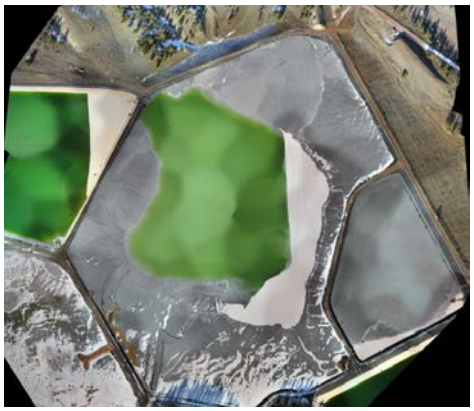
2018 SURFACE IMPOUNDMENT
ANNUAL INSPECTION REPORT
COLSTRIP STEAM ELECTRIC STATION
COLSTRIP, MONTANA



Prepared for:

Talen Montana
Environmental Compliance Dept.
Attn: Mr. Gordon Criswell
P.O. Box 38
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Prepared by:

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January 17, 2019

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January 17, 2019

Mr. Gordon Criswell
Talen Montana—Environmental Compliance Dept.
P.O. Box 38
Colstrip, MT 59323

RE: 2018 SURFACE IMPOUNDMENT ANNUAL INSPECTION REPORT,
COLSTRIP STEAM ELECTRIC STATION, COLSTRIP, MONTANA

Dear Mr. Criswell:

As requested by Talen Montana, the following report summarizes the findings of the surface impoundment annual inspection of the Colstrip Steam Electric Station in Colstrip, Montana. We have prepared this report to comply with coal combustion residual (CCR) regulations published in the Federal Register on April 17, 2015, specifically to Title 40 CFR 257.83(b).

This report also serves to document collection and assessment of data from instrumentation installed within the Colstrip Steam Electric Station's effluent holding pond embankments. Measurements were collected from piezometers and slope inclinometers installed at the Units 1 & 2 Stage II Evaporation Ponds (1&2 STEP), the Plantsite Units 1 & 2 Bottom Ash Pond, and the Units 3 & 4 Effluent Holding Pond (3&4 EHP). The monitoring program will continue at intervals not exceeding thirty (30) days throughout 2019.

Our visual inspection and review of the 2018 monitoring data indicate the design, construction, operation, and maintenance of the CCR units are consistent with recognized and generally accepted good engineering standards. In particular, the instrumentation demonstrates the safety and reliability of the embankment dams. Engineering services relevant to the annual inspection and monitoring were conducted by or under the direct supervision of a Montana registered Professional Engineer.

Respectfully submitted,

JORGENSEN GEOTECHNICAL, LLC

Colter H. Lane, P.E.
Geotechnical Project Manager

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 ANNUAL INSPECTION SUMMARY

The Colstrip Steam Electric Station in Colstrip, Montana, deposits and stores coal combustion residual (CCR) materials in surface impoundments in three main areas shown on Figure 1: the Units 1 & 2 Stage II Evaporation Pond (1&2 STEP), the Plantsite Units 1 & 2 Bottom Ash Pond, and the Units 3 & 4 Effluent Holding Pond (3&4 EHP). Regulations addressing the annual inspection and reporting requirements of §257.83(b) of the Coal Combustion Residuals (CCR) Regulations, Code of Federal Regulations Title 40, Part 257, Subpart D. These regulations were published in the federal register on April 17, 2015, and became effective on October 19, 2015.

According to the requirements of §257.83(b)(1), the annual inspection must include:

(i) A review of available information regarding the status and condition of the CCR units, including, but not limited to, files available in the operating record (e.g., CCR unit design and construction information required by §257.73(c)(1) and §257.74(c)(1), previous periodic structural stability assessments required under §257.73(d) and §257.74(d), the results of inspections by a qualified person, and results of previous annual inspections.);
(ii) A visual inspection of the CCR units to identify signs of distress or malfunction of the CCR units and appurtenant structures;
(iii) A visual inspection of any hydraulic structures underlying the base of the CCR units or passing through the dike of the CCR units for structural integrity and continued safe and reliable operation; and

The production of an annual inspection report must address the following [§257.83(b)(2)]:

(i) Any changes in geometry of the impounding structure since the previous annual inspection;
(ii) The location and type of existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection;
(iii) The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection;
(iv) The storage capacity of the impounding structure at the time of the inspection;
(v) The approximate volume of the impounded water and CCR at the time of the inspection;
(vi) Any appearances of an actual or potential structural weakness of the CCR units, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR units and appurtenant structures; and
(vii) Any other changes which may have affected the stability or operation of the impounding structure since the previous annual inspection.

DRAFTED BY:	CHL
REVIEWED BY:	
PROJECT NUMBER	16419

SHEET TITLE:
Figure 1
Vicinity Map
(Schematic Drawing)

PROJECT TITLE:
2018 Annual Inspection Report
Talen Montana
Colstrip, Montana

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2.0 ANNUAL INSPECTION METHODOLOGY

2.1 Review of Available Information - §257.83(b)(1)(i)

Per §257.83(b)(i), Jorgensen Geotechnical (JG) reviewed documentation related to the status and condition of the surface impoundments of the Units 1 & 2 Stage II Evaporation Ponds (1&2 STEP), the Plantsite Units 1 & 2 Bottom Ash Pond, and the Units 3 & 4 Effluent Holding Pond (3&4 EHP). These documents include, but are not limited to, the following:

- Results of Weekly Inspections by a Qualified Person [§257.83(a)(i) and (ii)], provided by Talen Montana
- Results of Monthly Inspections by a Qualified Person [§257.83(a)(iii)], documented by Jorgensen Geotechnical
- Design and Construction Reports from Bechtel Power Corporation (Bechtel, 1979, 1982, 1985)
- History of Construction Report [§257.73(c)(1)] (Geosyntec, 2016a)
- Liner Construction Documentation Report [§257.71(a)(1)] (Geosyntec, 2016b)
- Initial Structural Stability Assessment Report [§257.73(d)] (Hydrometrics, 2016)
- Initial Annual Inspection Report [§257.83(b)(2)] (Jorgensen, 2016a)
- Initial Safety Factor Assessment Reports [§257.73(e)] (Jorgensen, 2016b and 2016c)
- 2016 Annual Inspection Report [§257.83(b)(2)] (Jorgensen, 2017)
- 2017 Annual Inspection Report [§257.83(b)(2)] (Jorgensen, 2018)
- Units 3&4 EHP J Cell Closure Certification Statement [§257.102]
- Units 3&4 EHP J-1 Cell Liner Construction Certification Statement [§257.72(a) & (b)]
- Units 3&4 EHP New Clearwell Liner Design Certification Statement [§257.72(a) & (b)]
- Compliance Demonstration Report: 3&4 EHP J-1 Cell (Geosyntec, 2017)

Documents not produced by this office were provided by Talen Montana and were not independently verified for accuracy.

2.2 Visual Inspection - §257.83(b)(1)(ii) and (iii)

Colter H. Lane, P.E., of Jorgensen Geotechnical (JG) performed the inspection of CCR surface impoundments located at the Units 1&2 STEP, the Plantsite Units 1&2 Bottom Ash Pond, and the Units 3&4 EHP on October 16-17, 2018. The inspection included a visual inspection of each CCR surface impoundment to identify signs of distress or malfunction and a visual inspection of hydraulic structures underlying the base or passing through the embankment of surface impoundments, where applicable. No signs of distress or malfunction were observed. For surface impoundments with hydraulic structures, structural integrity was not observed during the inspection to be compromised.

2.3 CCR Material Survey

E-Cell at the Units 1&2 STEP and C-Cell at the Units 3&4 EHP contain CCR material which extends above the stored water surface. In order to better estimate the impounded volume of CCR material, JG surveyed these cells in November 2018. Topographic data of consolidated

paste deposits at both surface impoundments were obtained by deploying a rotary wing Unmanned Aerial Vehicle (UAV). The UAV was flown in a grid pattern over the cell at a constant elevation in order to capture photos. Photos from the UAV were then processed using specialized photogrammetry software to create a Digital Terrain Model (DTM). GPS survey equipment was used to set photo control points (i.e., flight panels) and to verify elevation data produced by the photo processing. The DTM was refined in CAD software and used for depth, elevation, and volume calculations presented in Sections 3.3 and 3.4.

3.0 ANNUAL INSPECTION REPORTING

The report summarizes the findings of the annual inspection as required by §257.83(b)(2). Table 3-1 presents a summary of the inspection requirements and the location of the report in which each is addressed.

Table 3-1: Inspection Report Summary

Category	Regulation Reference	Section Addressed
Changes in Geometry	§257.83(b)(2)(i)	3.1
Instrumentation	§257.83(b)(2)(ii)	3.2
Depth and Elevation Estimates	§257.83(b)(2)(iii)	3.3
Estimated Storage Capacity	§257.83(b)(2)(iv)	3.4
Impounded Volume Estimate	§257.83(b)(2)(v)	3.4
Structural Weakness	§257.83(b)(2)(vi)	3.5
Other Changes	§257.83(b)(2)(vii)	3.6

3.1 Changes in Geometry - §257.83(b)(2)(i)

No changes in geometry have occurred to surface impoundments located at the Units 1&2 STEP since the previous annual inspection (October 2017).

There have been two notable changes in geometry at the Units 3&4 EHP in 2018:

- The western embankment of F-Cell was widened to the west by placing fill material adjacent the existing embankment in order to accommodate construction of a larger wind fence. Stability of the embankment has increased as a result.
- CCR material was being end-dumped into the northwest corner of G-Cell for use in making the embankment slopes less steep and providing padding for the proposed liner. The material was observed to be dry and represents a very low risk of mobilization in the unlikely event of a structural failure at the facility.

Neither represents a change of conditions which disrupts or has the potential to disrupt the operation and safety of the CCR units and appurtenant structures. No other changes in geometry have occurred to surface impoundments at the 3&4 EHP since the previous annual inspection.

3.2 Instrumentation - §257.83(b)(2)(ii)

Numerous piezometers and slope inclinometers exist within the embankments surrounding the surface impoundments of the CSES facility. The initial annual inspection report (Jorgensen, 2016a) described the history of instrument installation and monitoring in detail and will not be repeated for this report. Results of inclinometer and piezometer monitoring are discussed in Sections 3.2.1 and 3.2.2, respectively. Maps showing each instrument location accompany the data in Appendices A through H. Data from instrumentation measuring flow rates in toe drains underlying the 3&4 EHP Main Dam and the 1&2 STEP Main Dam are discussed in Section 3.2.3.

3.2.1 **Slope Inclinometers**

There are 23 slope inclinometers at the site: 9 at the 1&2 STEP and 14 at the 3&4 EHP. Refer to the maps in Appendices A, B, C, D, and E for the slope inclinometer locations within each embankment. No changes to the inclinometer monitoring program have occurred since the previous annual inspection.

Slope inclinometer measurements were performed using a Durham Geo Slope Indicator portable measurement system (Digitilt AT) owned by Jorgensen and consisting of a probe, cable, and data recorder tablet. Readings are taken every 2 feet from the bottom of the casing up to 2 feet below the top of the casing. A complete measurement event consists of two separate passes of the probe. The first, called the “0” pass, is performed and then the probe is turned to face the opposite direction and data is collected again in what is called the “180” pass. The probe measures tilt in two perpendicular directions creating a profile of the inclinometer casing in two perpendicular directions (i.e., A and B).

Inclinometer measurement data are plotted by calculating the change between the current profile and the initial profile (i.e., Profile Change Plot); initial surveys for this annual inspection report are dated December 12 or 13, 2017. The difference between the current and the initial (i.e., displacement) is summed from the bottom of the casing up to the ground surface (i.e., cumulative displacement). Inclinometer data plots are in Appendices A, B, C, D, and E. ***Maximum readings are not applicable to slope inclinometer instrumentation.***

In general, the inclinometer profile change plots exhibit very little deviation from the baseline readings and most of the deflections observed on the graphs are likely related to small measuring discrepancies and not actual ground movement. The inclinometer data have been adjusted for instrument bias and casing rotation effects for most of the inclinometer locations. Data are also corrected for orientation, so that the “A0” direction is perpendicular to the embankment. Applied corrections are indicated at the bottom of each data plot.

Inclinometer measurements typically indicate less than 0.1-inch of profile change since the previous annual inspection report with a few exceptions. These exceptions are as follows:

- Inclinometer STEP-09-2INC installed in the 1&2 STEP Main Dam is exhibiting small (less than 0.25-inch) deflection between depths of 120 to 126-ft below the top of the casing (TOC) in the A0 direction (i.e., northeast). Data are plotted in Appendix A.

- Inclinometer SD-15-17INC installed in the 3&4 EHP Saddle Dam displays approximately 0.25-inches of apparent displacement between depths of 26 to 46-ft below TOC (see Appendix C). Displacement is to the southeast (i.e., has components in both the A0 and B0 direction). This movement appears to have slowed or ceased during the latter part of 2018.
- Inclinometer MD-16-7INC installed in the 3&4 EHP Main Dam appears to show approximately 0.7-inches of cumulative displacement between depths of 24 to 36-ft below TOC in the A180 direction toward J-1 Cell (i.e., south) and B180 (i.e., east). Data are plotted in Appendix D.

The displacements described above are attributed to localized settlement near the instrument location causing the slope inclinometer casing to buckle into a “D” or “S” shape. We do not believe this is a cause for concern for several reasons:

1) Nearby inclinometer casings are not exhibiting the same apparent deflection, either at the same depths or the same behavior.
2) In general, measured deflection is not purely perpendicular to outside face of the embankment which, if observed, may be cause for concern.
3) Measured deflections are small and spread over a length of the inclinometer casing of 6-ft or more, rather than in a discrete zone (as would be expected from shearing associated with slope movement).
4) No surface expression exists to indicate movement of embankments.

The results of inclinometer monitoring demonstrate embankments are safe to operate at current water levels. Inclinometers STEP-09-2INC, SD-12-17INC, and MD-16-7INC will be watched closely for continued deflection. Should movement continue, additional investigation including installation of redundant instrumentation may be warranted.

3.2.2 **Piezometer Monitoring**

The 2018 monitoring program included 63 vibrating wire (VW) and standpipe piezometers. Piezometers are distributed across the facility as follows:

- 6 Units 1 & 2 STEP Main Dam
- 10 Additional Units 1 & 2 STEP (i.e., within impoundment divider dikes)
- 6 Plantsite Units 1 & 2 Bottom Ash Pond
- 18 Units 3 & 4 EHP Saddle Dam
- 13 Units 3 & 4 EHP Main Dam
- 10 Additional Units 3 & 4 EHP (i.e., A-Cell, H-Cell, and F-Cell)

No changes to the piezometer monitoring program occurred in 2018. Refer to the maps in Appendices F, G, and H for piezometer locations within each embankment.

The piezometers consist of VW transducers and slotted PVC standpipes. The VW piezometers transmit frequency signals which are read by a Durham VW Data Recorder and converted to

water pressures. The standpipe water levels were measured using an electronic water level meter (i.e., a "sounder") from Heron Instruments. Appendices F, G, and H contain plots of groundwater instrumentation results alongside nearby effluent holding pond surface water elevations. Piezometer readings were collected by qualified JG personnel and the effluent holding pond surface water levels were provided by Talen Montana staff. ***Maximum and minimum piezometric surface elevations since the previous annual inspection report may be ascertained from the plots.***

Piezometric water surface levels generally appear to be stable and very little change was observed in 2018:

- At the 3&4 EHP dry conditions in G-Cell, a CCR-rule compliant liner in J-1 Cell, and careful management of water in C-Cell appear to be controlling piezometric surface elevations measured in embankments across the facility.
- The liners of 1&2 STEP appear to continue to function properly as piezometers within the embankments and divider dikes indicate dry conditions over this monitoring period.
- At the Plantsite Units 1 & 2 Bottom Ash Pond, instruments BOTASH-09-4P and PONDA-9-3P appear to be detecting seasonal fluctuations in groundwater underlying the pond. BOTASH-09-1P, BOTASH-09-2P, and PONDA-09-4P were installed into embankment material and have generally recorded dry conditions since installation, the one exception being June 2011, which was an unusually wet year. Elevated water measurements recorded in BOTASH-09-3P have been carefully observed in 2018. It has been determined the instrument has malfunctioned and we recommend abandoning and/or replacing the instrument in 2019.

Measured piezometric surface elevations through December 2018 do not indicate adverse conditions that would lead to embankment instability at any of the three CSES facilities.

3.2.3 **Hydraulic Structure Instrumentation**

Toe drain flumes at the 3&4 EHP Main Dam (MD) and Saddle Dam (SD) and the 1&2 STEP Main Dam (STEP-MD) are visually inspected weekly by Talen Montana personnel and monthly by qualified JG staff. Water in the MD toe drain and the STEP-MD toe drain has appeared clear when observed. The toe drain of the SD was dry throughout 2018.

Flow rates through the STEP-MD are measured with a Telog Model 2109E pressure flow recorder. Data from the recorder are averaged over four different time periods each month and converted to gallons per minute (gpm). Data were not collected in June and July 2017 due to problems with equipment. A maximum flow of 6.9 gpm (April 14, 2018) and a minimum flow of 1.5 gpm (February 7, 2018) were recorded since the previous annual inspection. The 3&4 EHP MD toe drain flow rate is measured using a Greyline Instruments Model AVFM 5.0 area-velocity flow meter the output of which is observed and recorded as part of the weekly and monthly inspections. A maximum flow rate of 31.01 gpm was observed on May 3, 2018, and a minimum of 17.86 gpm was observed on March 27, 2018.

3.3 Minimum, Maximum, and Present Depth and Elevation - §257.83(b)(2)(iii)

The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR material since the previous annual inspection are presented in Tables 3-2, 3-3, and 3-4. Depths and elevations were estimated using available design and construction drawings, existing topographic data, observations made during the inspection, and surface water measurements provided by Talen Montana.

