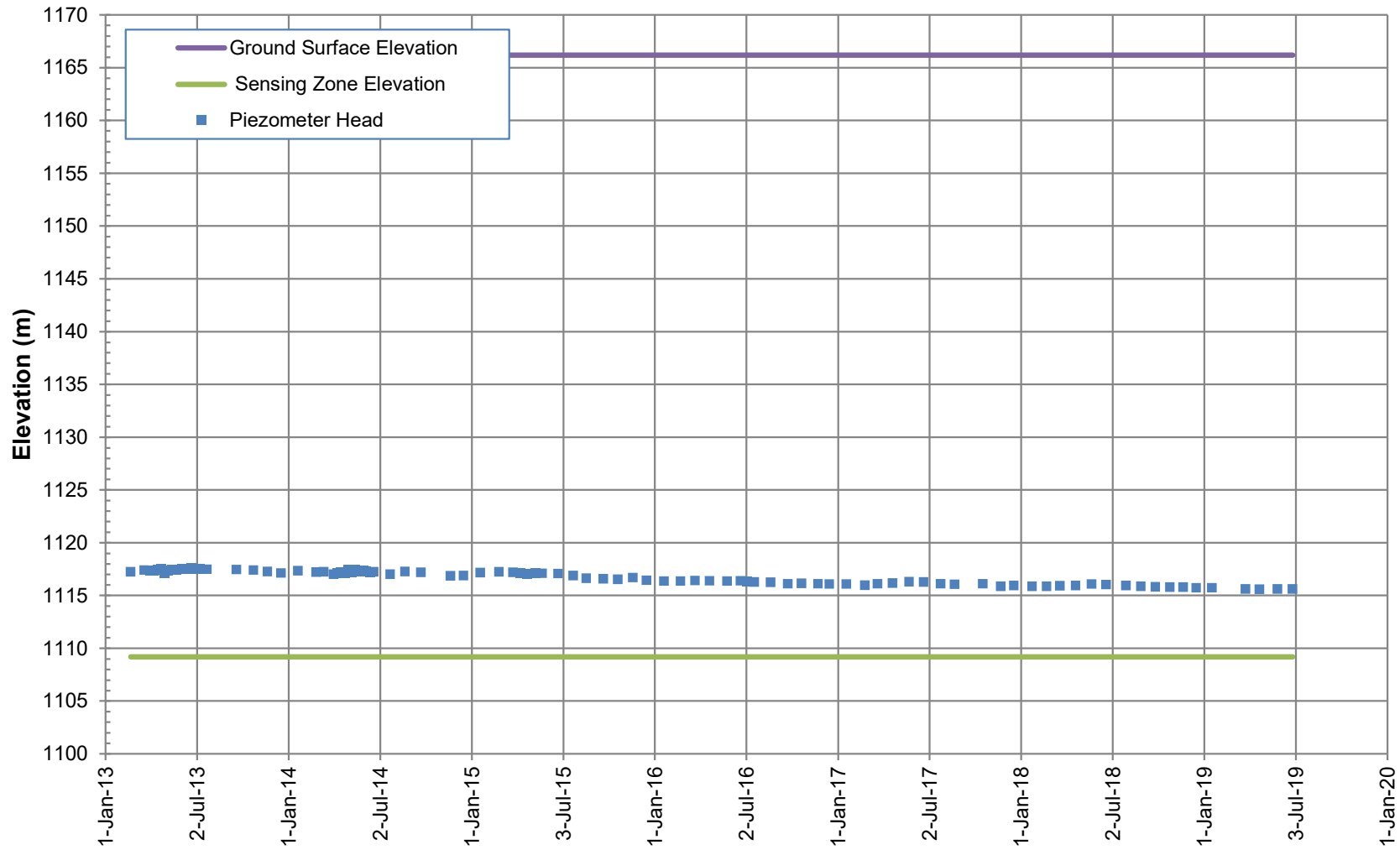
PROJECT	TECK ELKVIEW OPERATIONS 2019 DAM SAFETY INSPECTION	
TITLE	LAGOON D INCLINOMETER MONITORING INCLINOMETER LD_N TIME VS. DISPLACEMENT	
PROJECT No.	M09963A07	FIG. No. IV-6



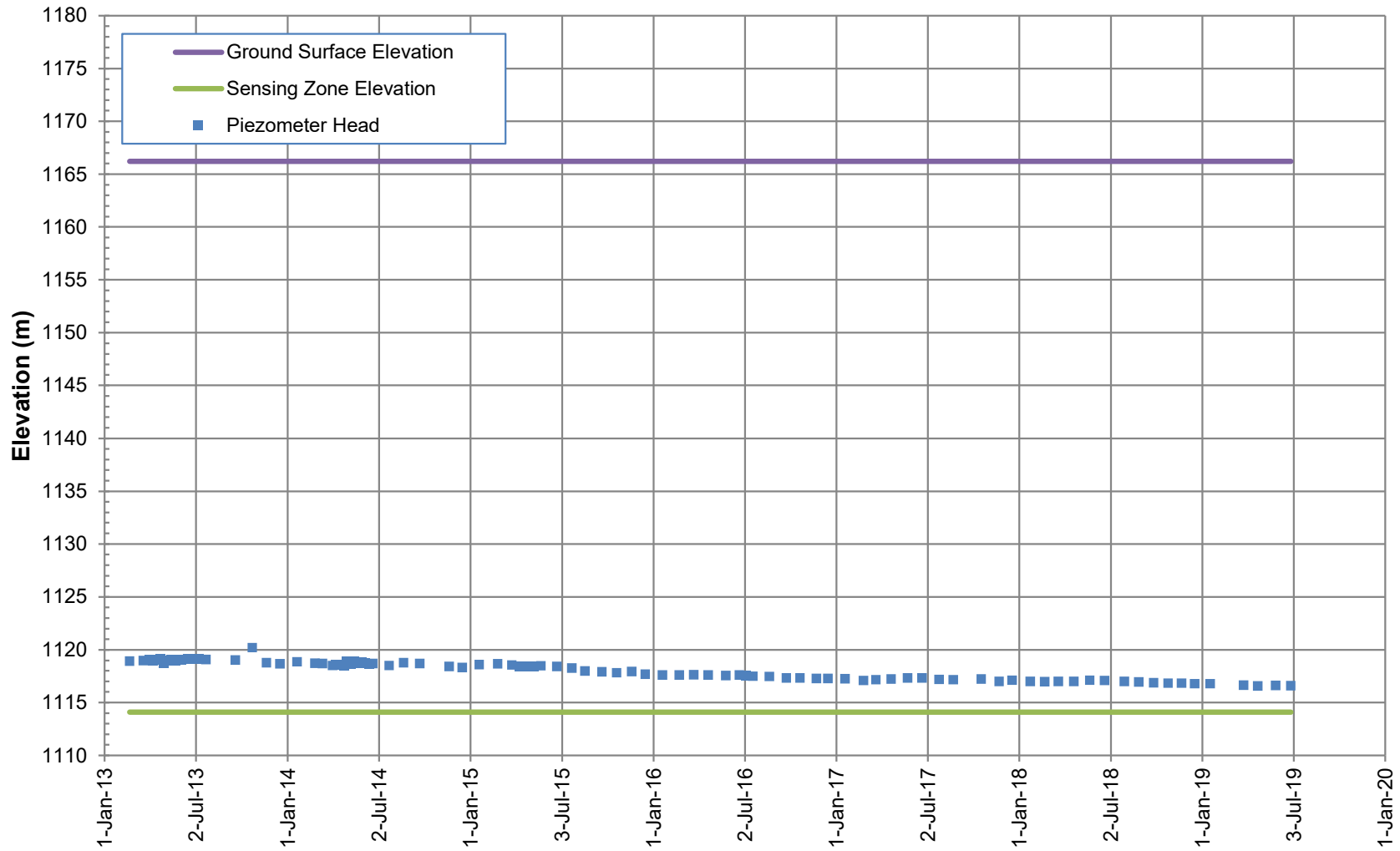
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
VW 23897 Pore Pressure		Name:	



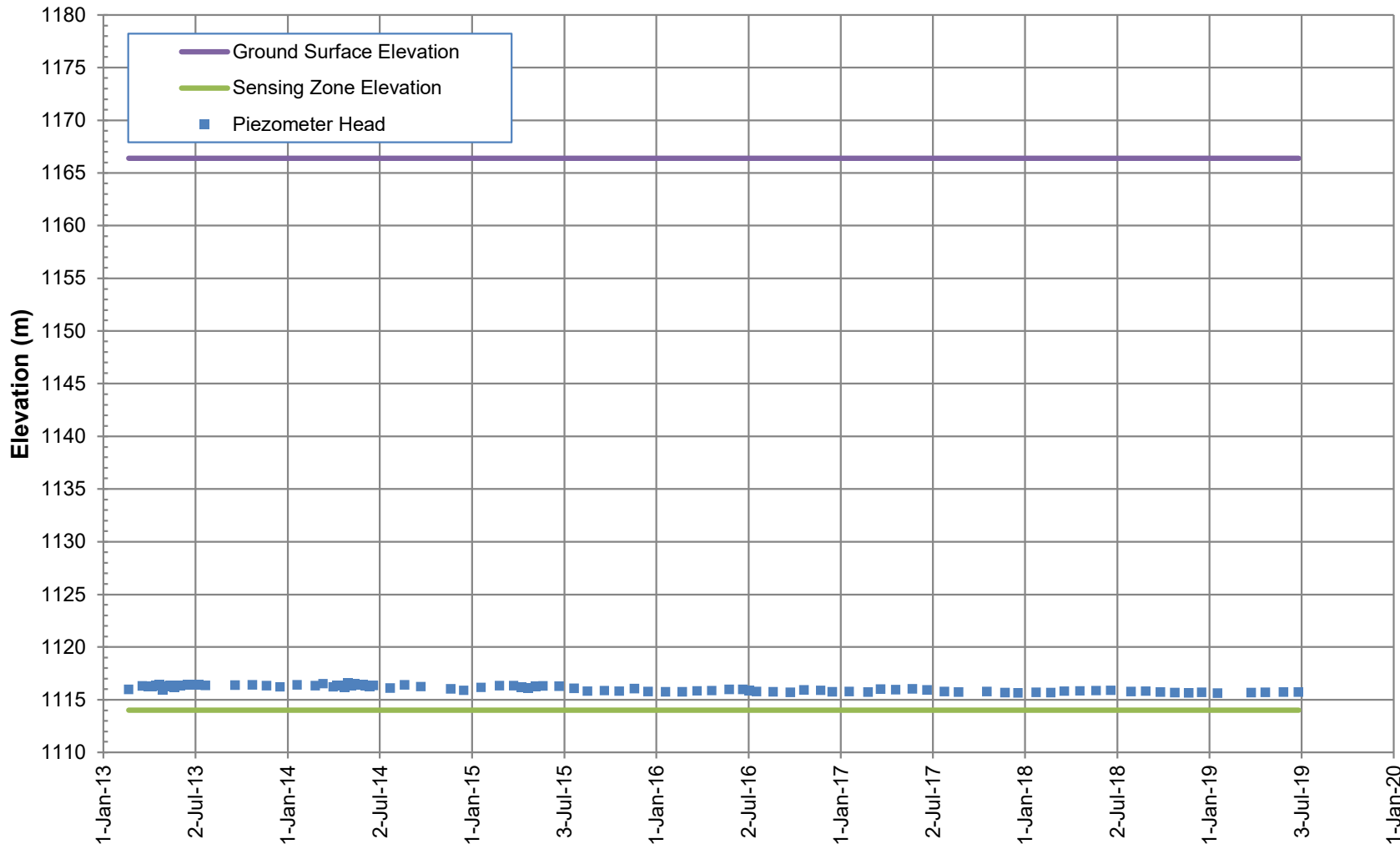
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Lagoon D Piezometers		Date:	Revision:
VW 23898 Pore Pressure		Name:	



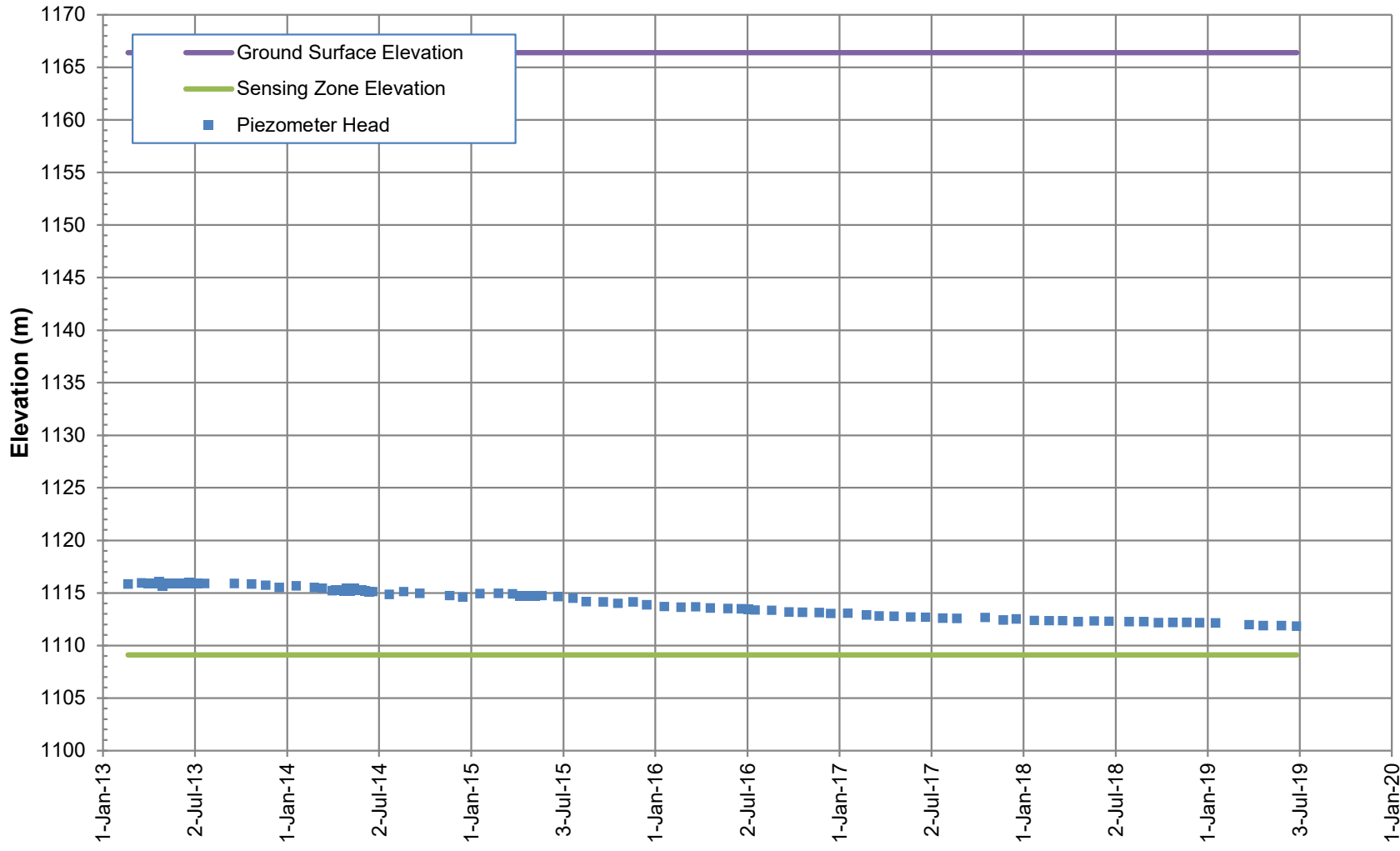
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
VW 23896 Pore Pressure		Name:	



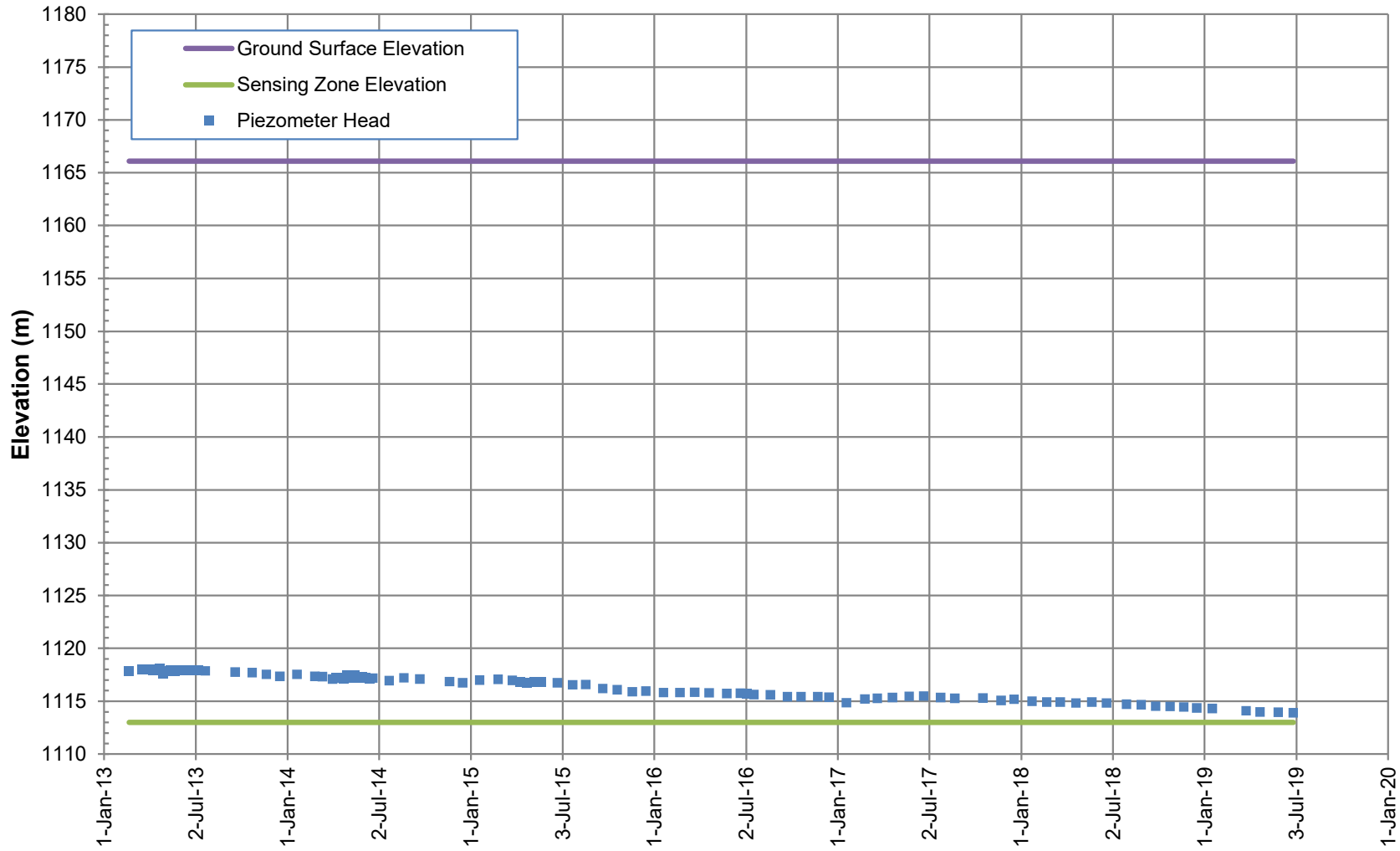
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision:
VW 23895 Pore Pressure		Name:	



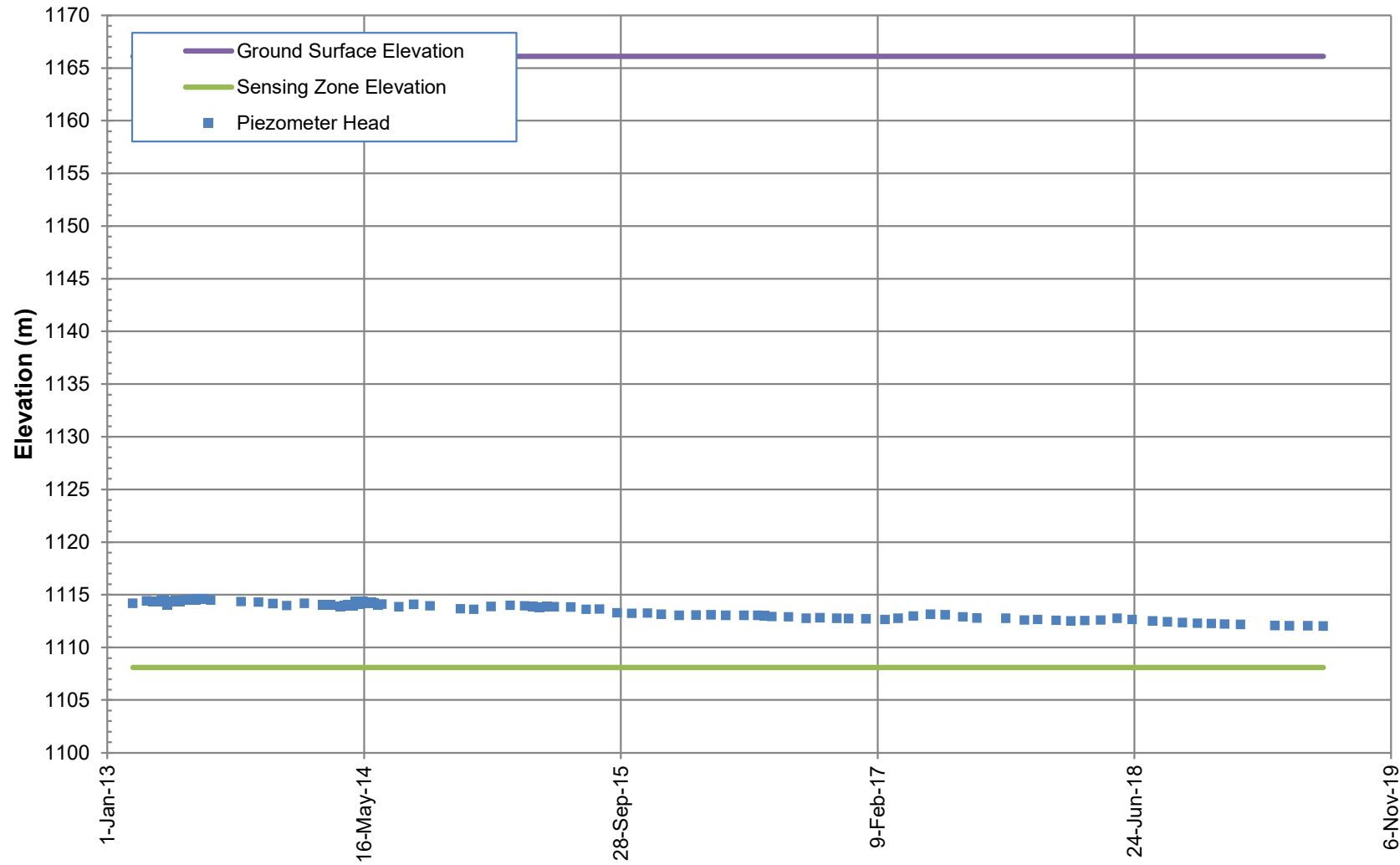
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Lagoon D Piezometers		Date:	Revision:
VW 23892 Pore Pressure		Name:	



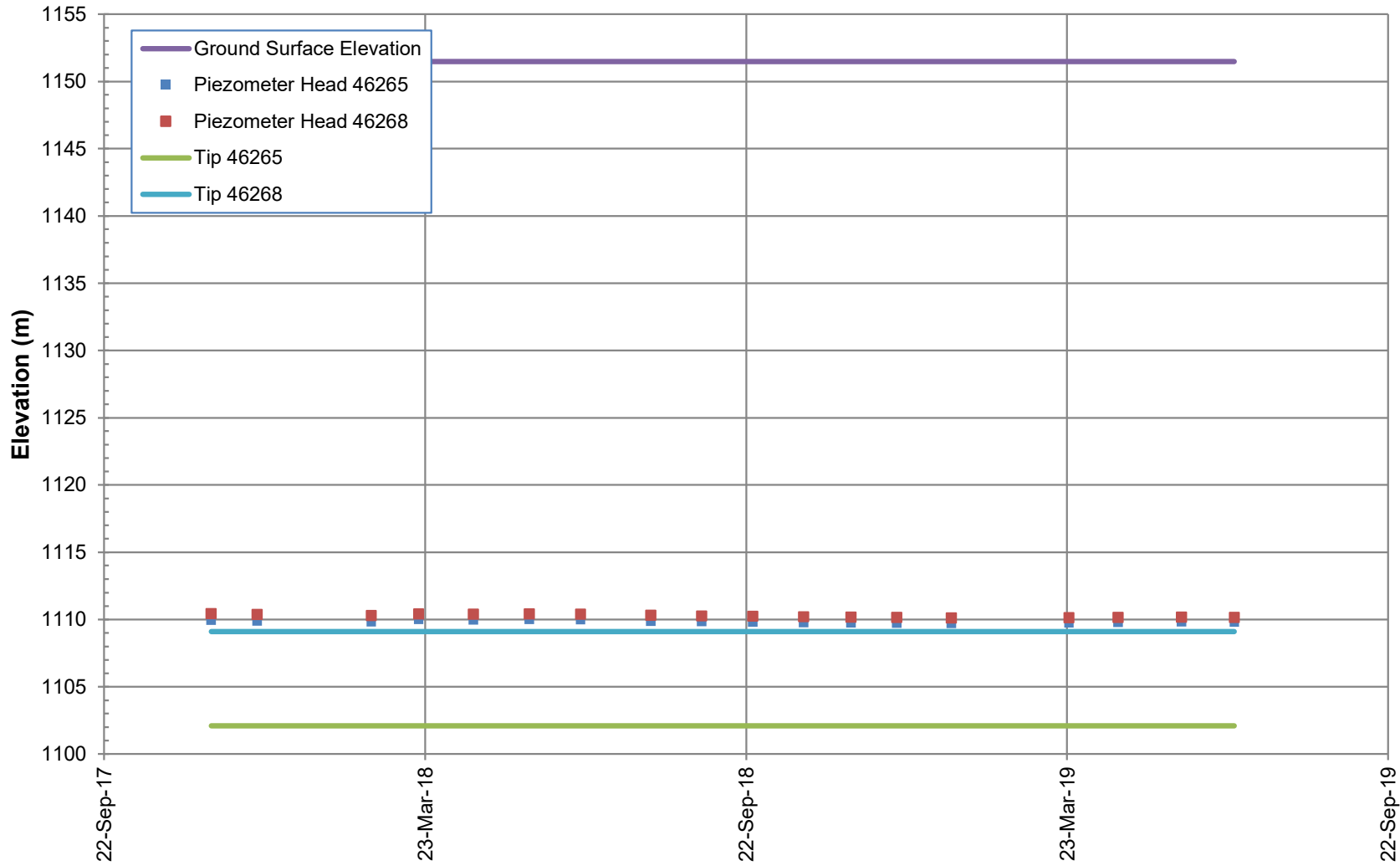
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Lagoon D Piezometers		Date:	Revision:
VW 23891 Pore Pressure		Name:	



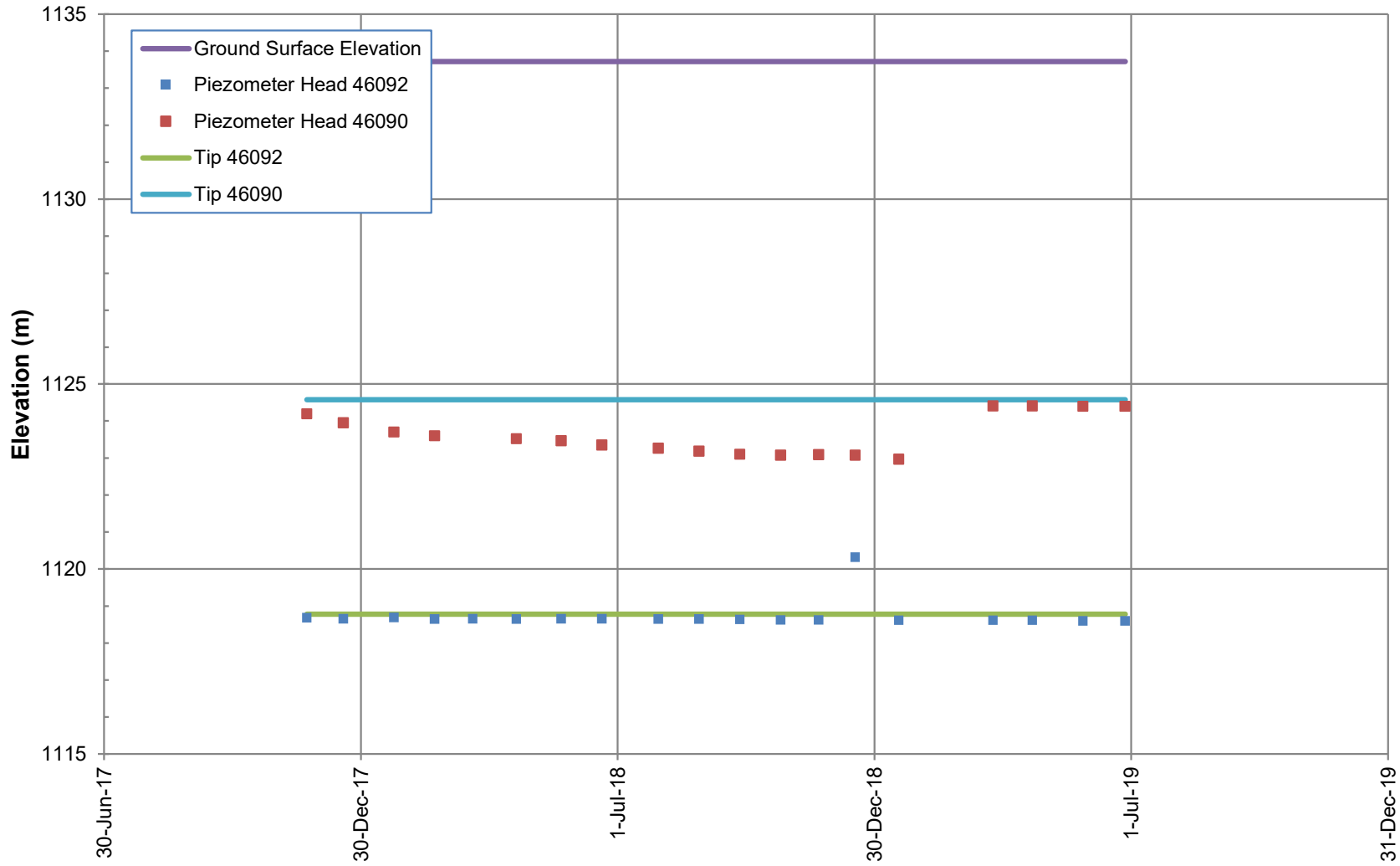
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Lagoon D Piezometers		Date:	Revision:
VW 23885 Pore Pressure		Name:	



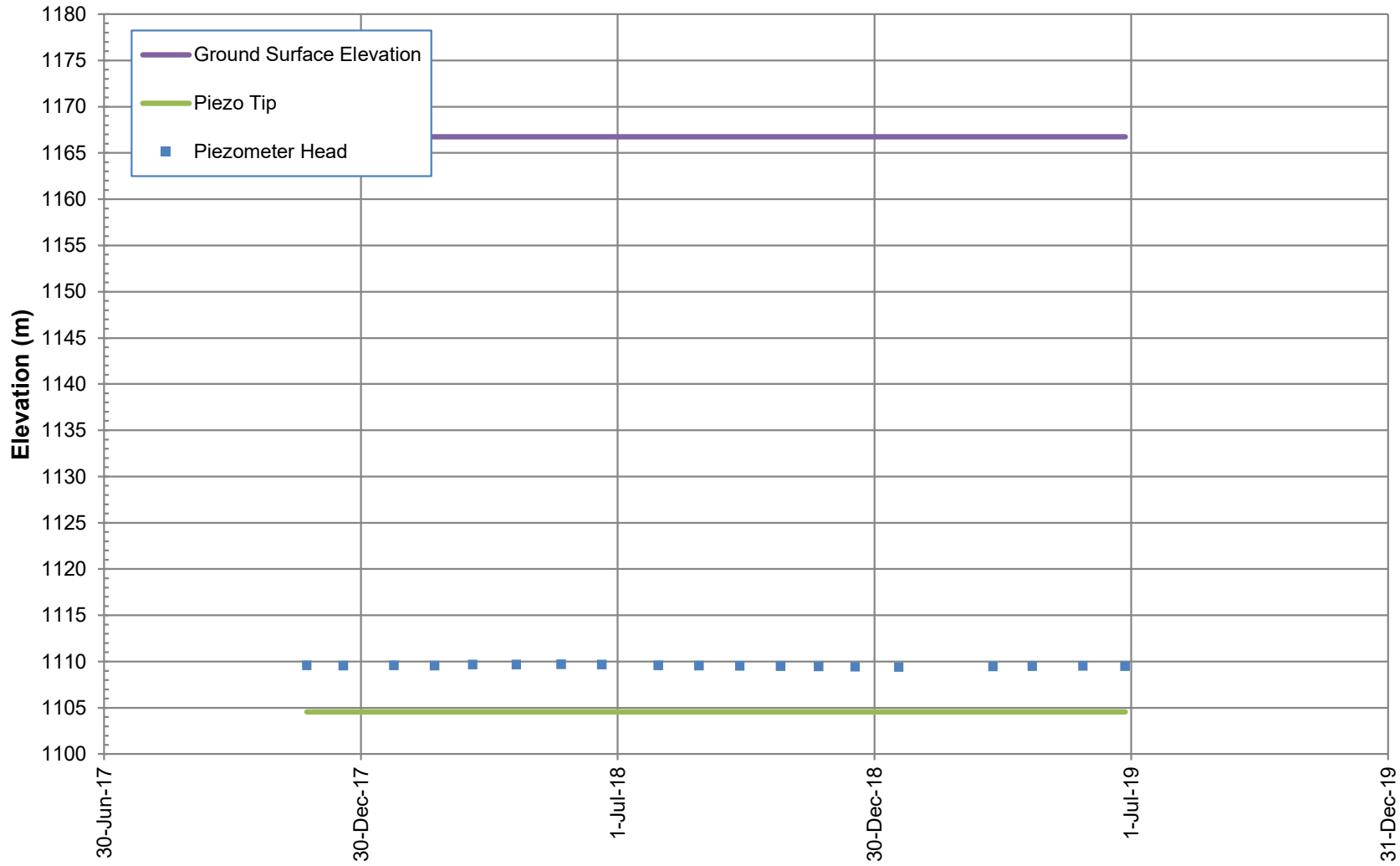
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Lagoon D Piezometers		Date:	Revision
VW 23886 Pore Pressure		Name:	