Table 3-2: Units 1 & 2 Stage II Evaporation Ponds - §257.83(b)(2)(iii)

Surface Impoundment[1]	Depth (ft)			Elevation (ft)		
	Min	Max	Present[2]	Min	Max	Present[2]
Clearwell	29.8	33.2	33.0	3261.8	3265.2	3265.0
E-Cell[3]	21.8	25.0	23.1	3264.8	3268.0	3266.1
D-Cell	32.2	36.8	32.23	3264.2	3268.8	3264.2

Notes:
1. B-Cell not presented in this table as it does not impound CCR material.
2. Present depth and elevations based on a pond level survey during the annual inspection on October 18, 2018, by Talen Montana.
3. Depths and elevations presented for E-Cell represent the surface of free water and saturated paste measured by Talen Montana. Consolidated paste deposits were surveyed in November 2018. The approximate maximum elevation of CCR material at that time was measured to be 3,270-ft. The corresponding maximum CCR depth is approximately 32 feet. Consolidated paste deposits do not fluctuate; therefore minimum values are not pertinent.

Table 3-3: Units 3 & 4 Effluent Holding Pond - §257.83(b)(2)(iii)

Surface Impoundment[1]	Depth (ft)			Elevation (ft)		
	Min	Max	Present[2]	Min	Max	Present[2]
C-Cell[3]	24.0	24.0	24.0	3278.0	3278.0	3278.0
B-Cell	8.9	19.8	11.4	3274.9	3285.83	3277.4
J-1-Cell	9.9	20.3	12.0	3245.9	3256.26	3248.0

Notes:
1. G-Cell is not presented in this table as it did not impound water at the time of the annual inspection. F-Cell, H-Cell, and A-Cell/New Clearwell are not presented as they impound water but not CCR material.
2. Present depth and elevations based on a pond level survey during the annual inspection on October 18, 2018, by Talen Montana.
3. Depths and elevations presented for C-Cell represent the surface of free water and saturated CCR material measured by Talen Montana. Consolidated paste deposits and dry stored bottom ash were surveyed in November 2018. The approximate maximum elevation of CCR material at that time was measured to be 3,335.5-ft. The corresponding maximum CCR depth is approximately 74.5 feet. Consolidated paste deposits do not fluctuate and therefore minimum values are not pertinent.

Table 3-4: Plantsite Units 1 & 2 Bottom Ash Pond - §257.83(b)(2)(iii)

Surface Impoundment	Depth (ft)			Elevation (ft)		
	Min	Max	Present	Min	Max	Present[1]
Bottom Ash Pond	16.5	20.2	20.2	3258.0	3261.7	3261.7

Notes:
1. The water surface level in the surface impoundment was approximately 3,261.7-ft (i.e., full) at the time of the inspection.

3.4 Storage Capacity and Volume - §257.83(b)(2)(iv) and (v)

Storage capacity and approximate volume of impounded water and CCR at the time of the October 16-17, 2018, inspection are presented in Tables 3-5, 3-6, and 3-7. Storage capacities and impounded volumes were estimated using design and construction documents, Area-Capacity curves from the History of Construction Report (Geosyntec, 2016a), observations during the annual inspection, a topographic survey performed by JG in November 2018, and surface water measurements provided by Talen Montana.

Table 3-5: Units 1 & 2 Stage II Evaporation Ponds - §257.83(b)(2)(iv) and (v)

Surface Impoundment[1]	Storage Capacity[2] (yd^3)	Impounded Volume[2,3] (yd^3)
Clearwell	230,000	152,000
E-Cell	1,330,000	1,278,000[4]
D-Cell	800,000	685,000

Notes:
1. B-Cell not presented in this table as it does not impound CCR material.
2. Approximate storage capacities and impounded volume utilize the area-capacity curves (Geosyntec, 2016a). A maximum operational pool elevation of 3,267-ft was used for the 1&2 STEP surface impoundments.
3. Capacities and impounded volumes are estimated to the nearest 1,000 yd^3.
4. Value for E-Cell represents impounded volume of free water and saturated paste based on water surface elevation measured by Talen Montana using the available area-capacity curve. The survey by JG in November 2018 determined approximately *108,000* yd^3 of consolidated paste extends above the water surface elevation around the perimeter of the cell.

Table 3-6: Units 3 & 4 Effluent Holding Pond - §257.83(b)(2)(iv) and (v)

Surface Impoundment[1]	Operational Storage Pool Elevation (ft ASML)	Storage Capacity[2] (yd^3)	Impounded Volume[2,3] (yd^3)
C-Cell	3,285	1,315,000	704,000[4]
B-Cell	3,287	996,000	803,000
G-Cell	3,283	1,807,000	0[5]
J-1 Cell	3,285	2,089,000	139,000

Notes:
1. F-Cell, H-Cell, and A-Cell/New Clearwell are not presented as they do not impound CCR material.
2. Approximate storage capacities and impounded volume utilize the area-capacity curves (Geosyntec, 2016a). Storage capacities are estimated using the operational storage pool elevation indicated in the table.
3. Capacities and impounded volumes are estimated to the nearest 1,000 yd^3.
4. Value for C-Cell represents impounded volume of free water and saturated paste based on water surface elevation measured by Talen Montana and using the available area-capacity curve. The survey by JG in November 2018 determined a total of approximately 2.8 million yd^3 of CCR material was stored in C-Cell at the time of the survey, the large majority of which is dry and represents a very low risk of mobilization in the unlikely event of a structural failure at the facility.
5. Unit not impounding water at the time of the October 2018 inspection. The November 2018 UAV survey by Jorgensen indicates approximately 44,000 yd^3 of dry CCR material was deposited into G-Cell to prepare for a future liner.

Table 3-7: Plantsite Units 1 & 2 Bottom Ash Pond - §257.83(b)(2)(iv) and (v)

Surface Impoundment	Storage Capacity[(1)] (yd^3)	Impounded Volume[(1,2)] (yd^3)
Bottom Ash Pond	71,000	71,000

Notes:
1. Approximate storage capacity and impounded volume utilize the area-capacity curve (Geosyntec, 2016a) for the surface impoundment using a maximum storage pool elevation of 3,261.7-ft in the Bottom Ash Pond.
2. Capacity and impounded volume is estimated to the nearest 1,000 yd^3.

3.5 Appearance of Structural Weakness - §257.83(b)(2)(vi)

No signs of actual or potential structural weakness including, but not limited to, cracks, subsidence, seepage, excessive moisture, and ponding were observed along the embankments' face or crest areas. At the time of inspection, JG did not observe any conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR units and appurtenant structures inspected.

3.6 Other Changes - §257.83(b)(2)(vii)

Based on our field observations, no other changes which may have affected the stability or operation of the impounding structures have occurred since the previous annual investigation report.

4.0 LIMITATIONS

These services have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar conditions. The contents of this report are based solely on the observations of the conditions made by Jorgensen Geotechnical personnel and information provided to Jorgensen Geotechnical by Talen Montana.

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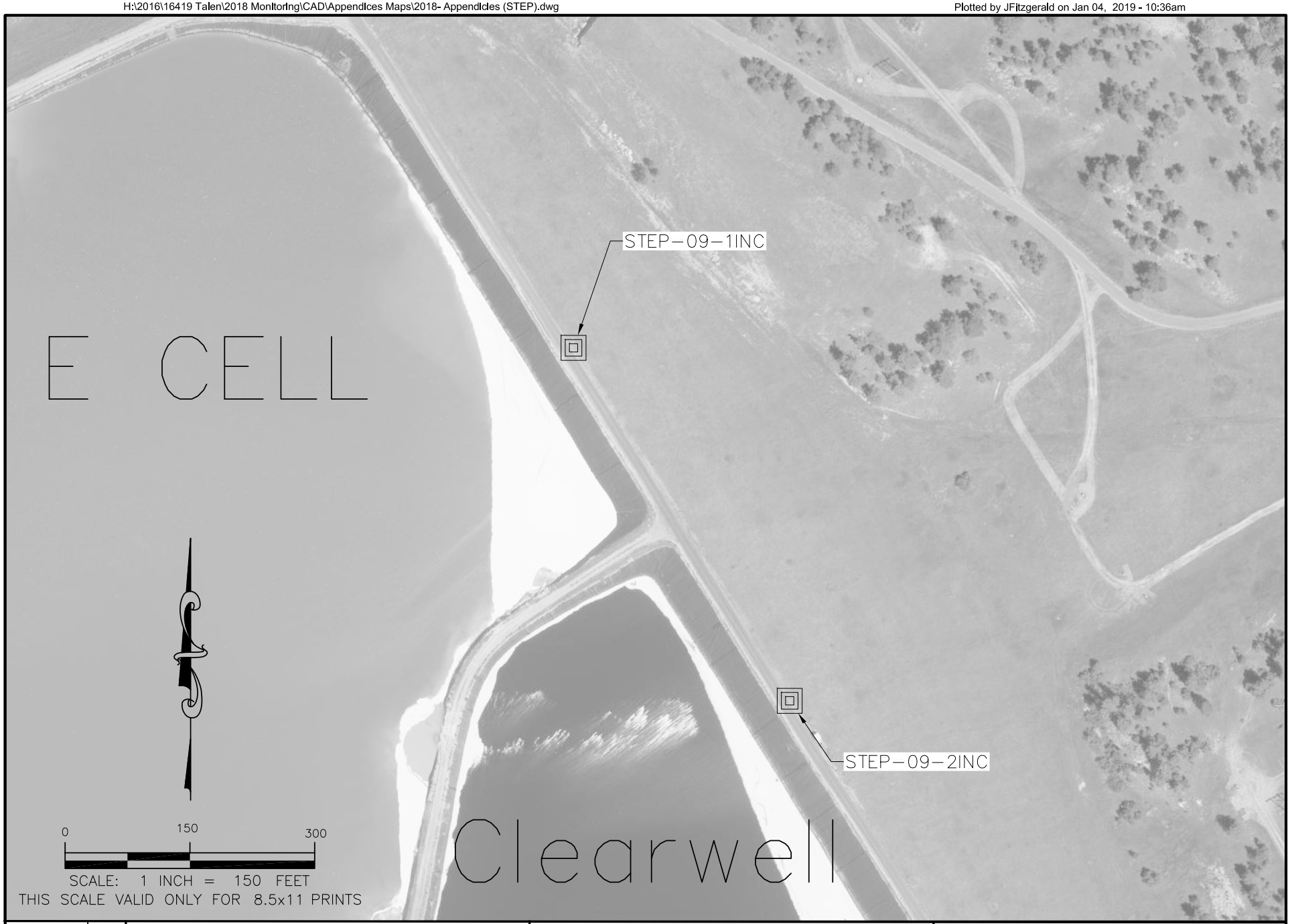
APPENDIX A

Units 1 & 2 STEP Main Dam
Inclinometer Plots

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendices (STEP).dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:36am



DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 1 & 2 STEP
Main Dam
Inclinometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

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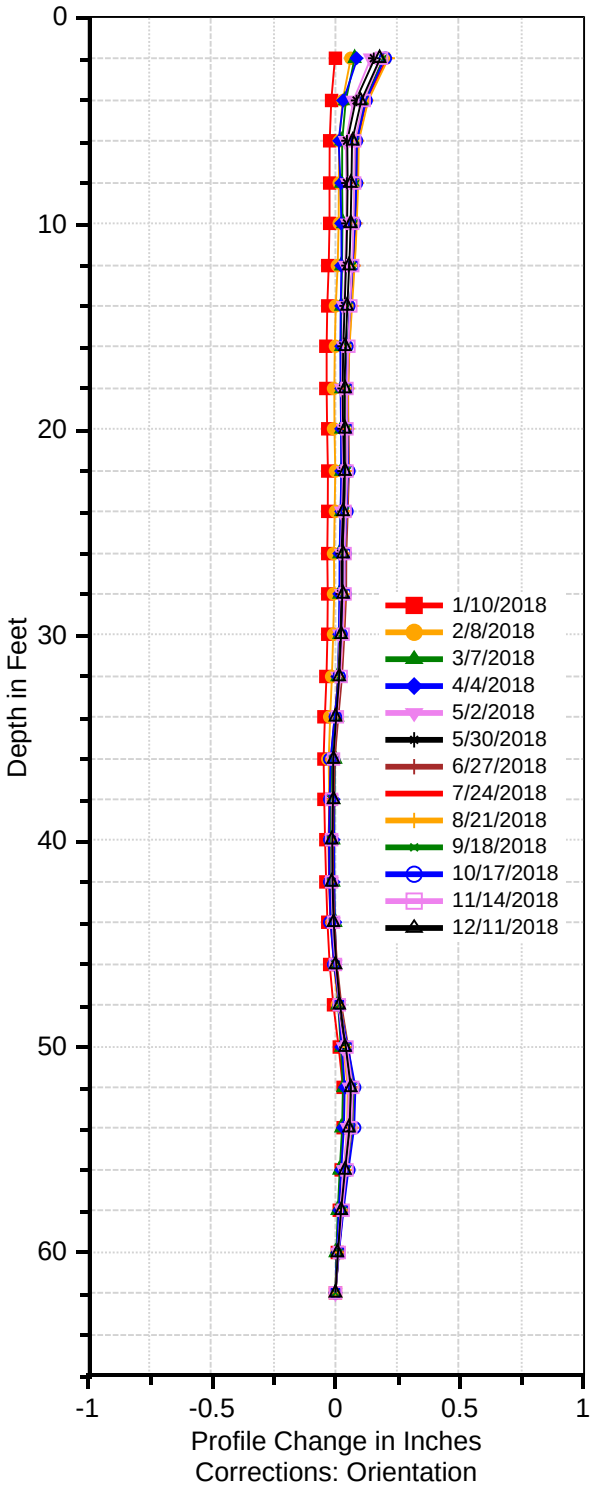
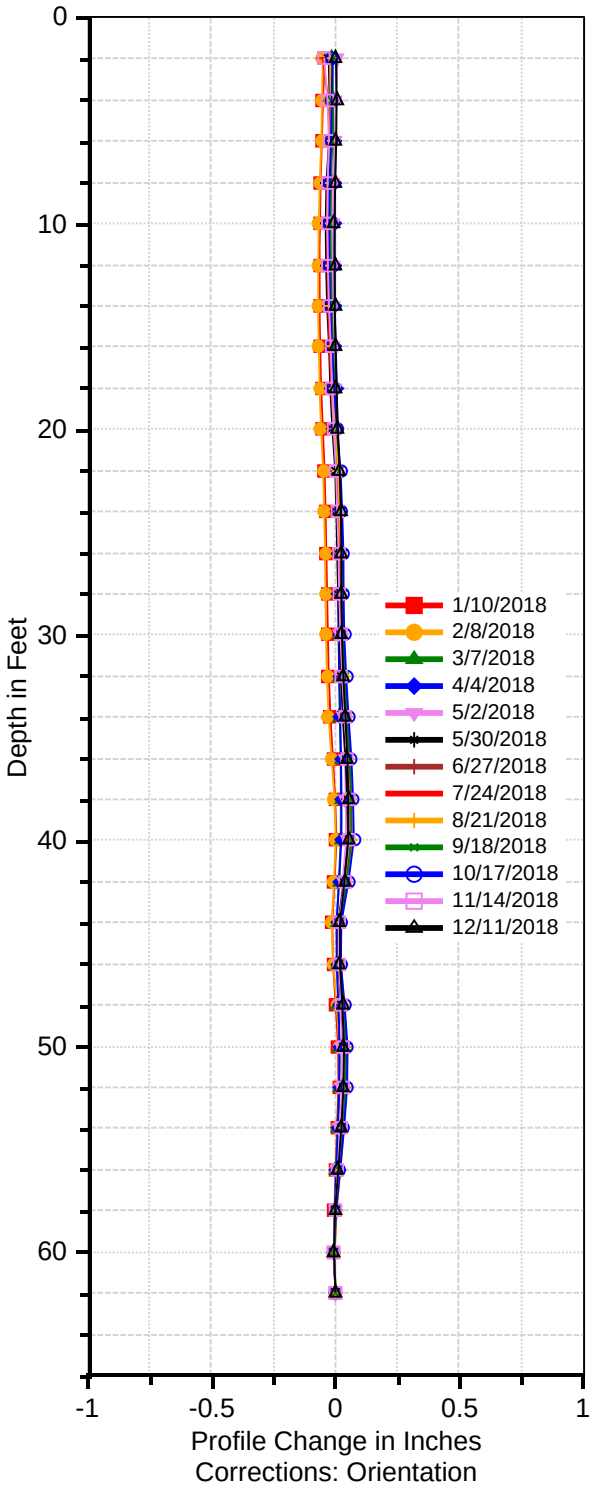
STEP 09-1INC A
Initial: 12/13/2017



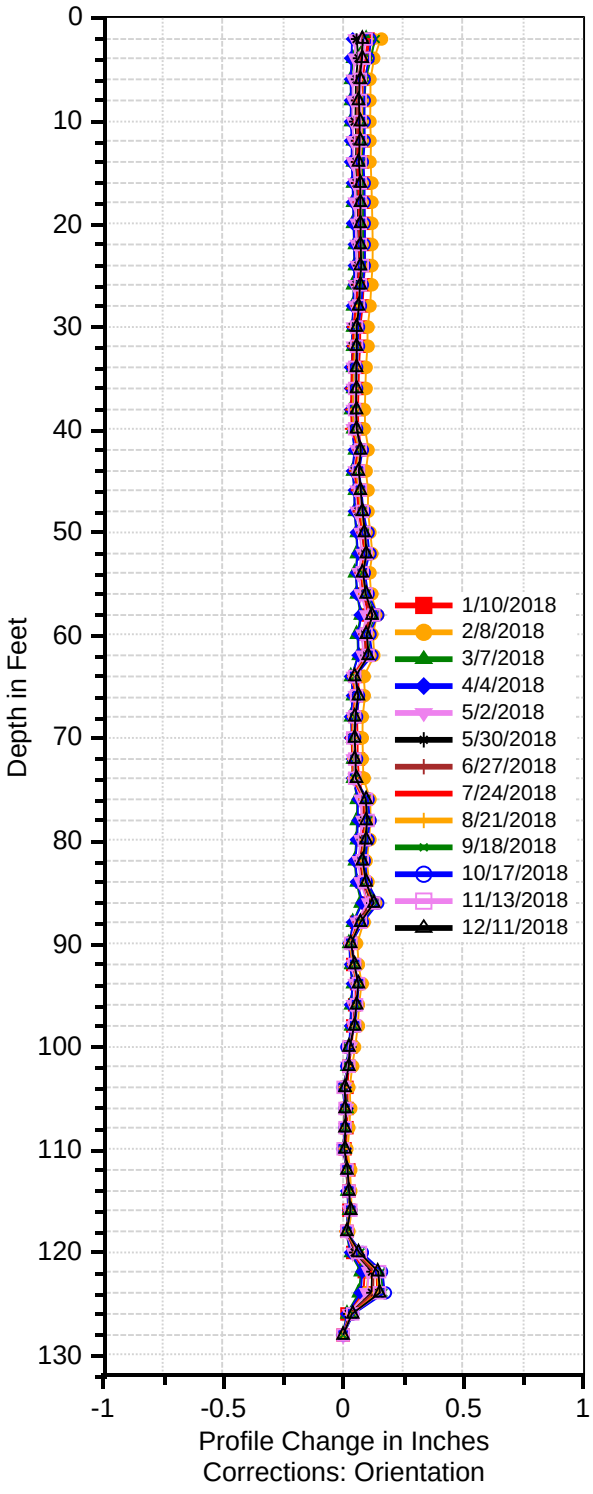
STEP 09-1INC B
Initial: 12/13/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: STEP-09-1INC

STEP 09-2INC A
Initial: 12/13/2017



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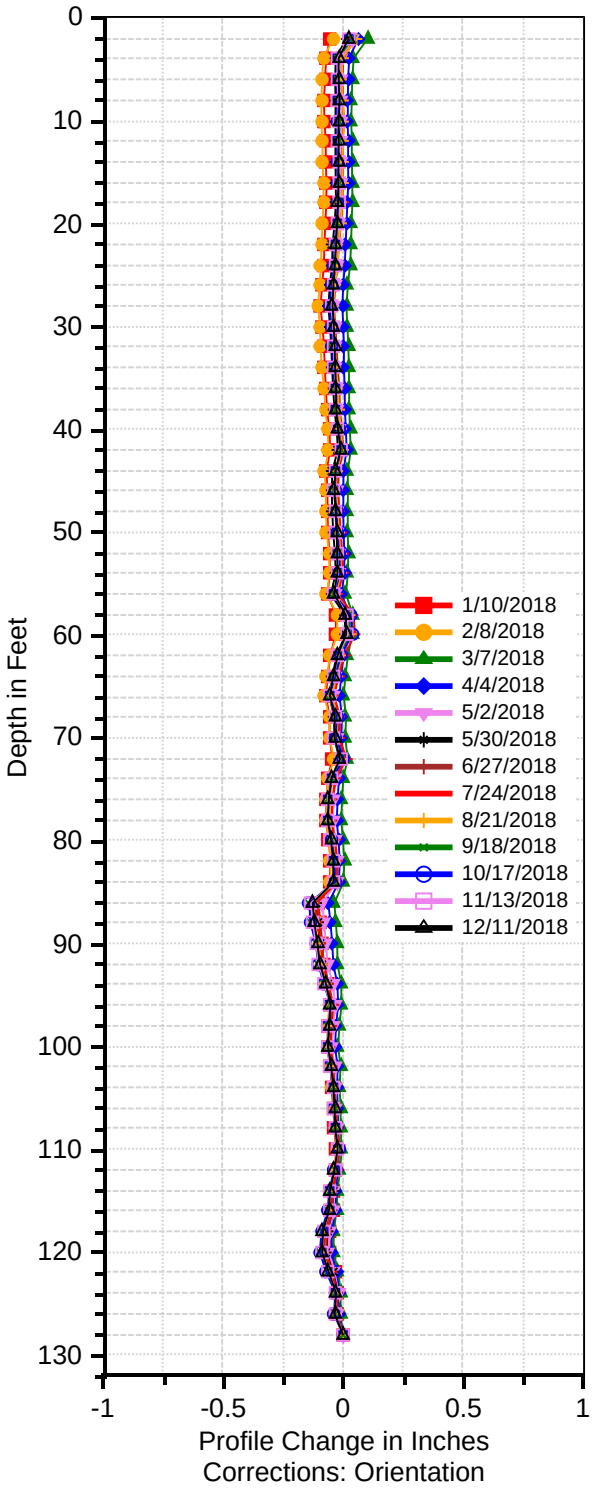
Initial: 12/13/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

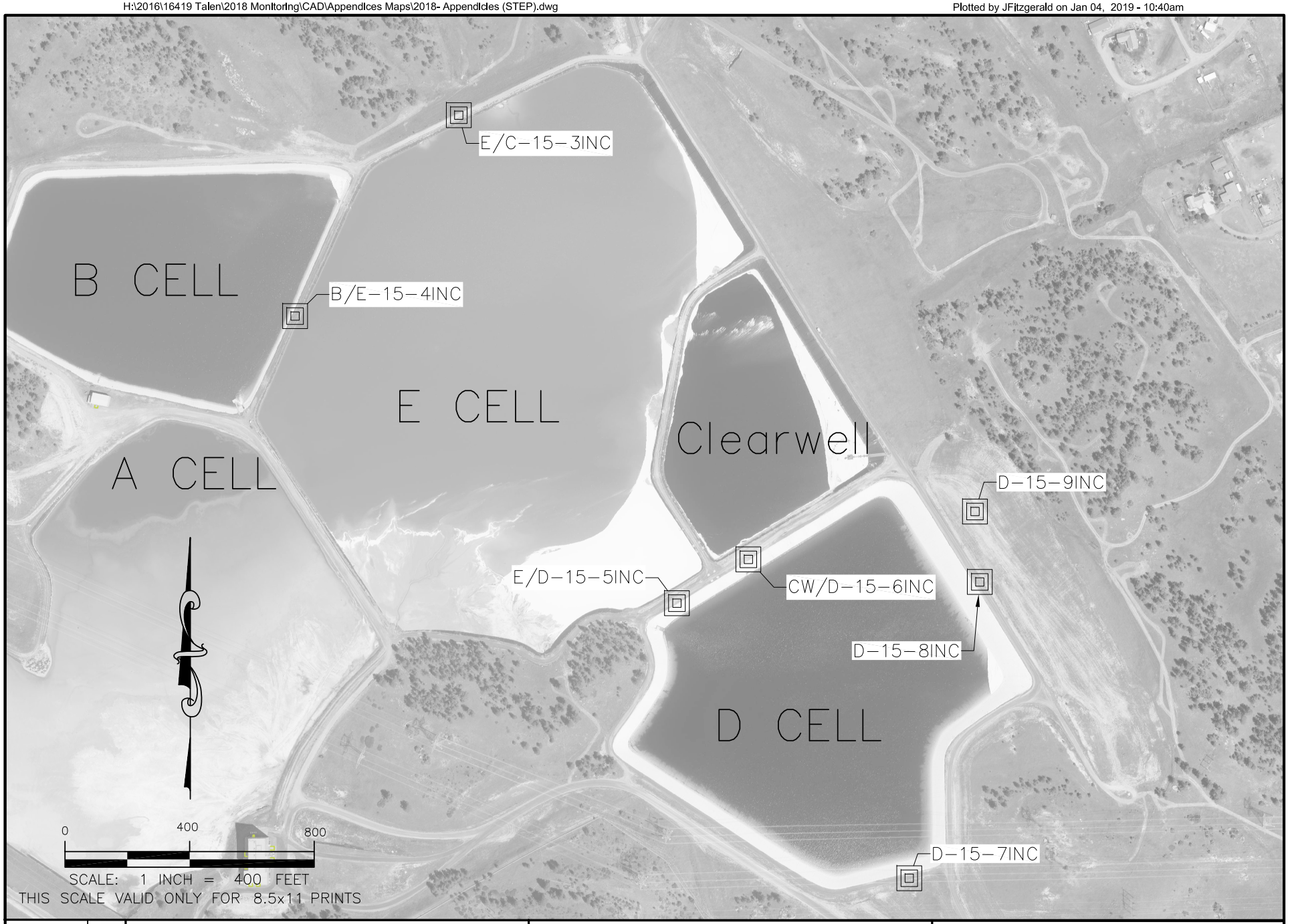
Location: Units 1&2 STEP
Instrument: STEP-09-2INC

APPENDIX B

Additional Units 1 & 2 STEP Area
Inclinometer Plots

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendices (STEP).dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:40am



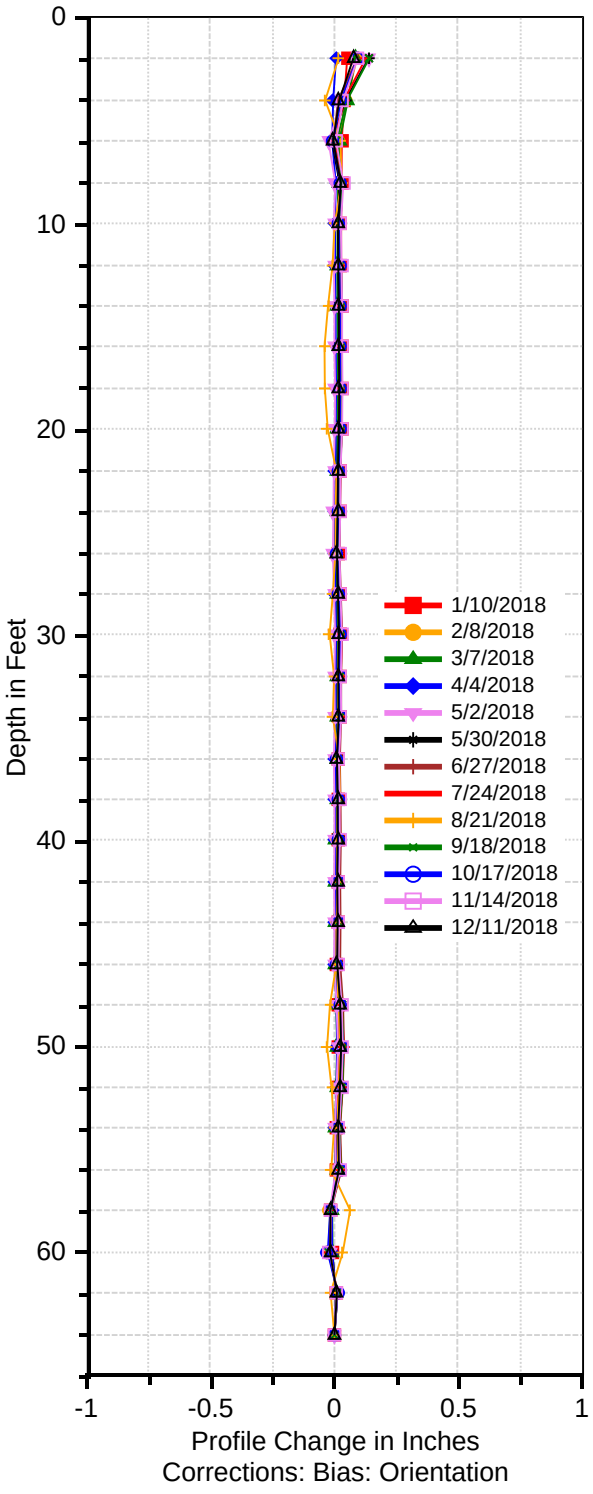
DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 1 & 2 STEP Area
Additional Inclinometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com

STEP EC-15-3INC A
Initial: 12/13/2017



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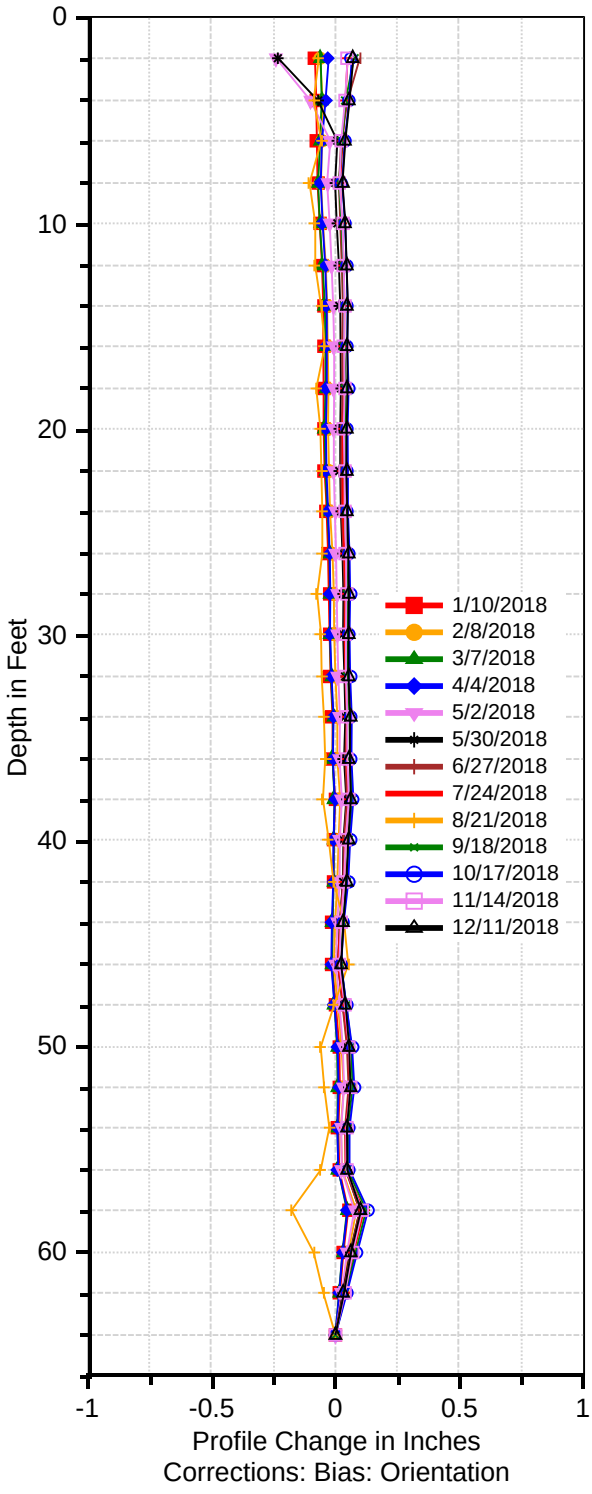

Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: E/C-15-3INC

STEP BE-15-4INC A
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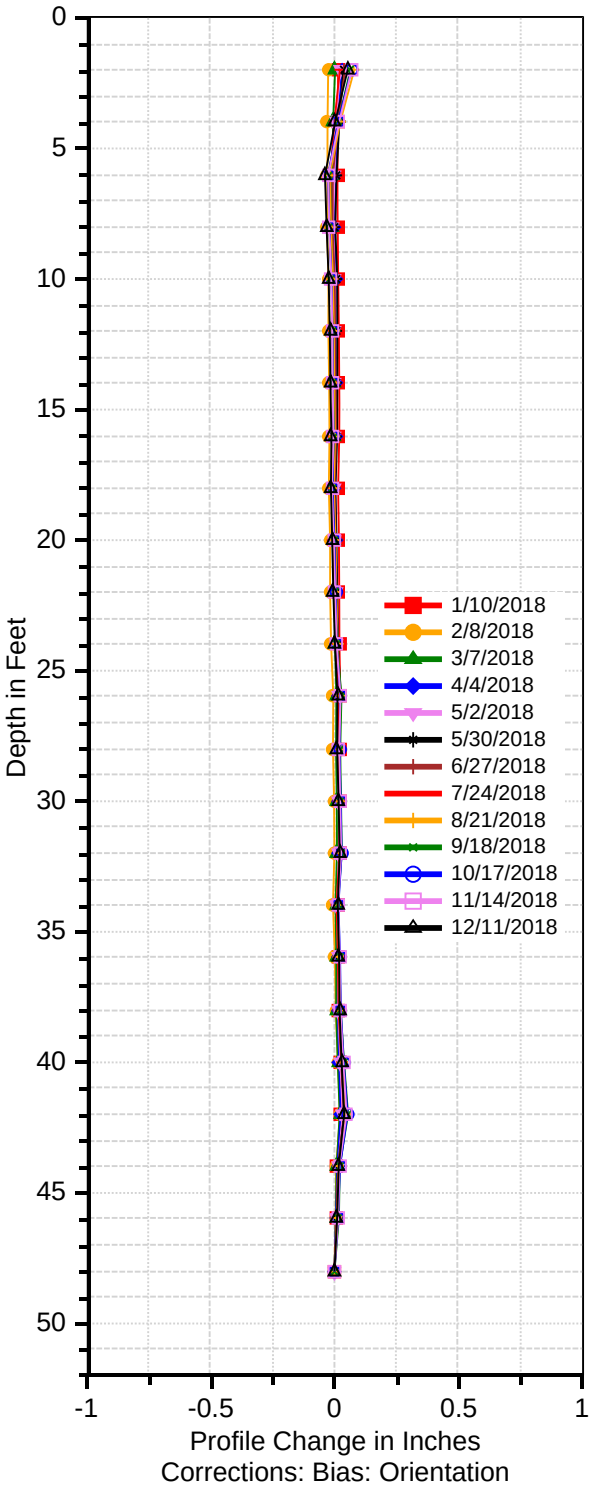