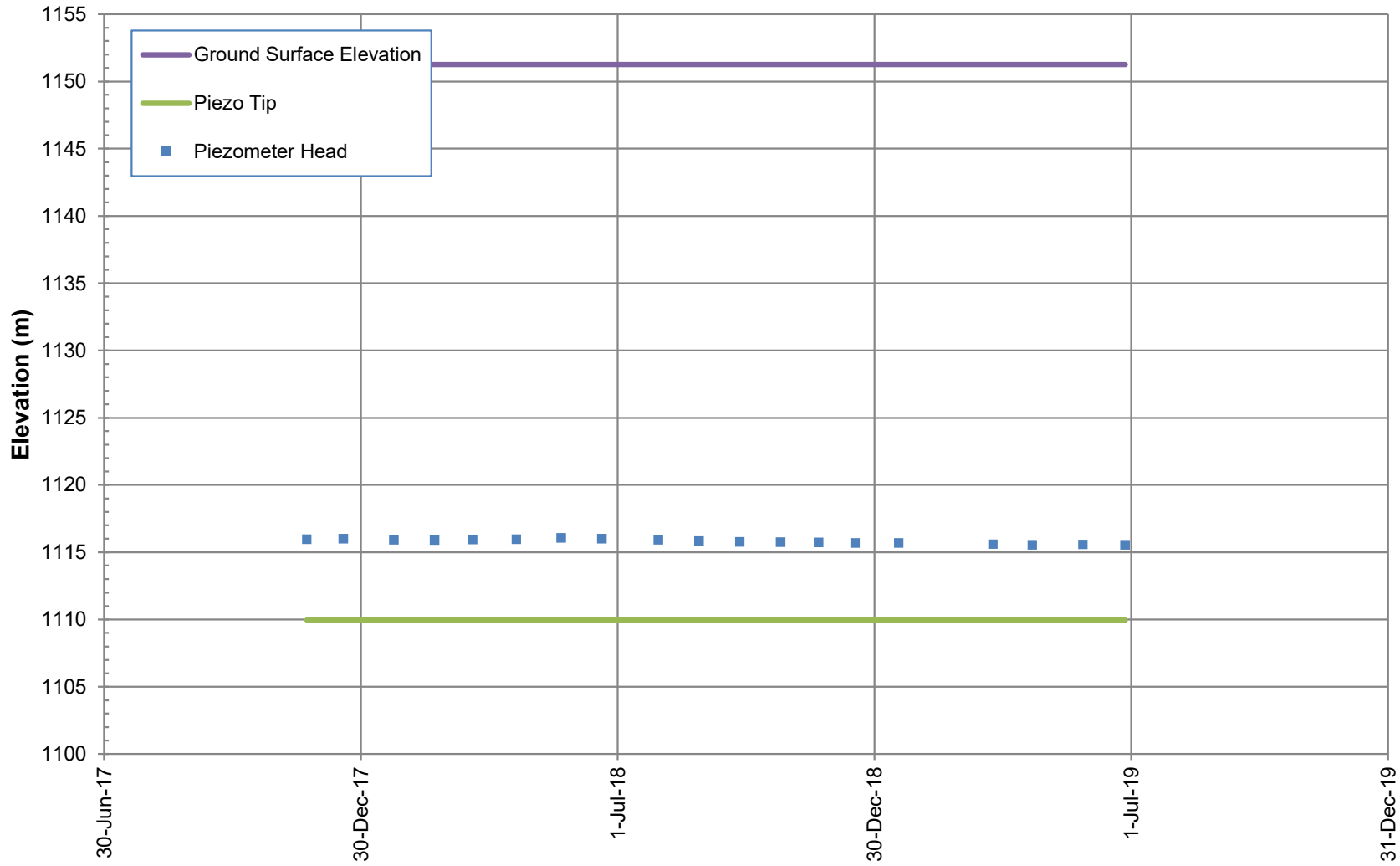
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Lagoon D Piezometers		Date:	Revision
VW 46265/46268		Name:	



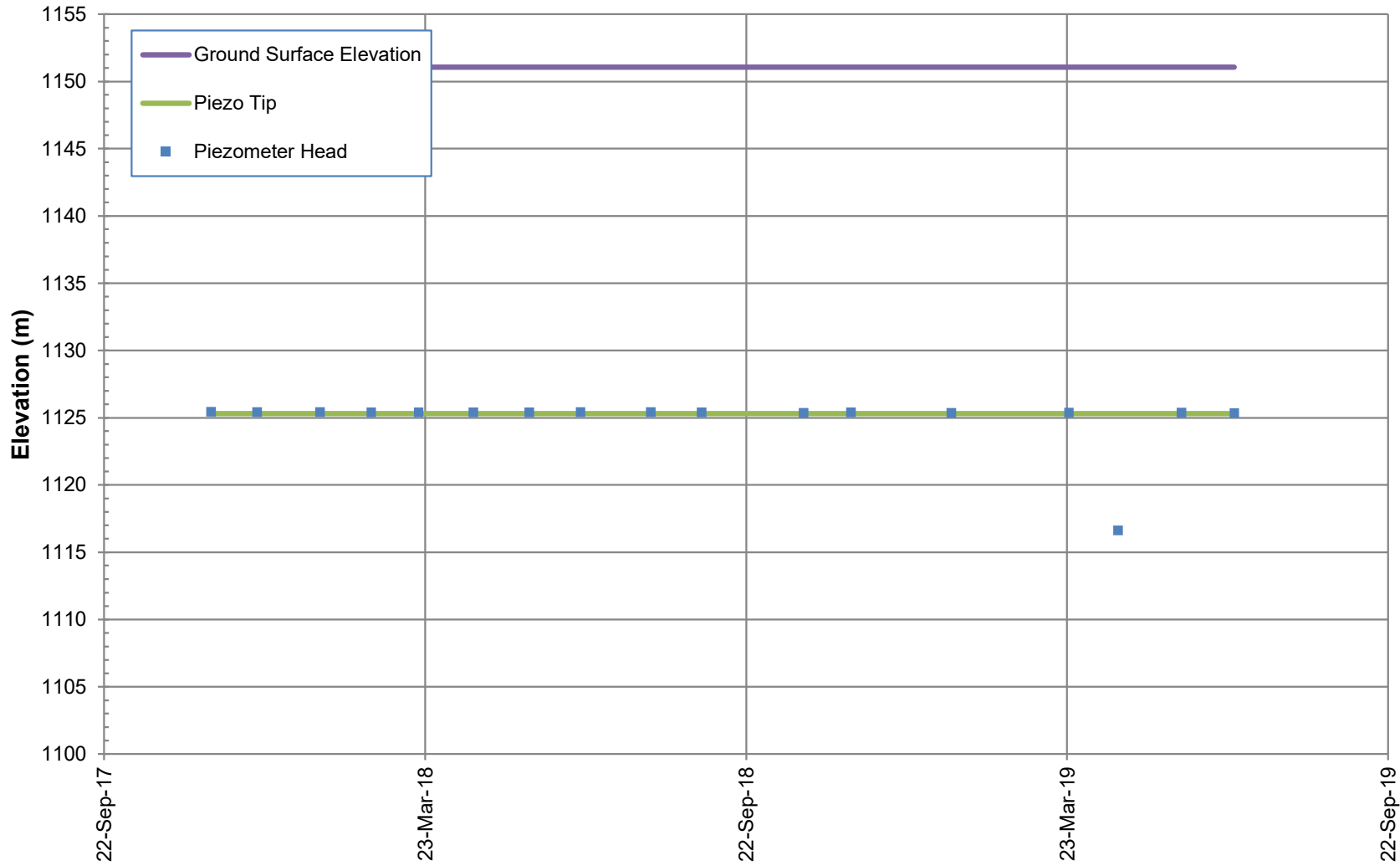
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Lagoon D Piezometers		Date:	Revision
VW 46092/ VW 46090		Name:	



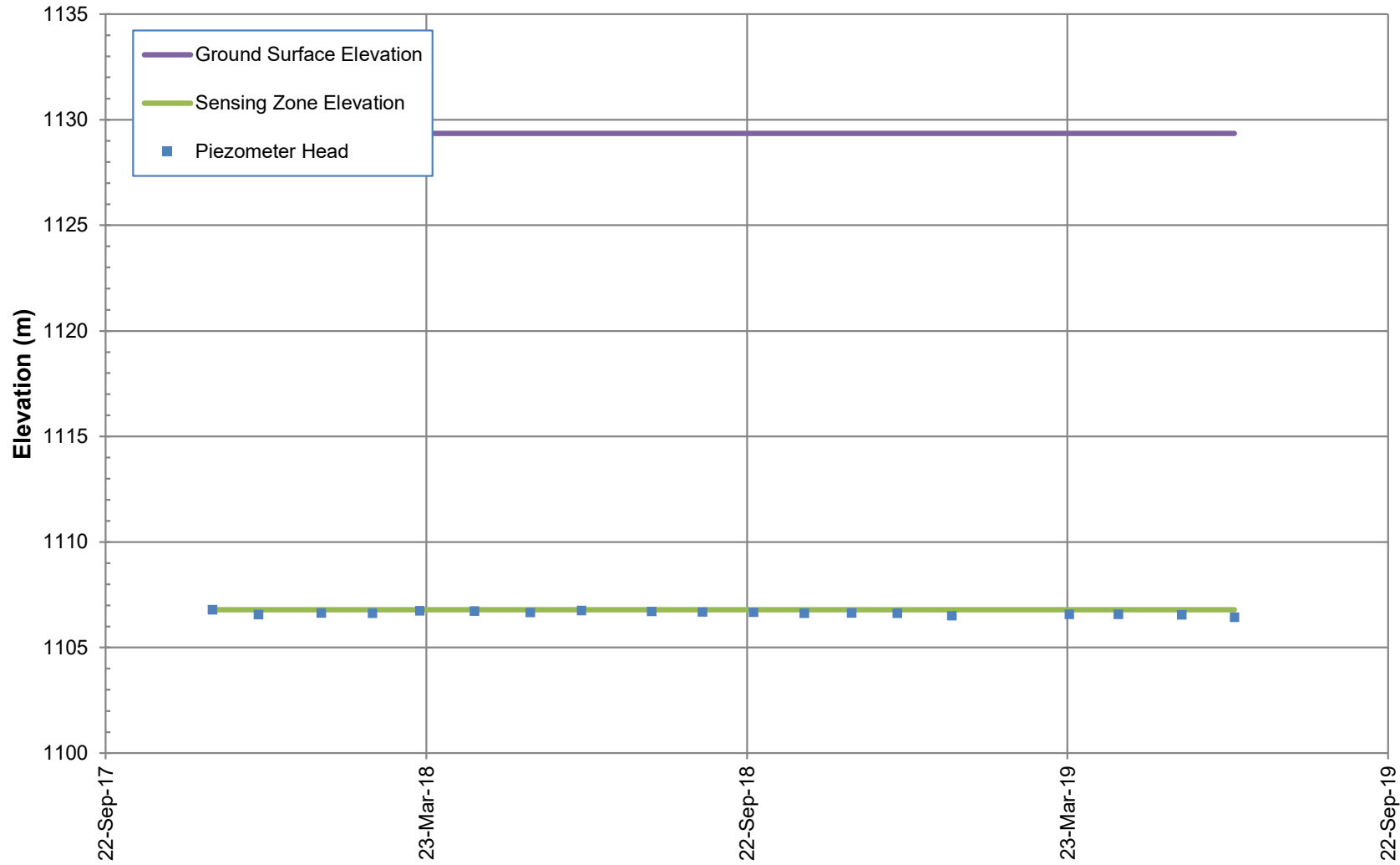
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Lagoon D Piezometers		Date:	Revision
VW 46269		Name:	



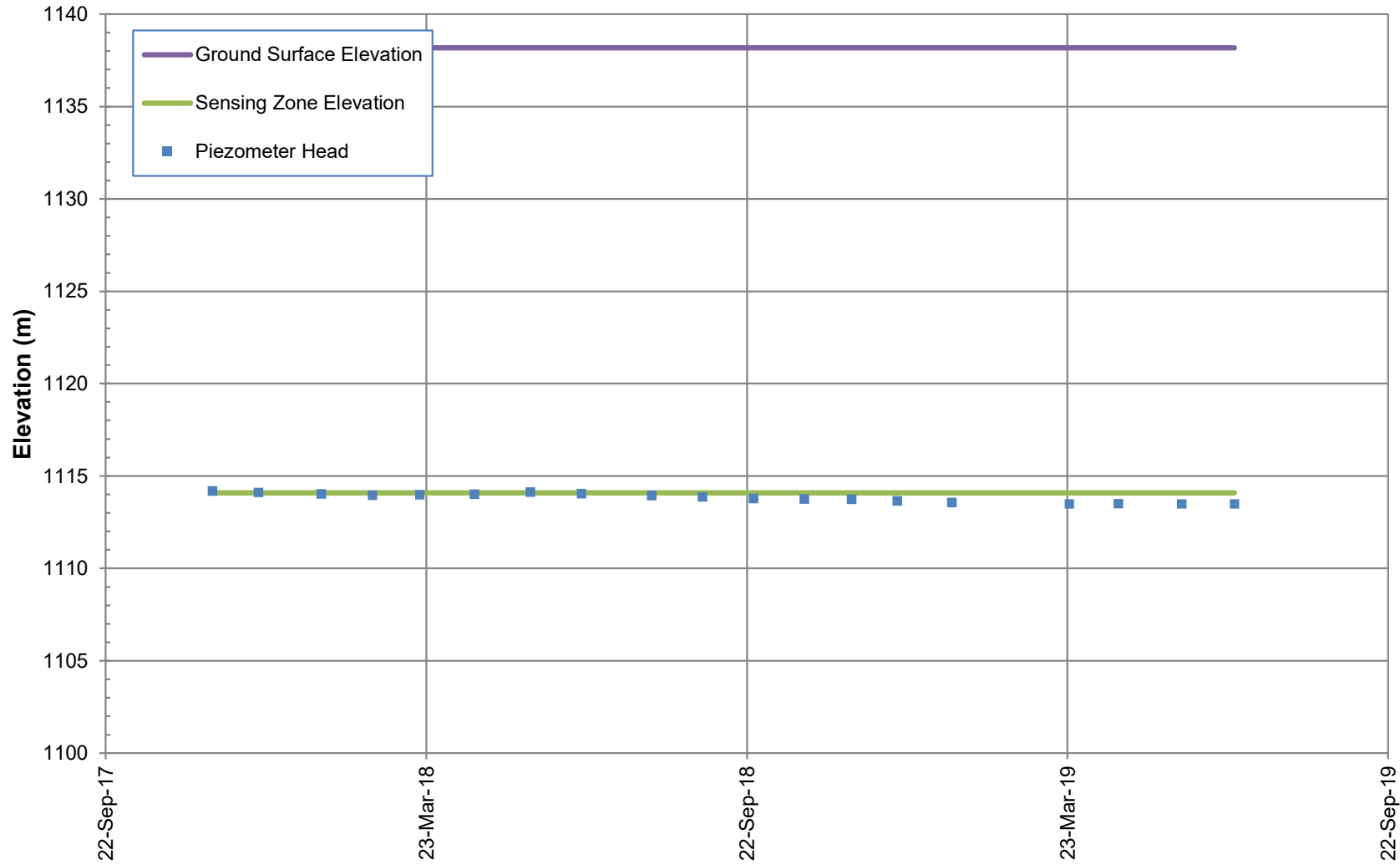
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Lagoon D Piezometers		Date: <input type="text"/>
VW 46263		Revision: <input type="text"/>
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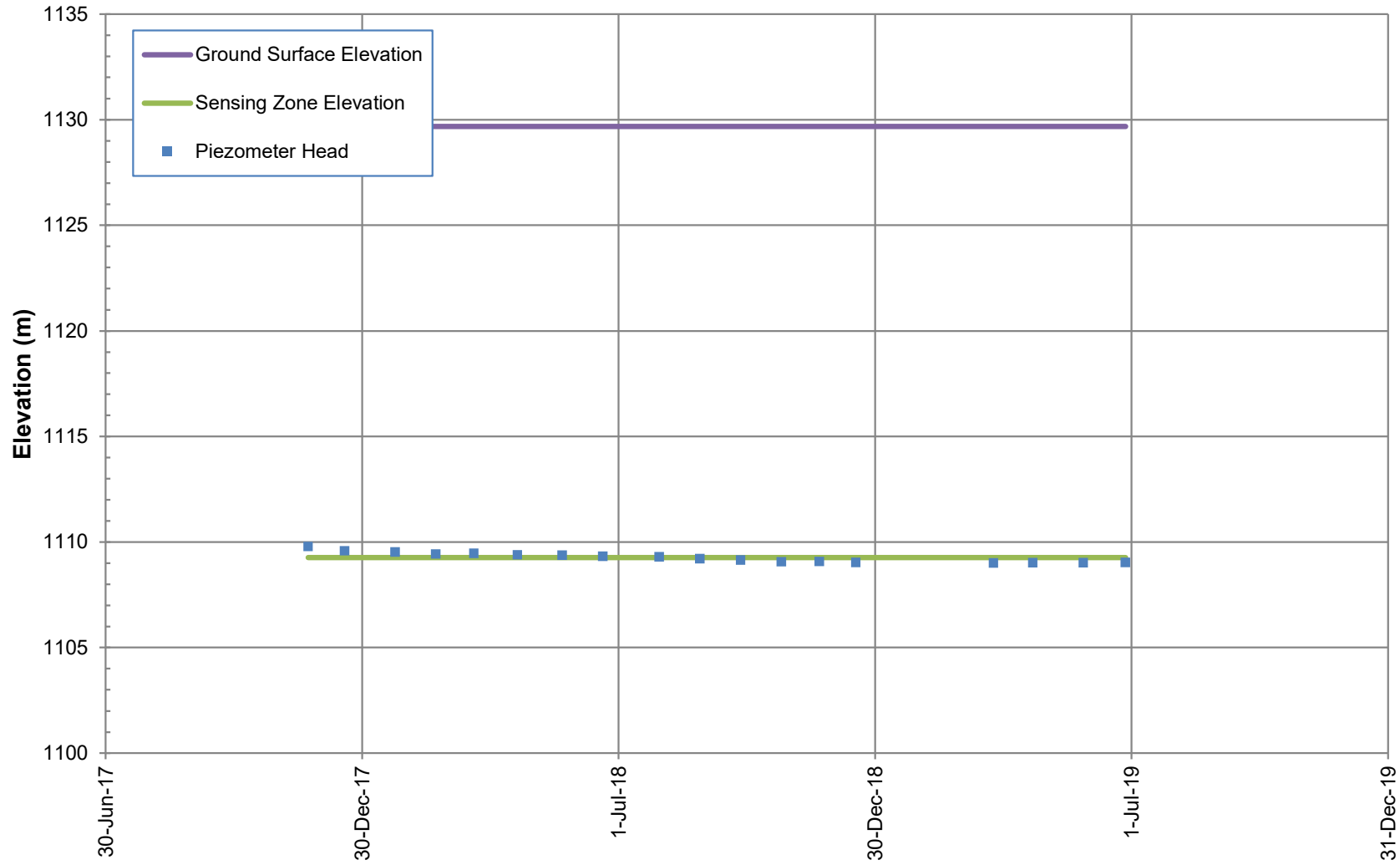
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Lagoon D Piezometers		Date:	Revision
VW 33234		Name:	



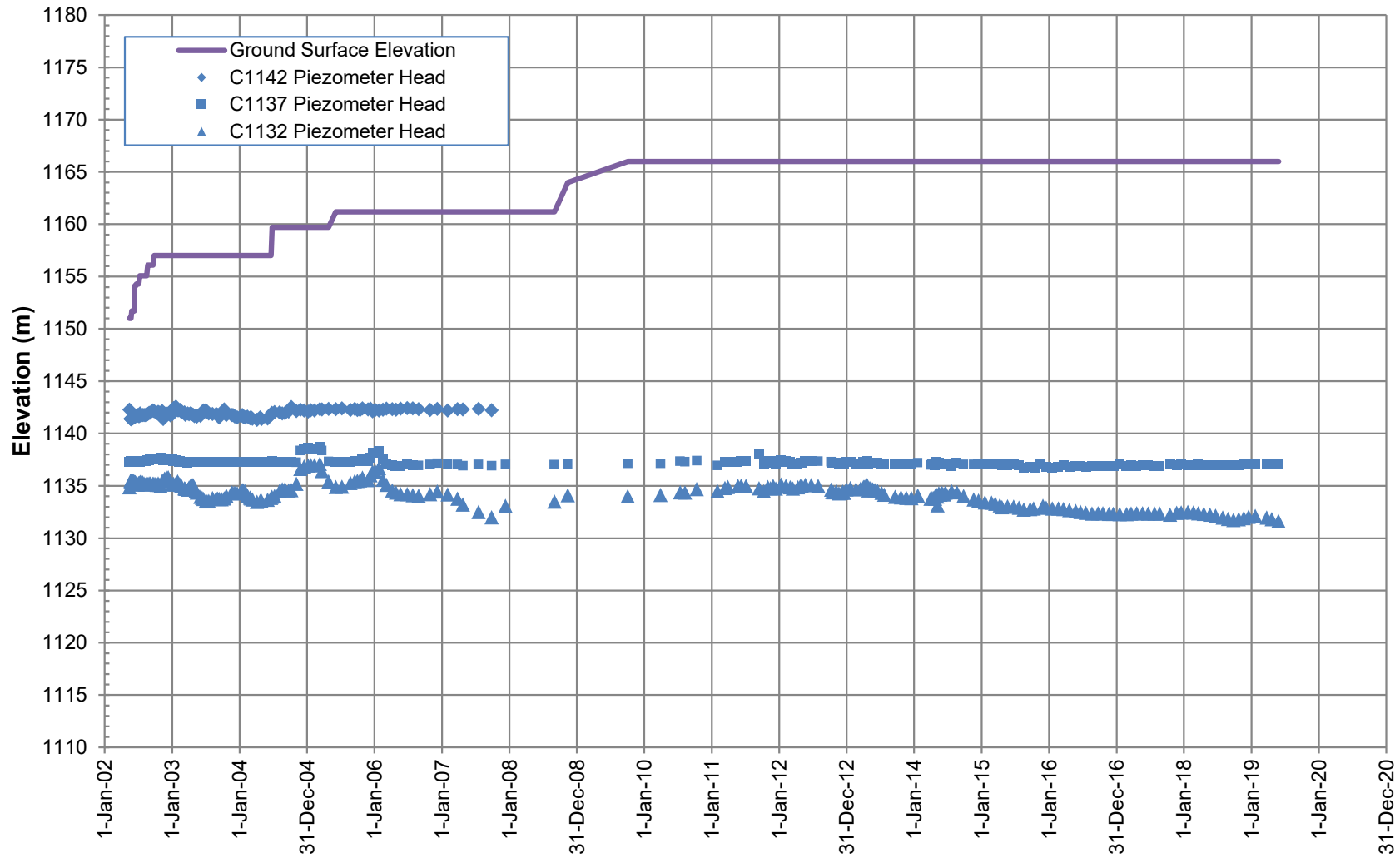
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
VW 33235		Name:	



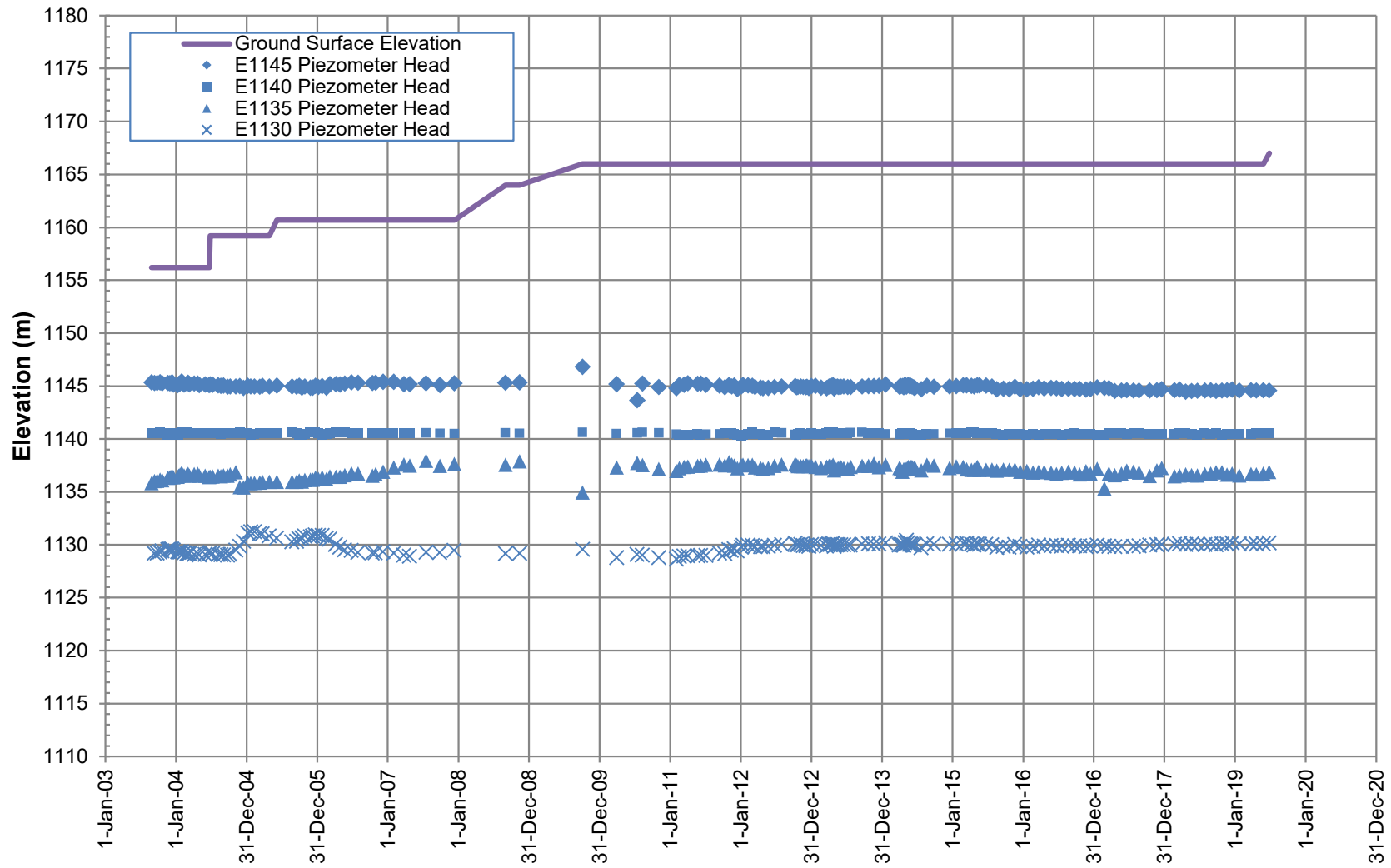
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
VW 45123		Name:	



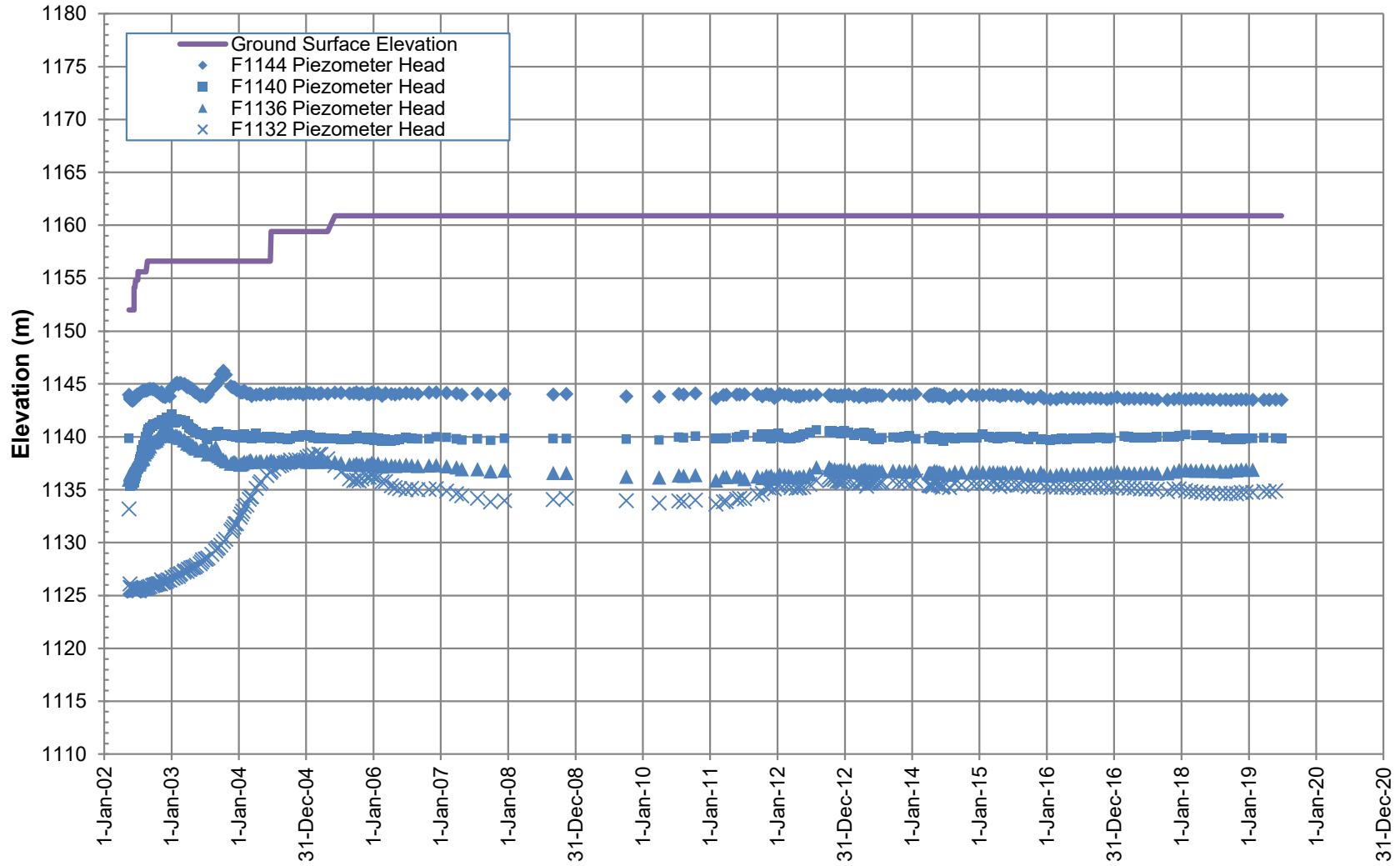
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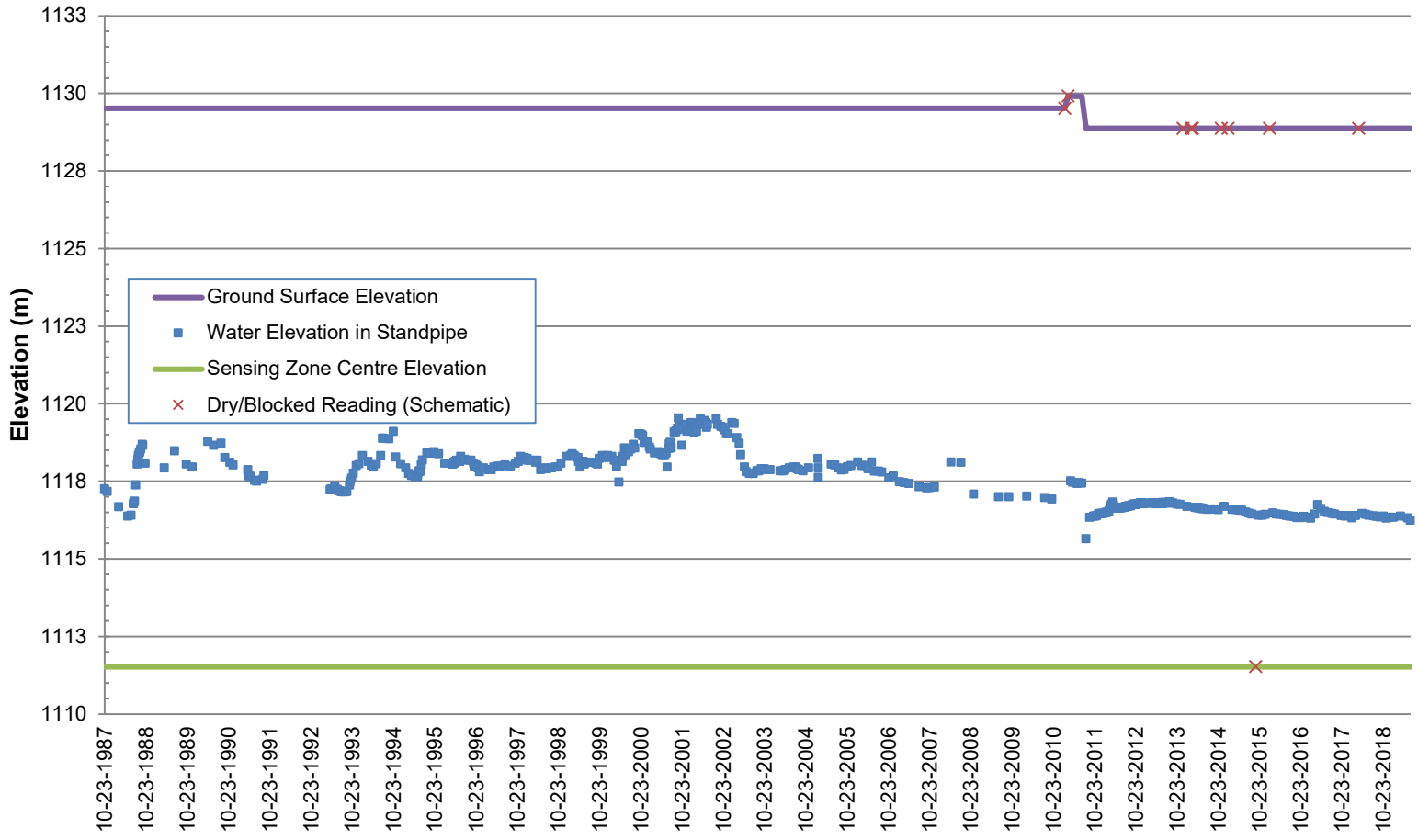
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Lagoon D Piezometers		Date:	Revision:
Series C VWP Pore Pressure		Name:	