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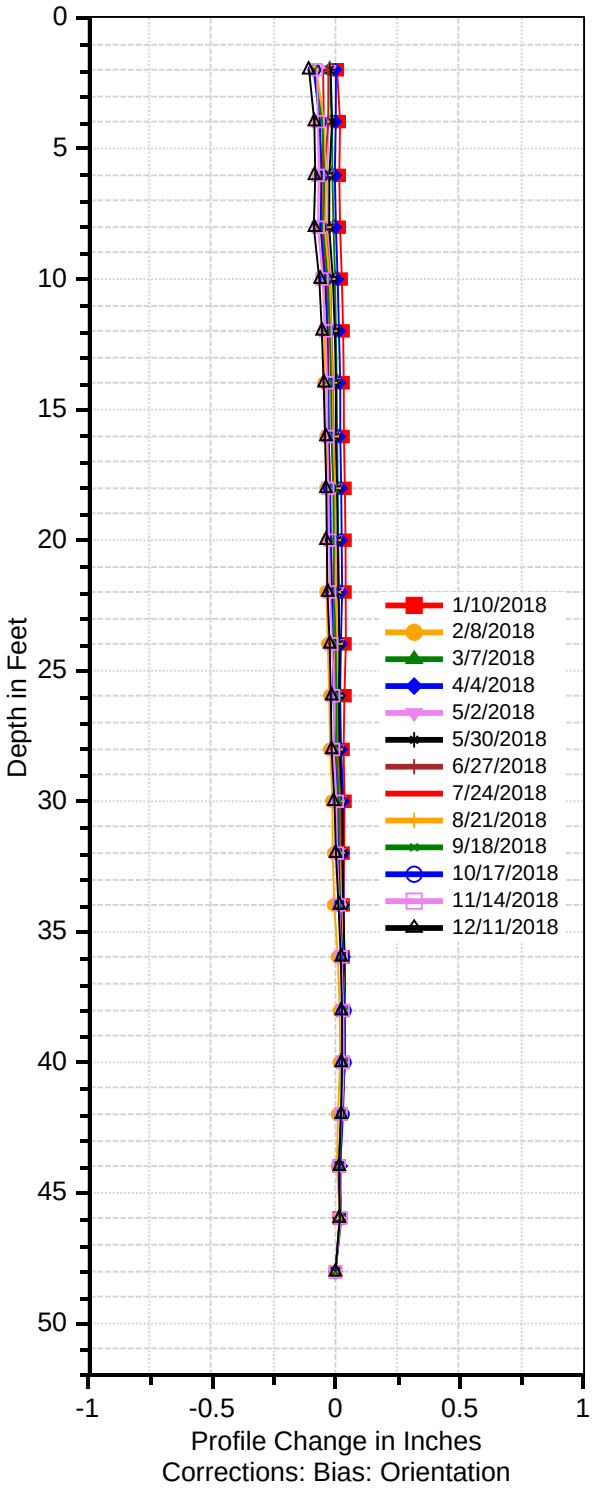
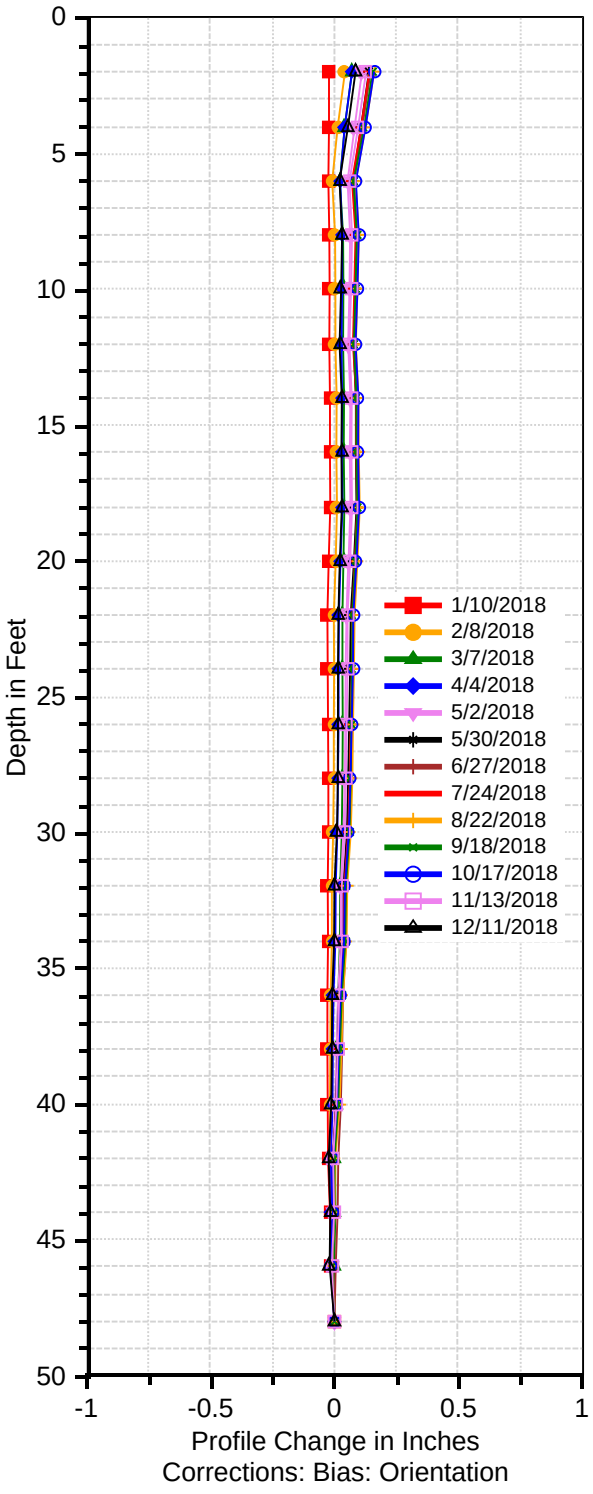


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: B/E-15-4INC

STEP ED-15-5INC A
Initial: 12/13/2017



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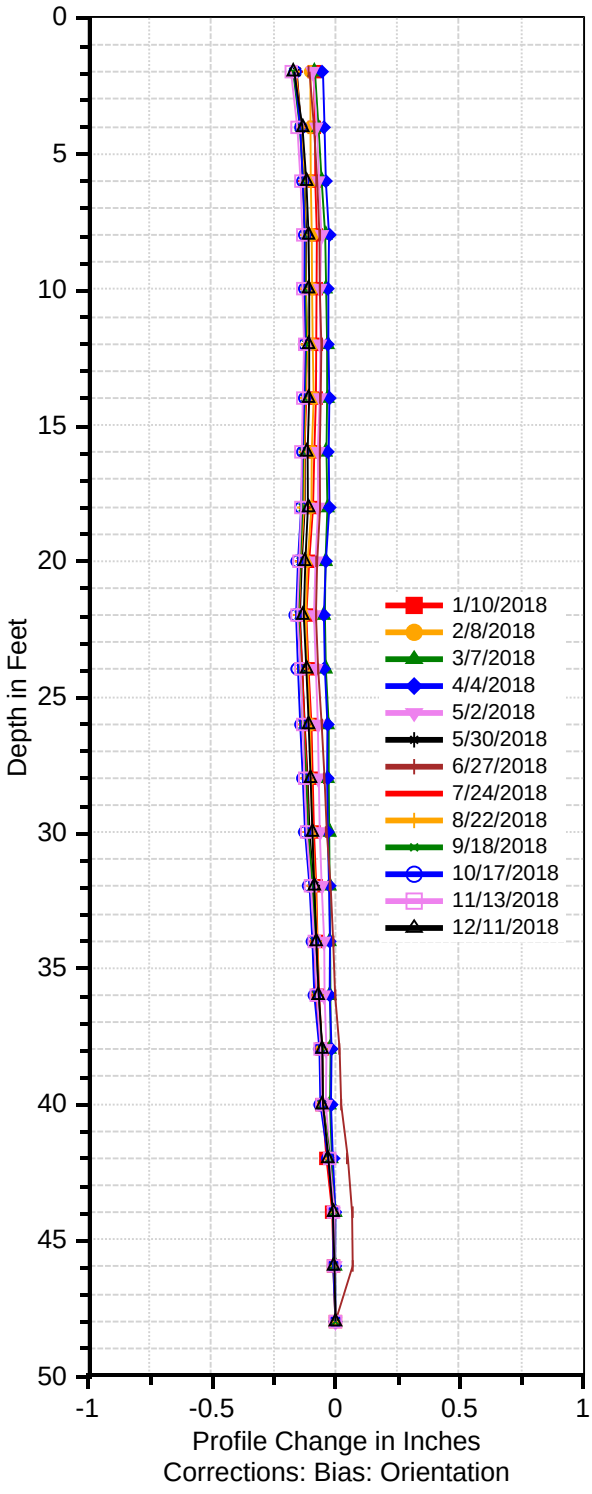
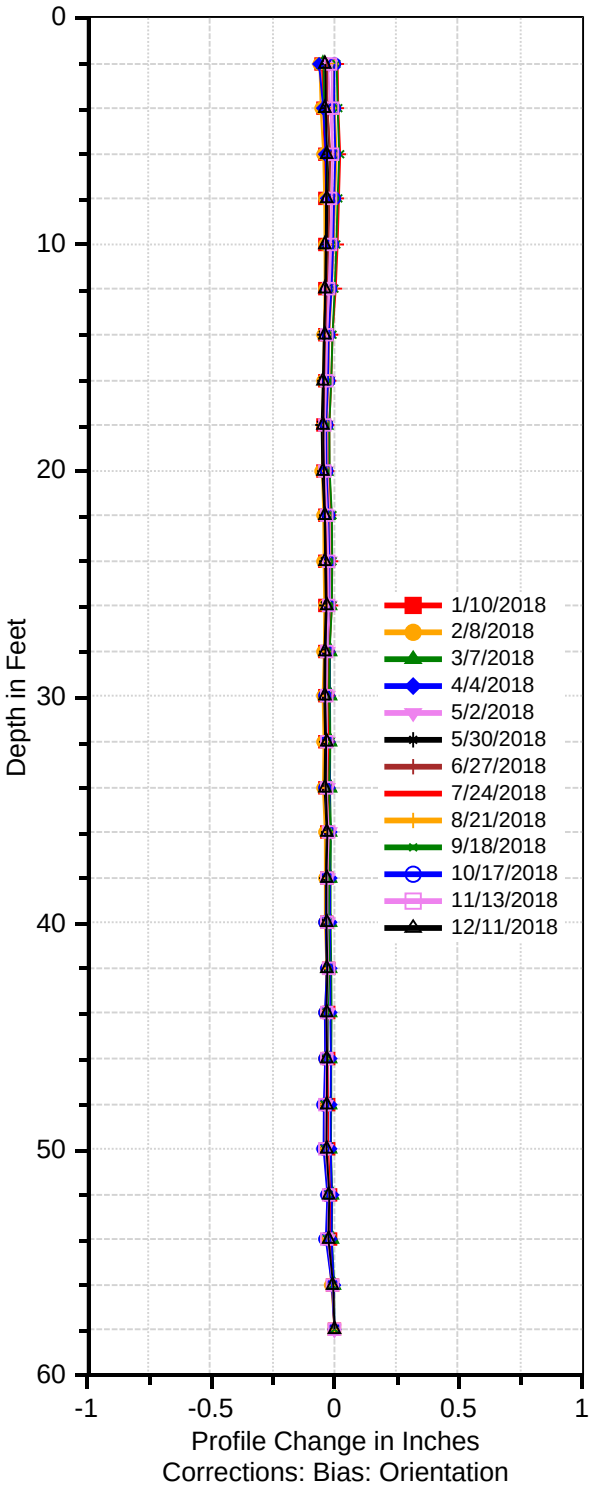


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: E/D-15-5INC

STEP CWD-15-6INC A
Initial: 12/13/2017



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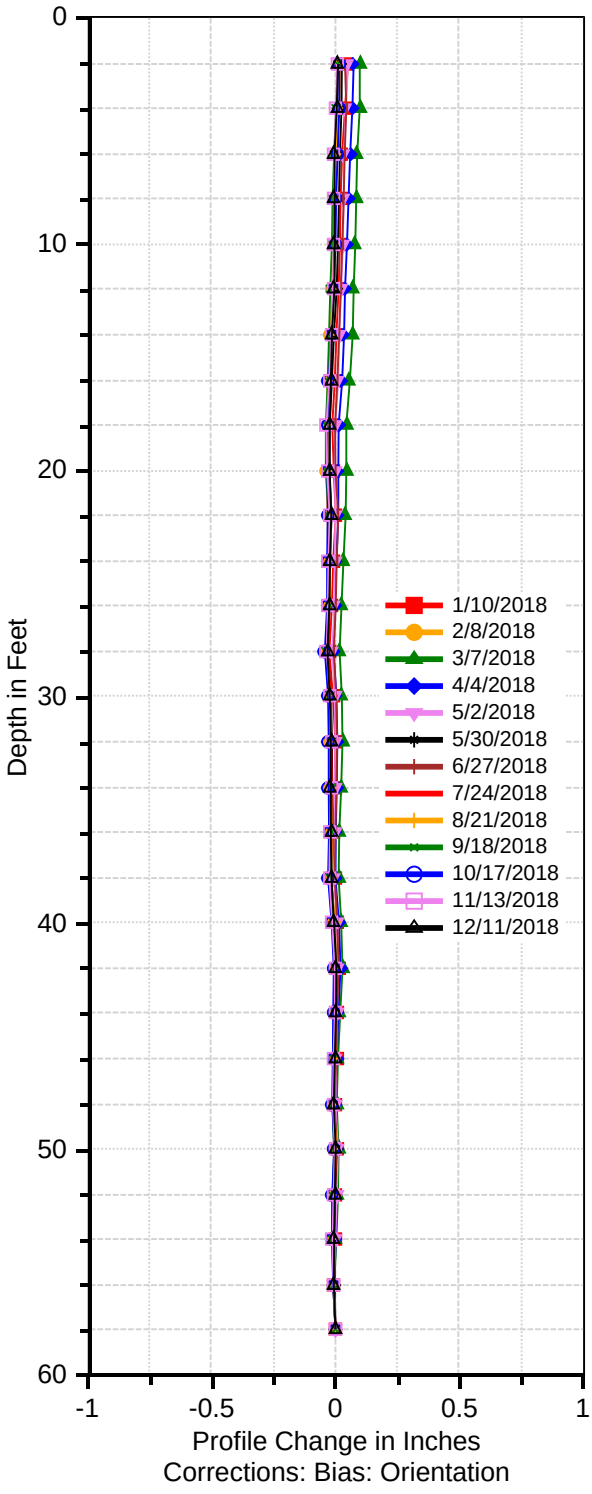
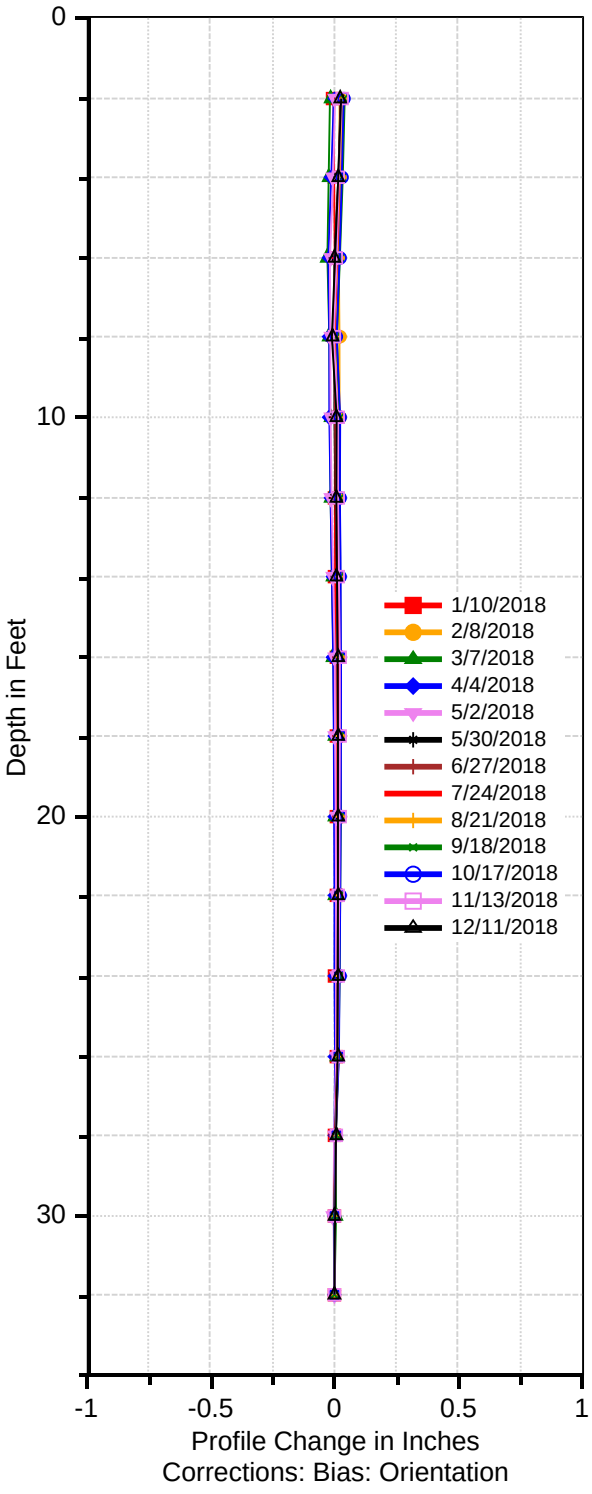
Initial: 12/13/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: CW/D-15-6INC