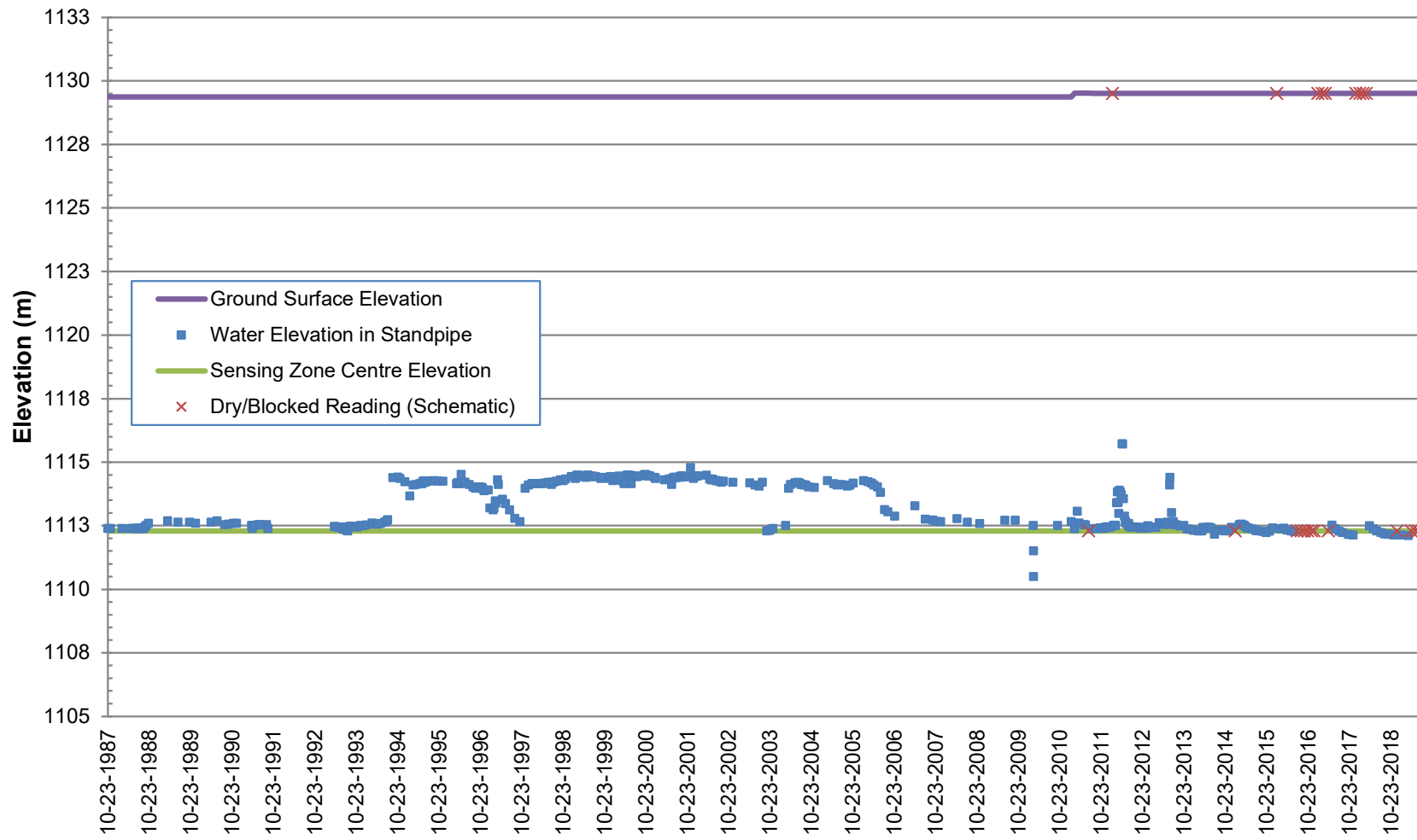
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Lagoon D Piezometers		Date:	Revision:
Series E VWP Pore Pressure		Name:	



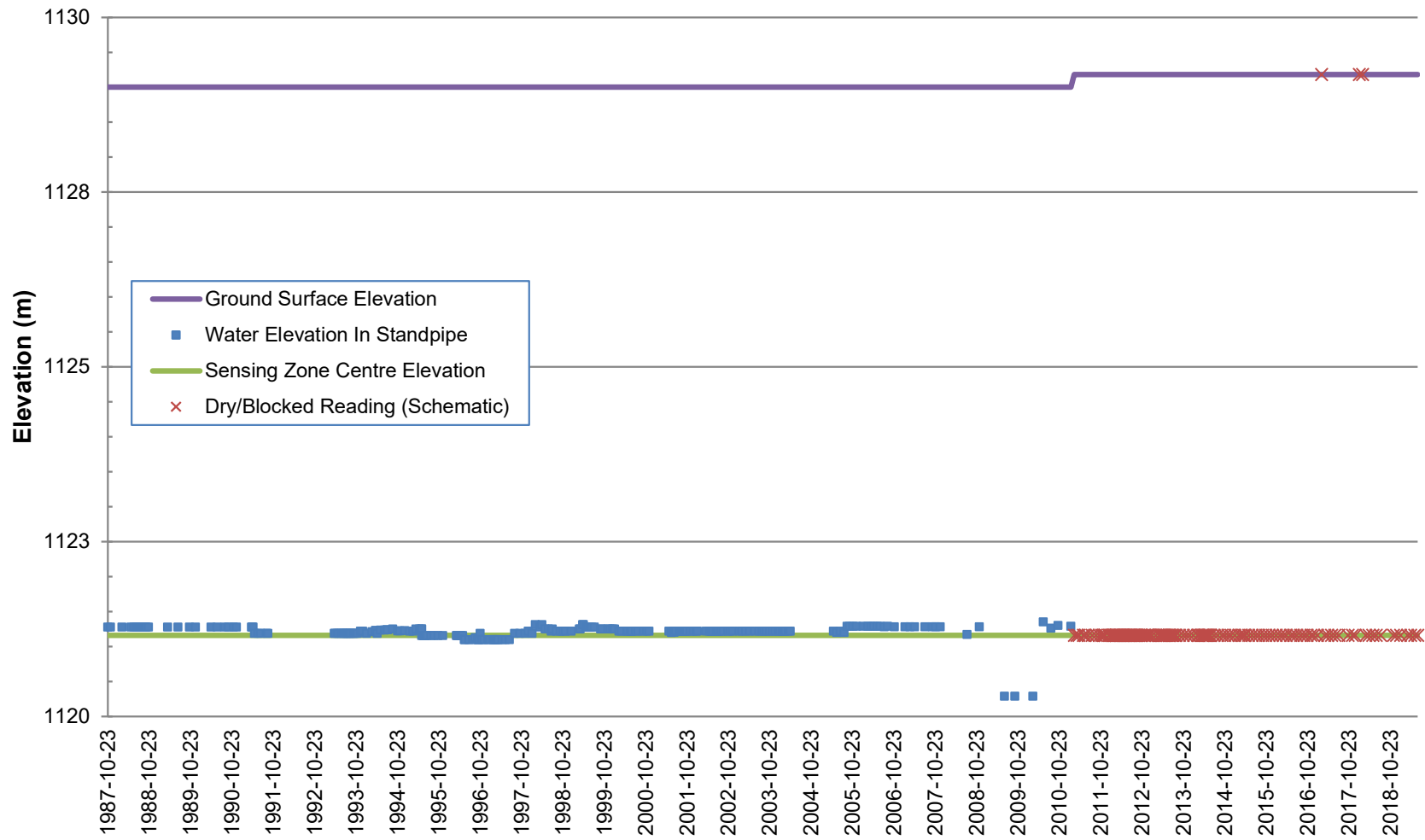
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
F Series VWP Pore Pressure		Name:	



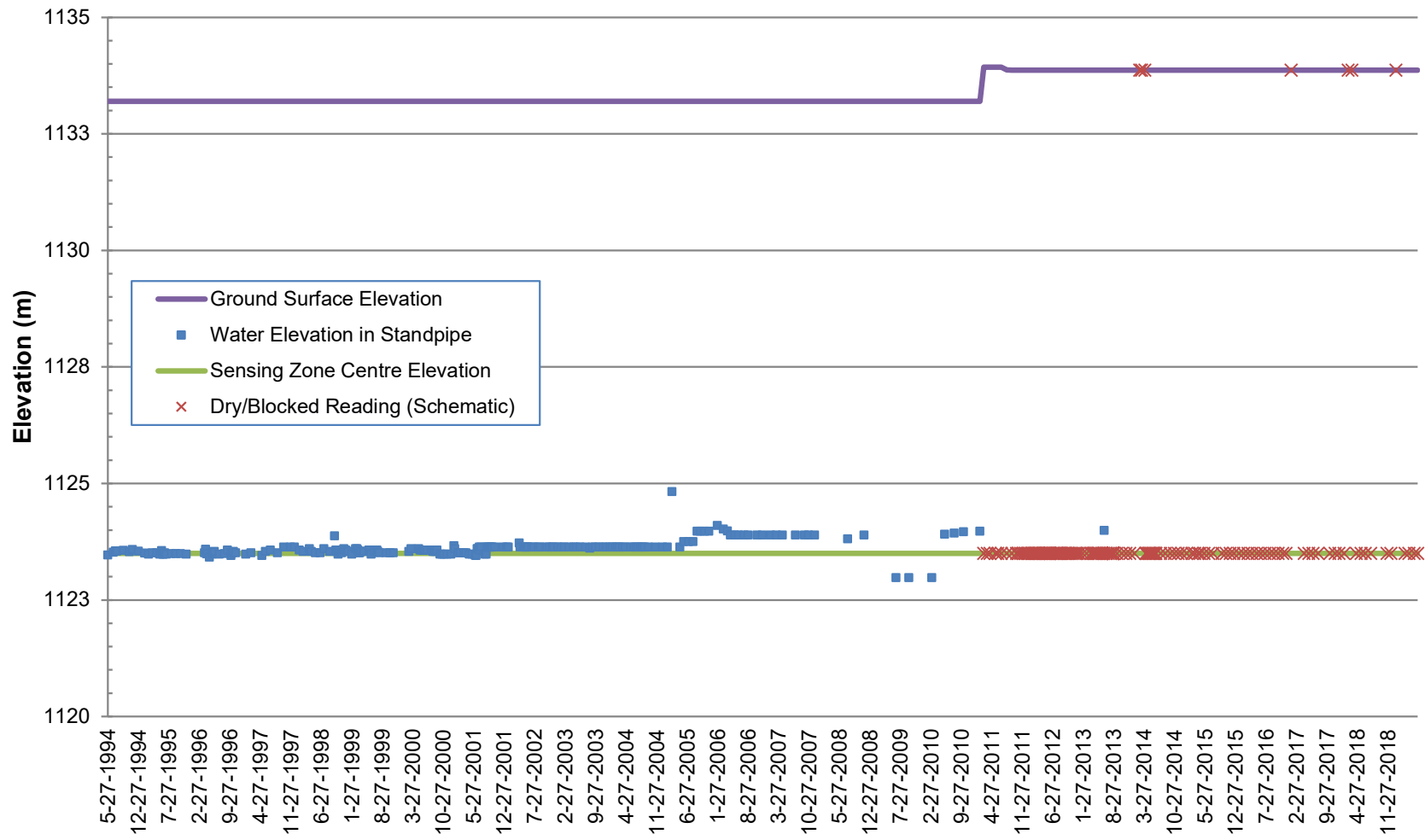
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Standpipe OW-7		Revision: <input type="text"/>



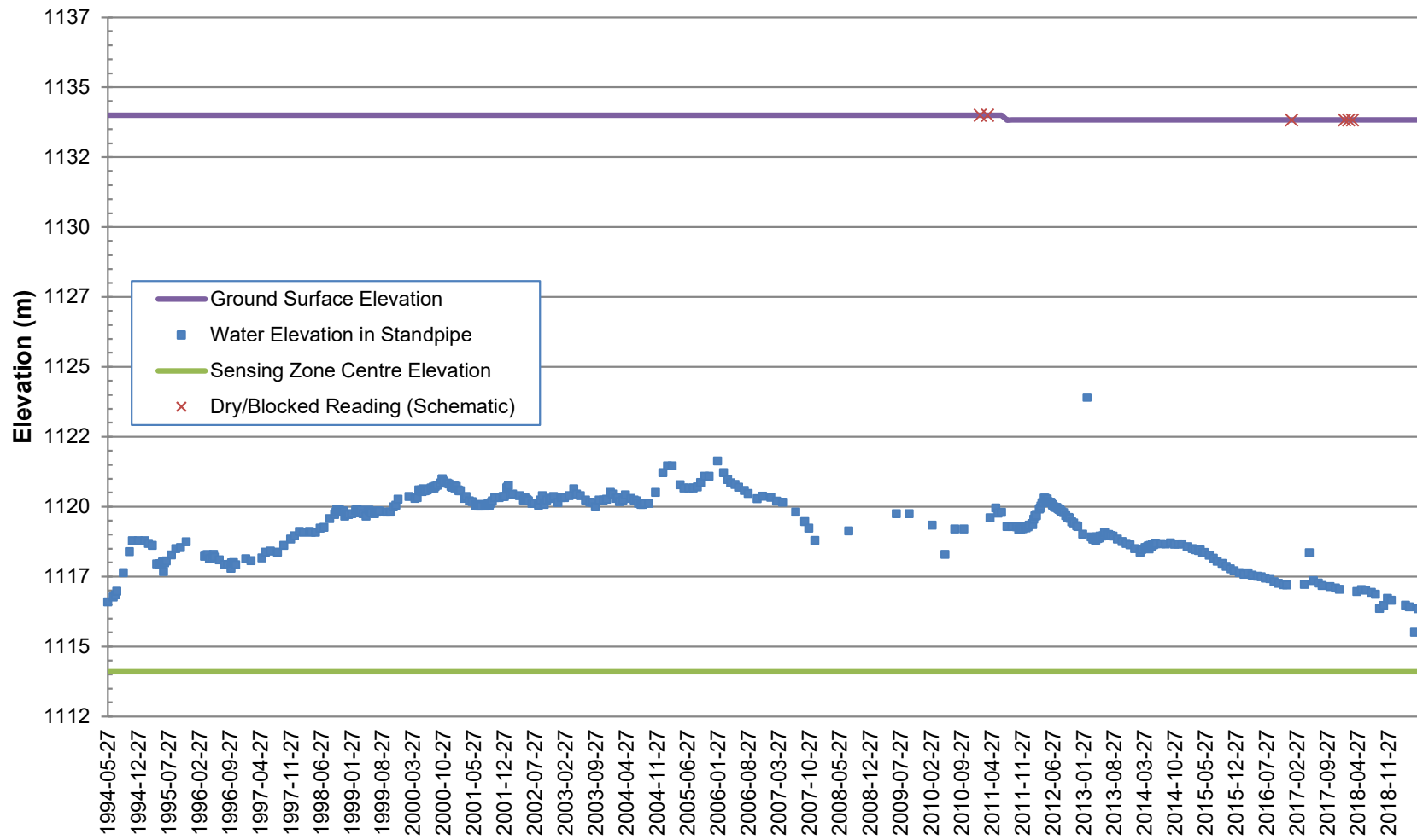
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Lagoon D Piezometers		Date:	Revision
Standpipe OW-9			



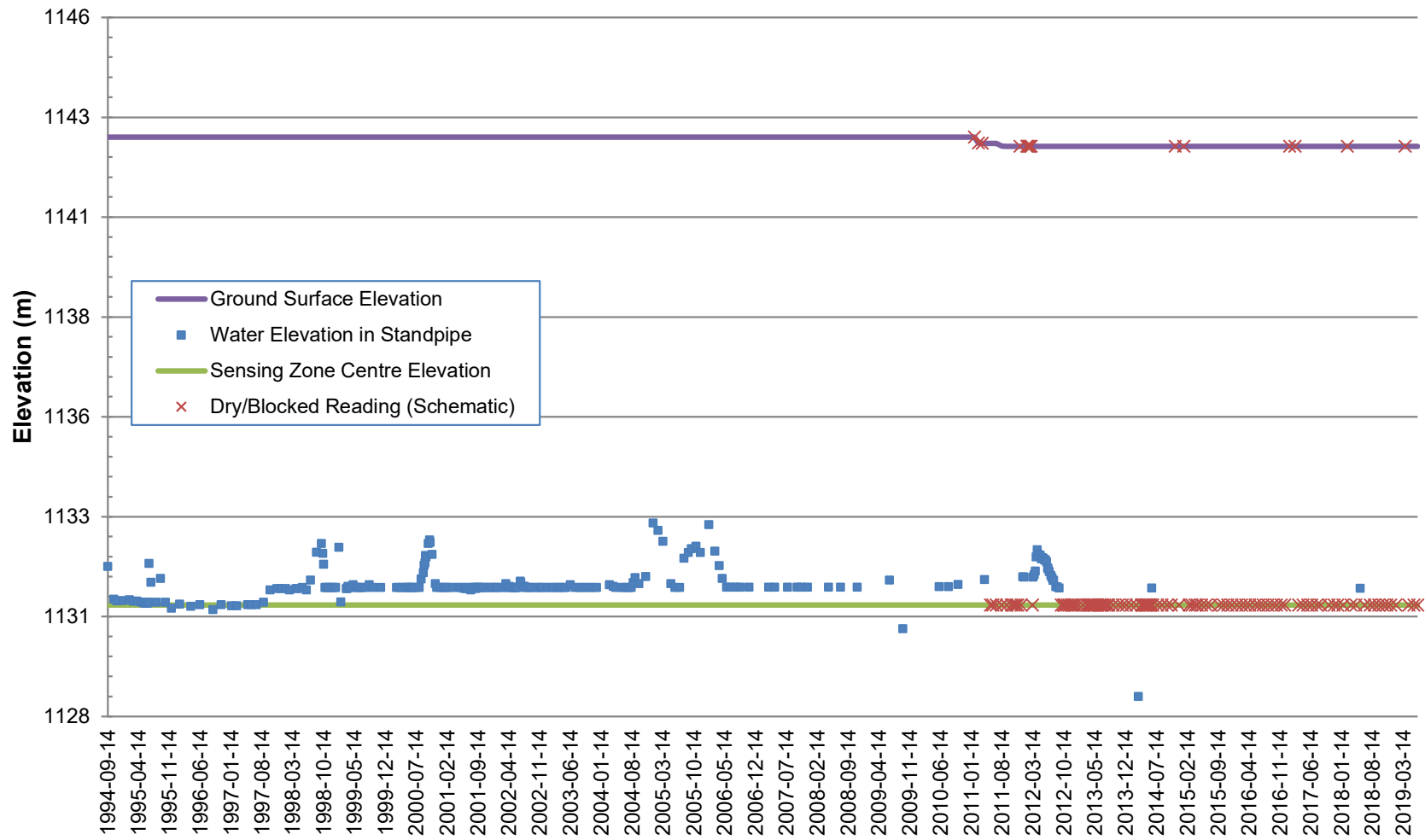
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW-10			



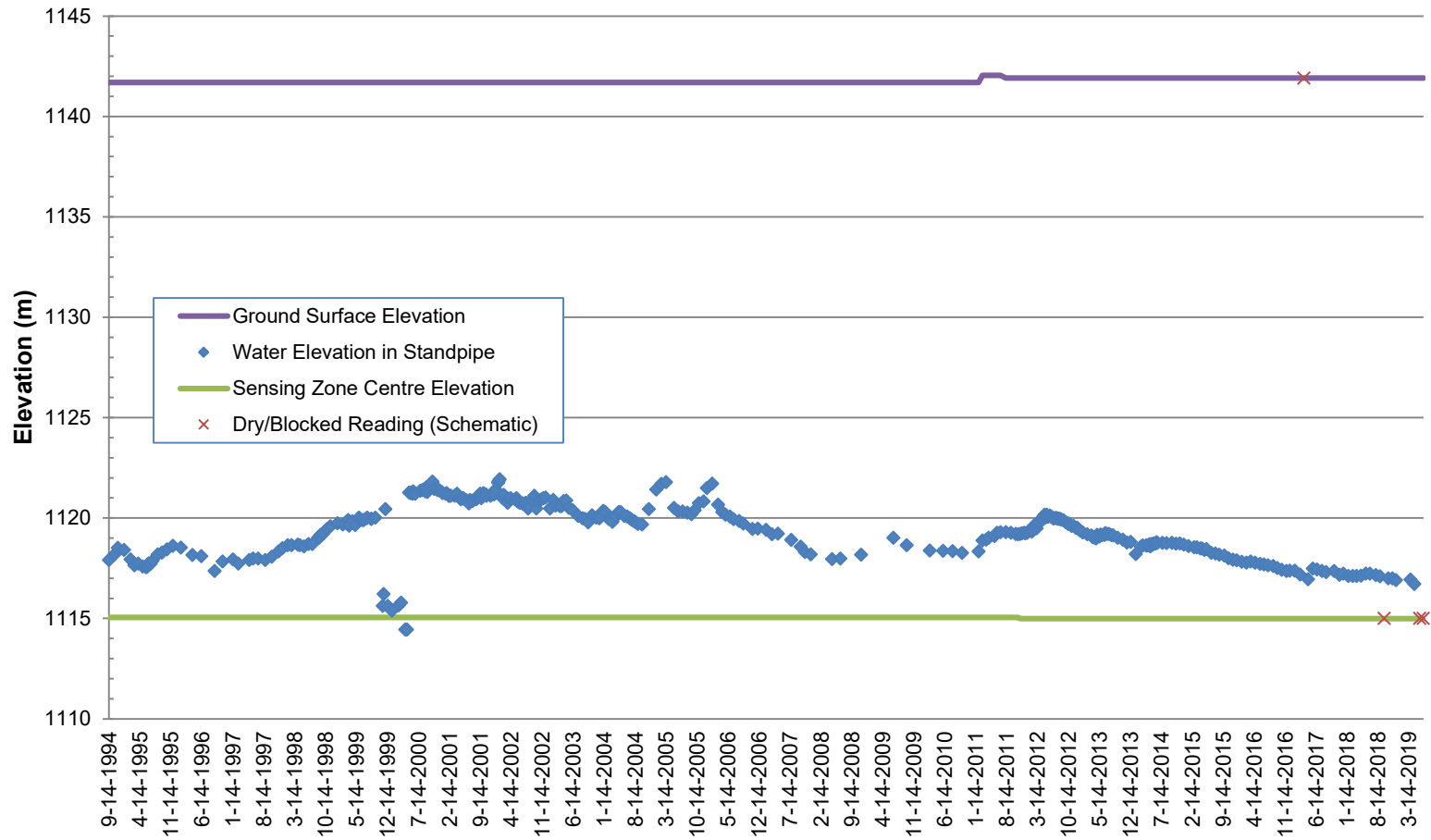
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Lagoon D Piezometers		Date:	Revision
Standpipe OW-12			



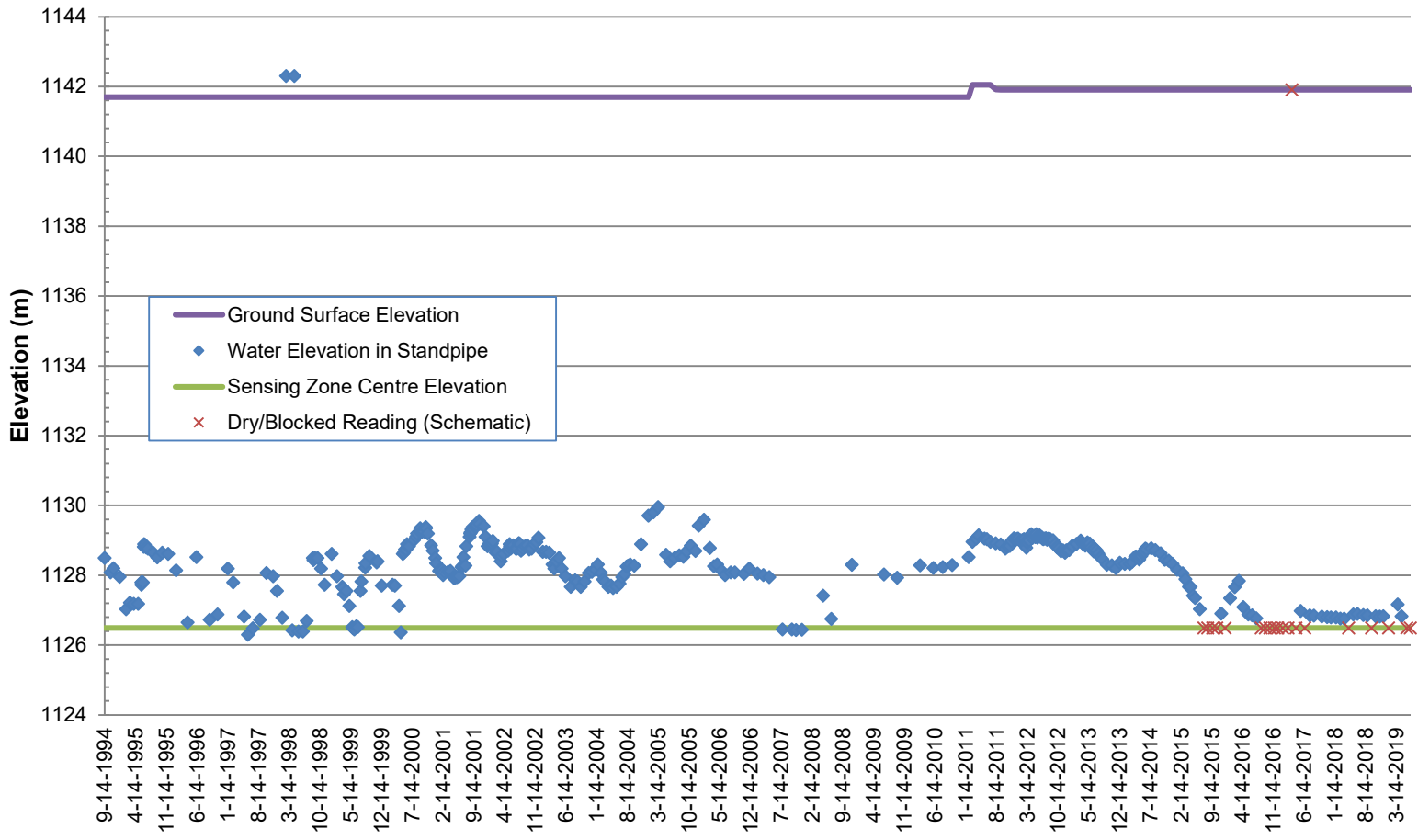
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Lagoon D Piezometers		Date:	Revision
Standpipe OW-12A			



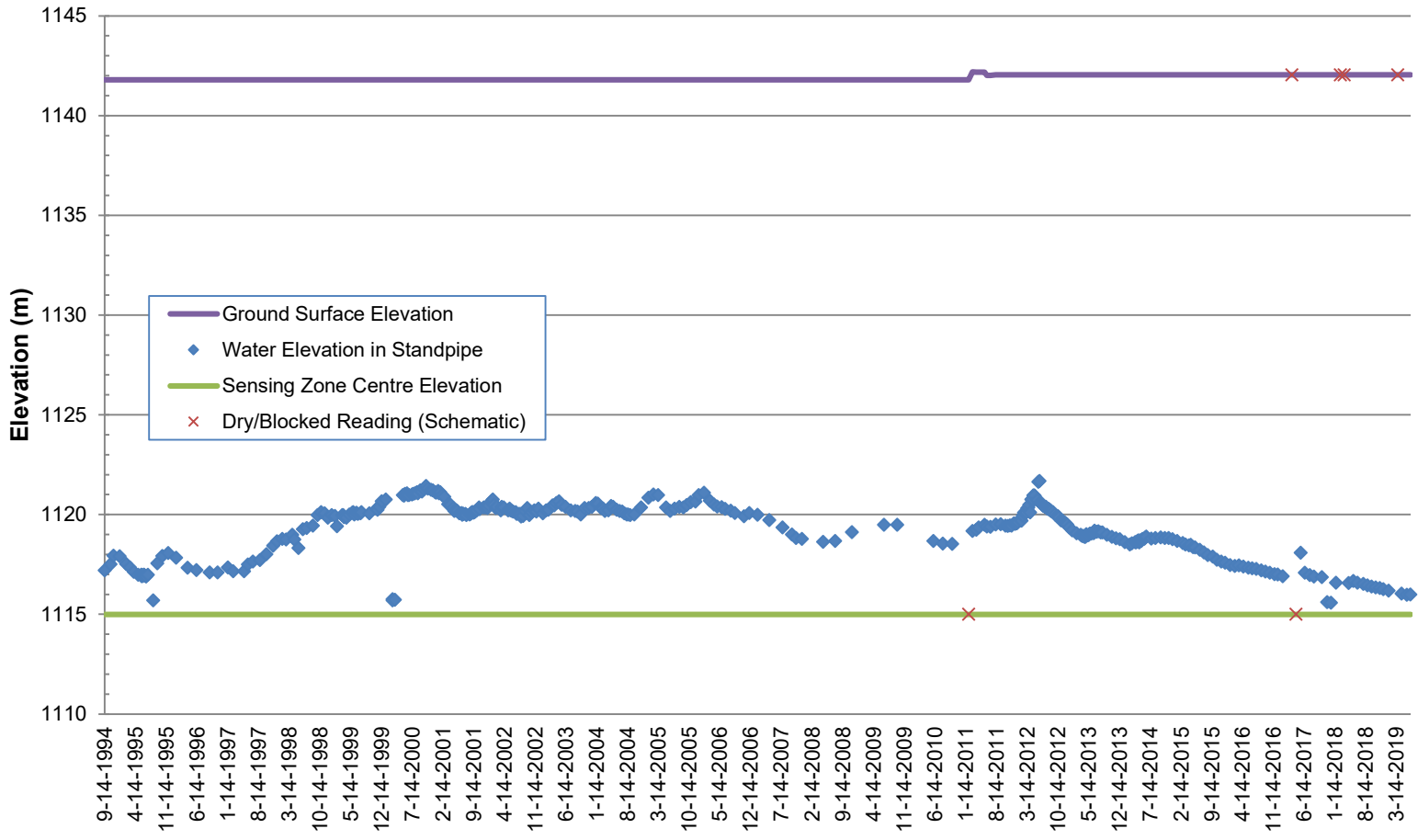
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9431			



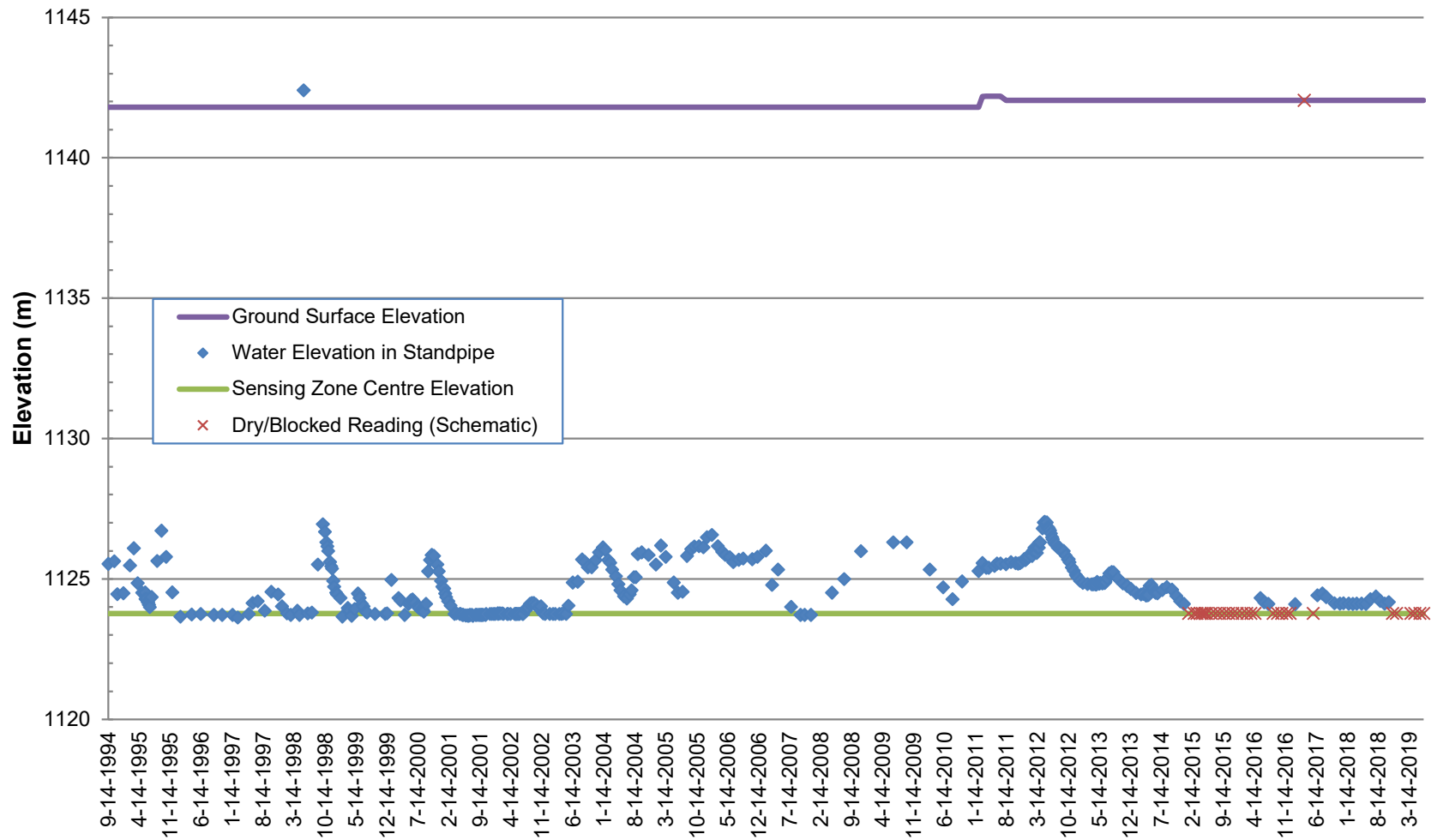
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9433A			



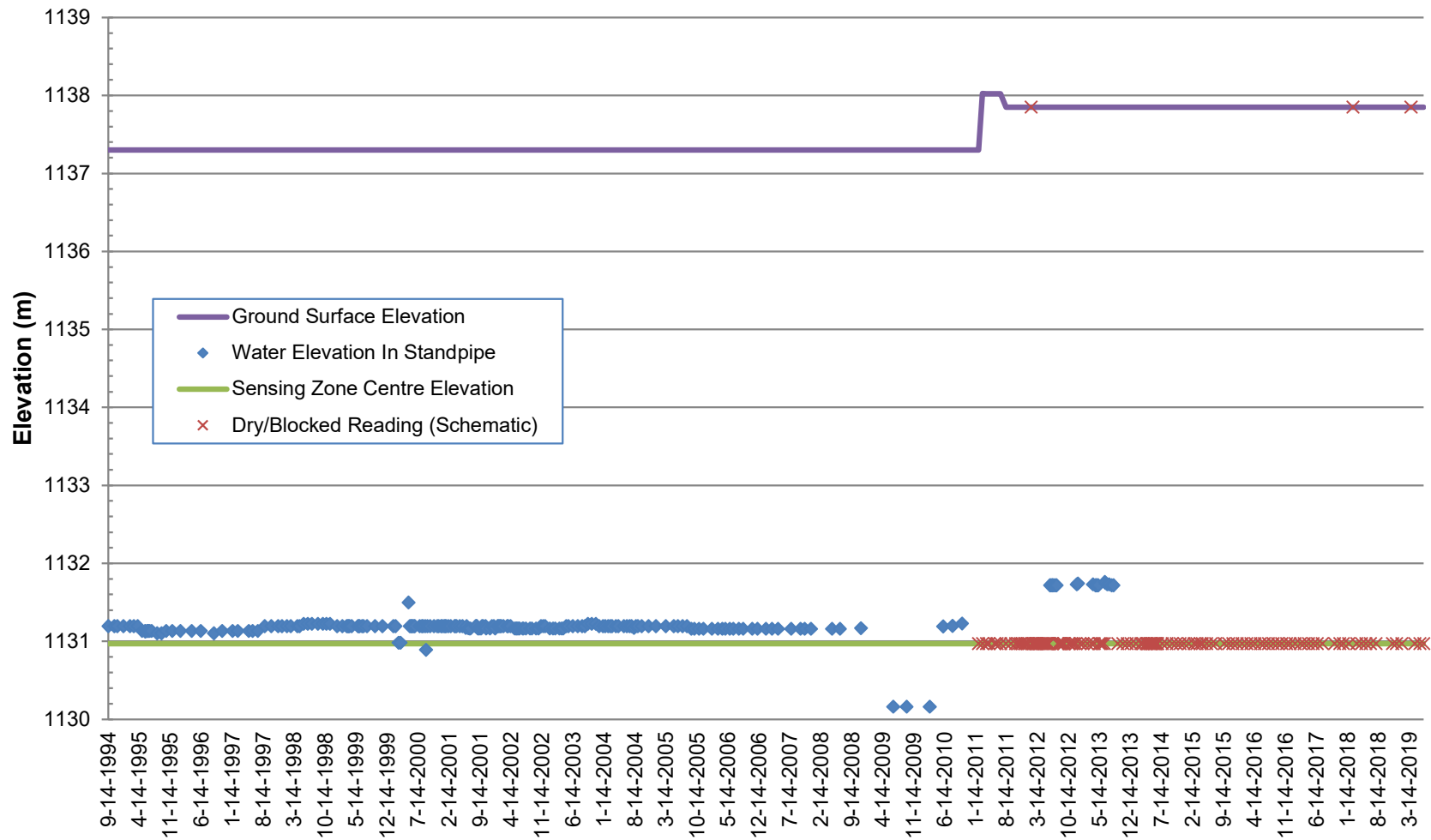
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9433B			



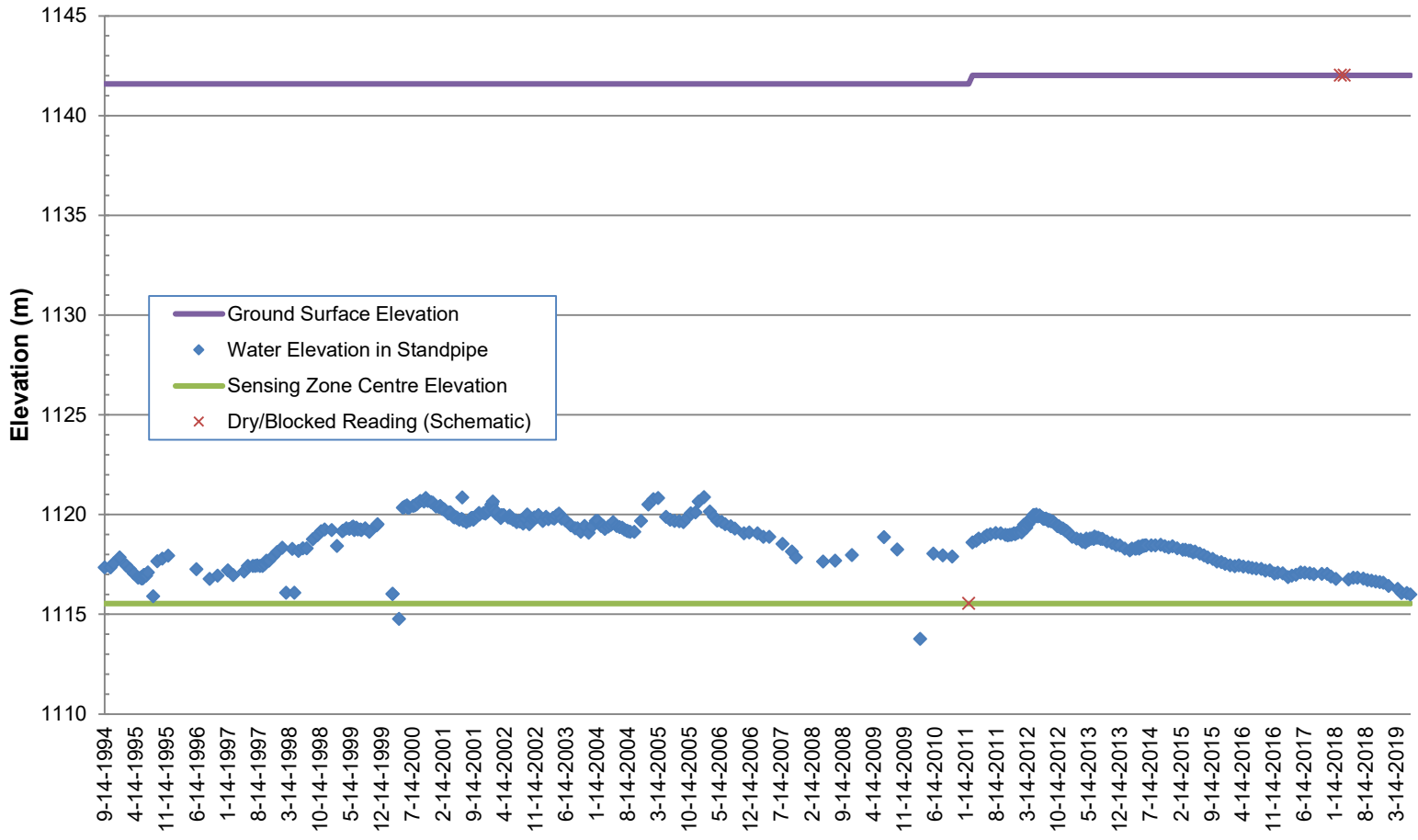
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9434A			



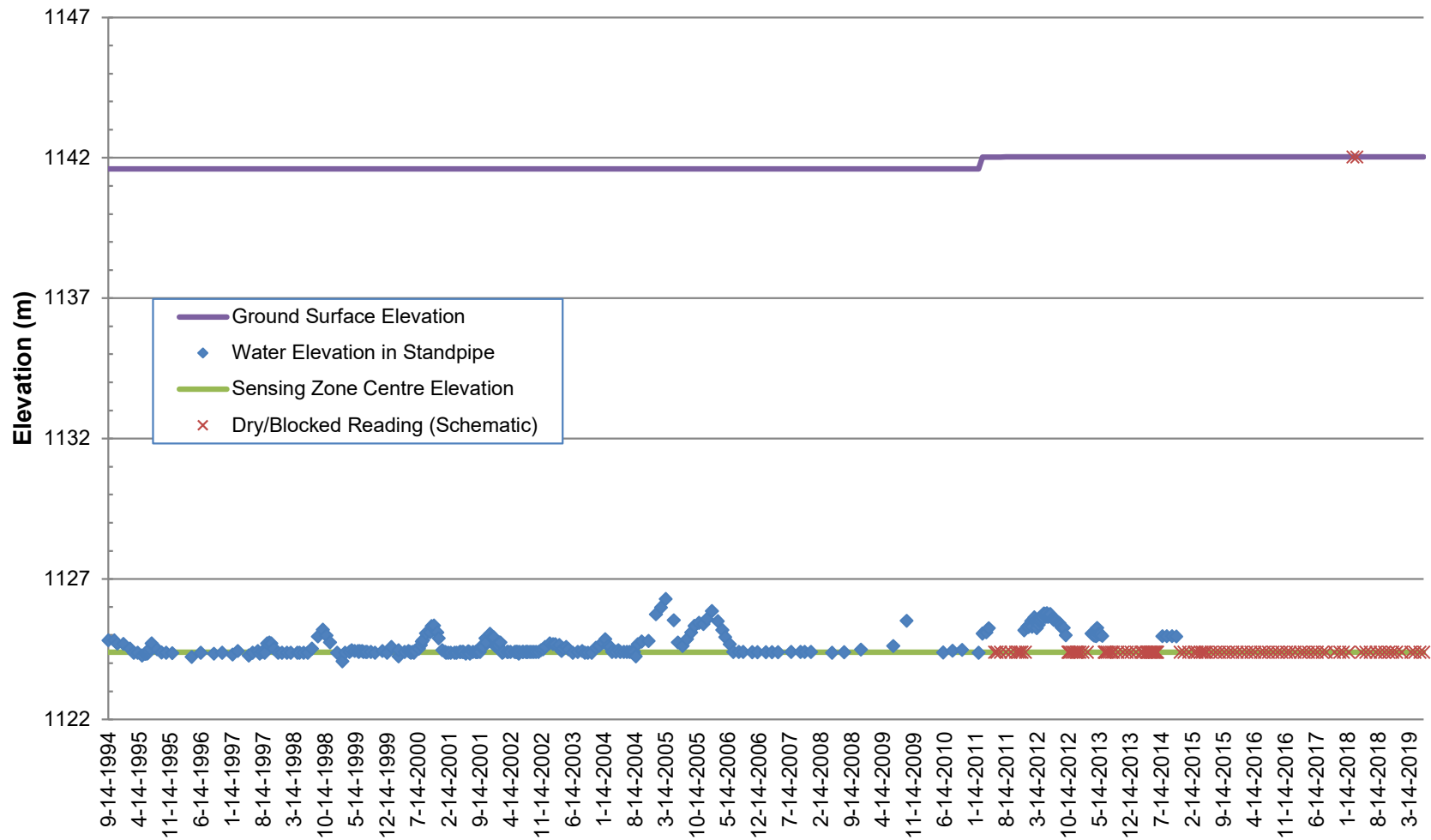
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Standpipe OW9434B		Revision: <input type="text"/>



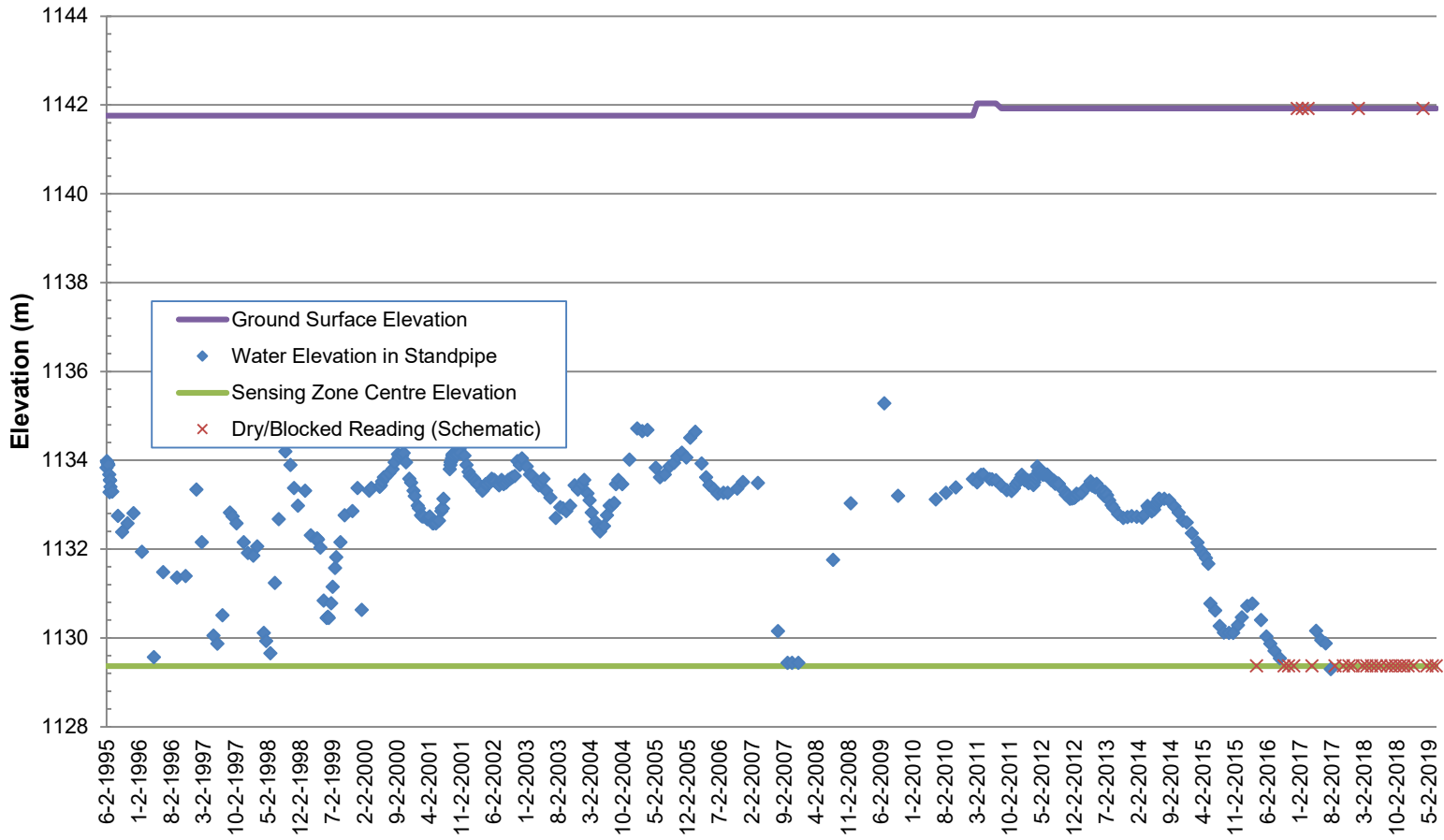
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9435			



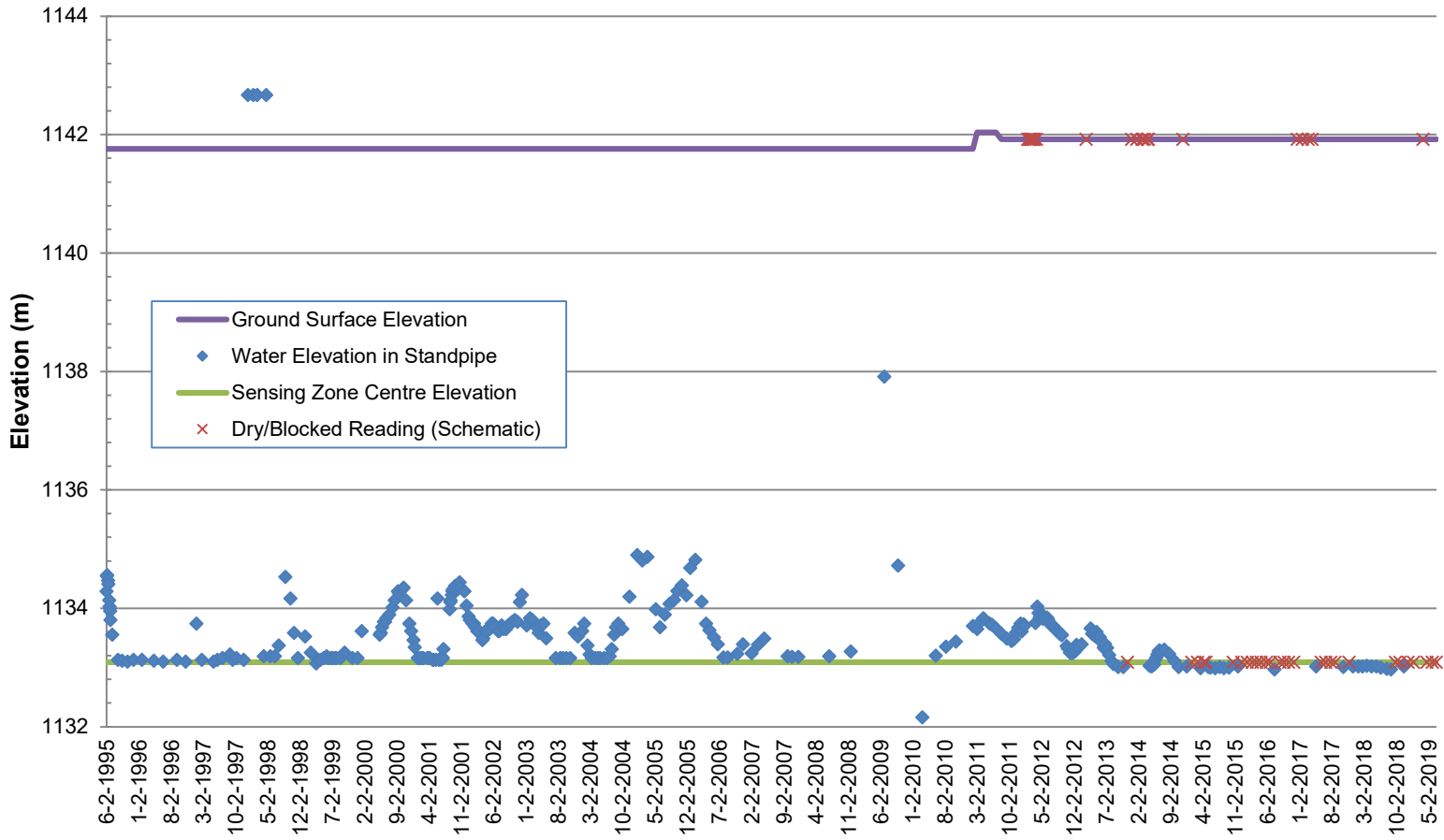
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9436A			



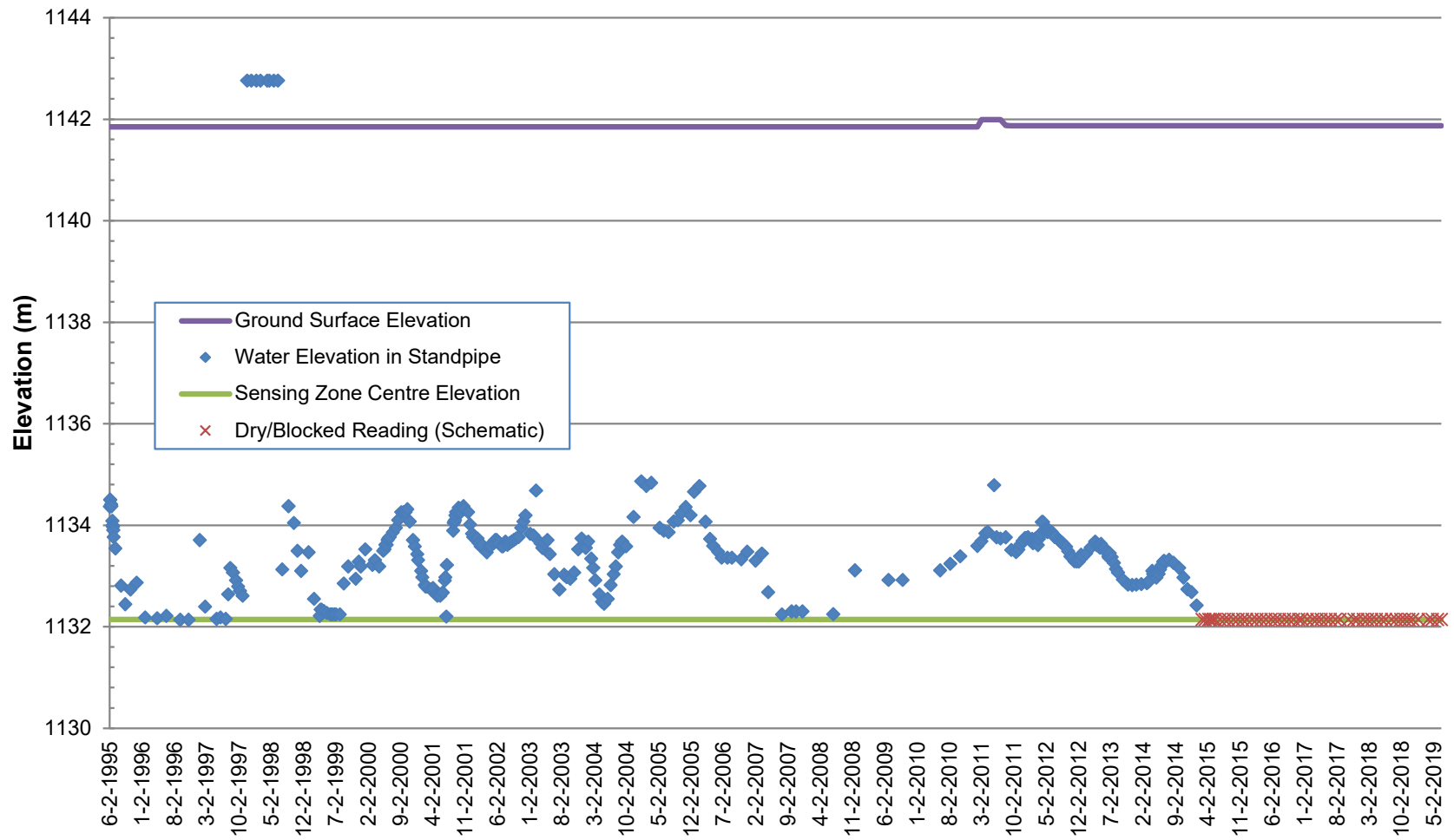
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9436B			



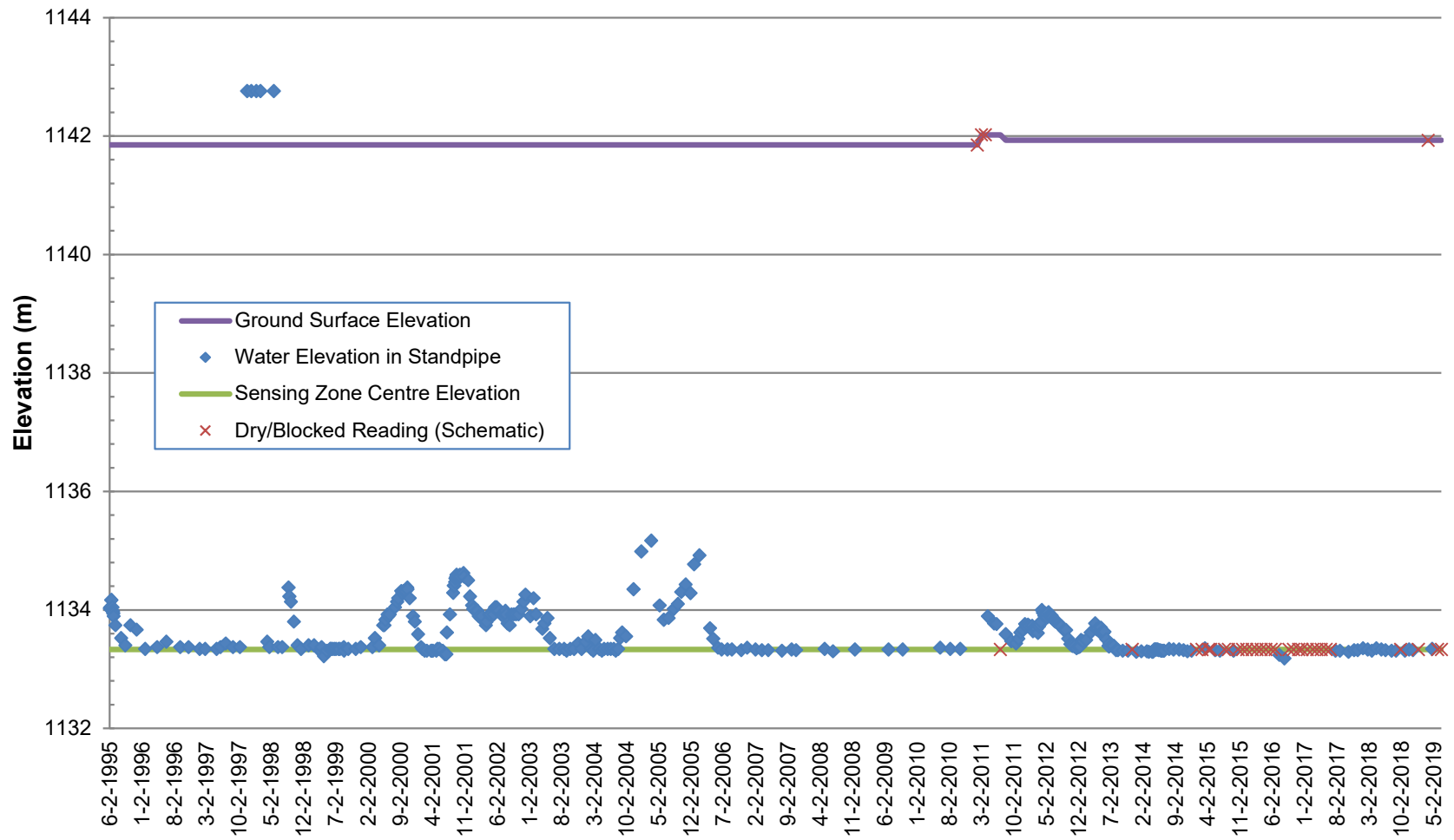
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9501A			



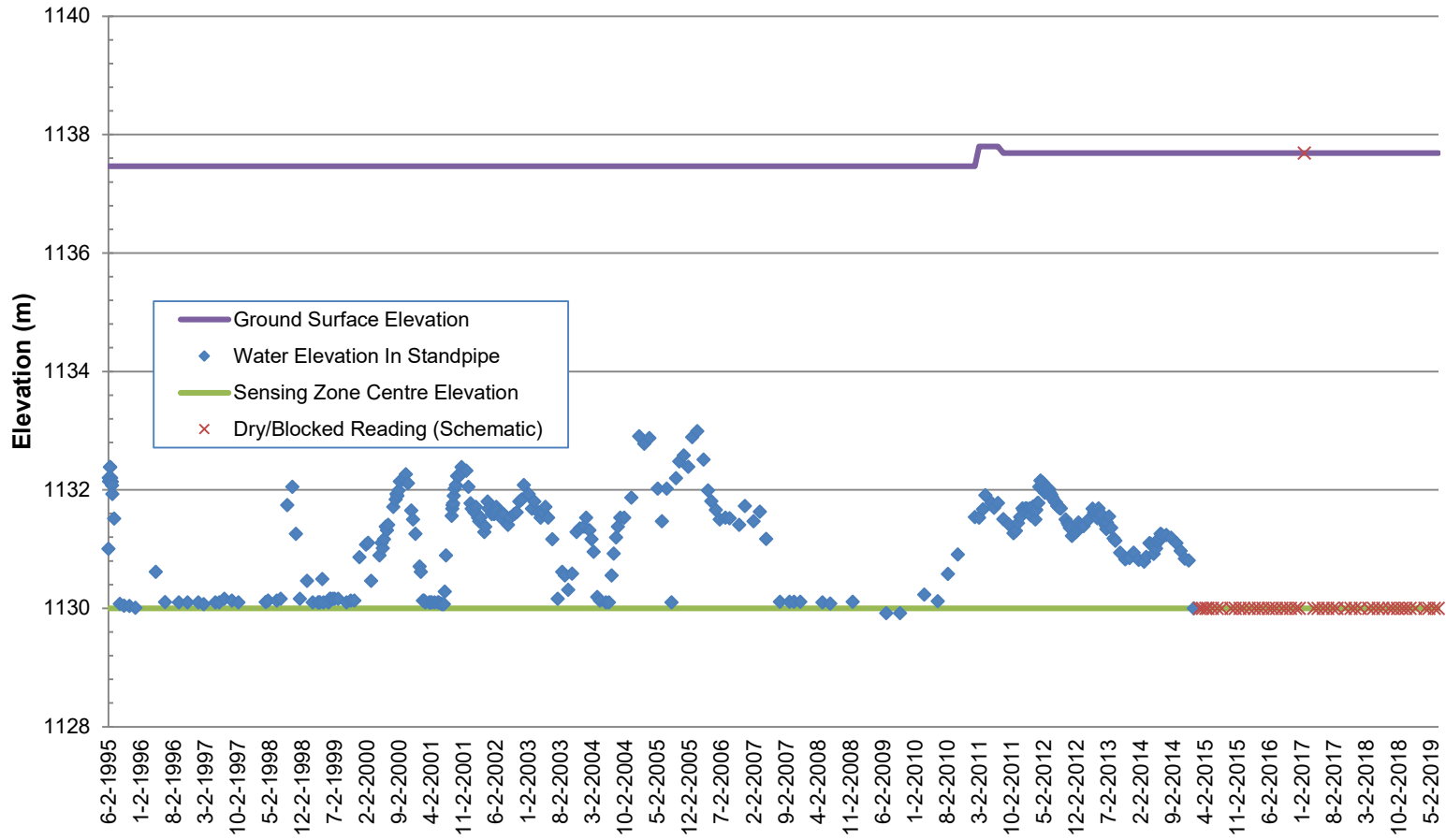
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9501B			



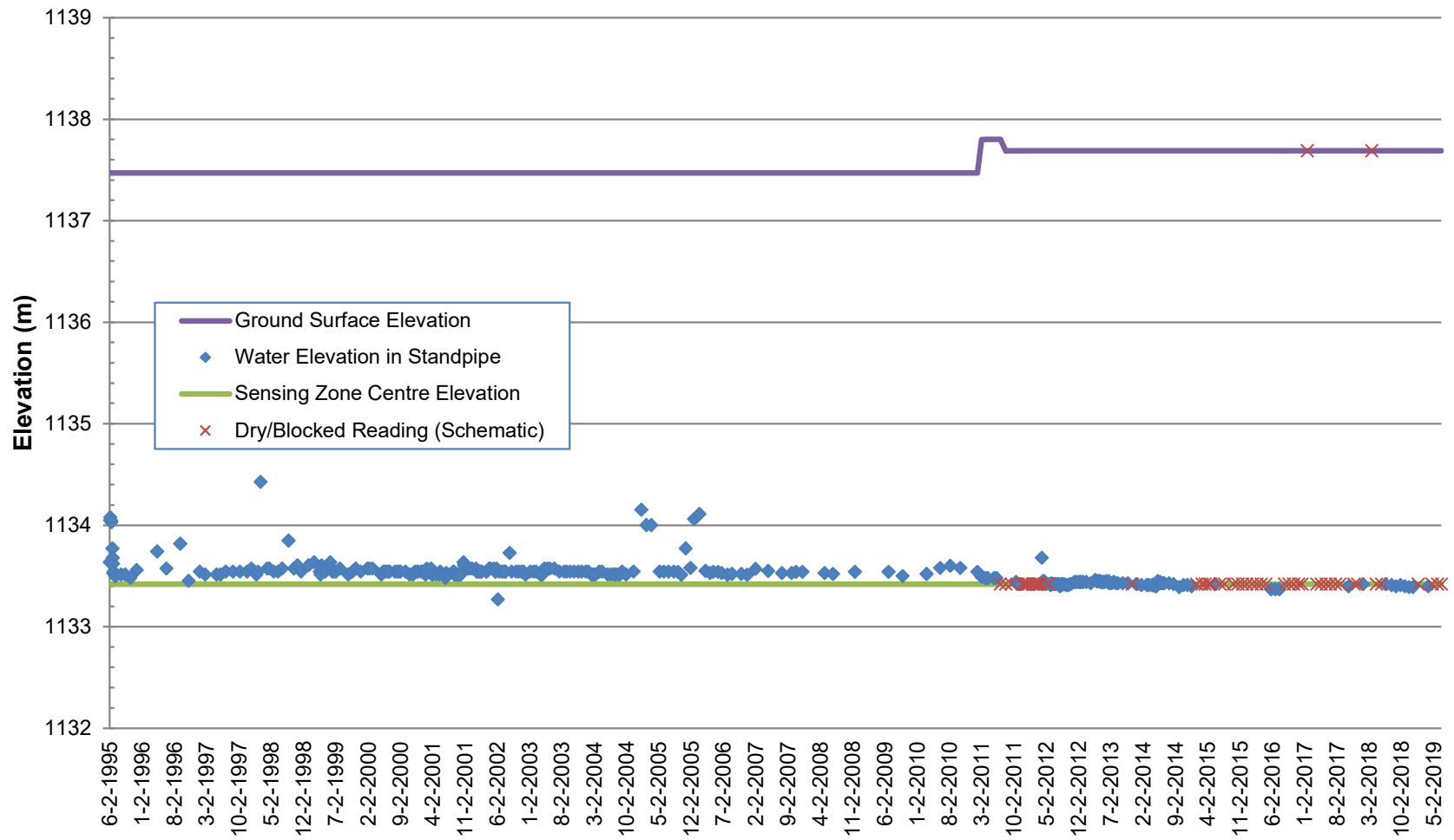
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9502			



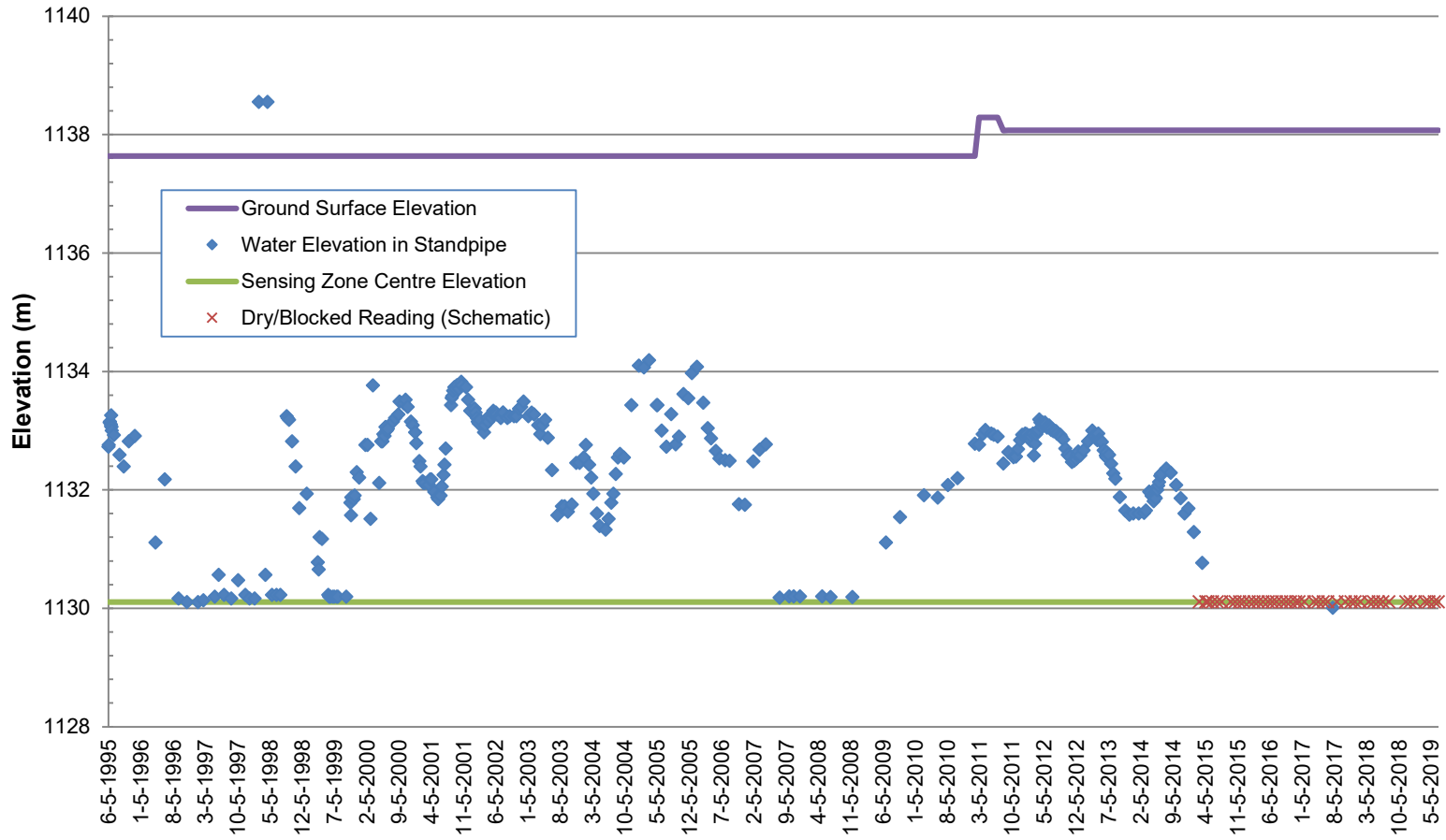
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9503			