STEP D-15-7INC A
Initial: 12/13/2017



STEP D-15-7INC B
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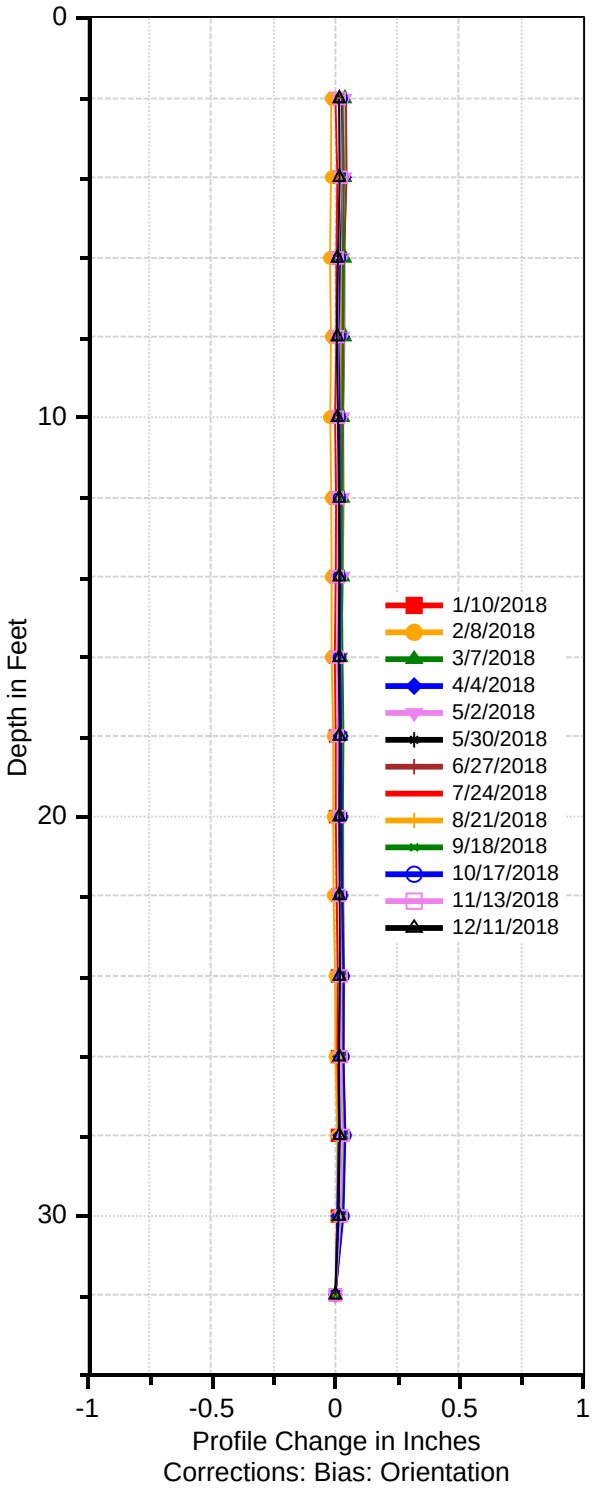
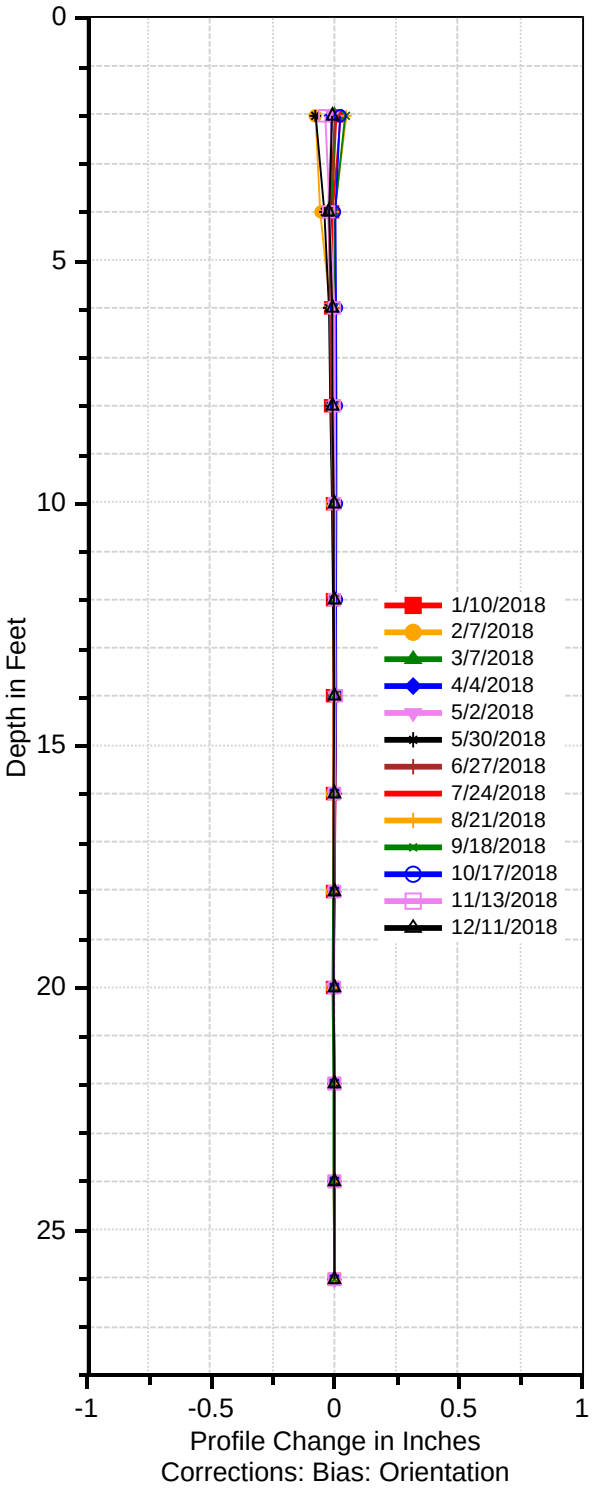


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: D-15-7INC

STEP D-15-8INC A
Initial: 12/13/2017



STEP D-15-8INC B
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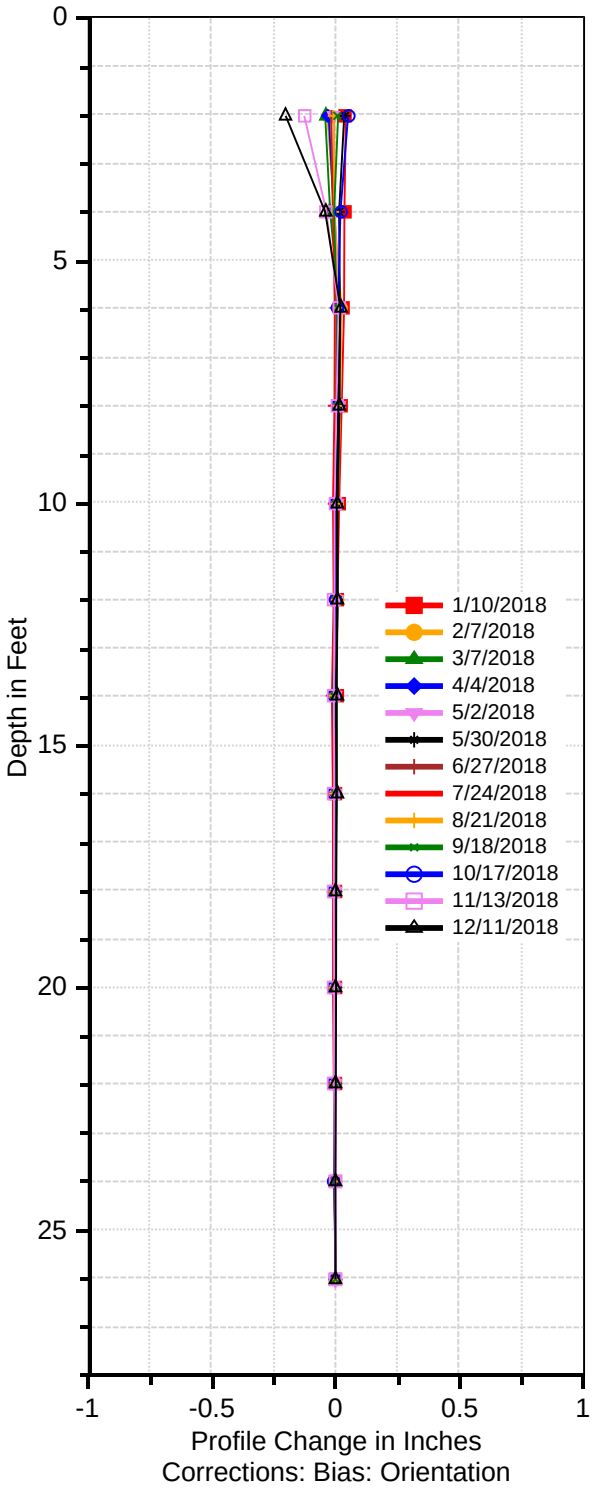
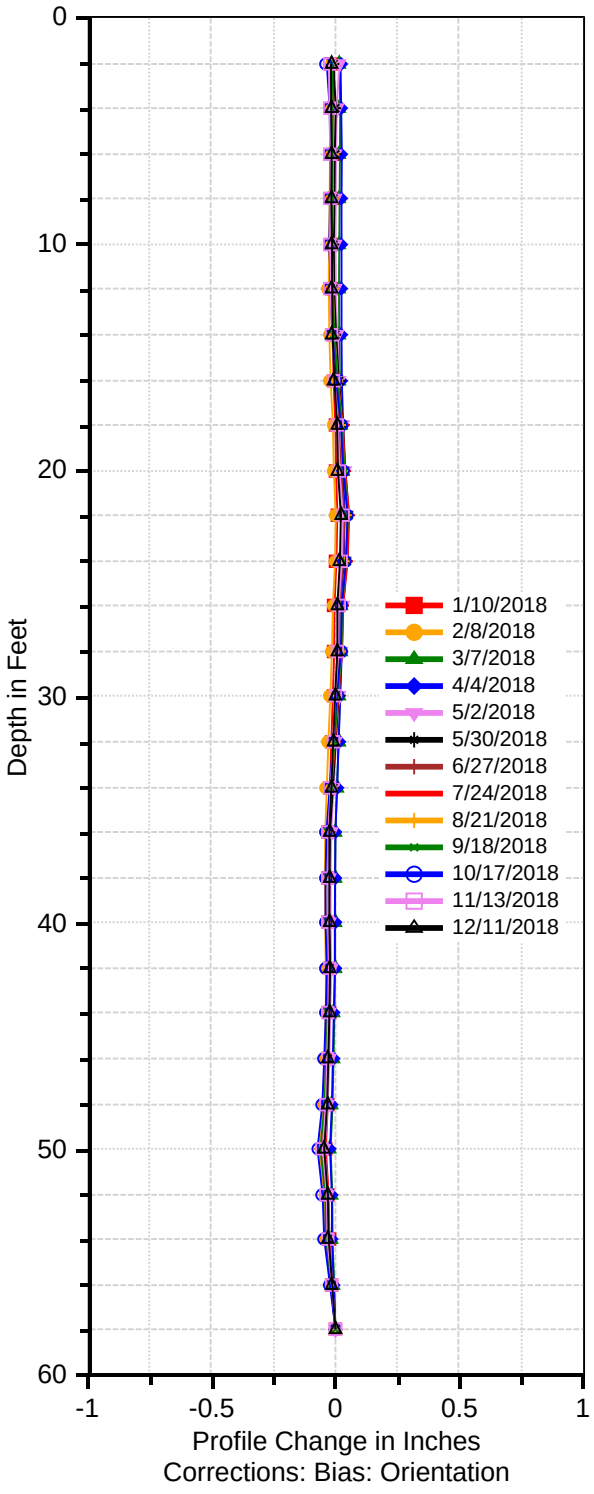


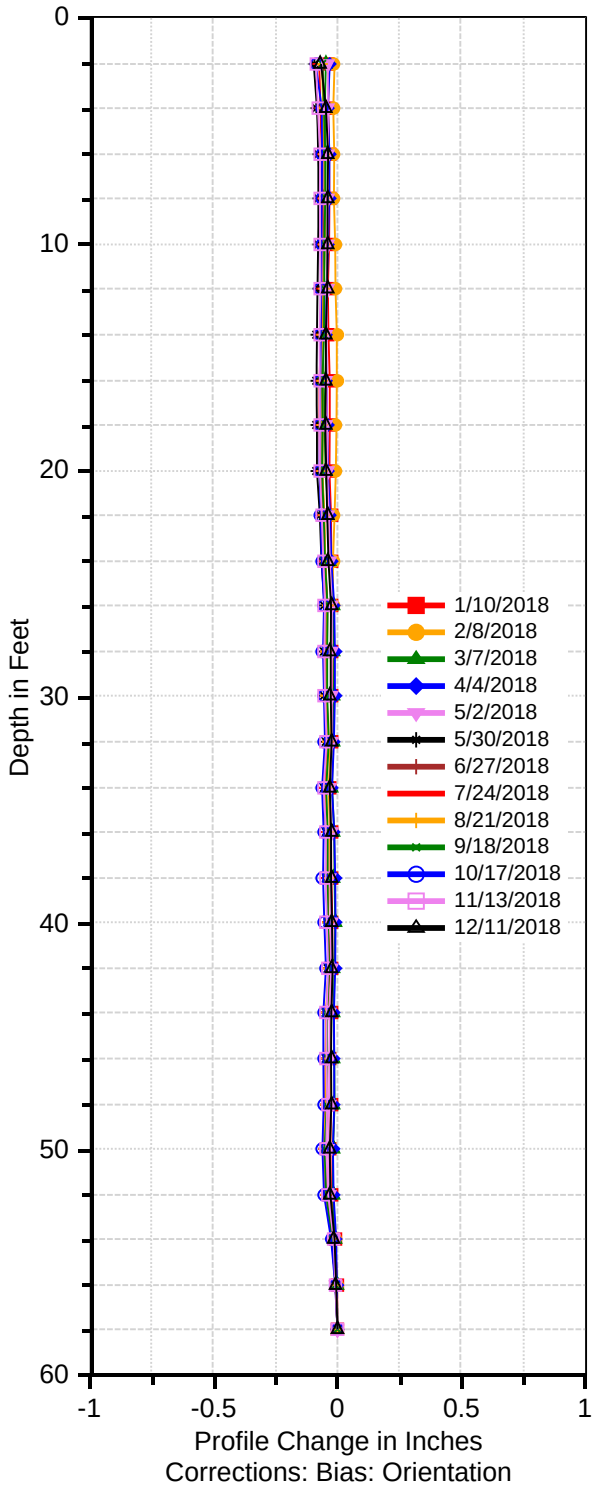
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: D-15-8INC

STEP D-15-9INC A
Initial: 12/13/2017



STEP D-15-9INC B
Initial: 12/13/2017

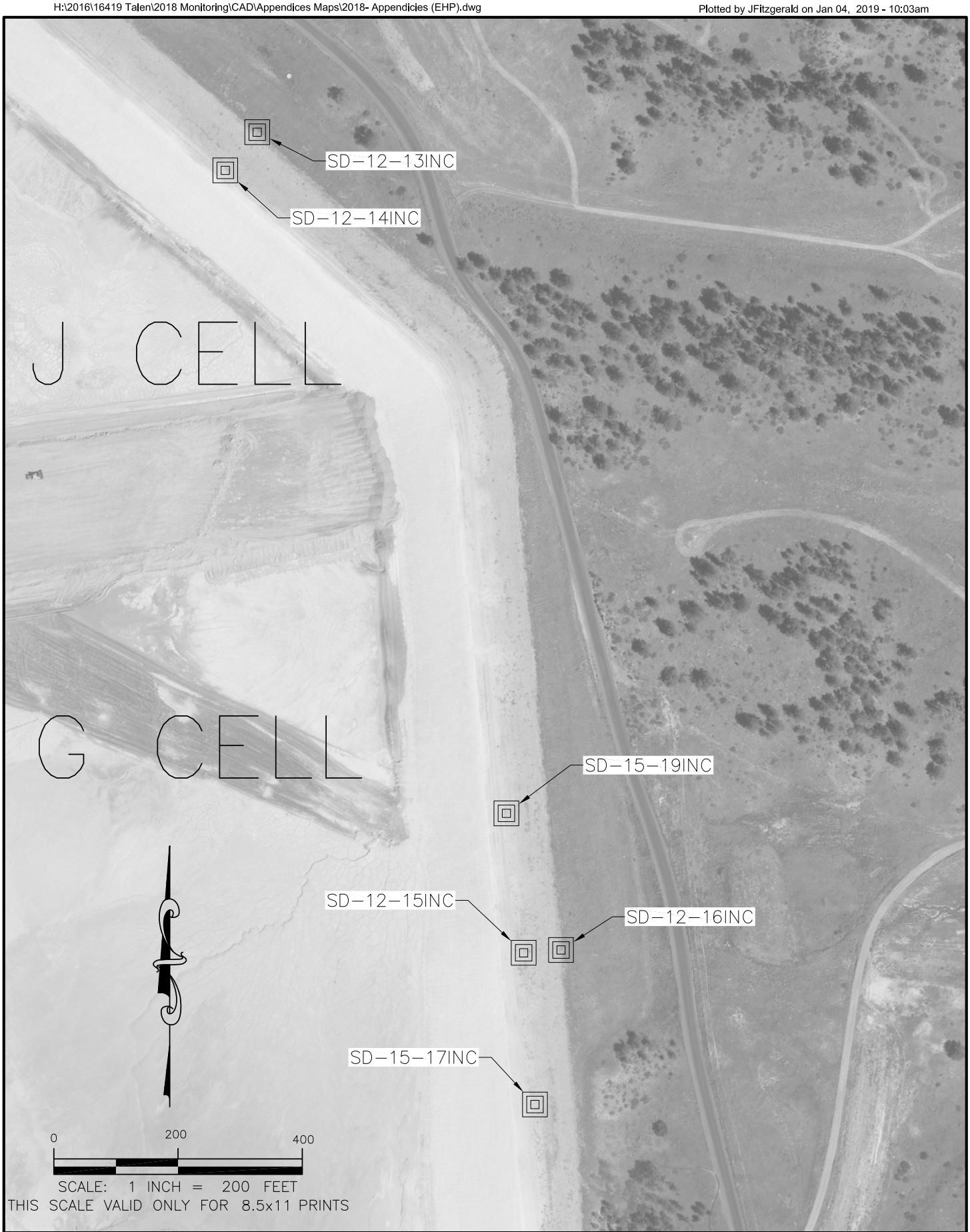


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 1&2 STEP
Instrument: D-15-9INC

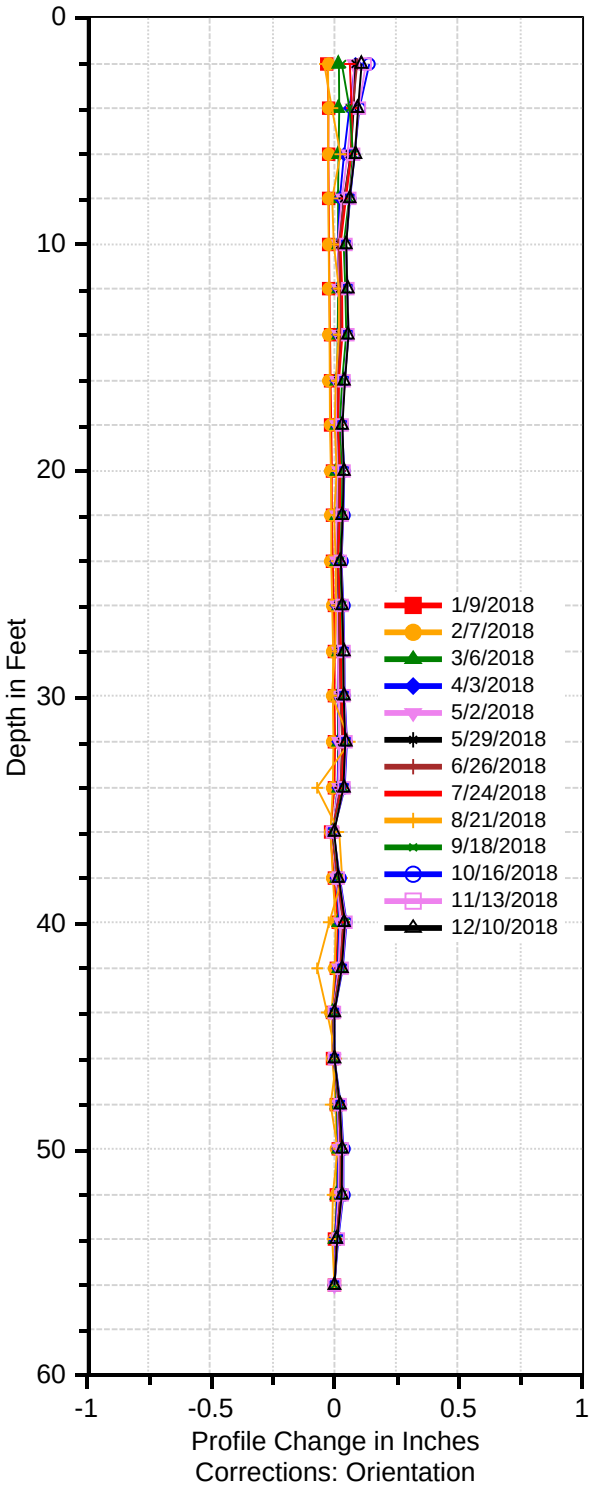
APPENDIX C

Units 3 & 4 EHP Saddle Dam
Inclinometer Plots



DRAFTED BY: JWF REVIEWED BY: CHL PROJECT NUMBER 16419	SHEET TITLE: Units 3 & 4 EHP Saddle Dam Inclinometer Location Map	PROJECT TITLE: 2018 Annual Inspection Report Talen Energy Colstrip, Montana	JORGENSEN Geotechnical, LLC 307-733-5150 www.jorgeng.com