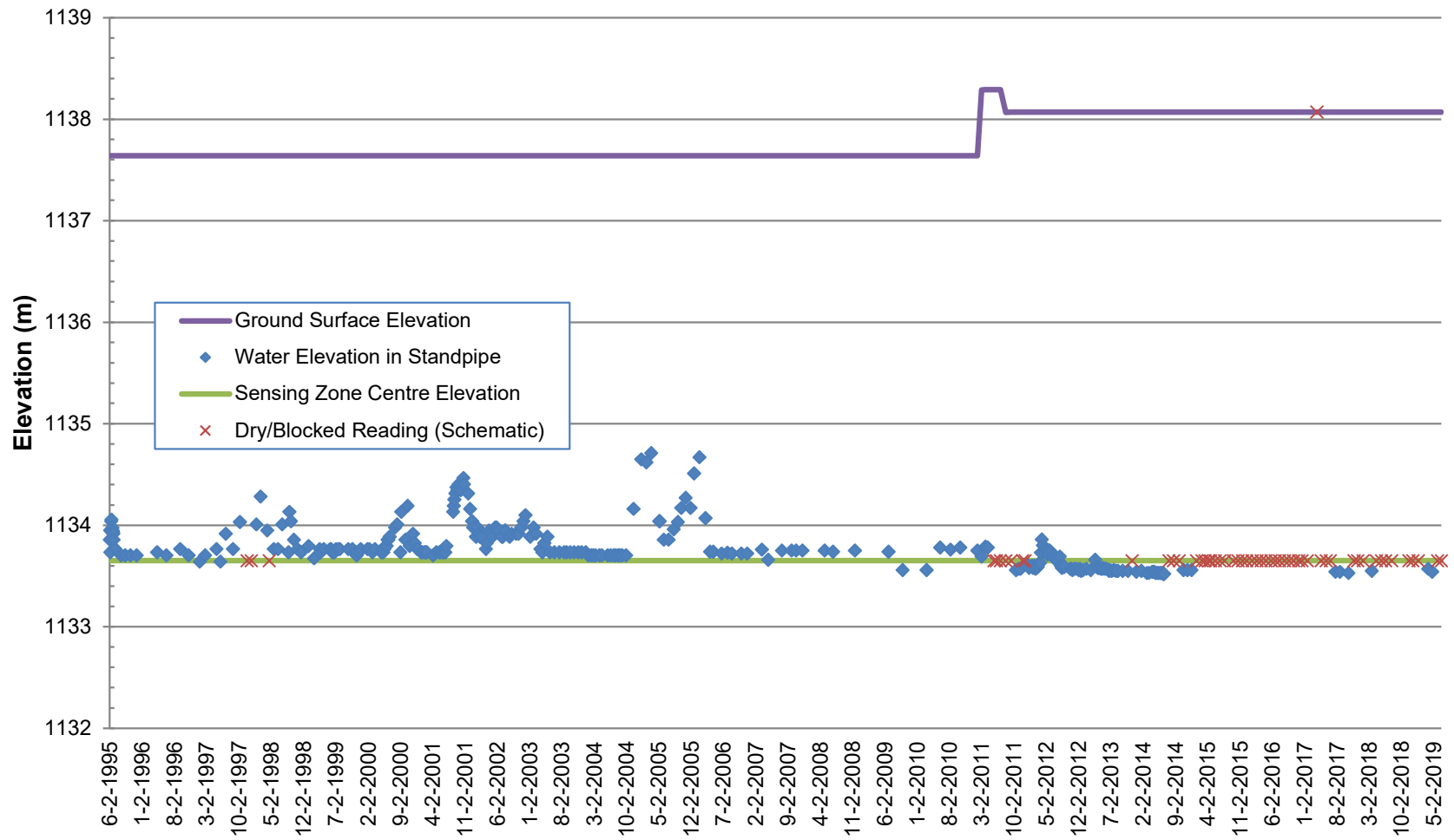
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Lagoon D Piezometers		Date:	Revision
Standpipe OW9504A			



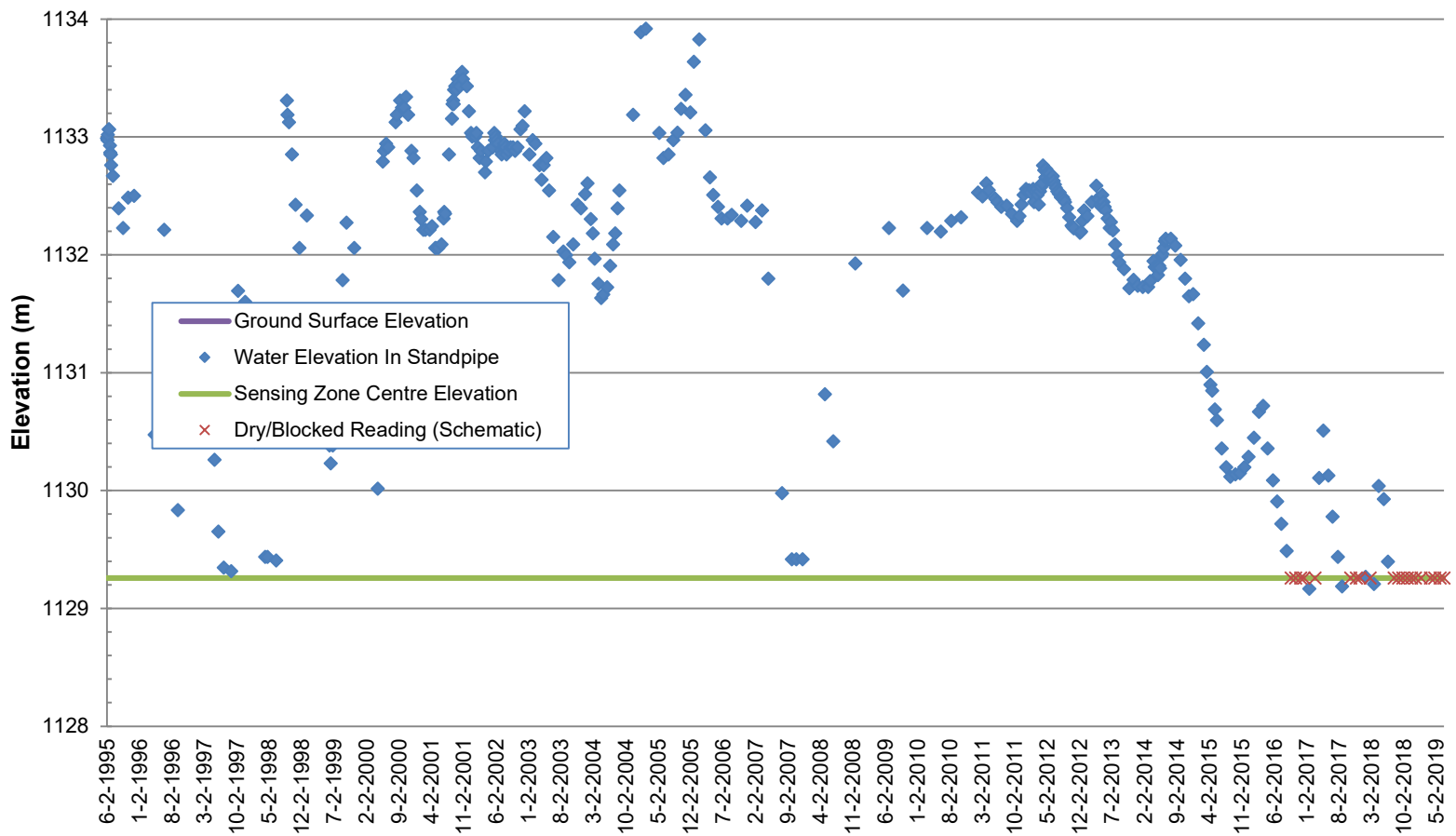
Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9504B			



Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9505A			

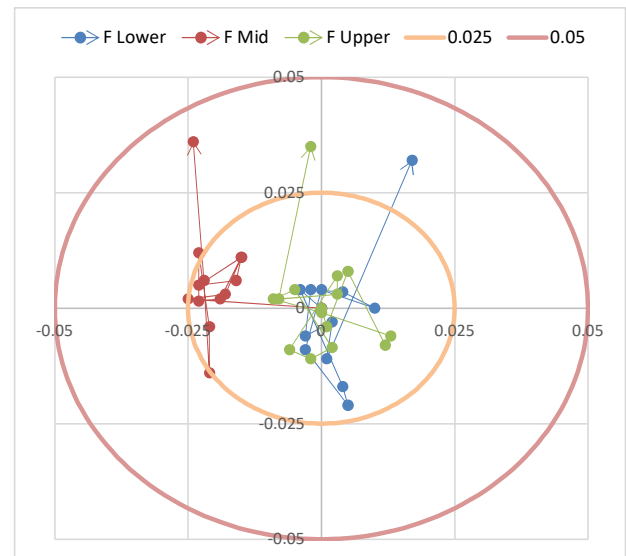
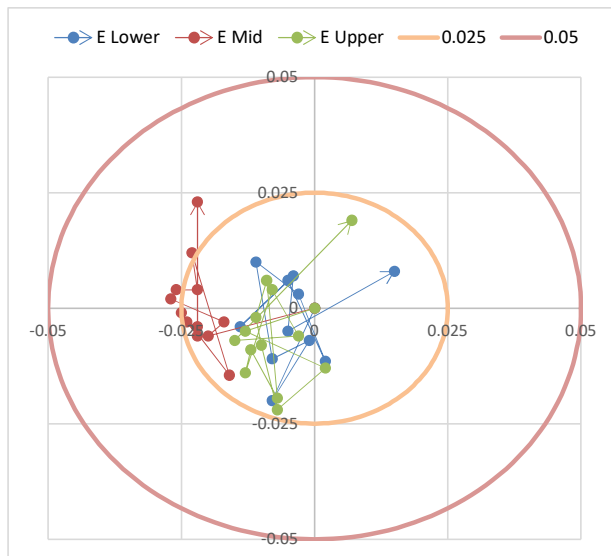
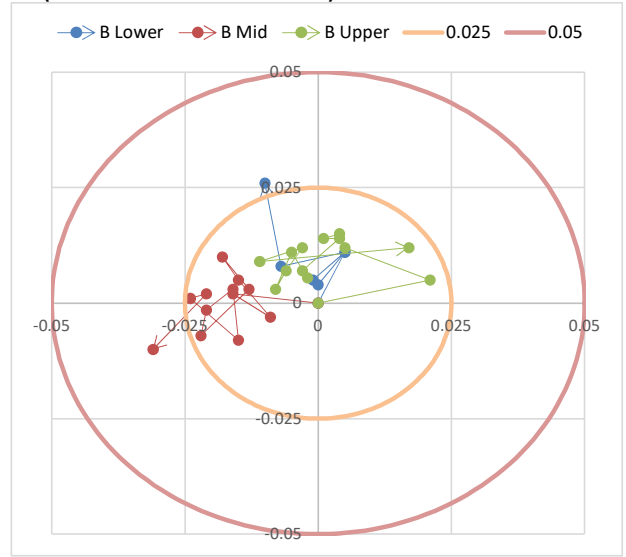
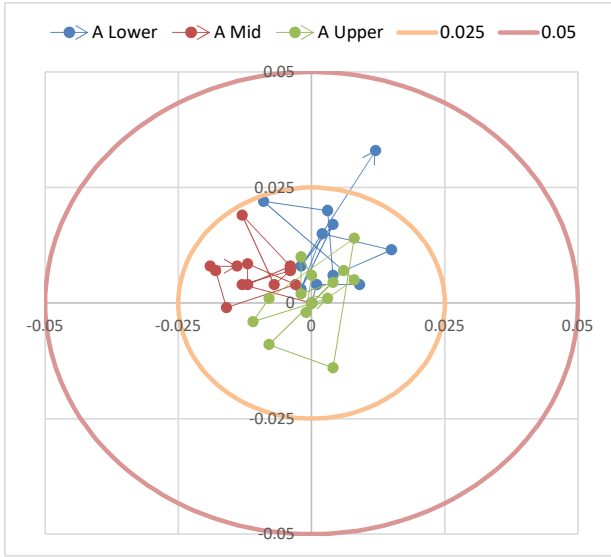


Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9505B			

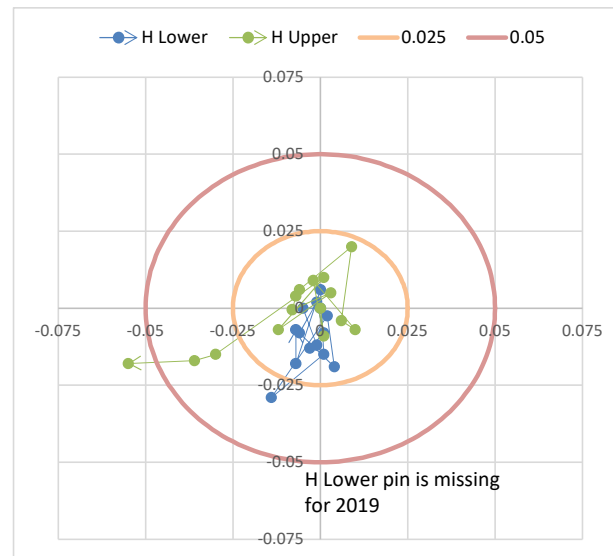
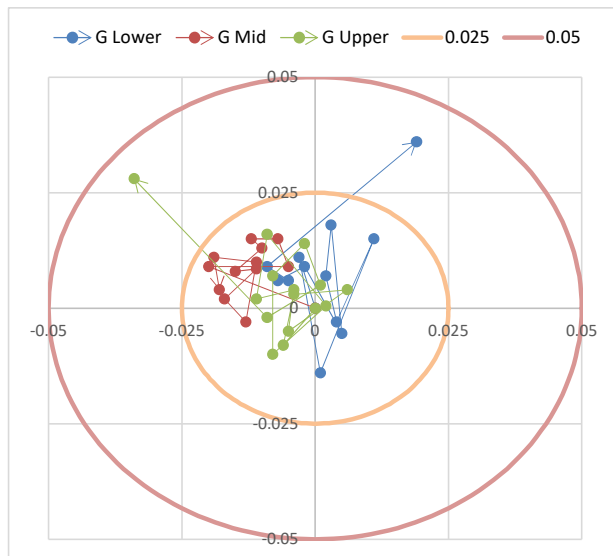
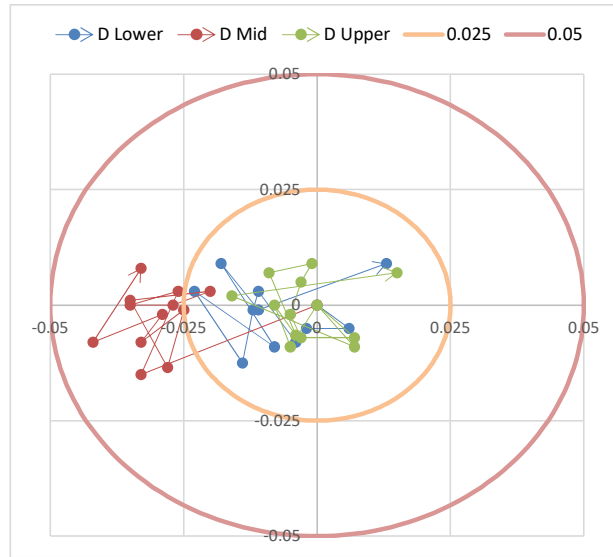
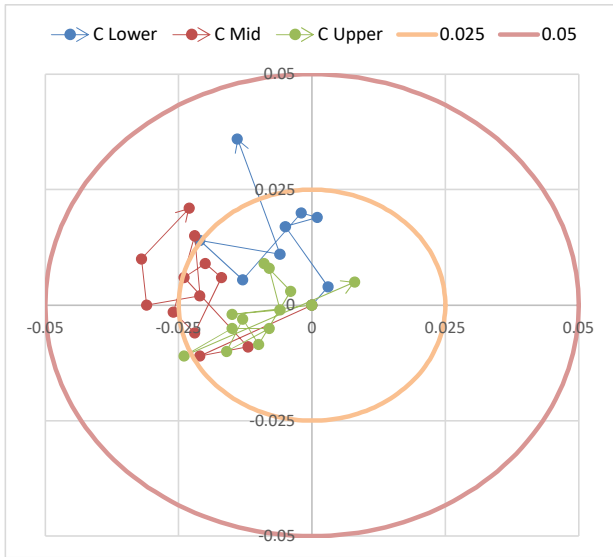


Teck Coal - Elkview Operations			
Lagoon D Piezometers		Date:	Revision
Standpipe OW9506			

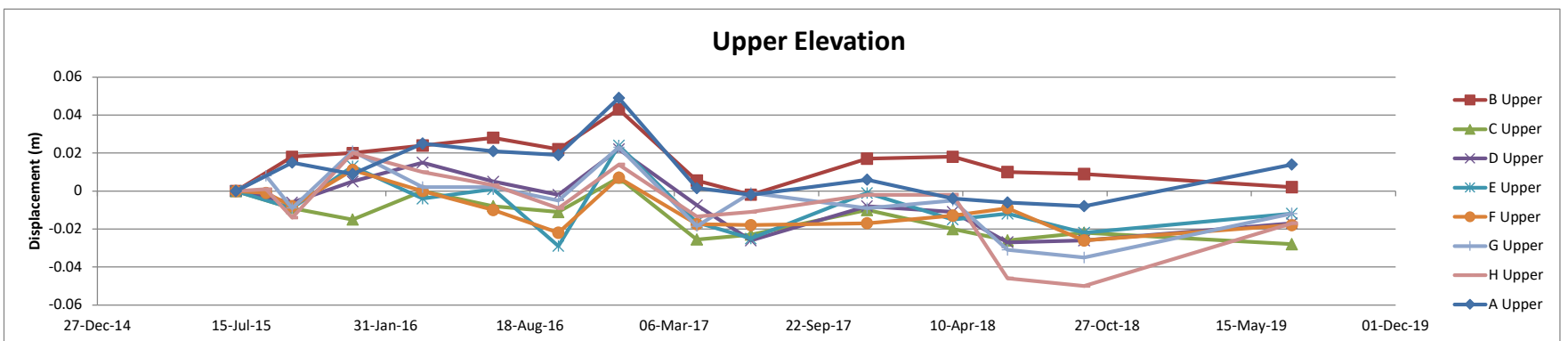
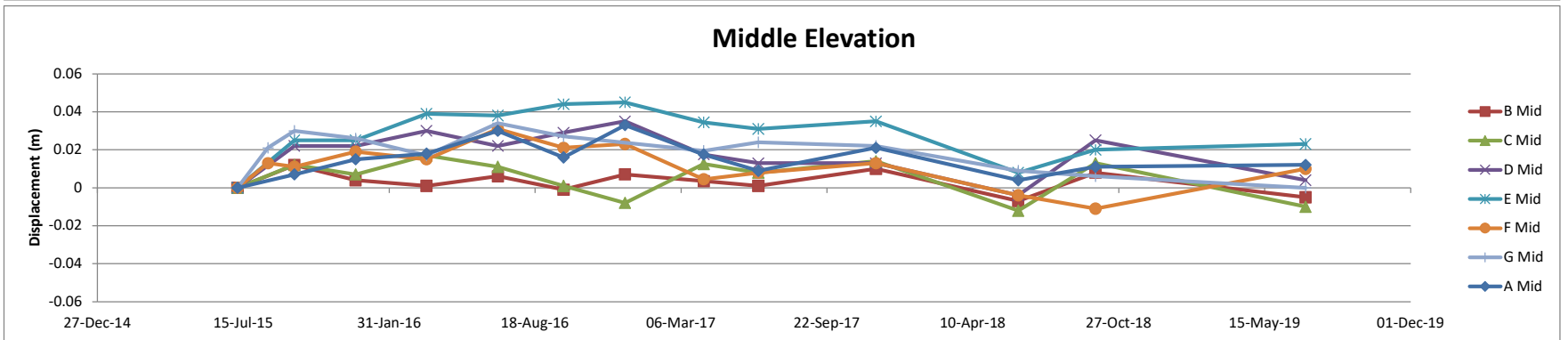
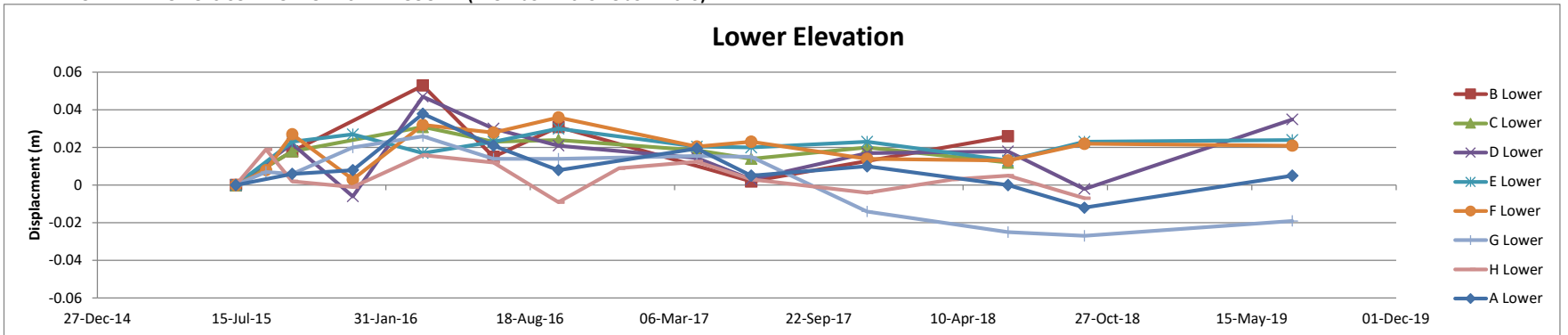
EASTING AND NORTHING DELTA FOR GPS CONTROL POINTS AT LAGOON D (FROM JULY 2015 TO JULY 2019)

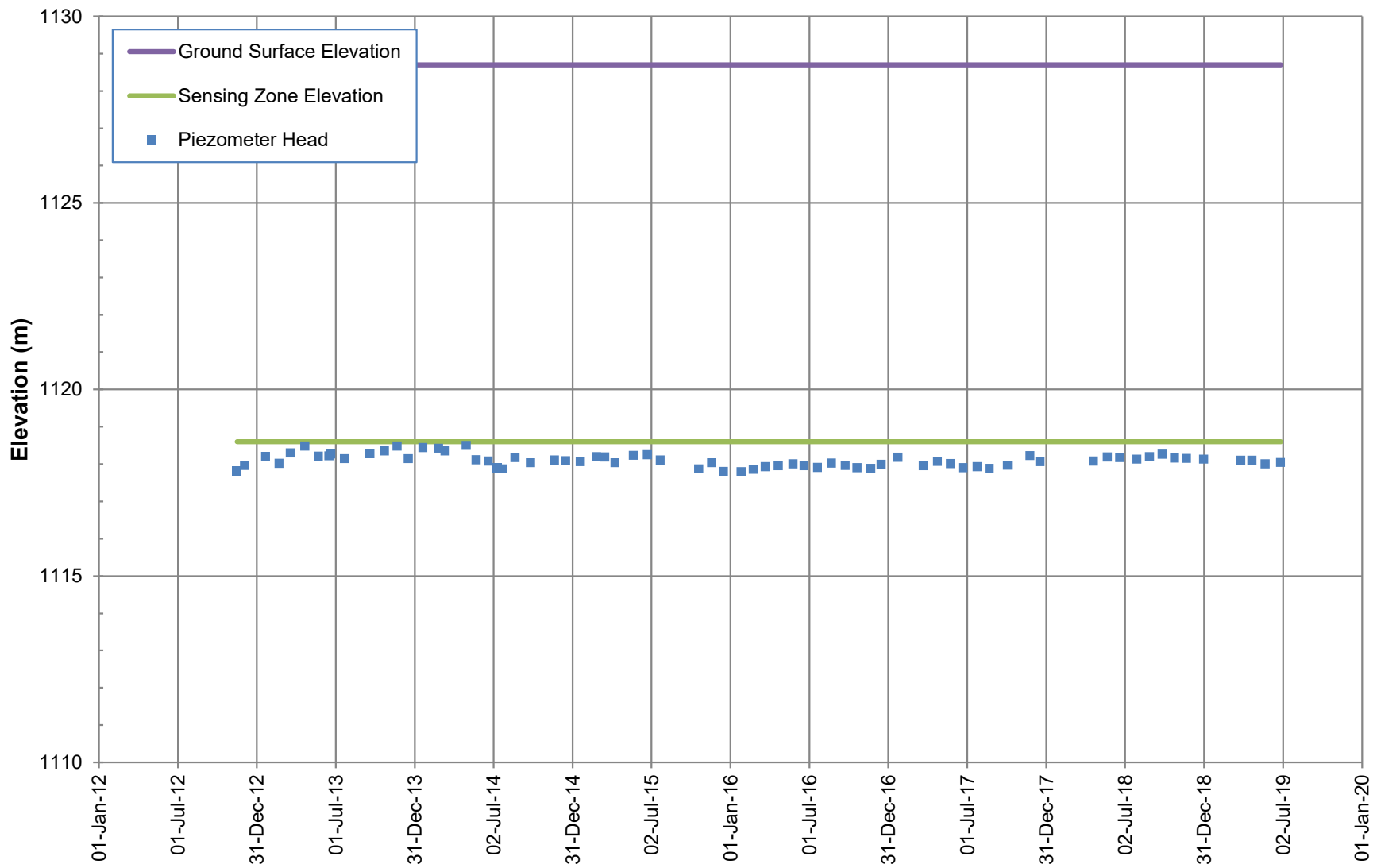


EASTING AND NORTHING DELTA FOR GPS CONTROL POINTS AT LAGOON D (FROM JULY 2015 TO JULY 2019)

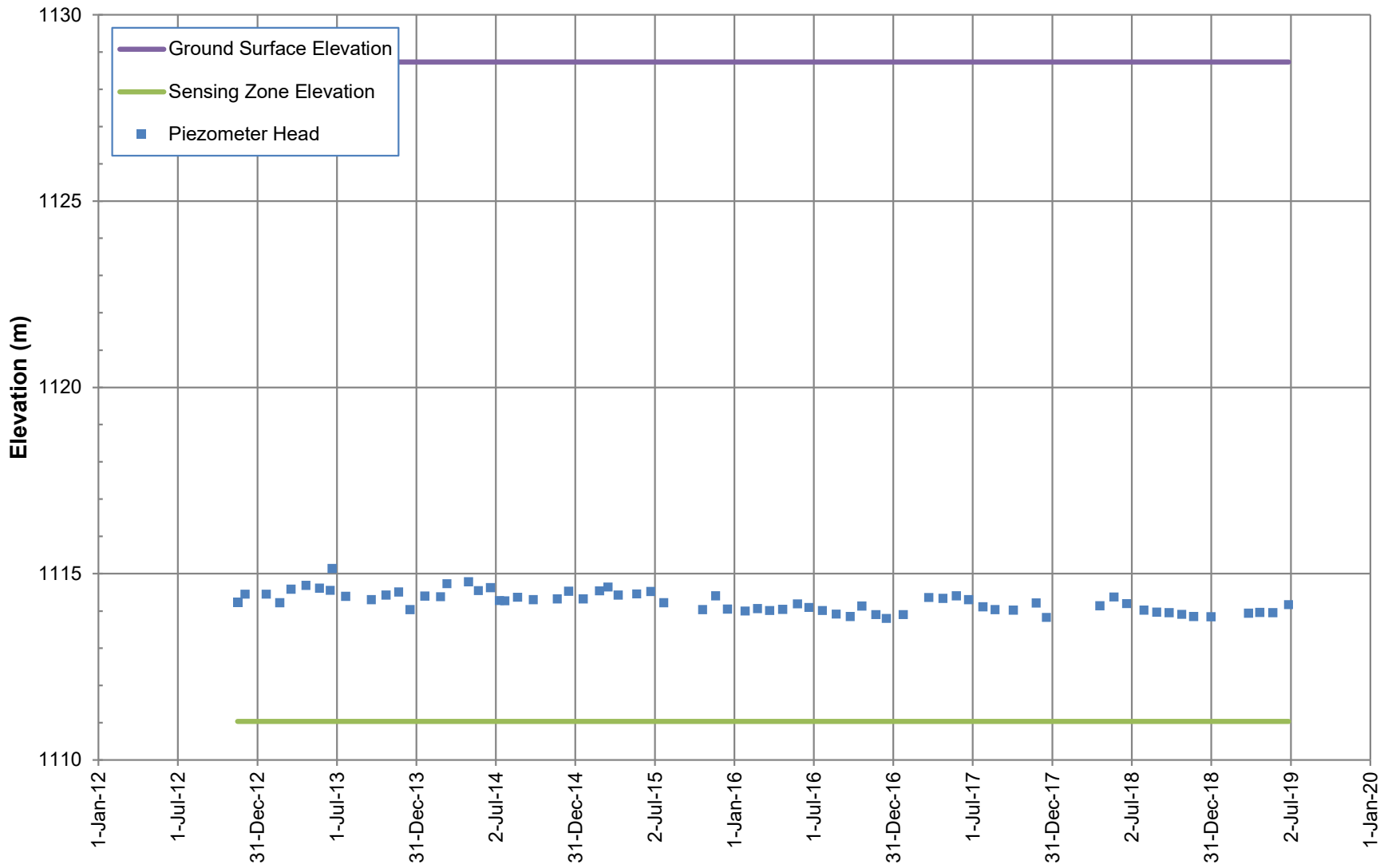


ELEVATION DELTA FOR GPS CONTROL POINTS AT LAGOON D (FROM JULY 2015 TO JULY 2019)

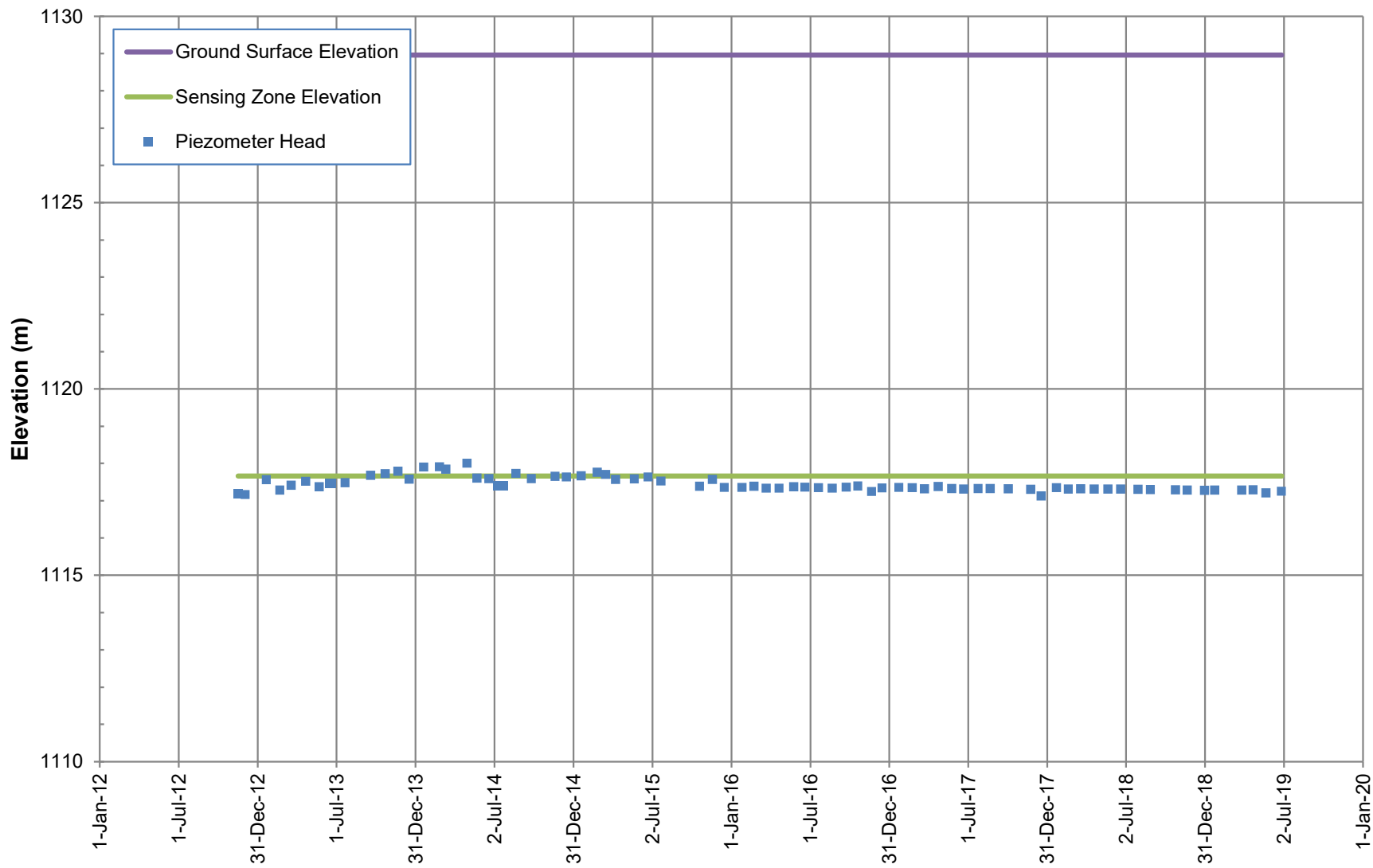




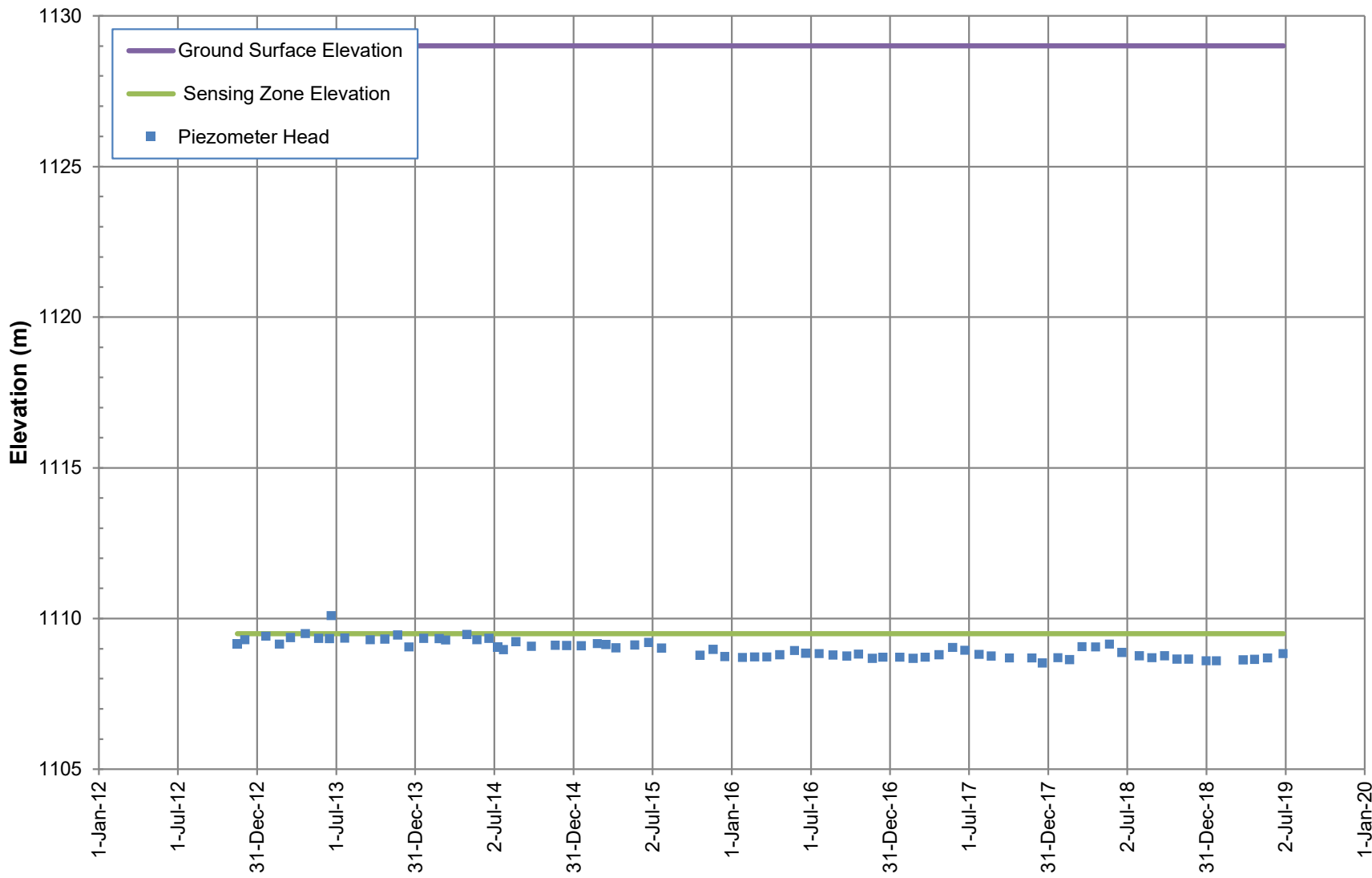
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23241 Pore Pressure		Name:	