SD 12-13INC A
Initial: 12/12/2017



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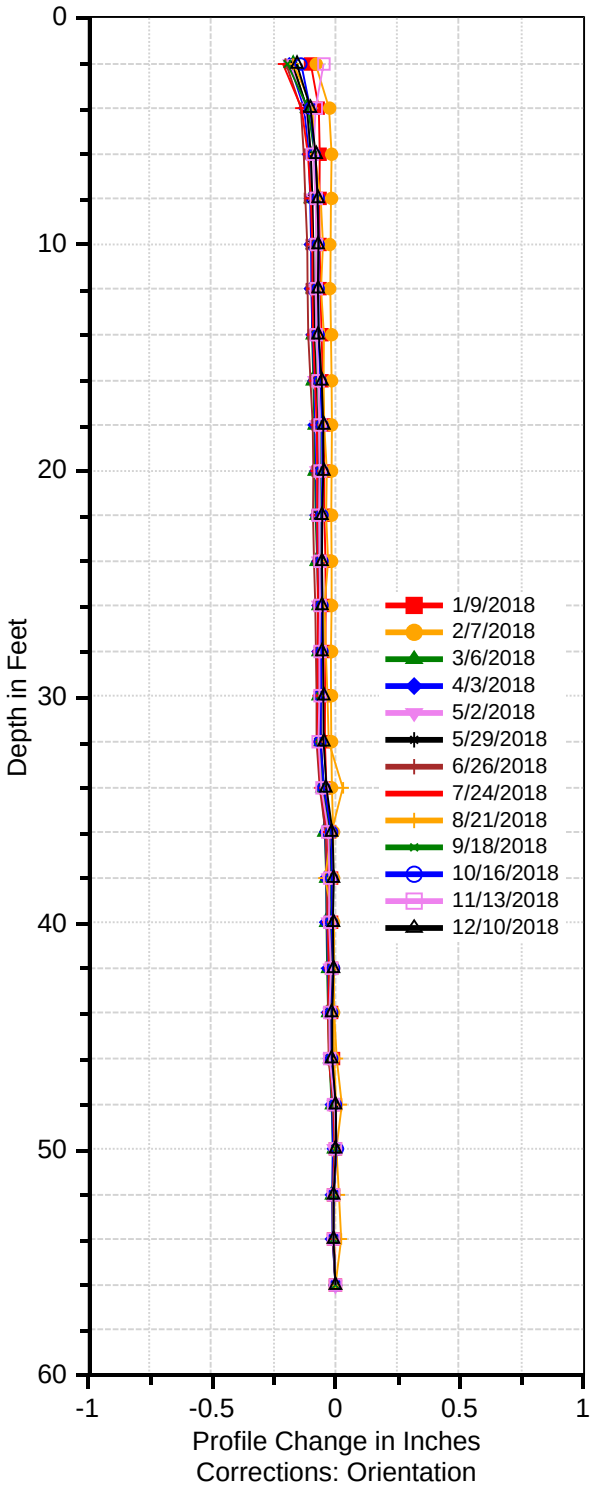
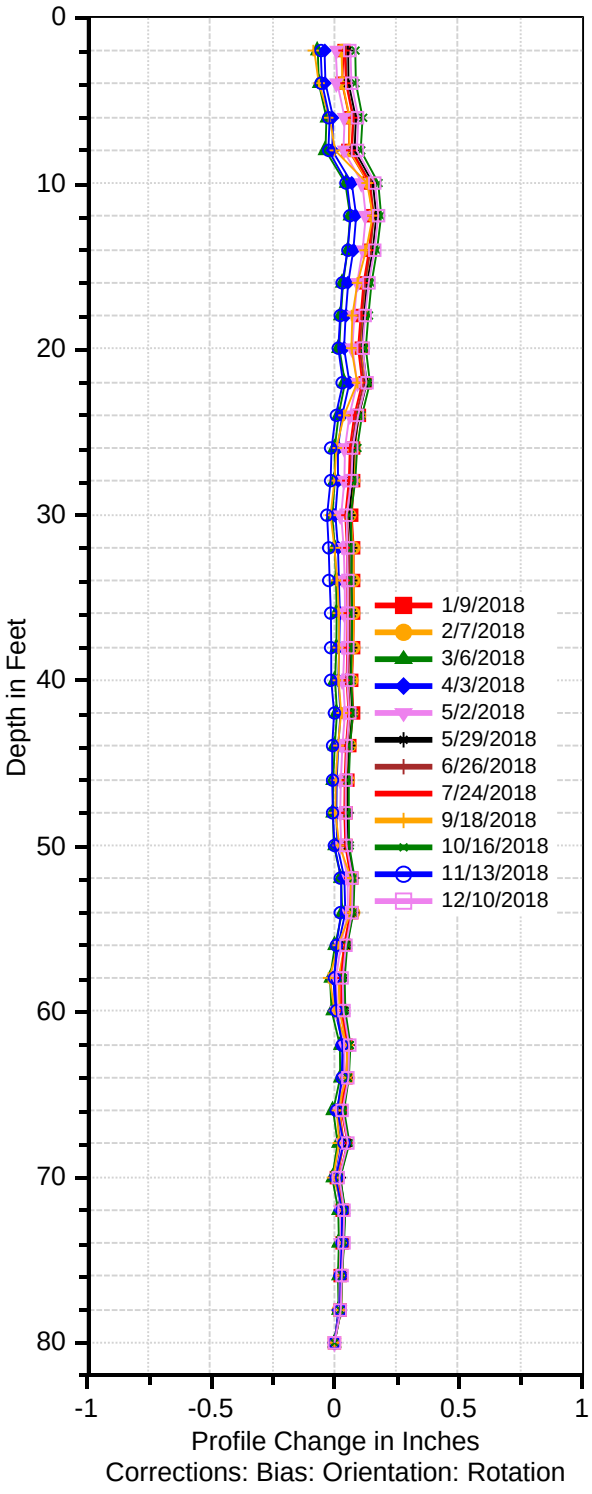


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: SD-12-13INC

SD 12-14INC A
Initial: 12/12/2017



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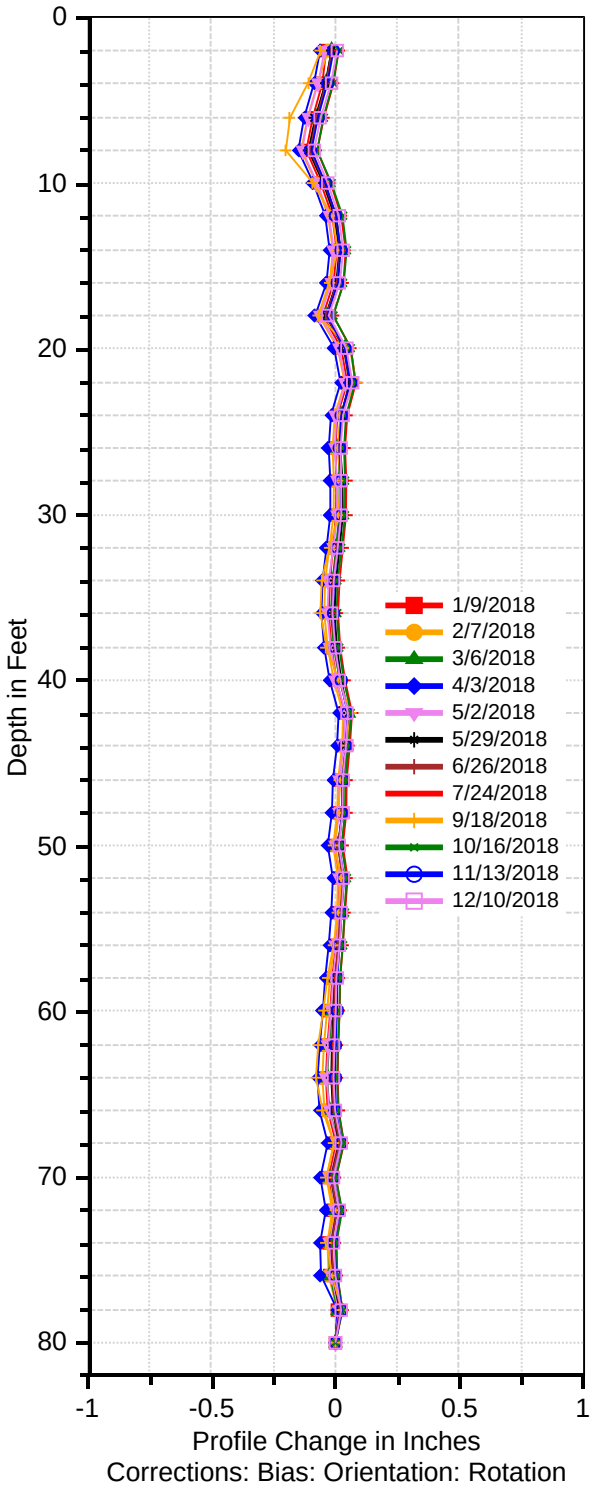
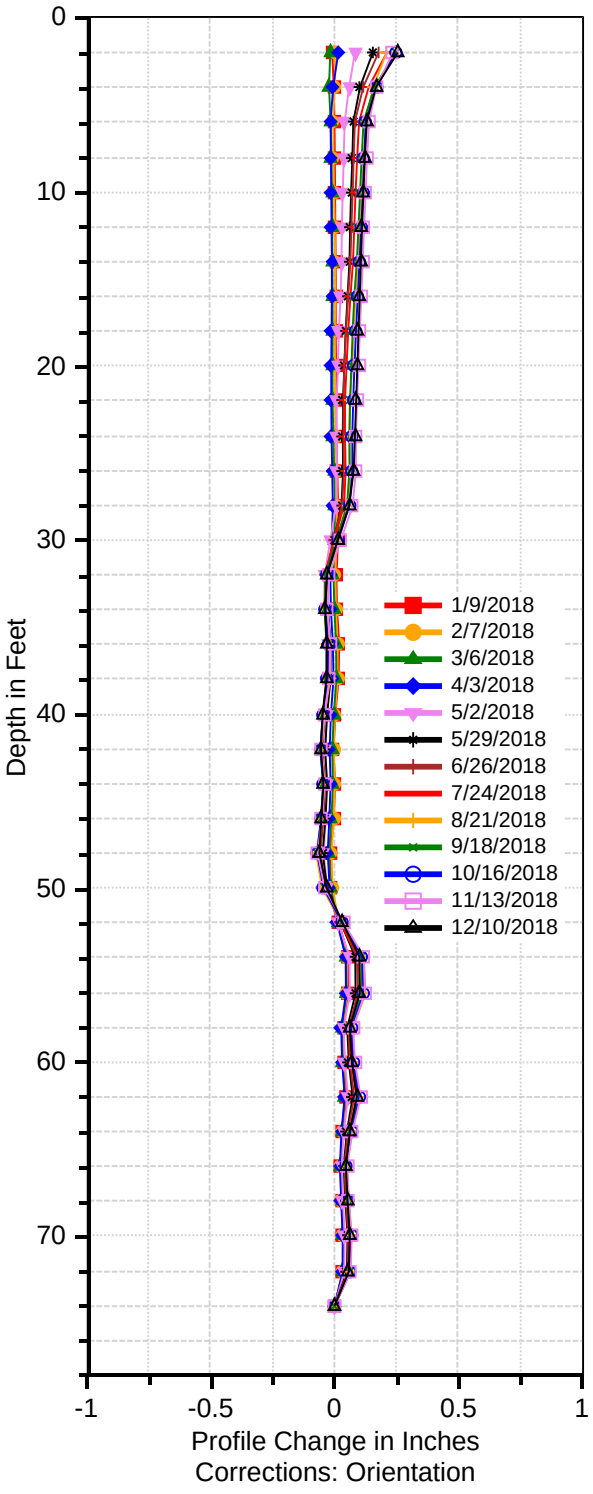
Initial: 12/12/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: SD-12-14INC

SD 12-15INC A
Initial: 12/12/2017



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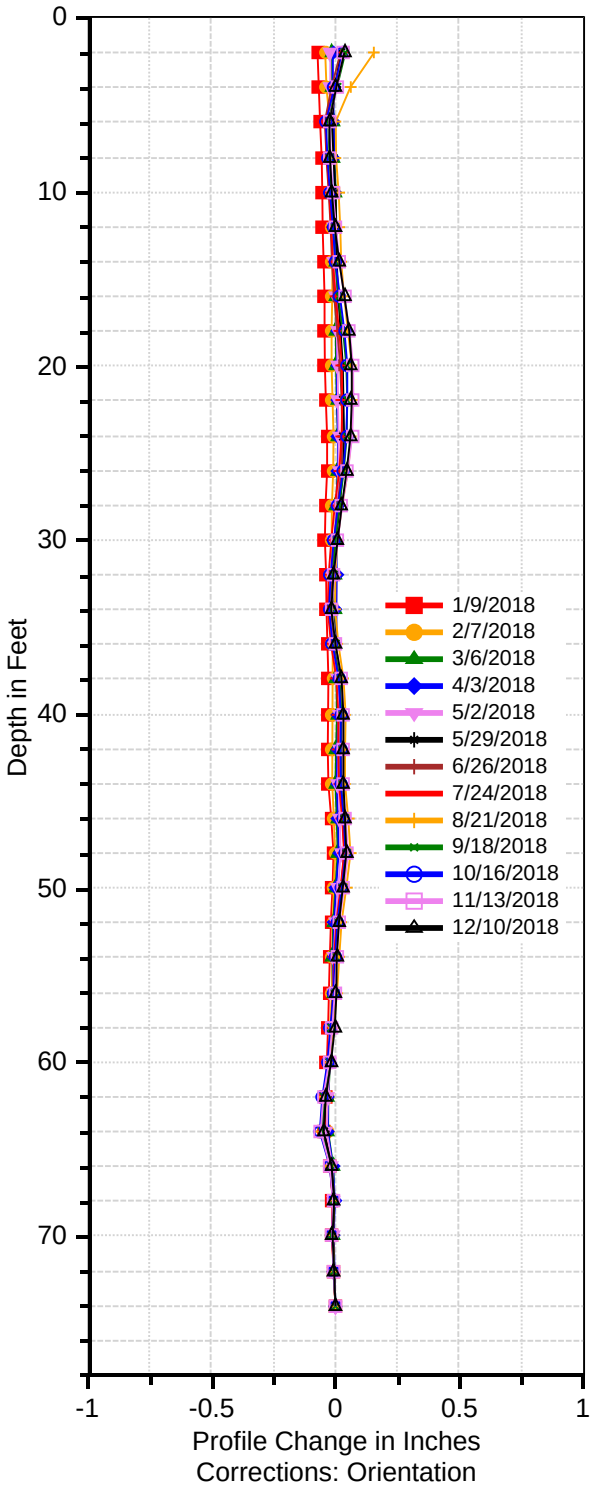
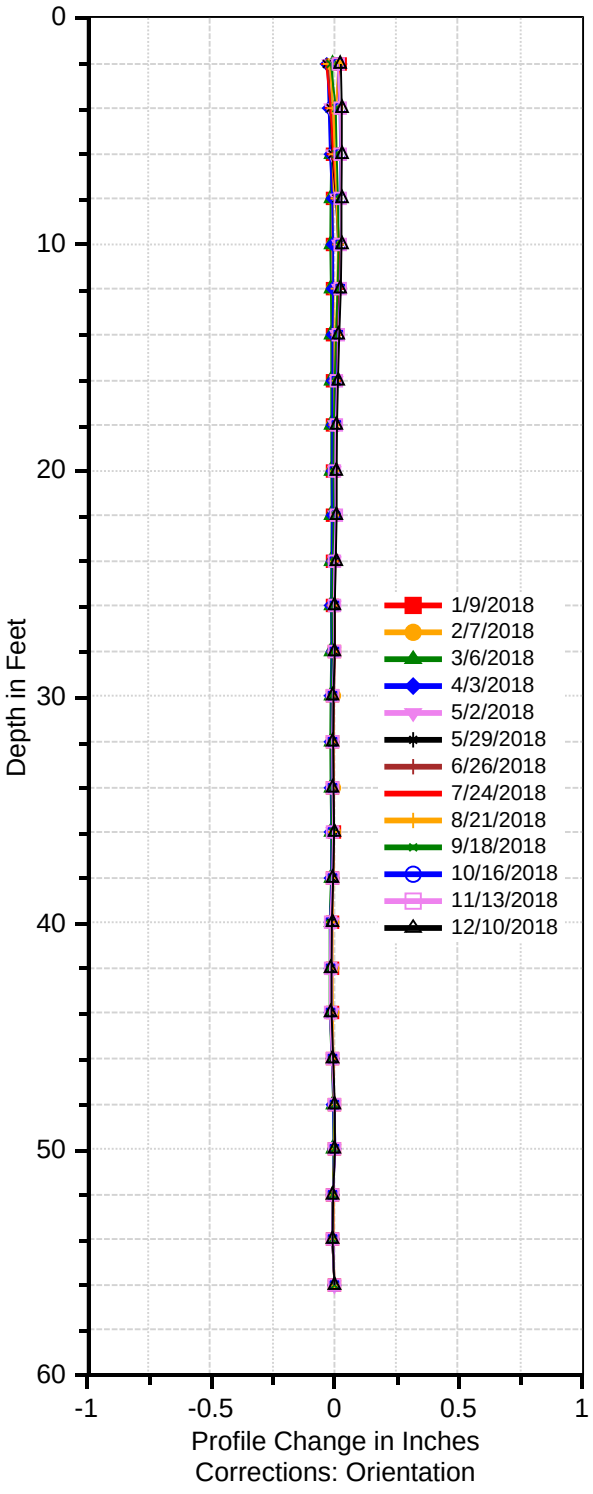


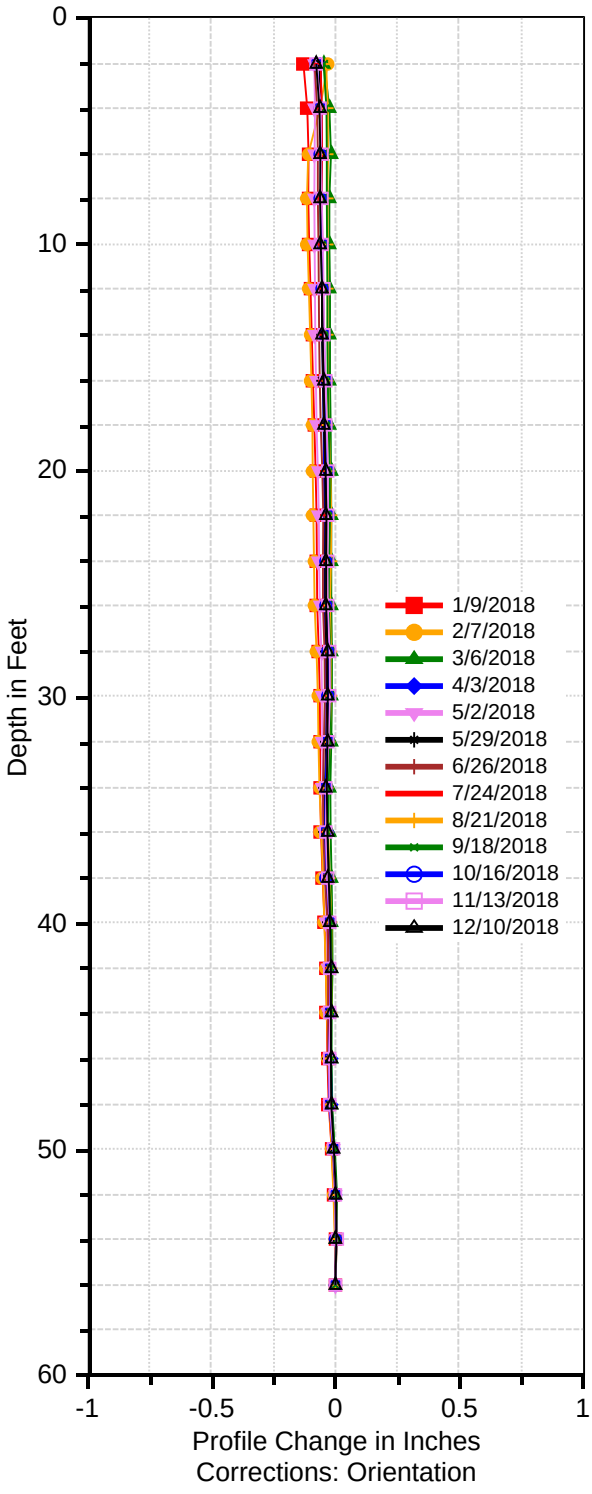
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3 & 4 EHP
Instrument: SD-12-15INC

SD 12-16INC A
Initial: 12/12/2017



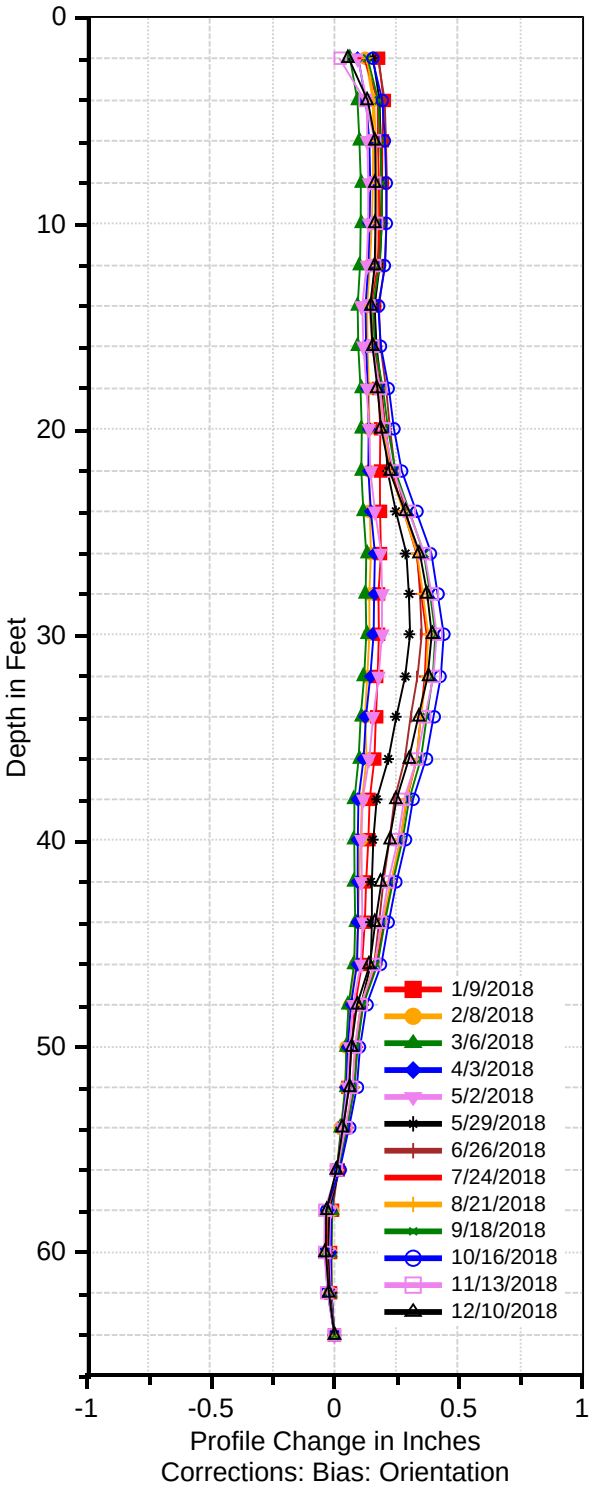
SD 12-16INC B
Initial: 12/12/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3 & 4 EHP
Instrument: SD-12-16INC

SD 15-17INC A
Initial: 12/12/2017



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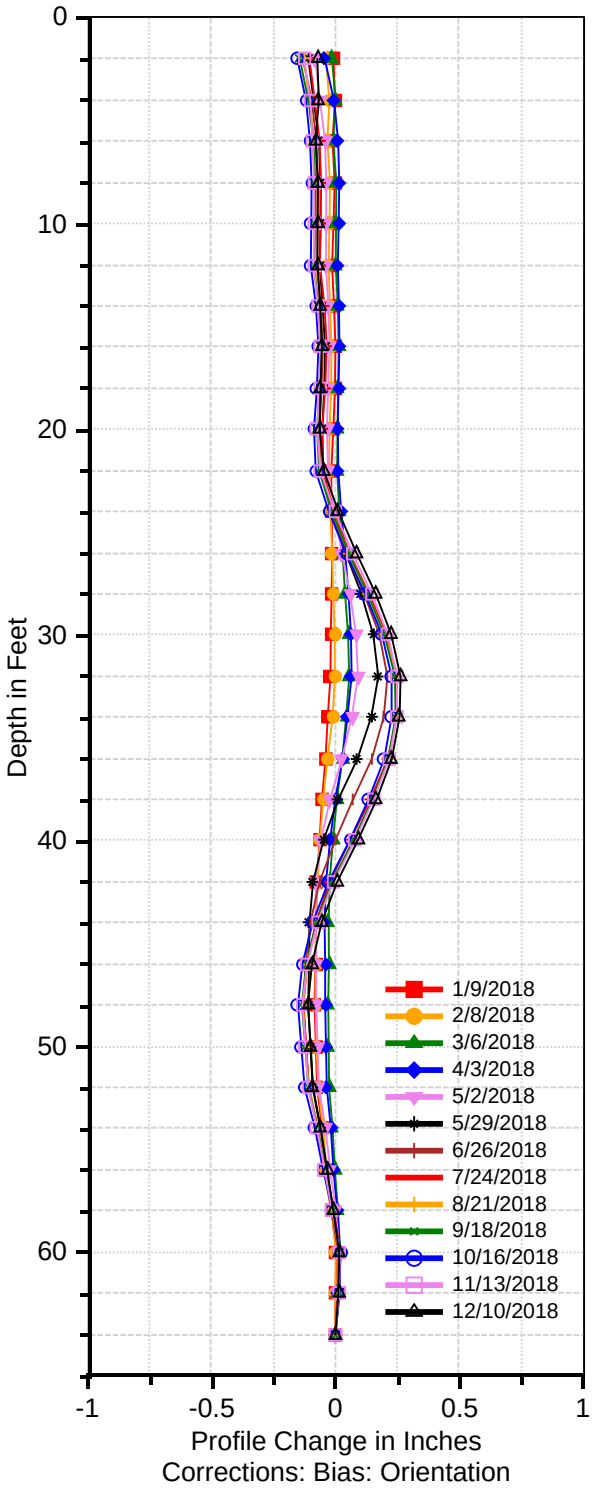
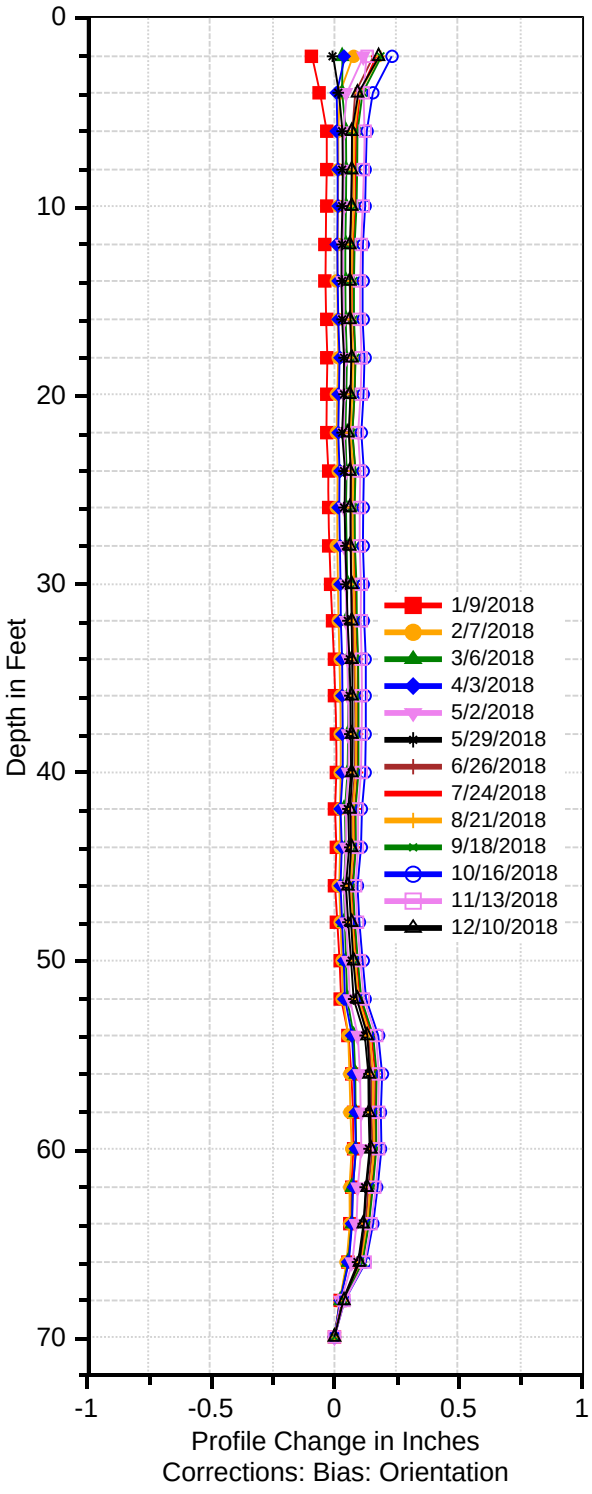


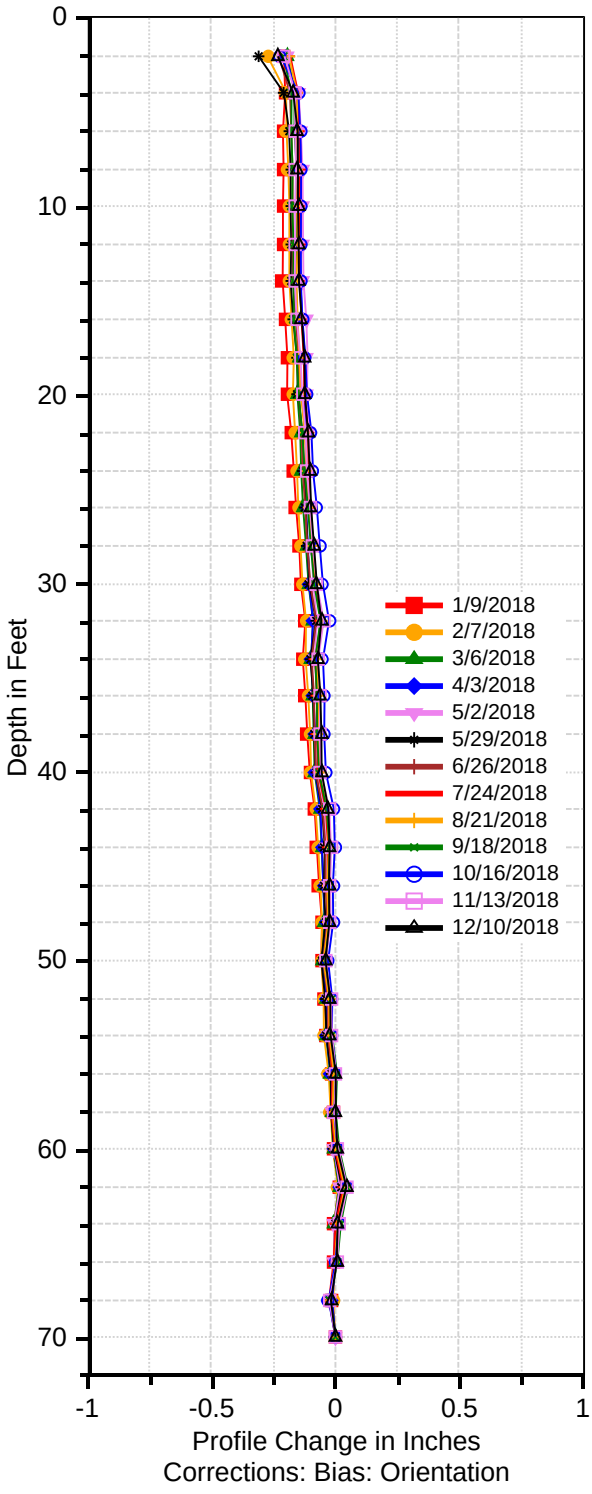
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: SD-15-17INC

SD 15-19INC A
Initial: 12/12/2017



SD 15-19INC B
Initial: 12/12/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: SD-15-19INC

APPENDIX D

Units 3 & 4 EHP Main Dam and A-Cell Inclinometer Plots

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendicies (EHP).dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:06am

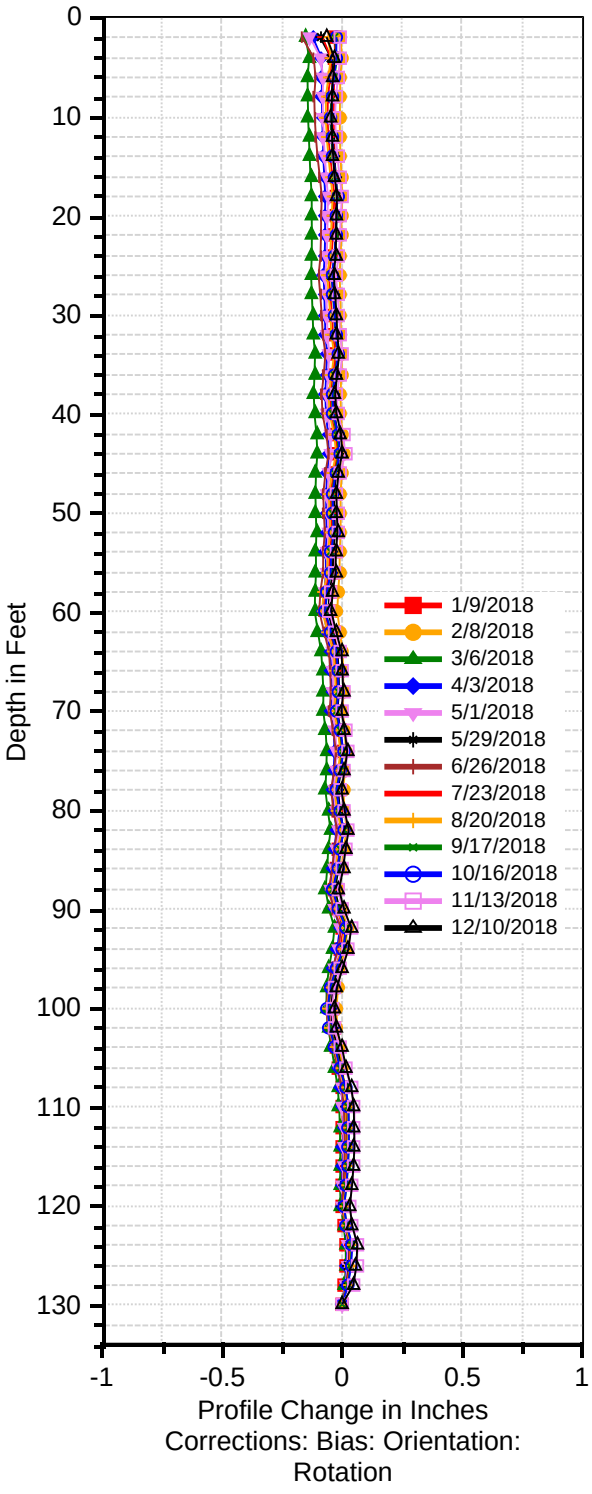
DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
Main Dam and A Cell
Inclinometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com