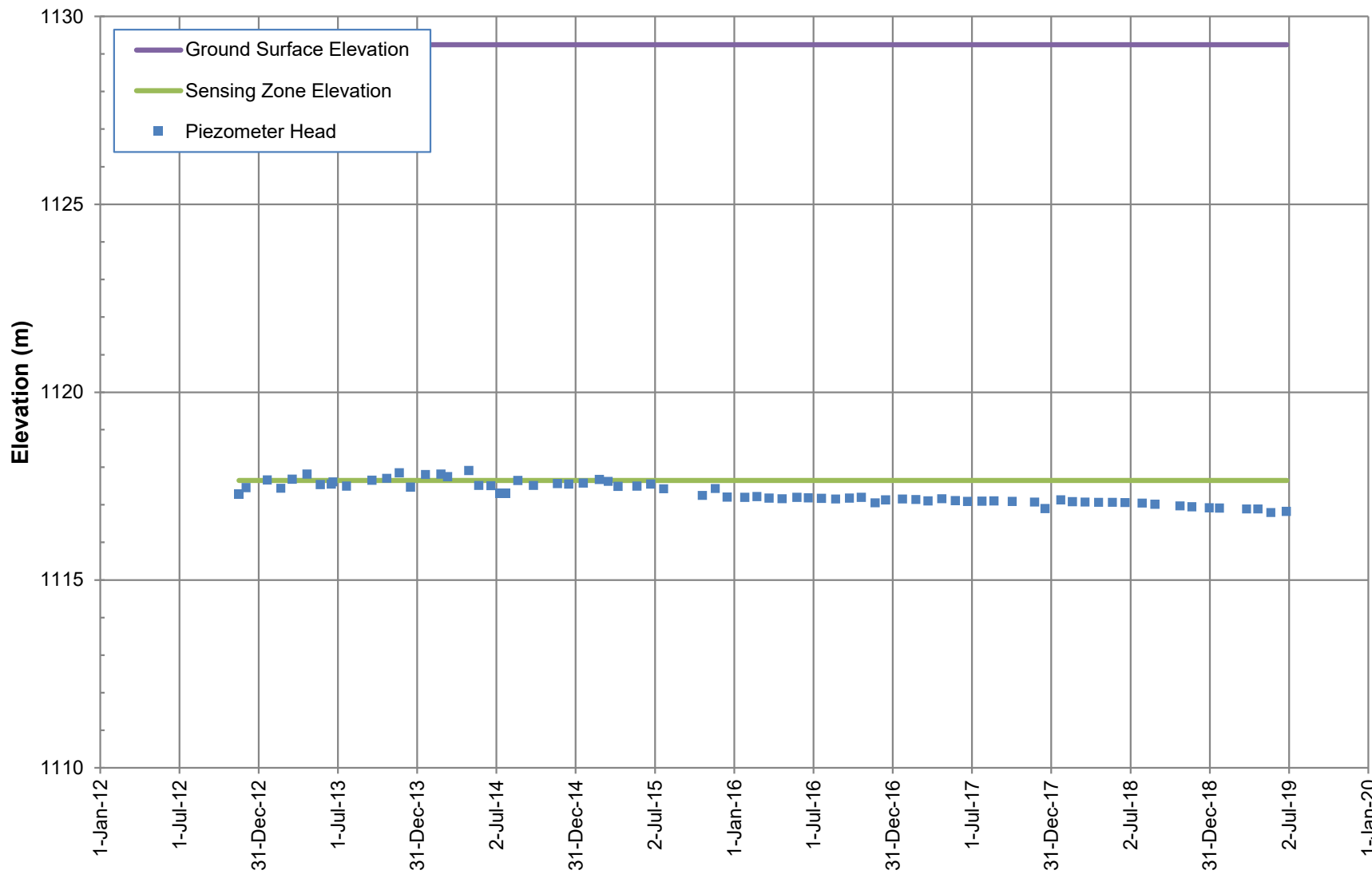
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23245 Pore Pressure		Name:	



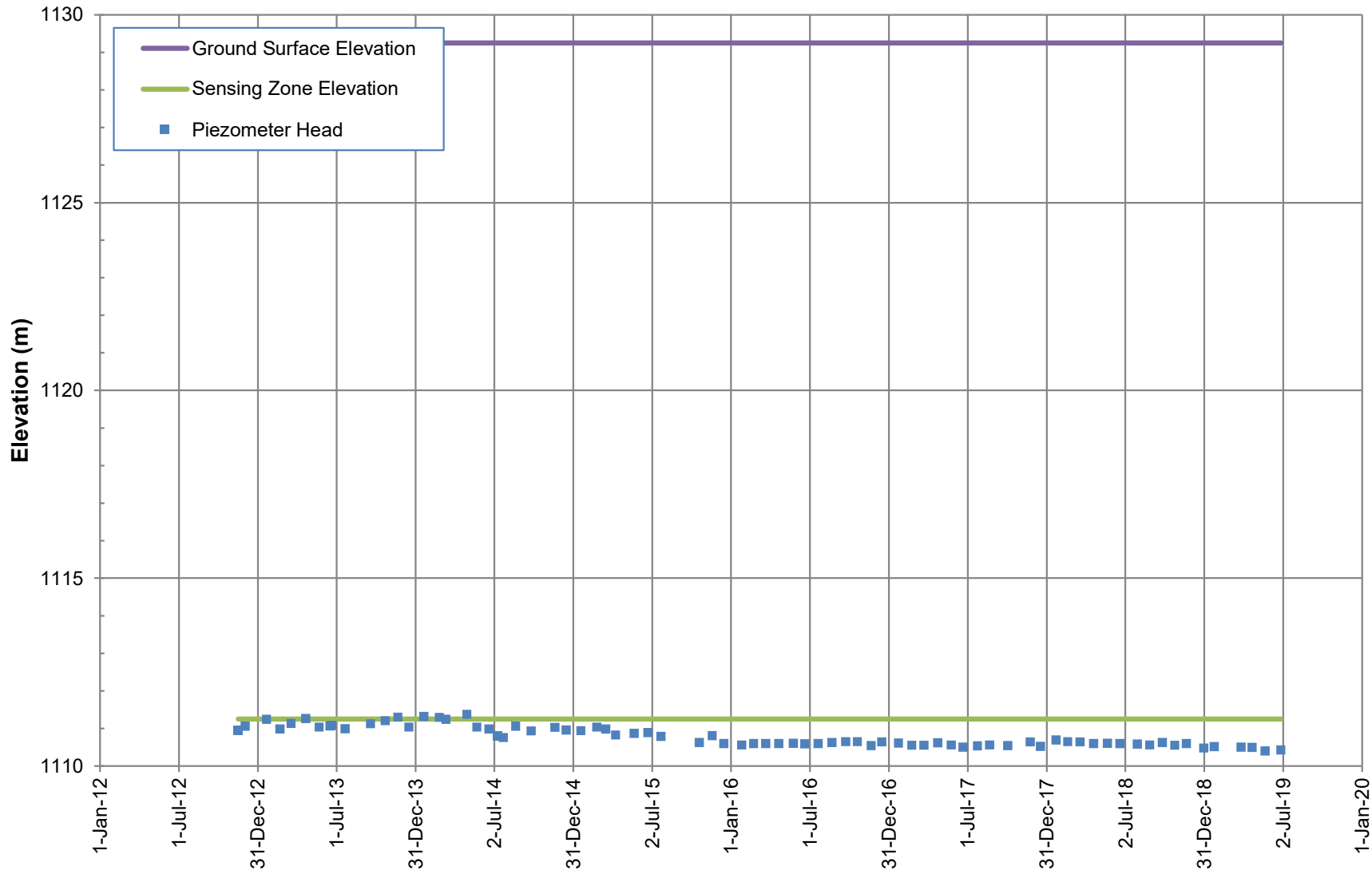
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23238 Pore Pressure		Name:	



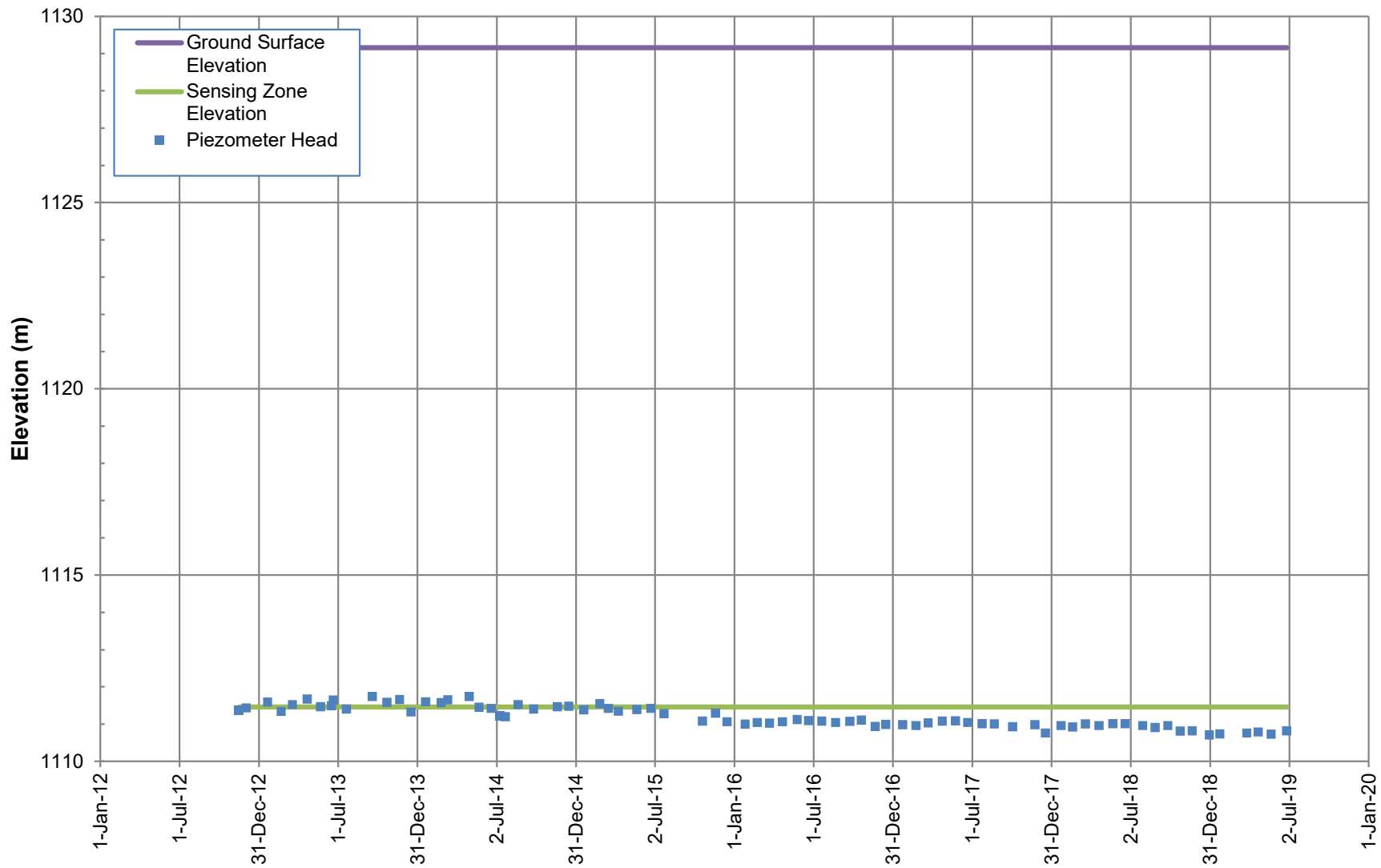
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23242 Pore Pressure		Name:	



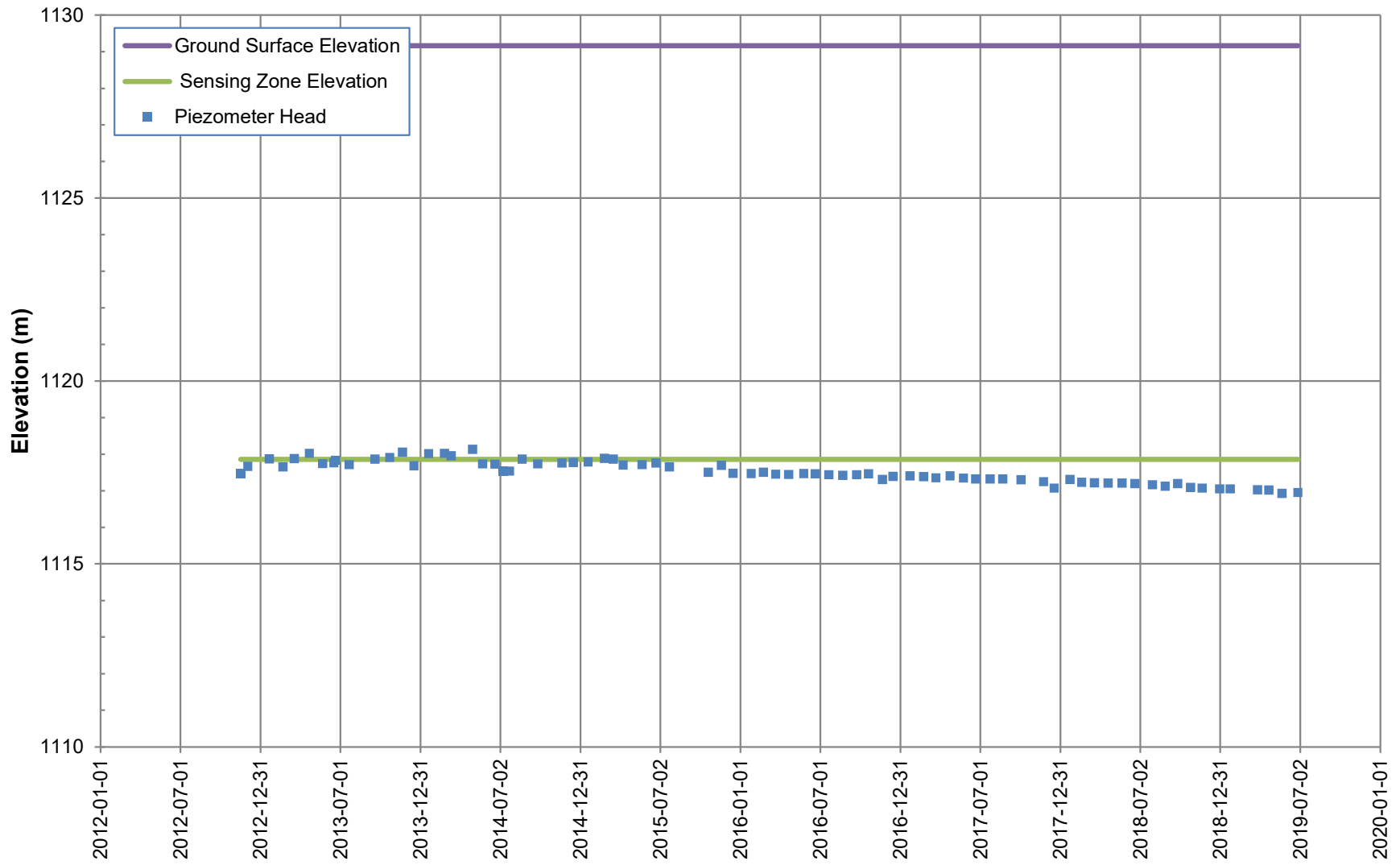
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23239 Pore Pressure		Name:	



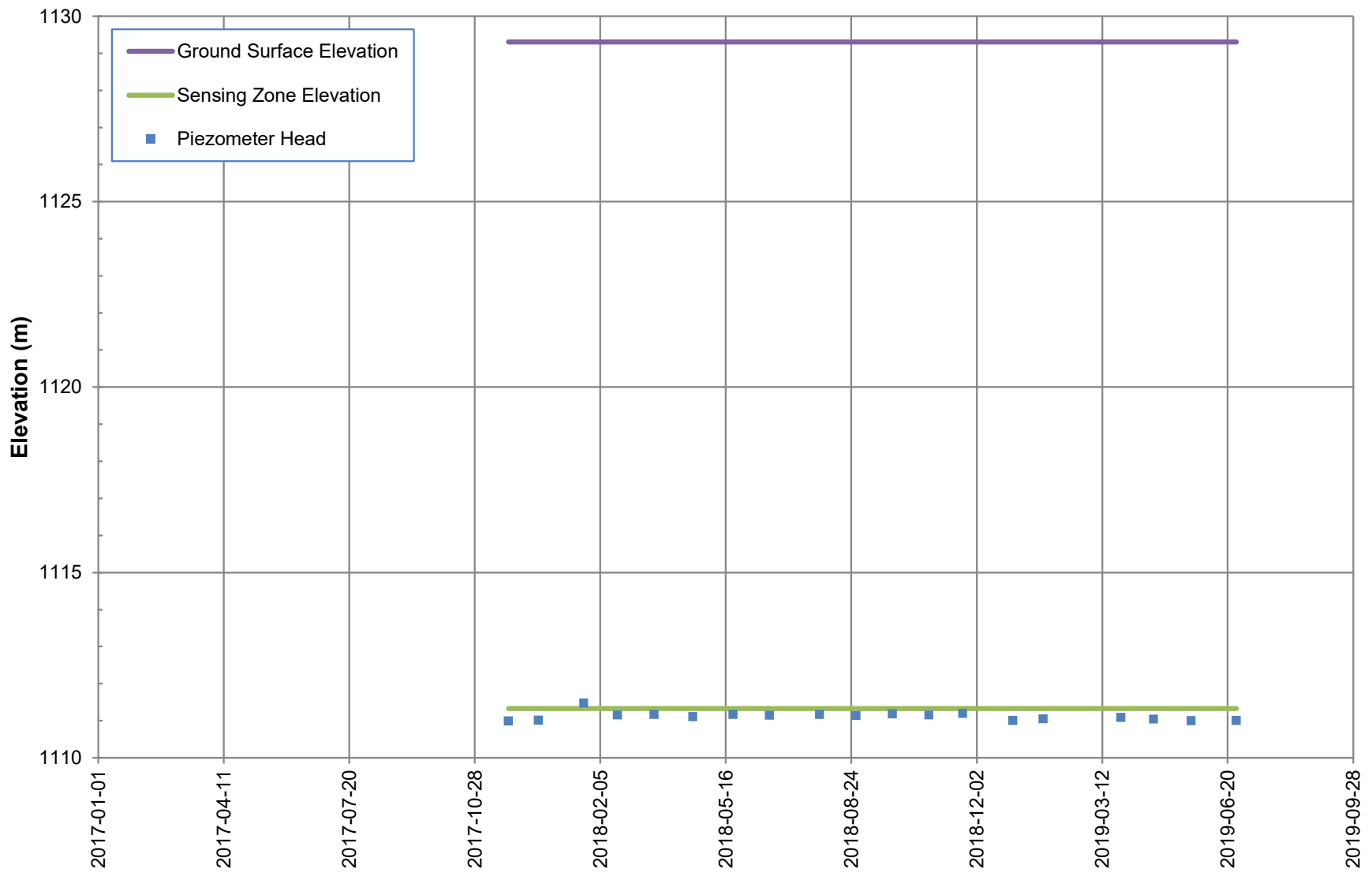
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 23243 Pore Pressure		Name:	



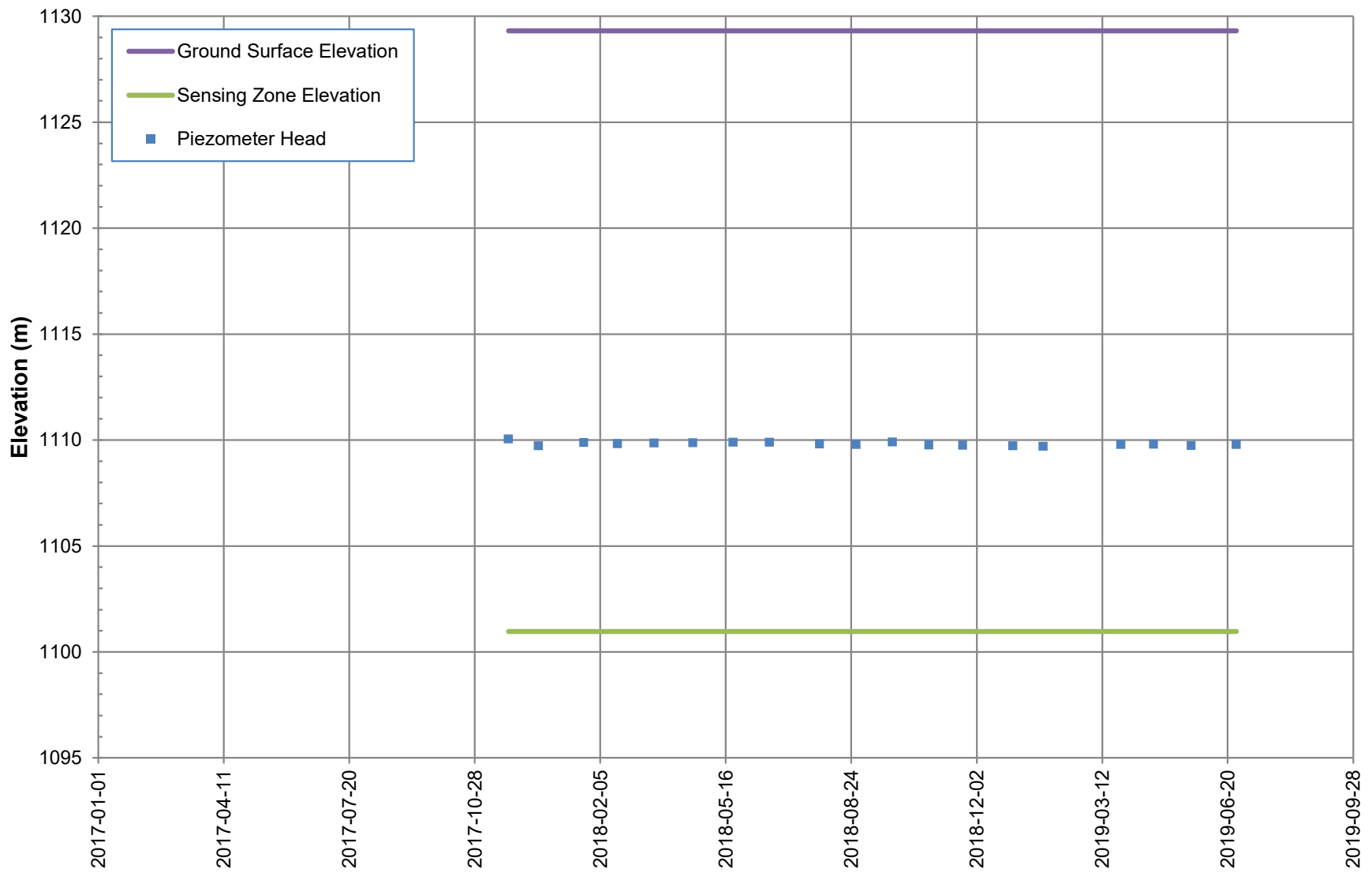
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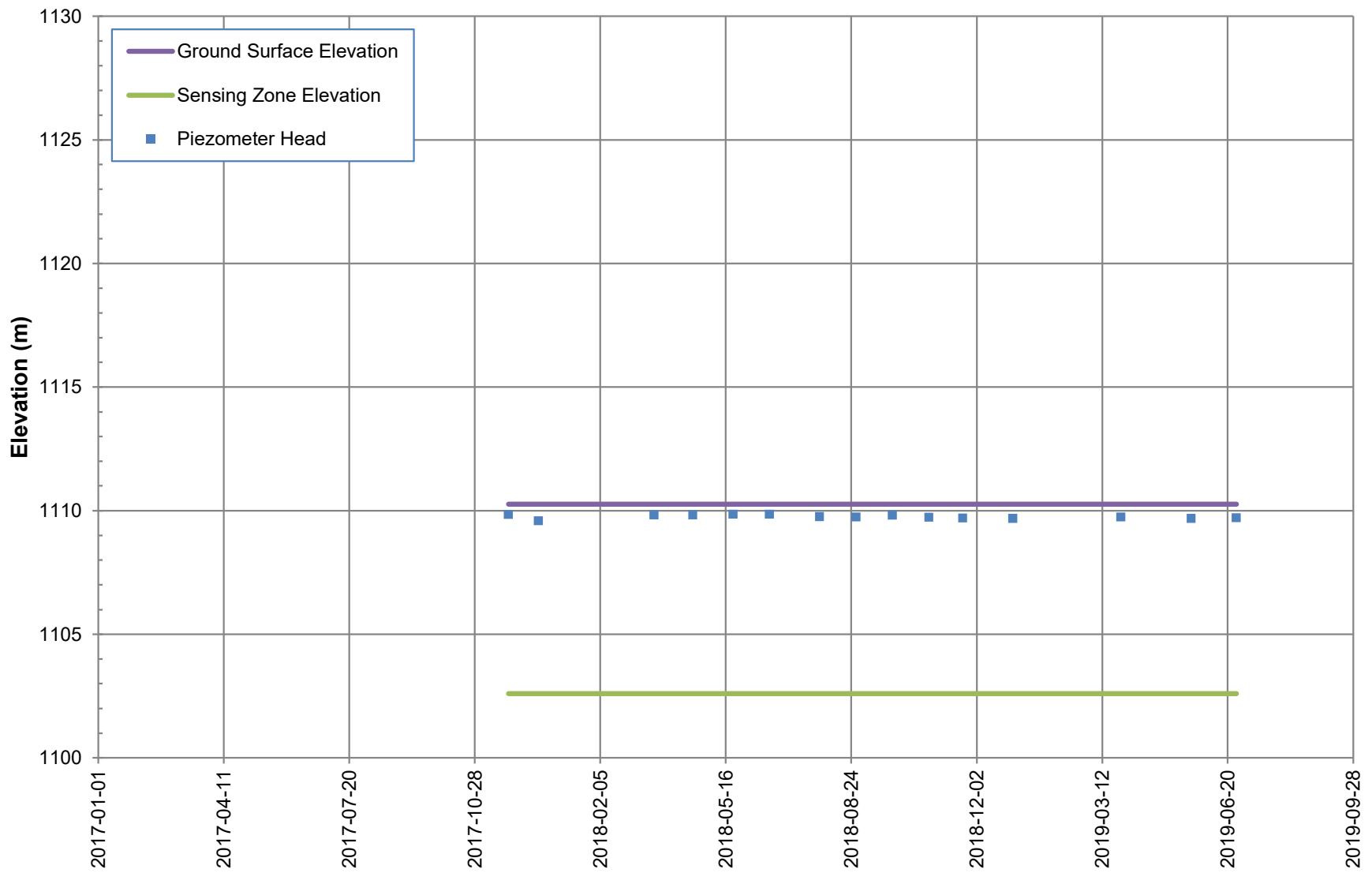
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Lagoon C Piezometers		Date:	Revision
VW 23240 Pore Pressure		Name:	



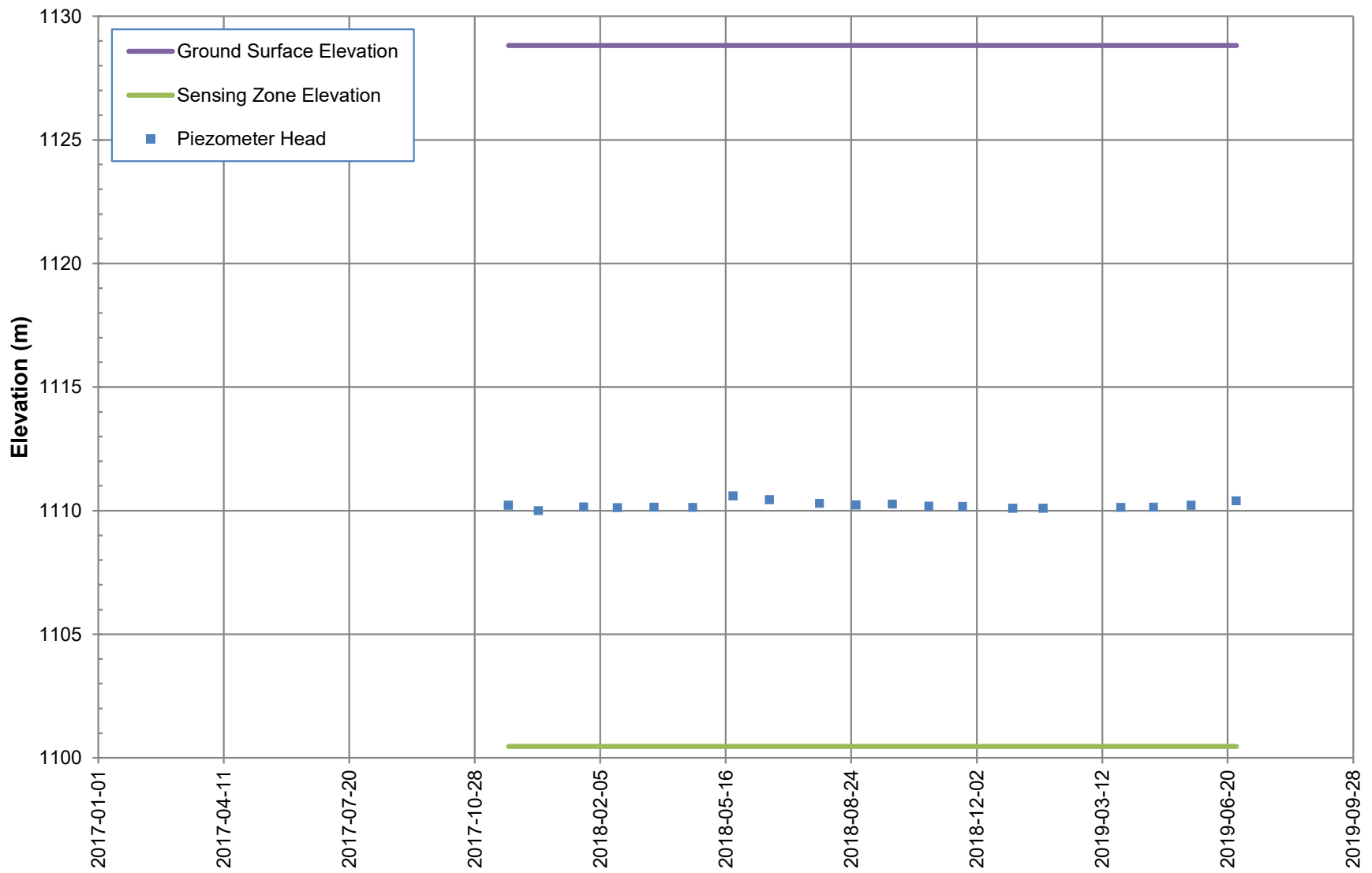
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 46191 Pore Pressure		Name:	



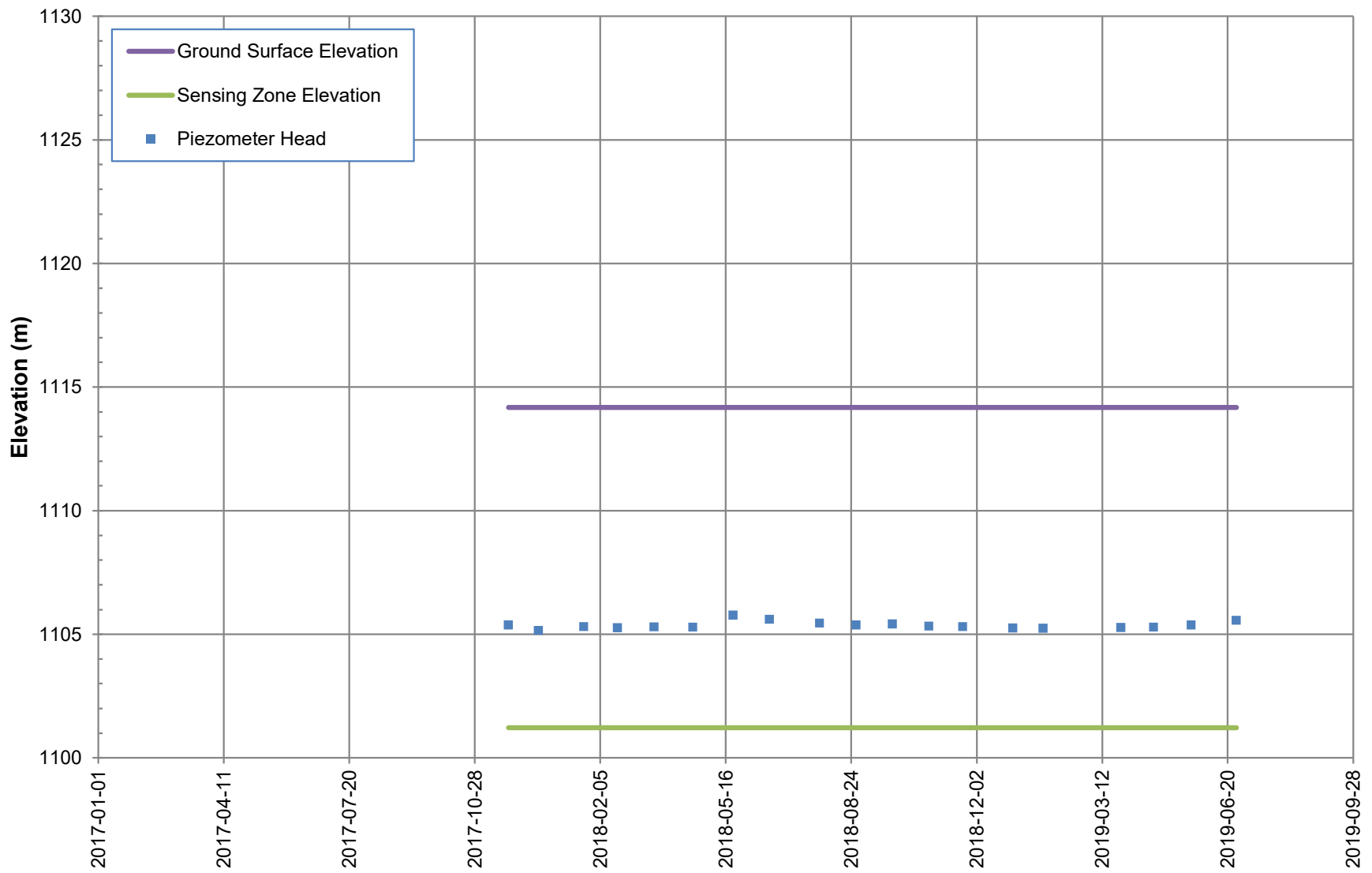
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 46262 Pore Pressure		Name:	



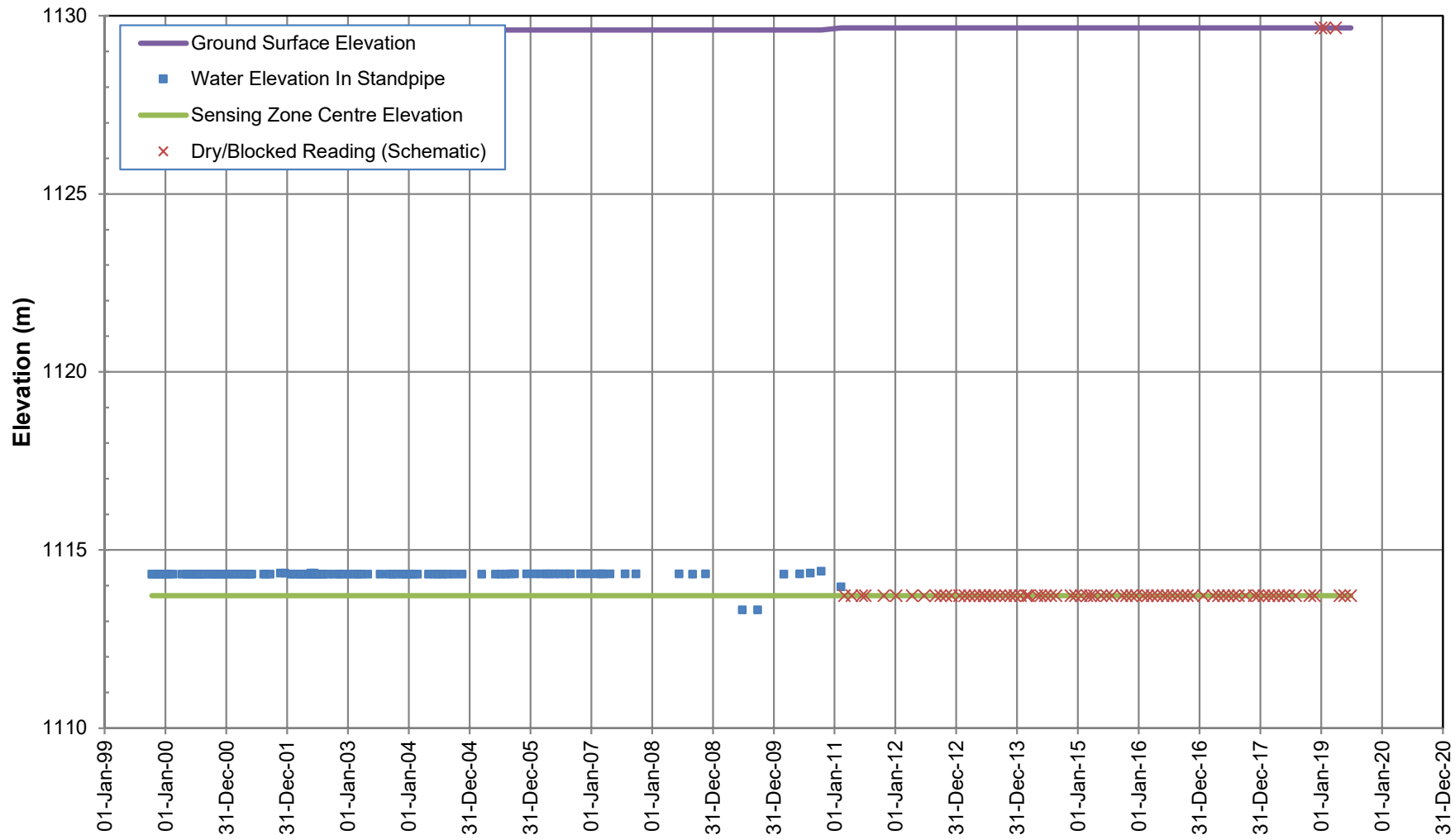
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Lagoon C Piezometers		Date:	Revision
VW 46091 Pore Pressure		Name:	



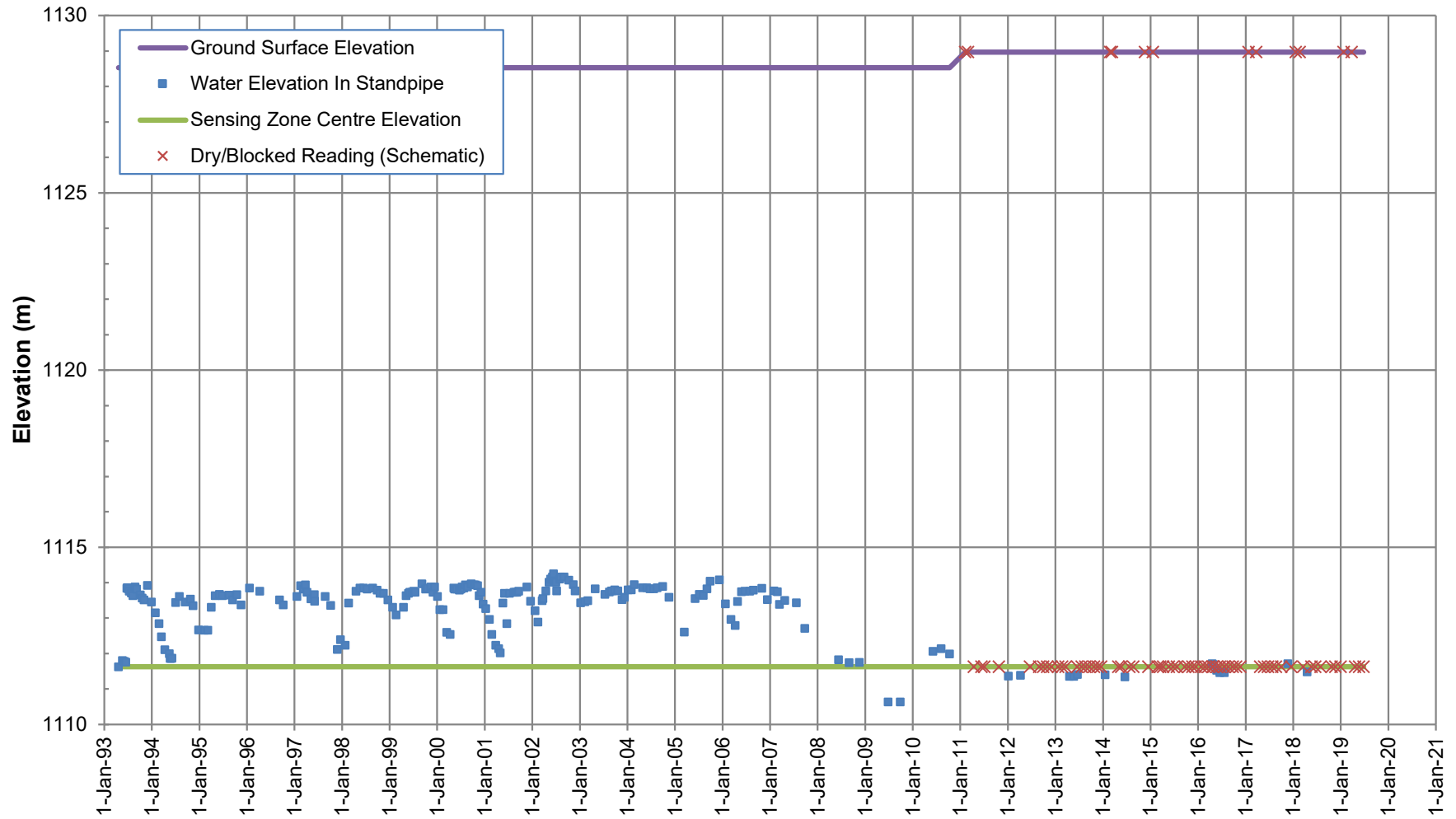
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Lagoon C Piezometers		Date:	Revision
VW 46261 Pore Pressure		Name:	



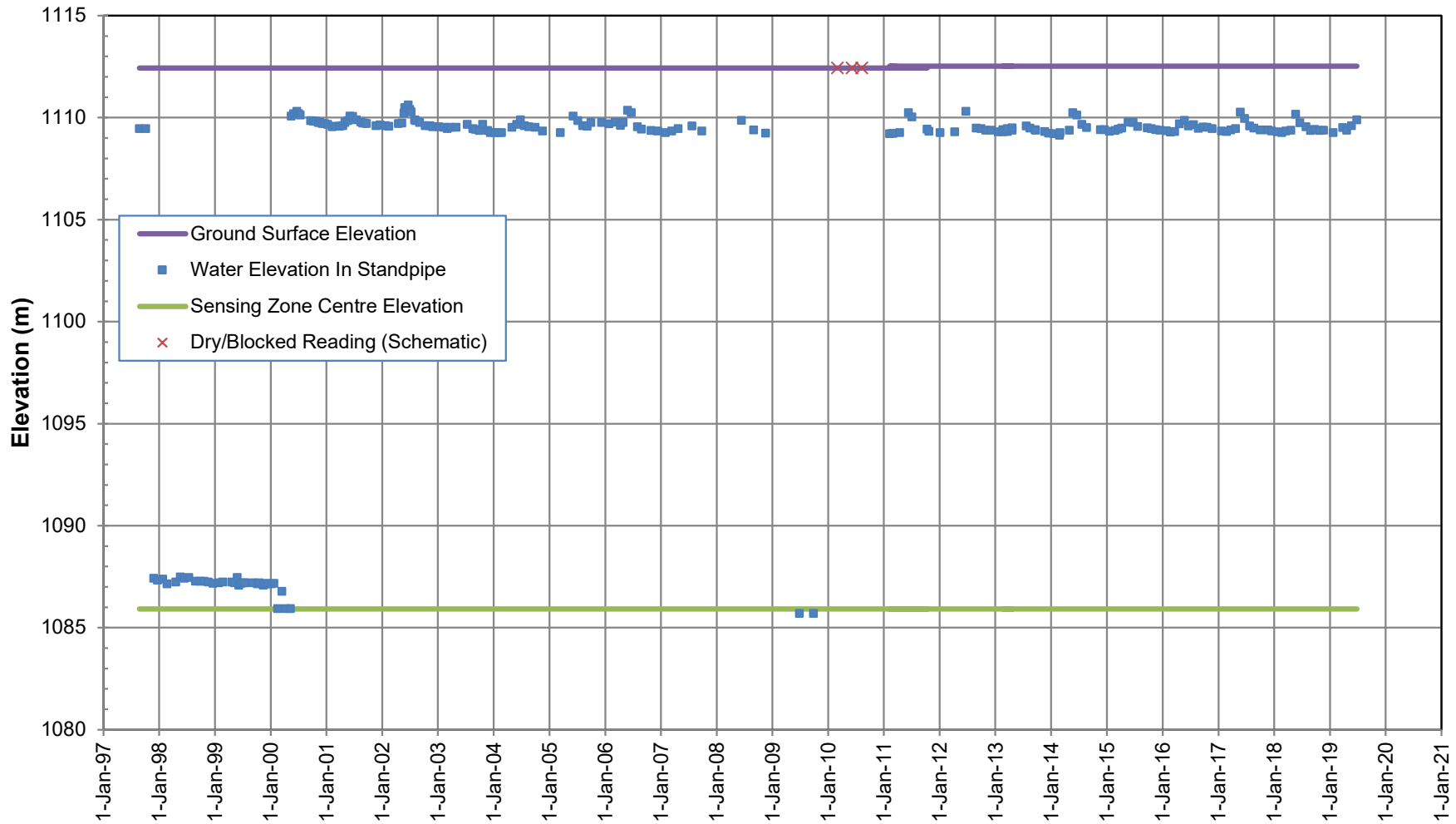
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
VW 46093 Pore Pressure		Name:	



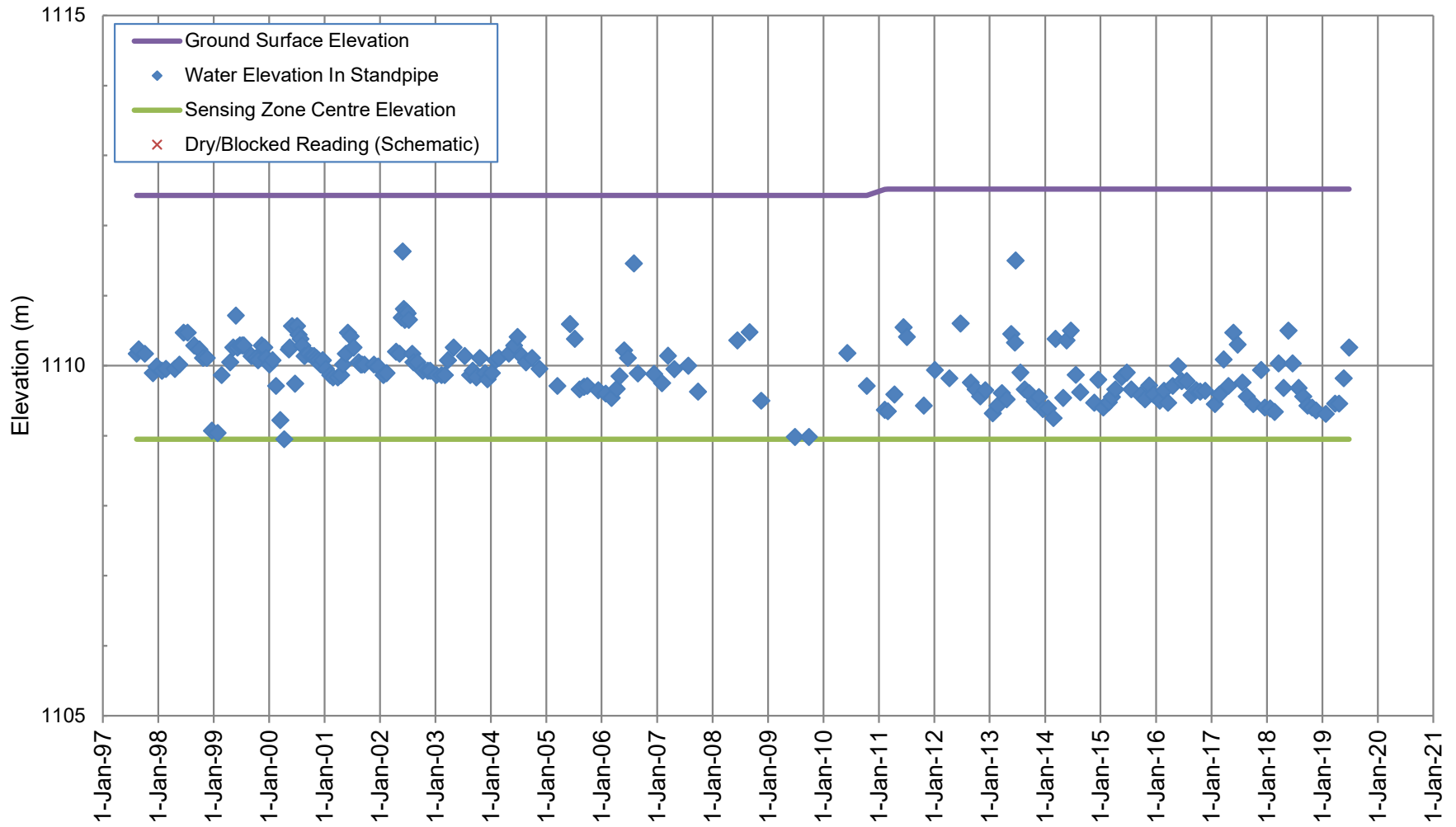
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Lagoon C Piezometers		Date:	Revision
Standpipe 99-01			



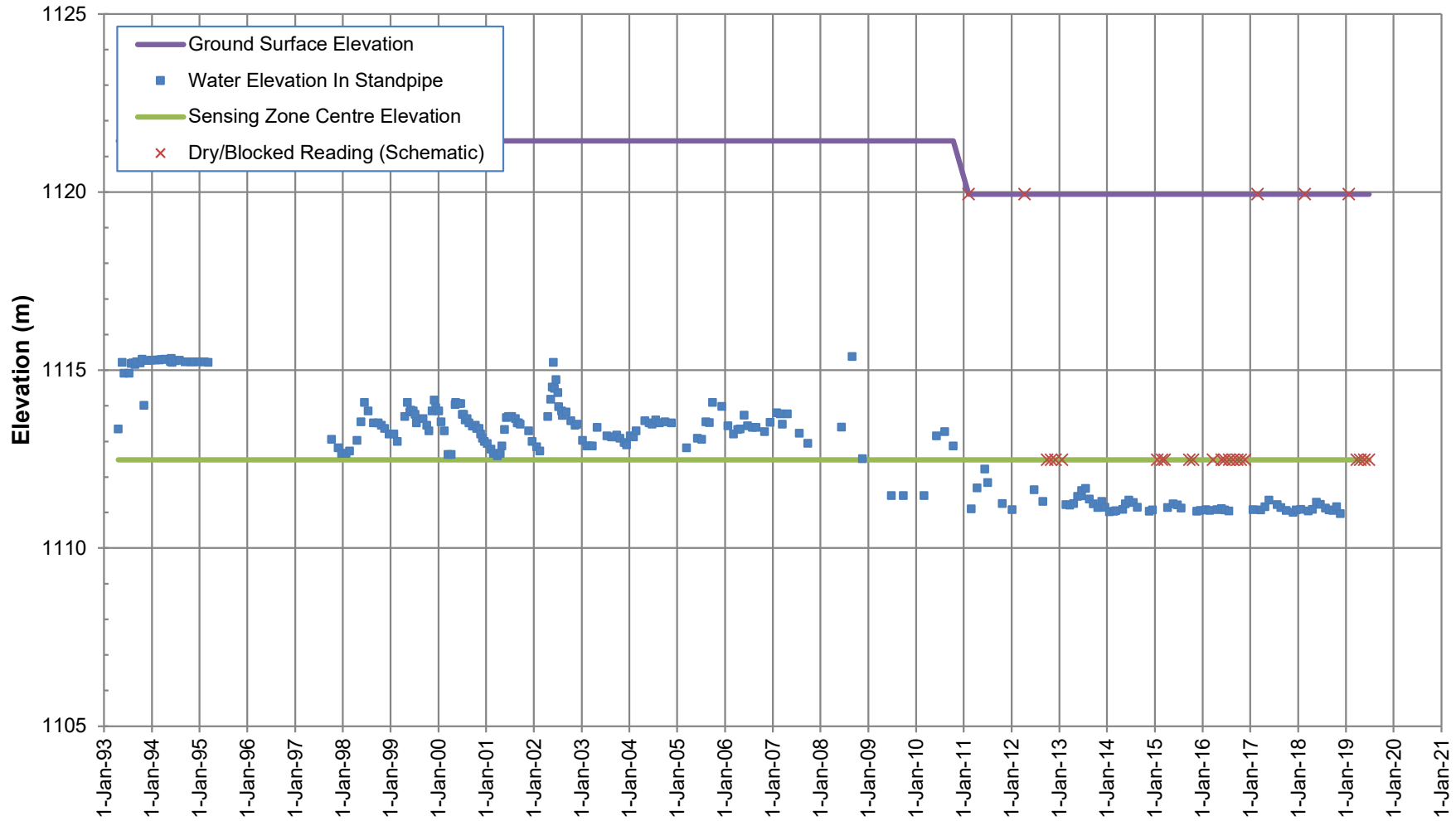
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
Standpipe C88-1			



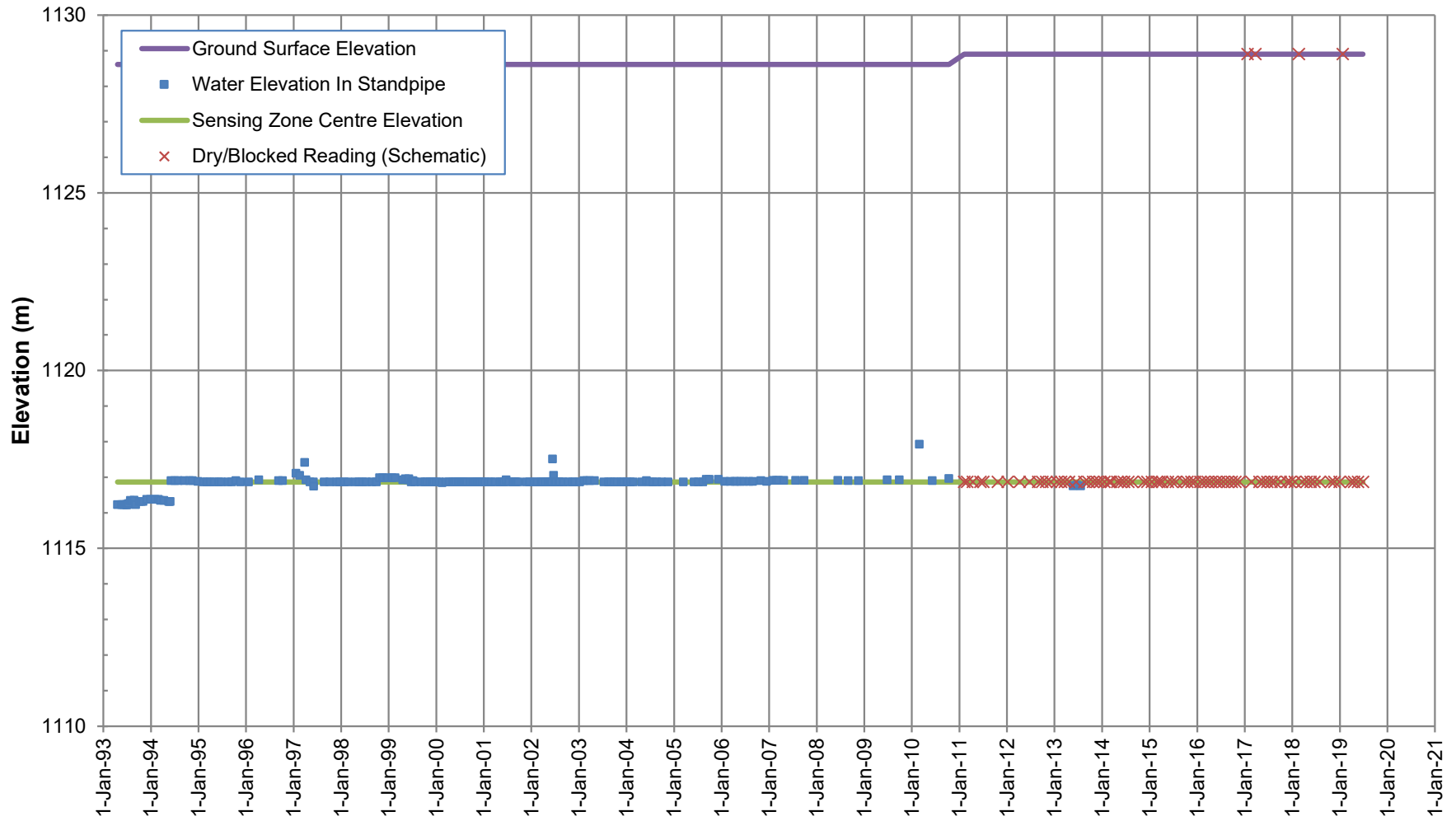
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
Standpipe GT-9703A			



Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
Standpipe GT-9703B			

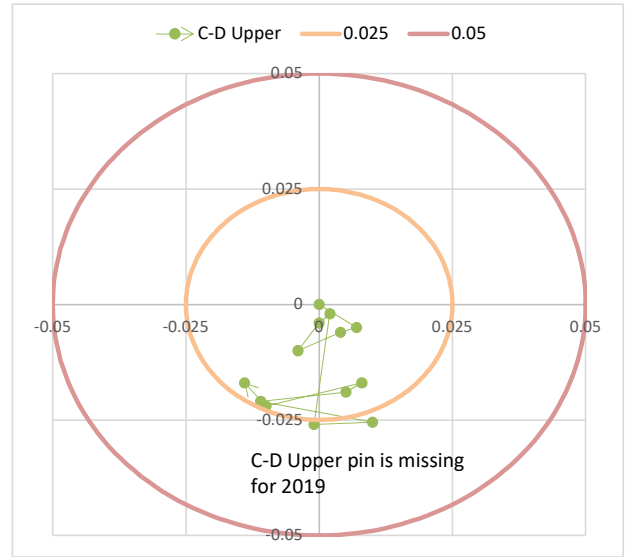
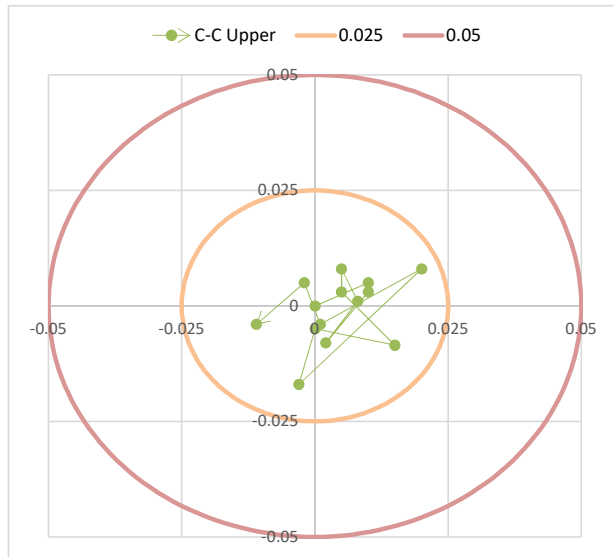
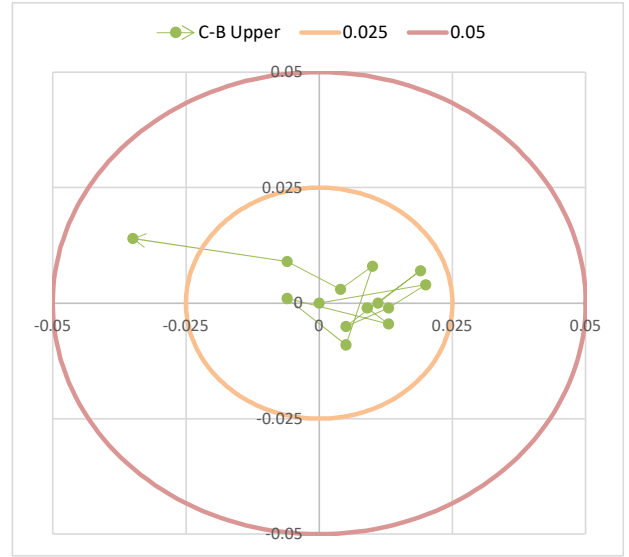
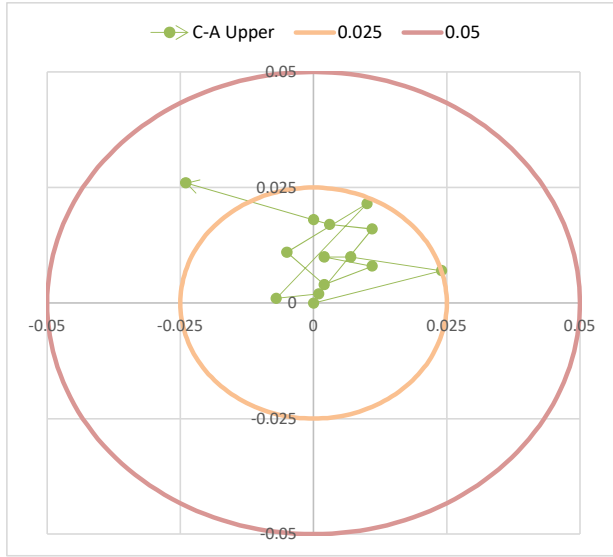


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Lagoon C Piezometers		Date: <input type="text"/>
Standpipe C88-2		Revision: <input type="text"/>

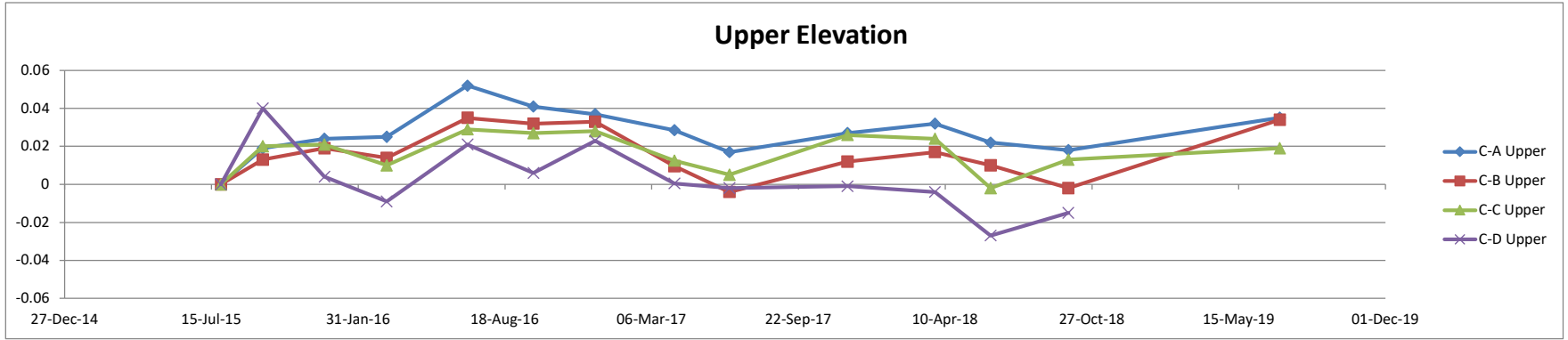


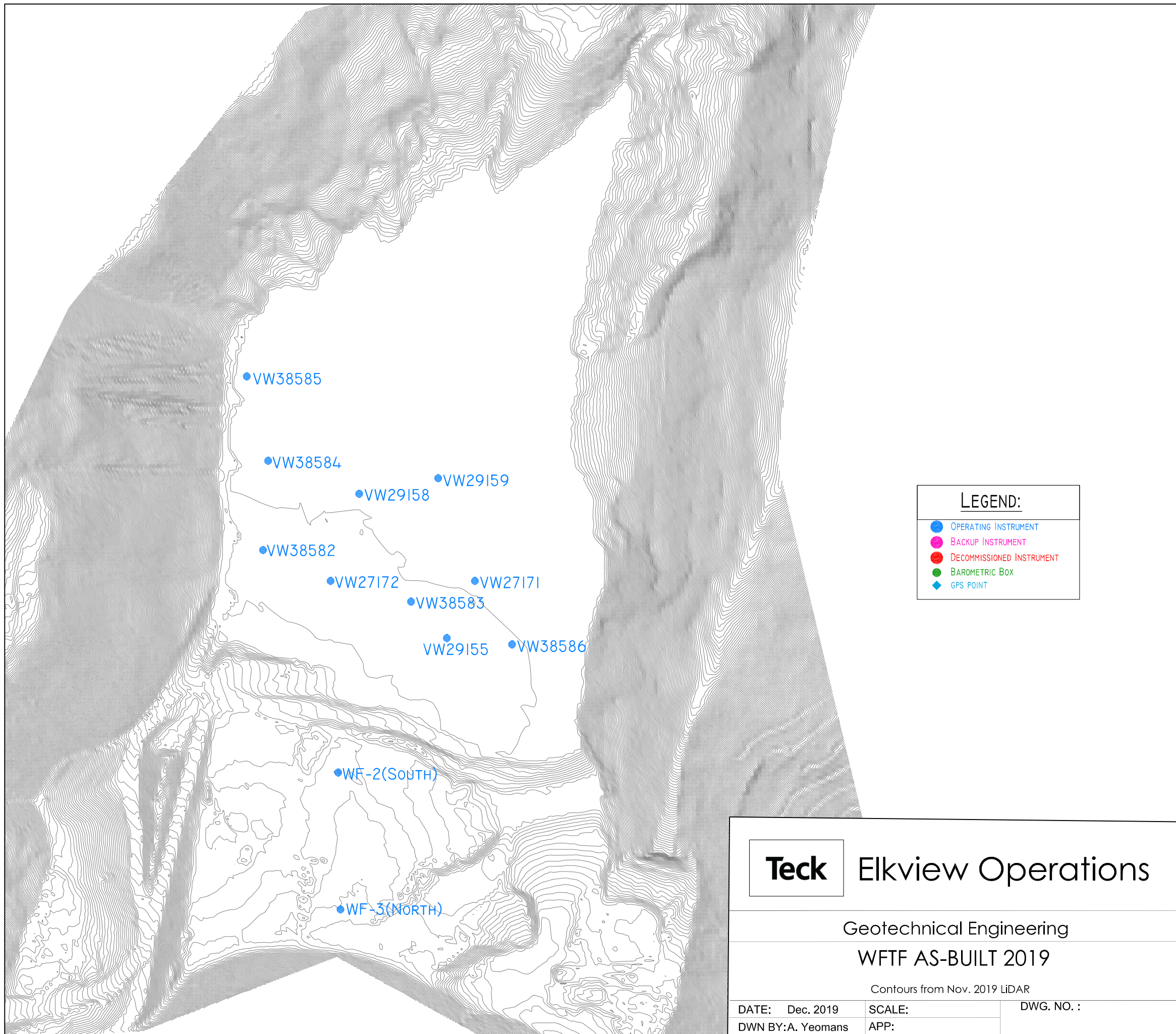
Teck Coal - Elkview Operations			
Lagoon C Piezometers		Date:	Revision
Standpipe OW-C2			

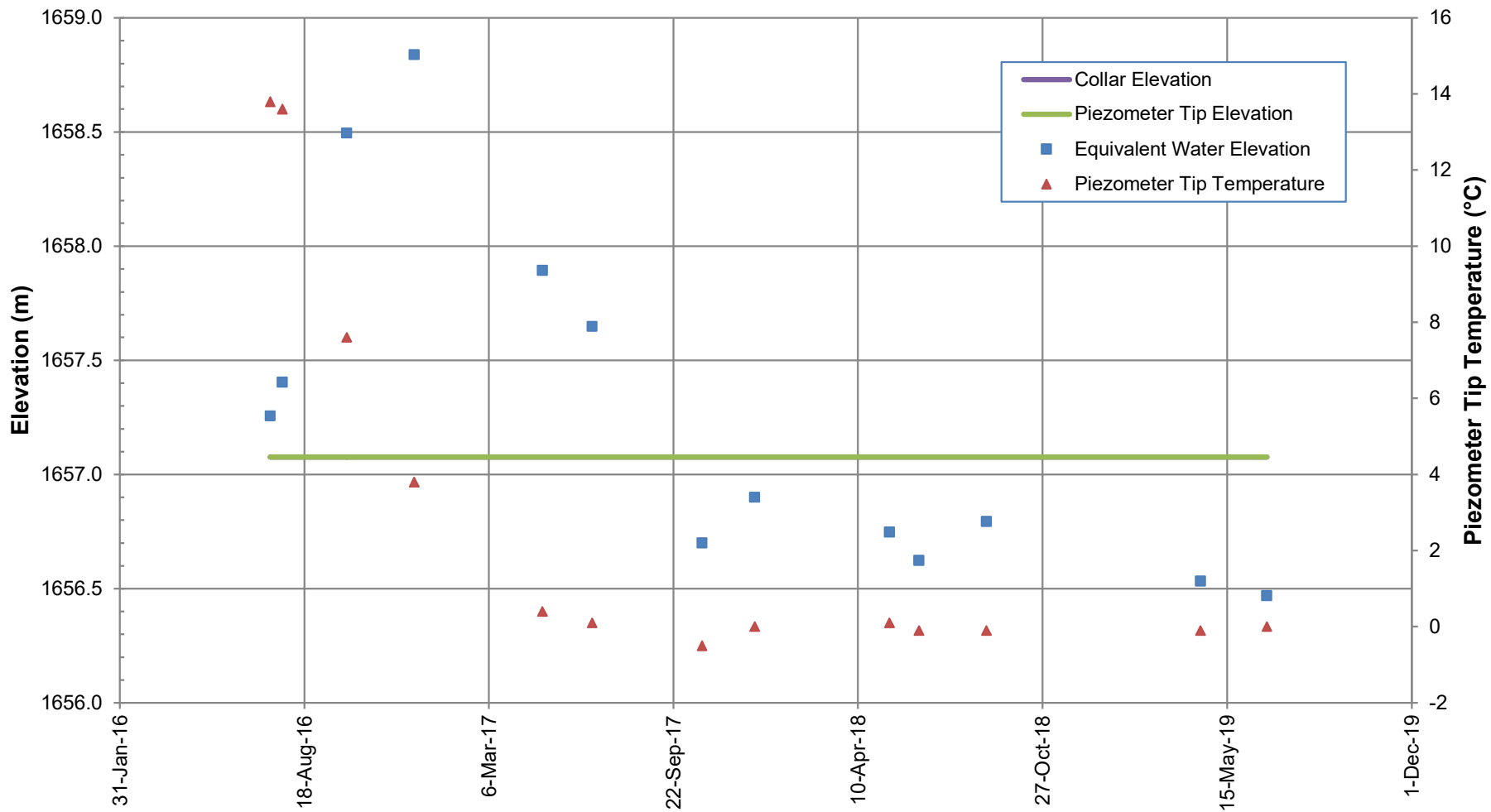
EASTING AND NORTHING DELTA FOR GPS CONTROL POINTS AT LAGOON C (FROM JULY 2015 TO JULY 2019)



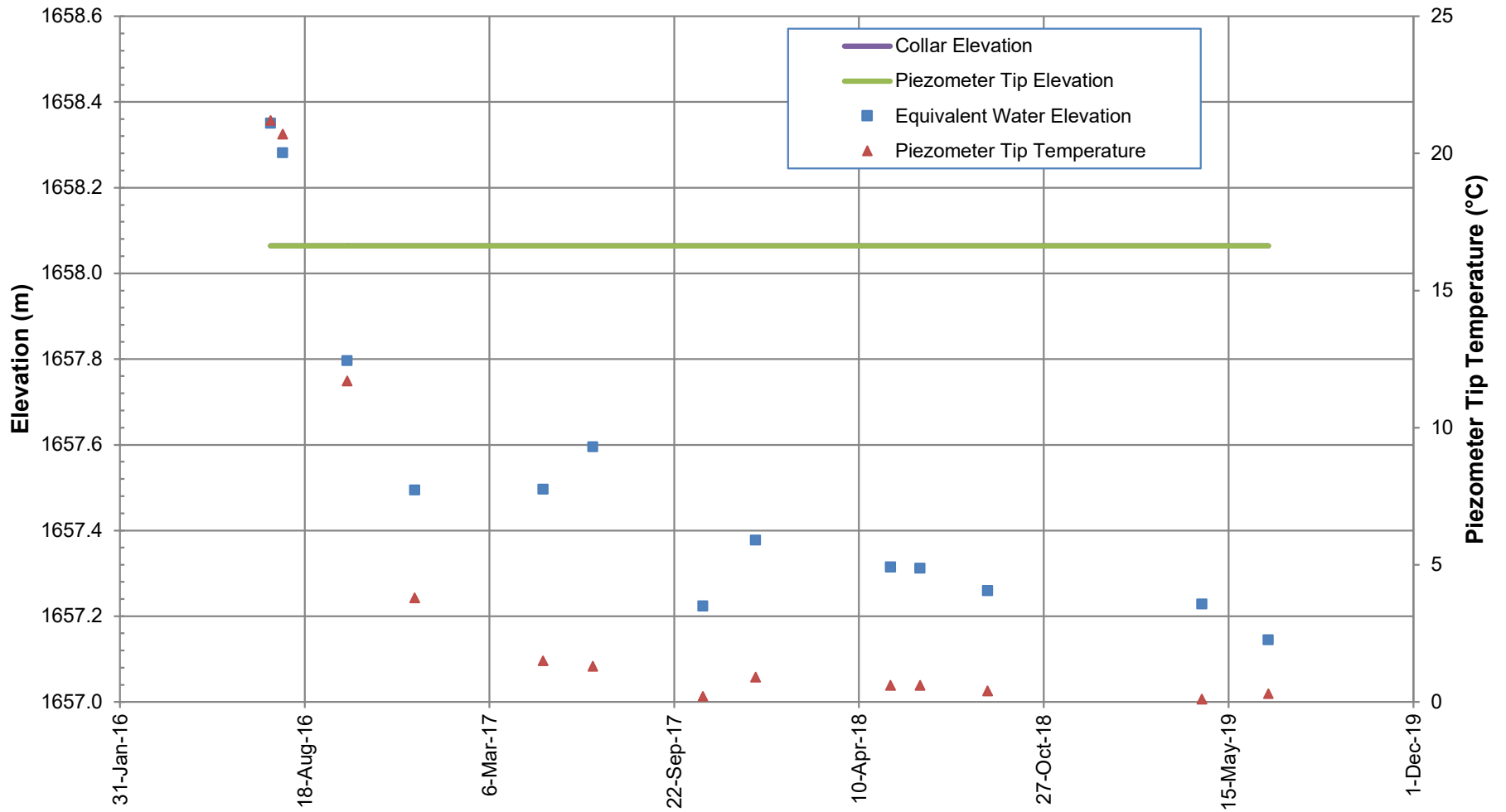
ELEVATION DELTA FOR GPS CONTROL POINTS AT LAGOON C (FROM JULY 2015 TO JULY 2019)



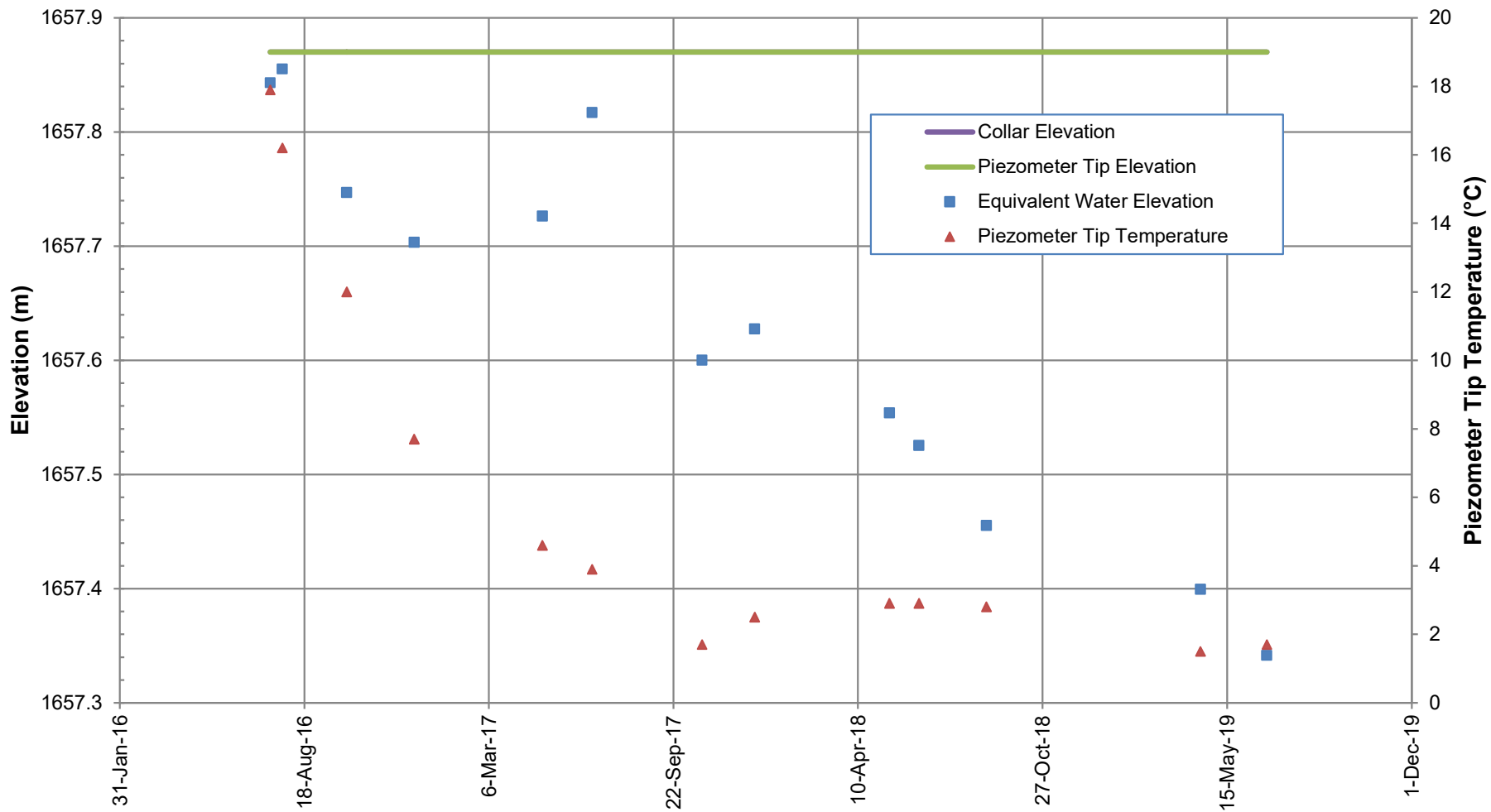




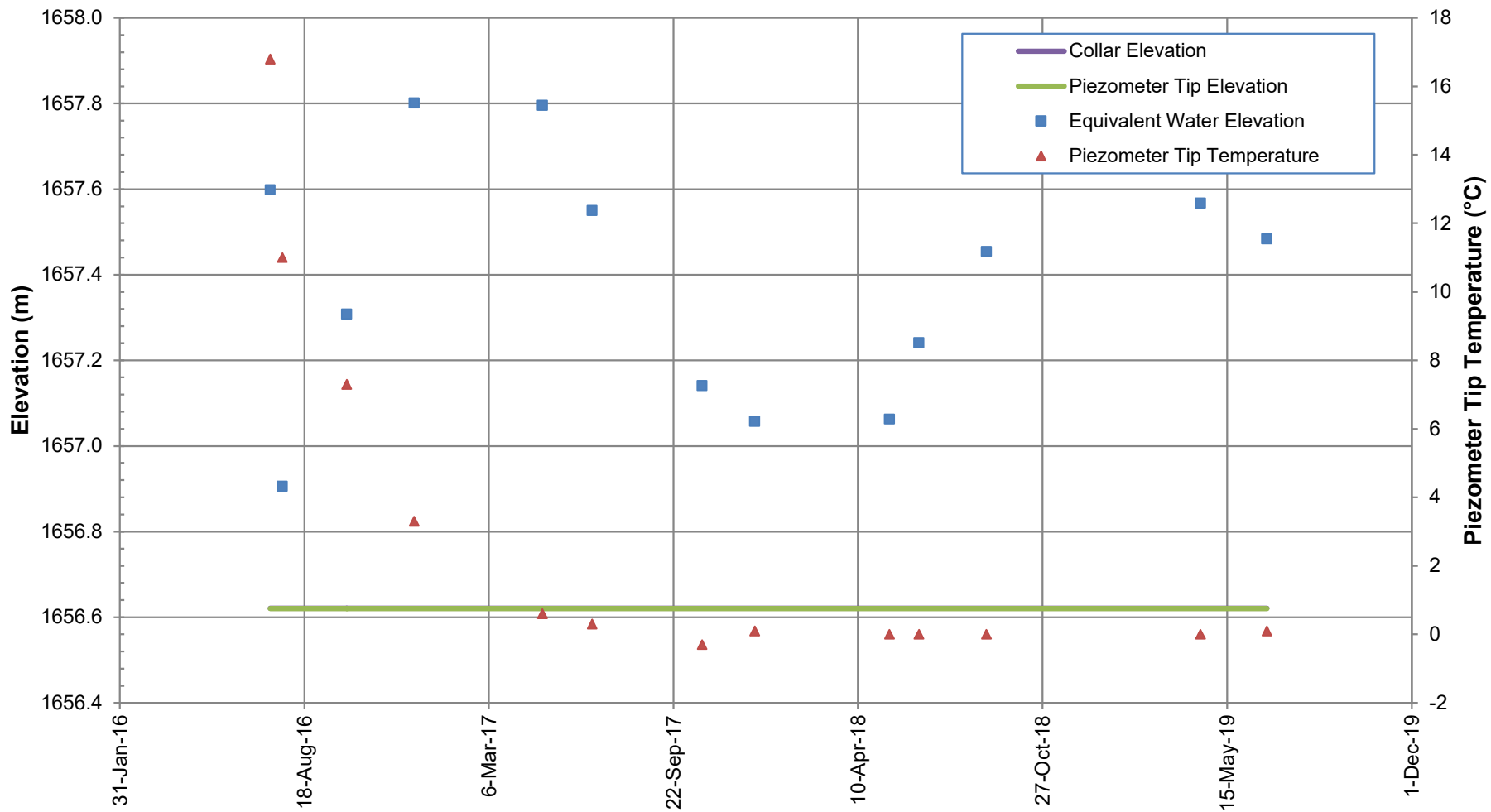
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 27171			



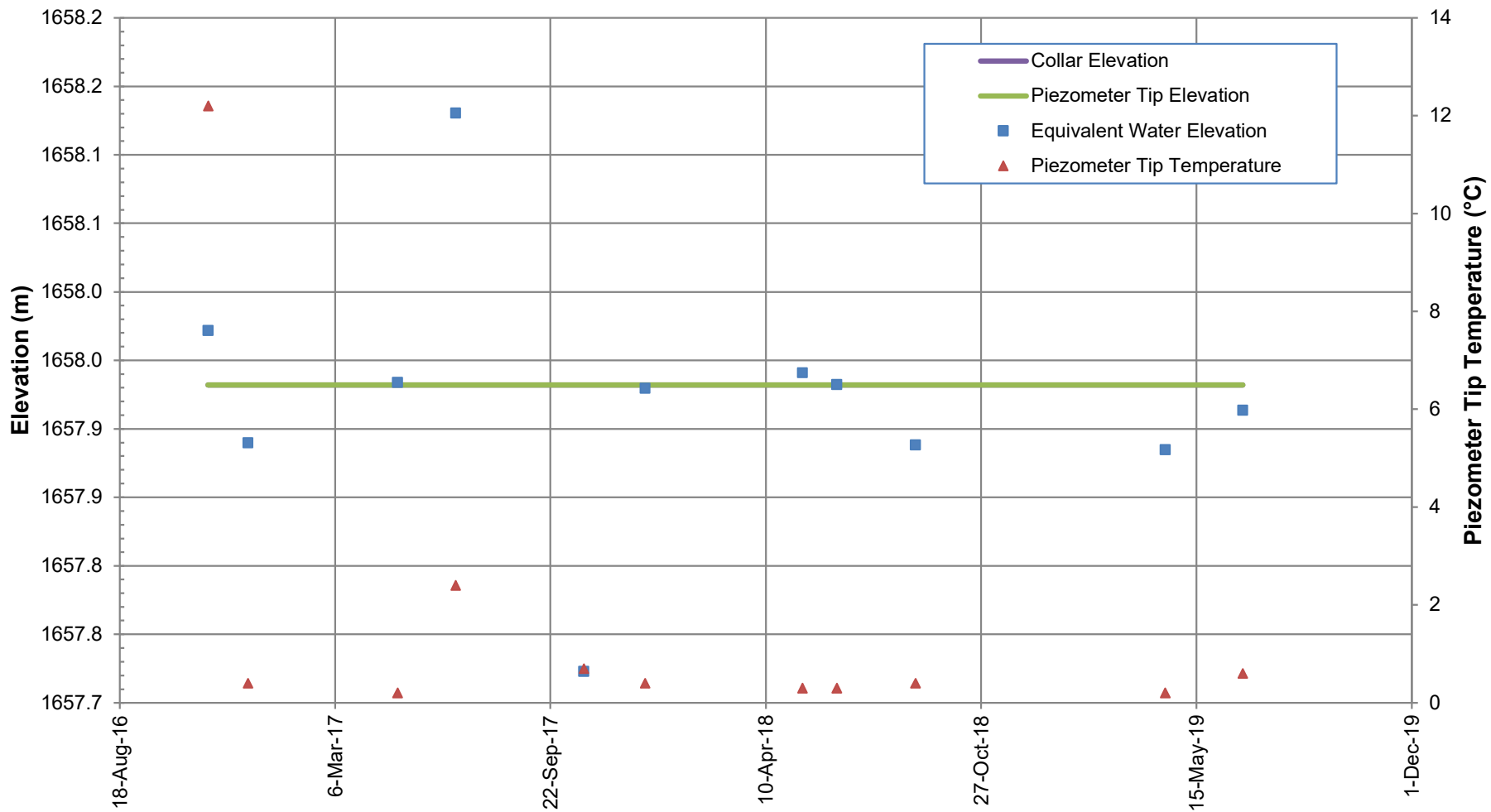
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 27172			



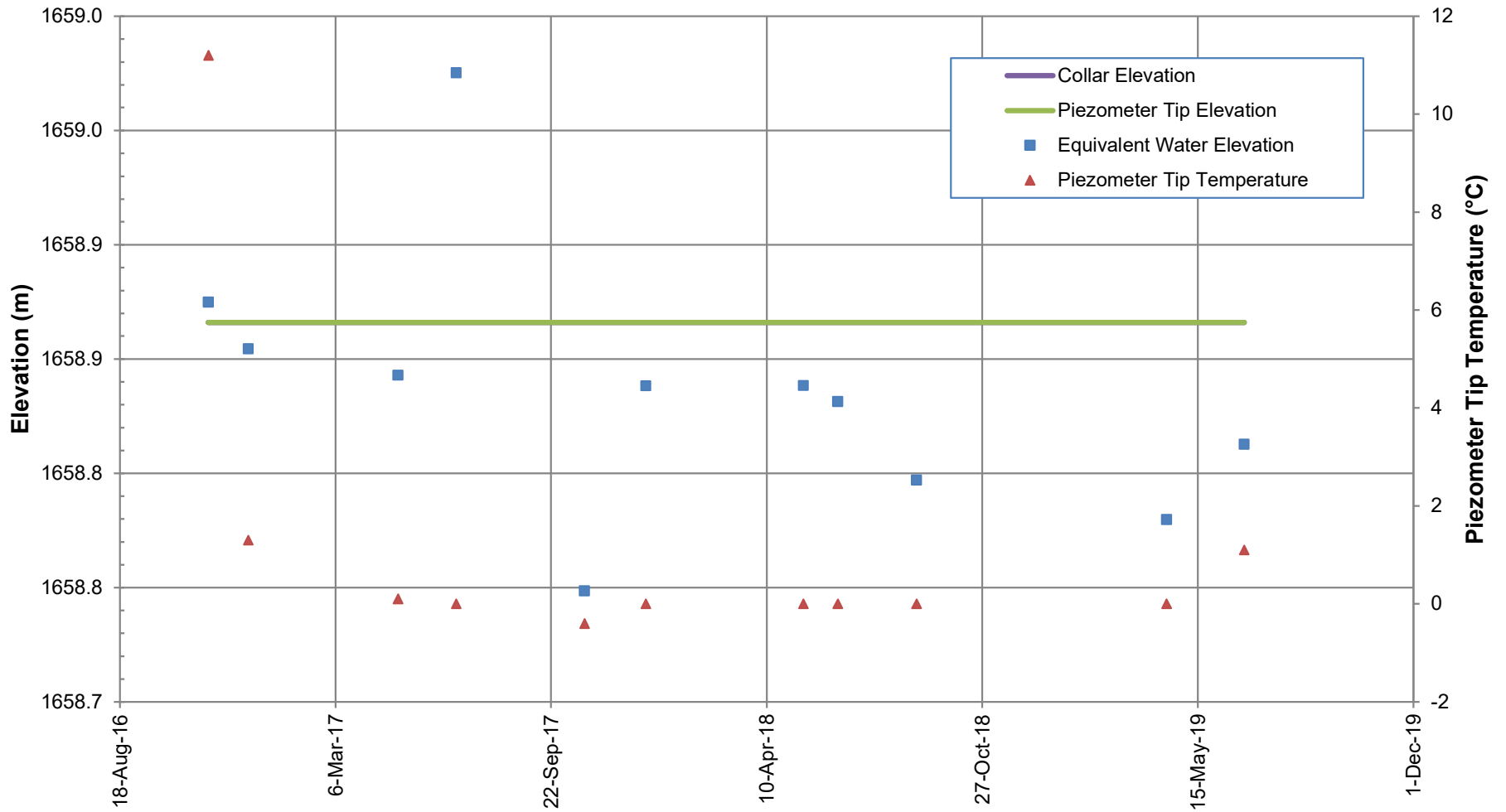
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 29155			



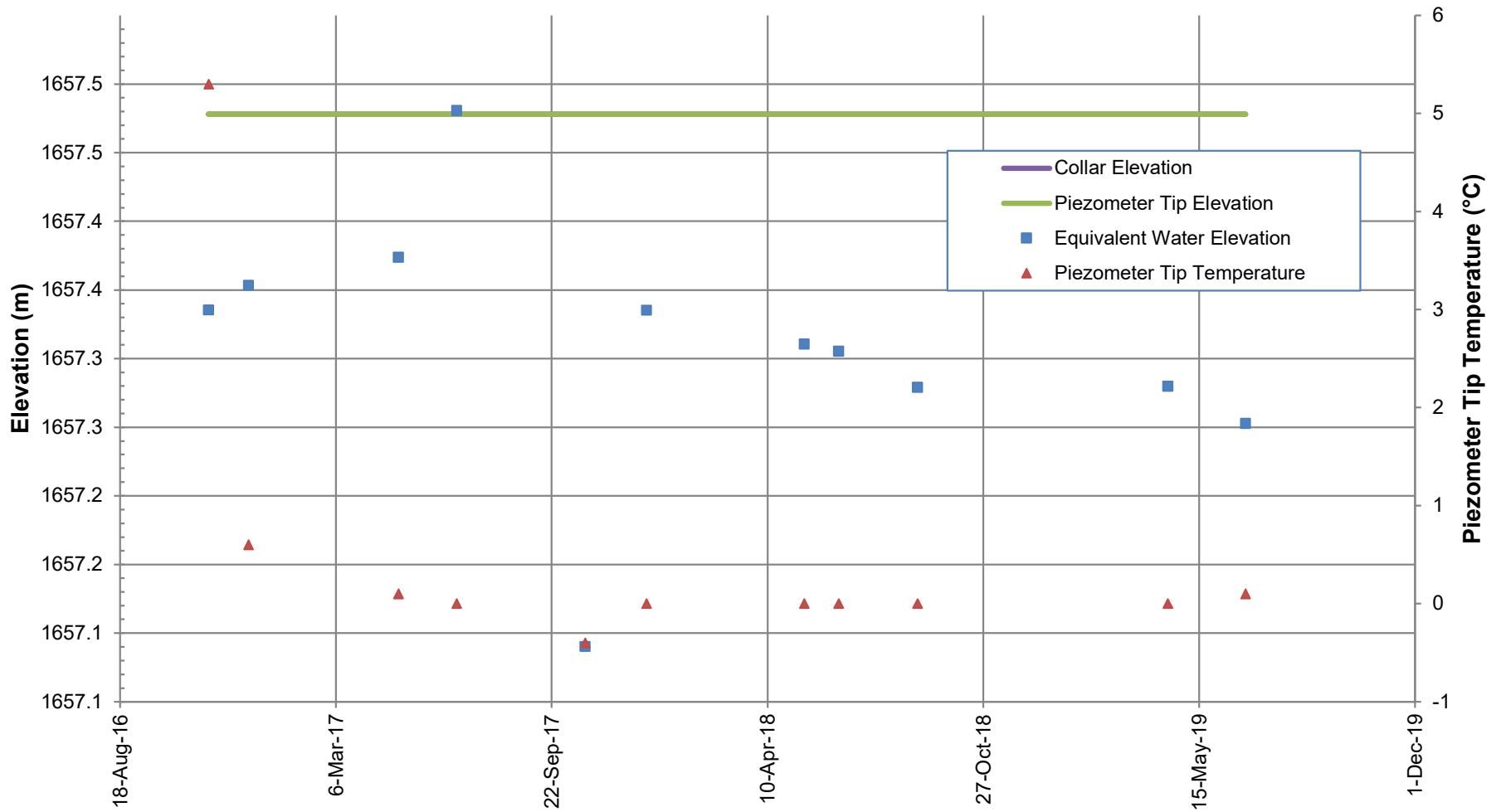
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 29159			



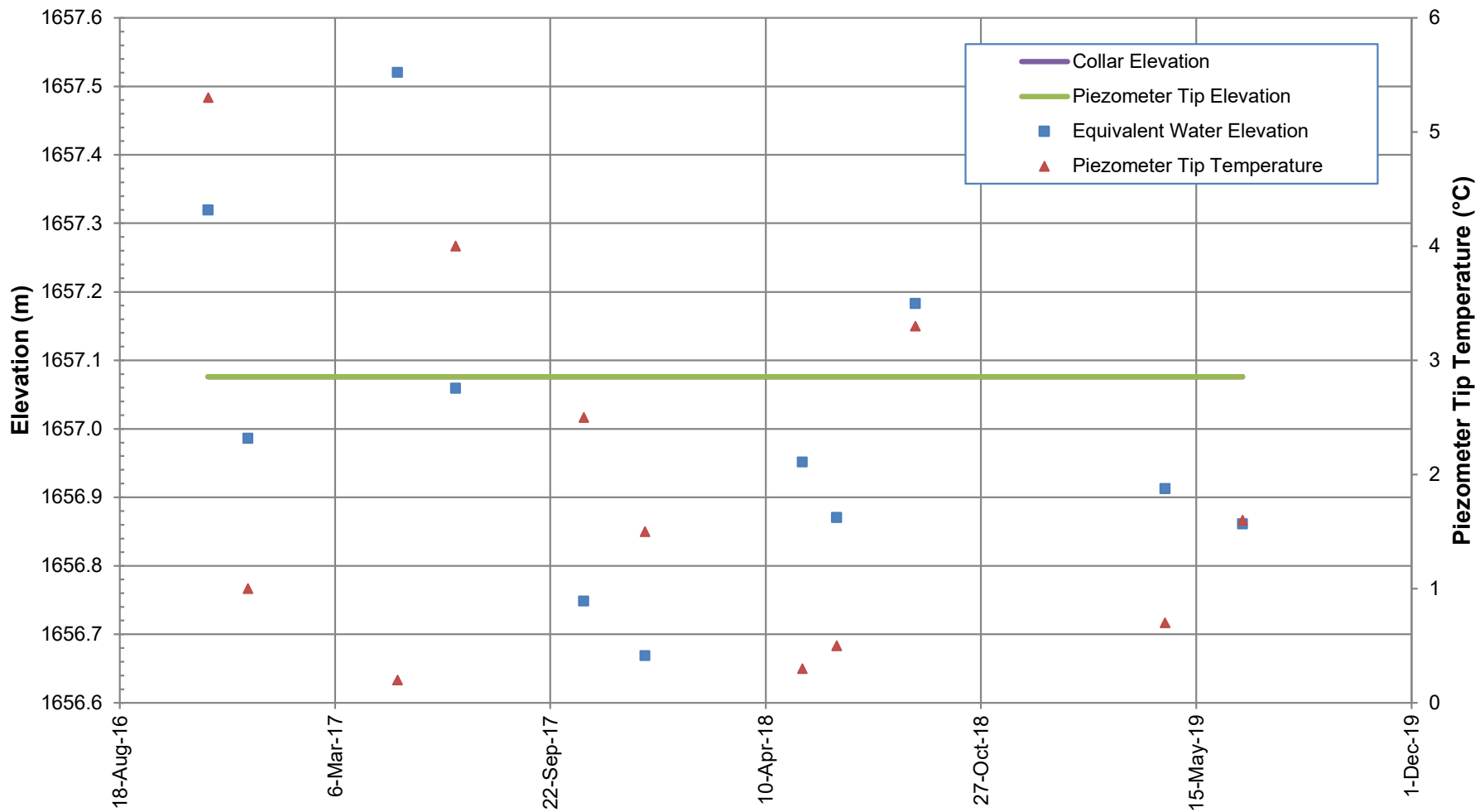
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 38582			



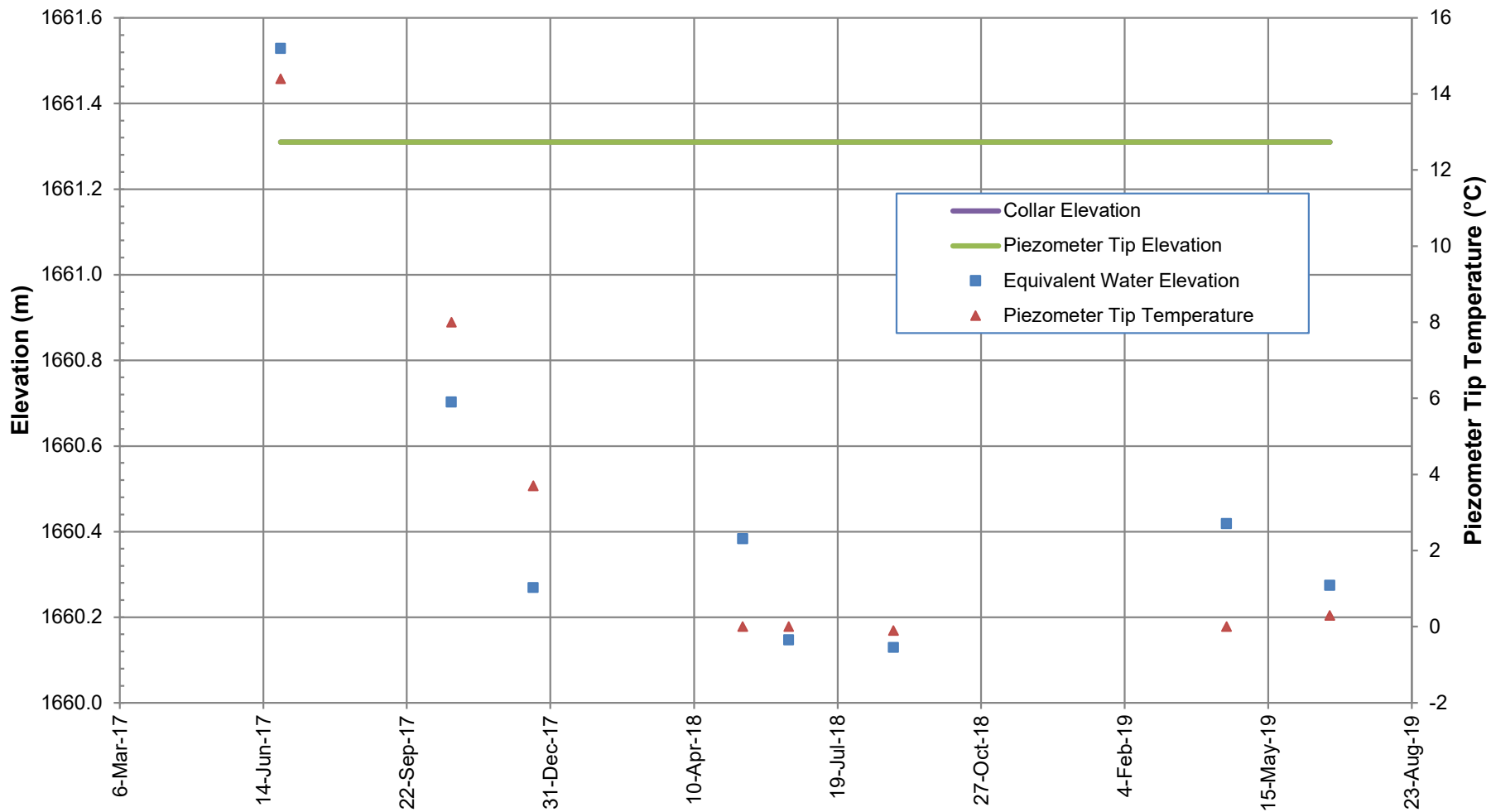
Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 38583			



Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 38584			



Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 38585			



Teck Coal - Elkview Operations			
West Fork Tailings Facility Piezometers		Date:	Revision
Vibrating Wire Piezometer 38585			