MD 12-3INC A
Initial: 12/12/2017



MD 12-3INC B
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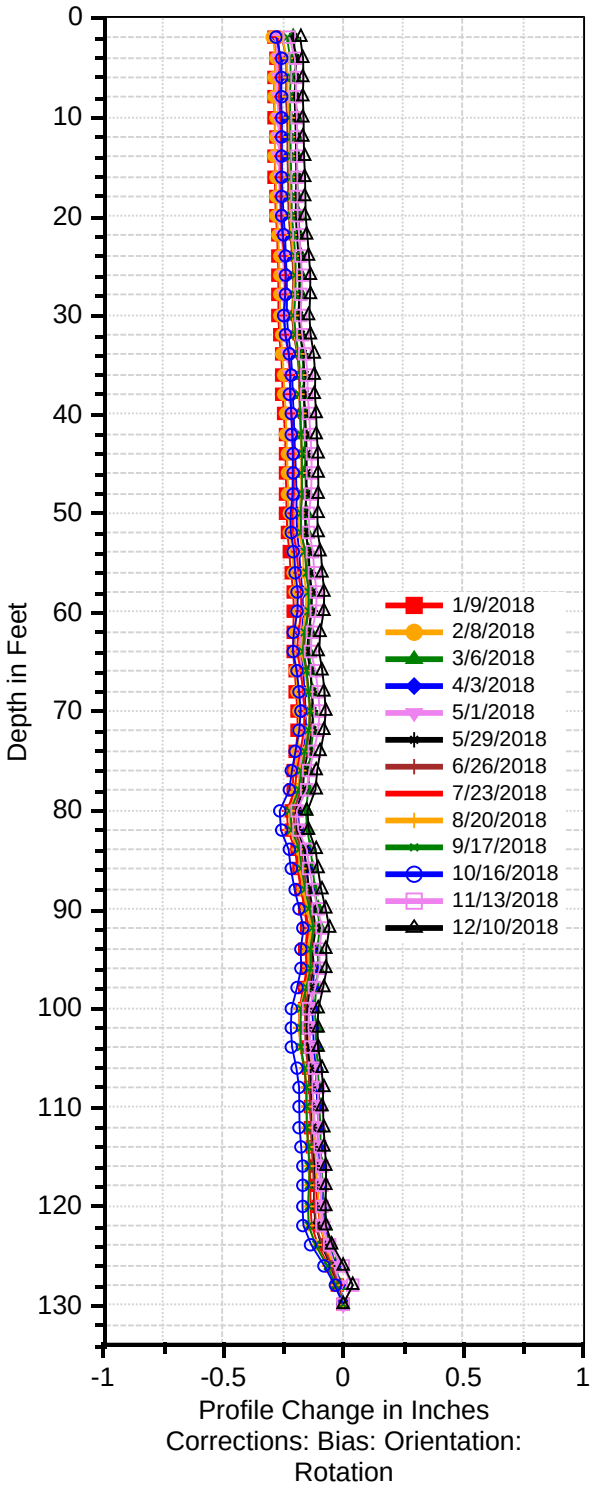
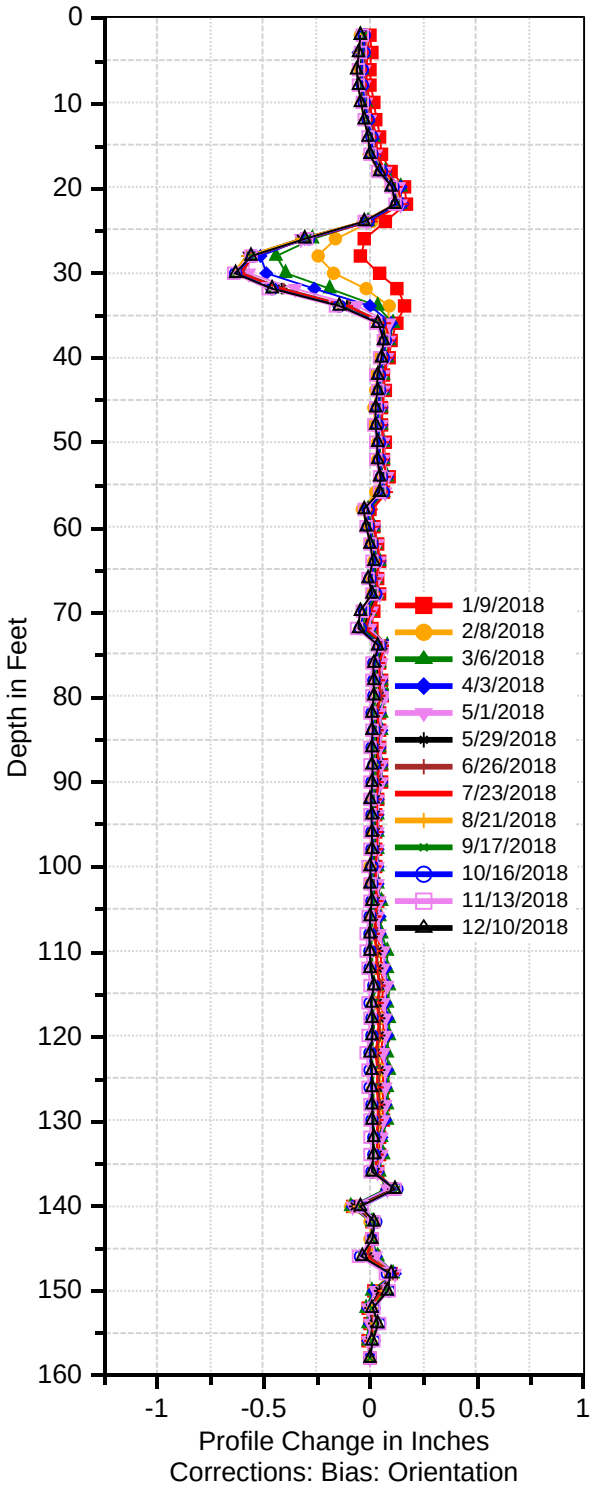


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: MD-12-3INC

EHP MD-16-7INC A
Initial: 12/12/2017



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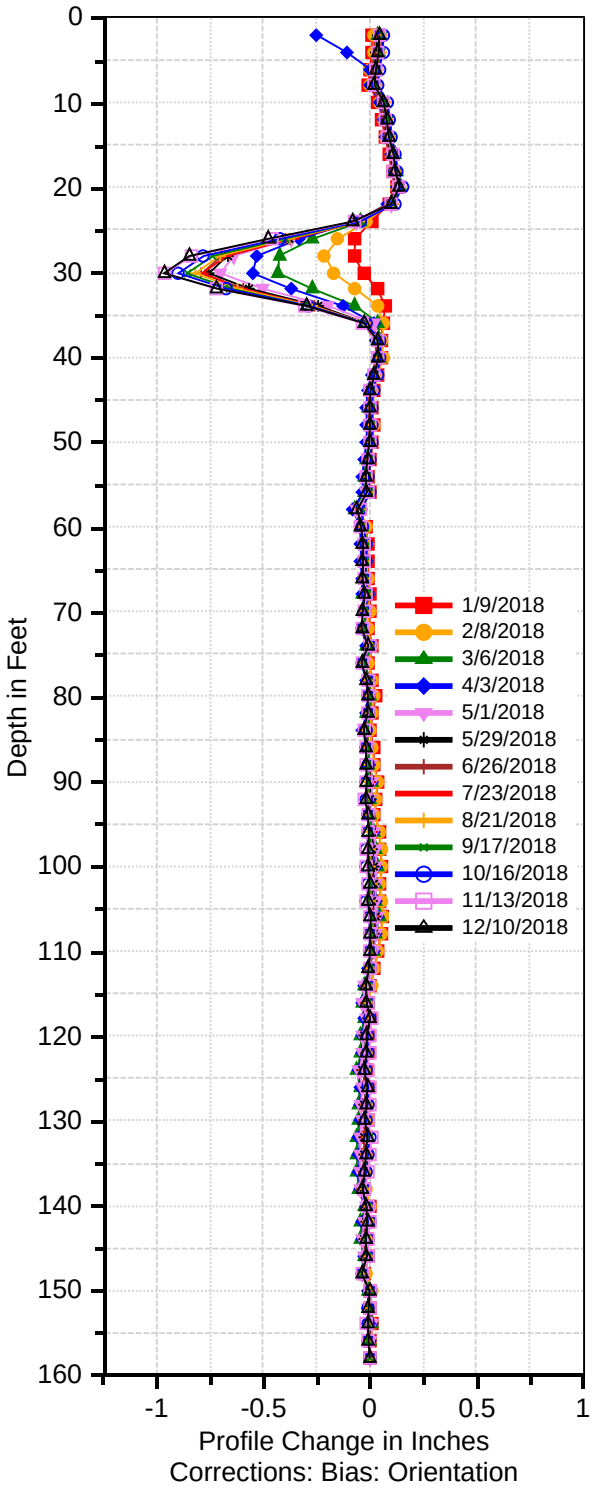
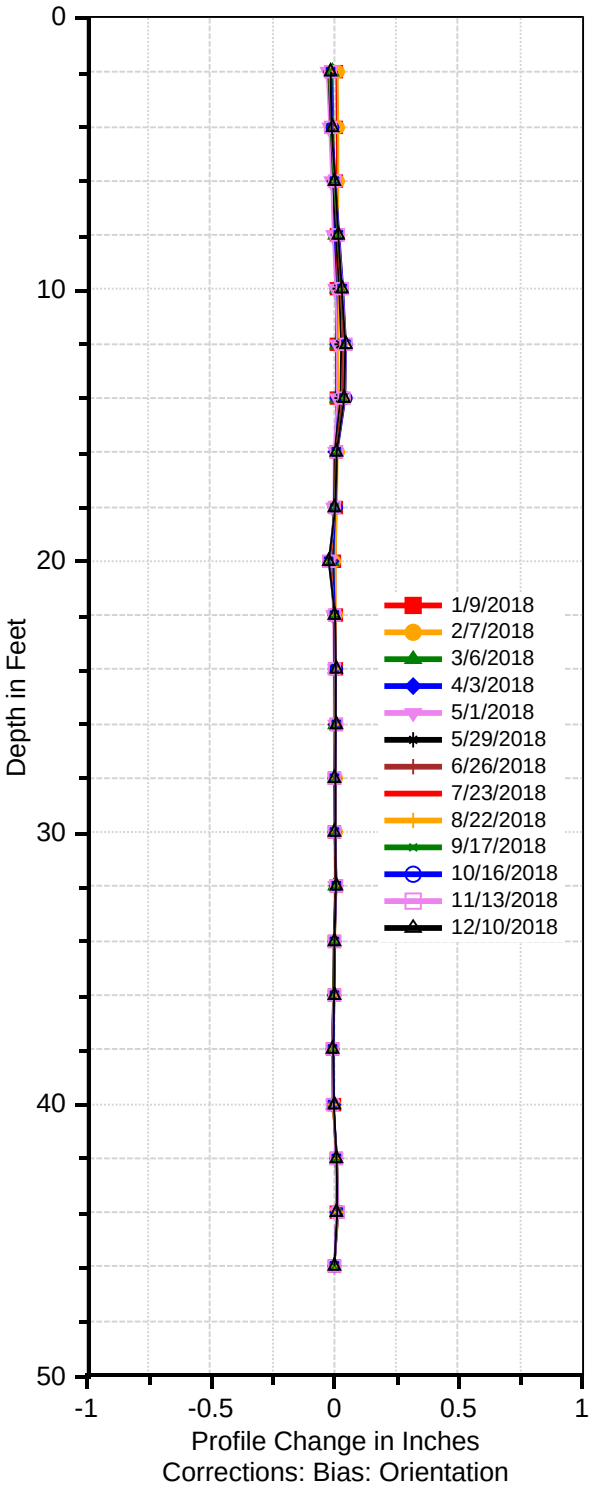
Initial: 12/12/2017



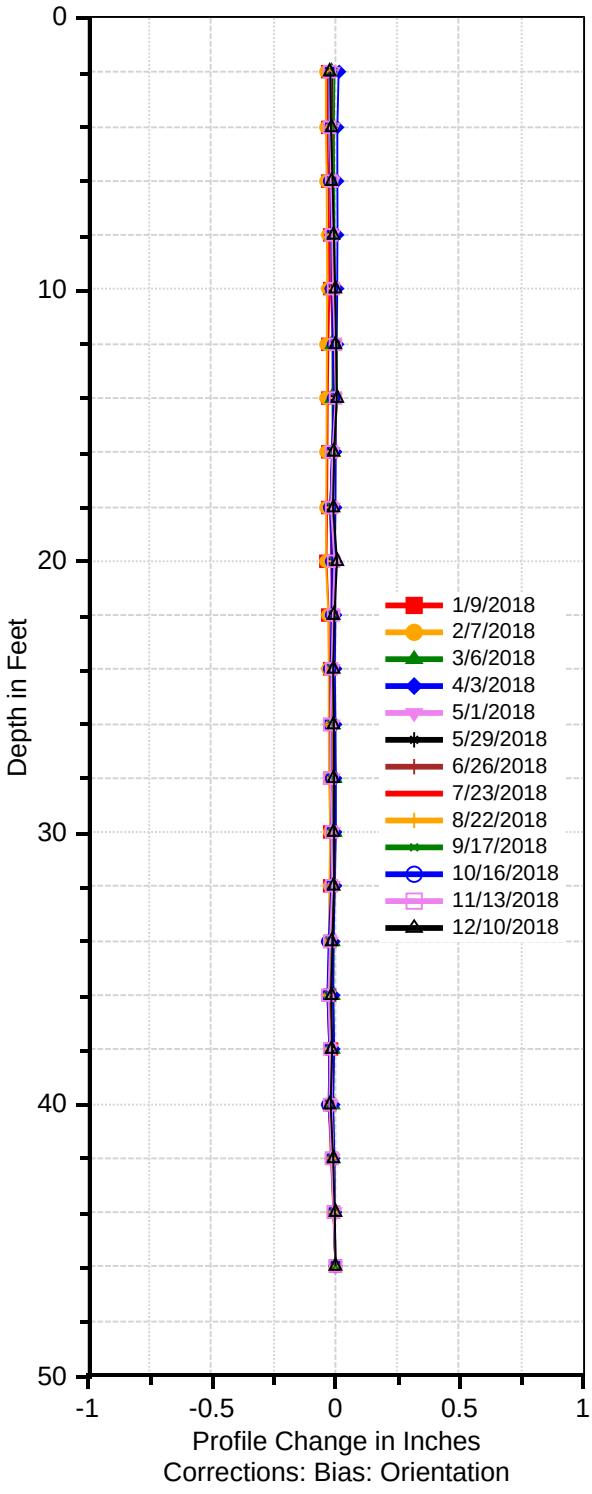
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: MD-16-7INC

EHP A-15-5INC A
Initial: 12/12/2017



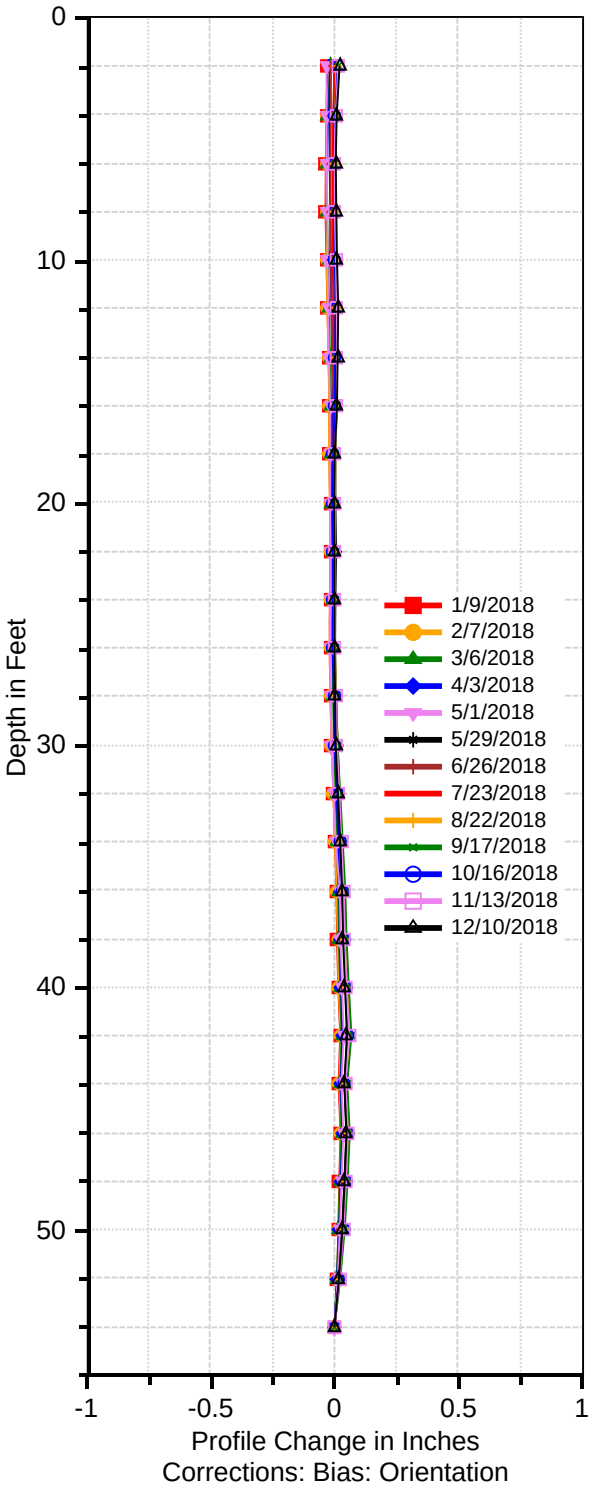
EHP A-15-5INC B
Initial: 12/12/2017



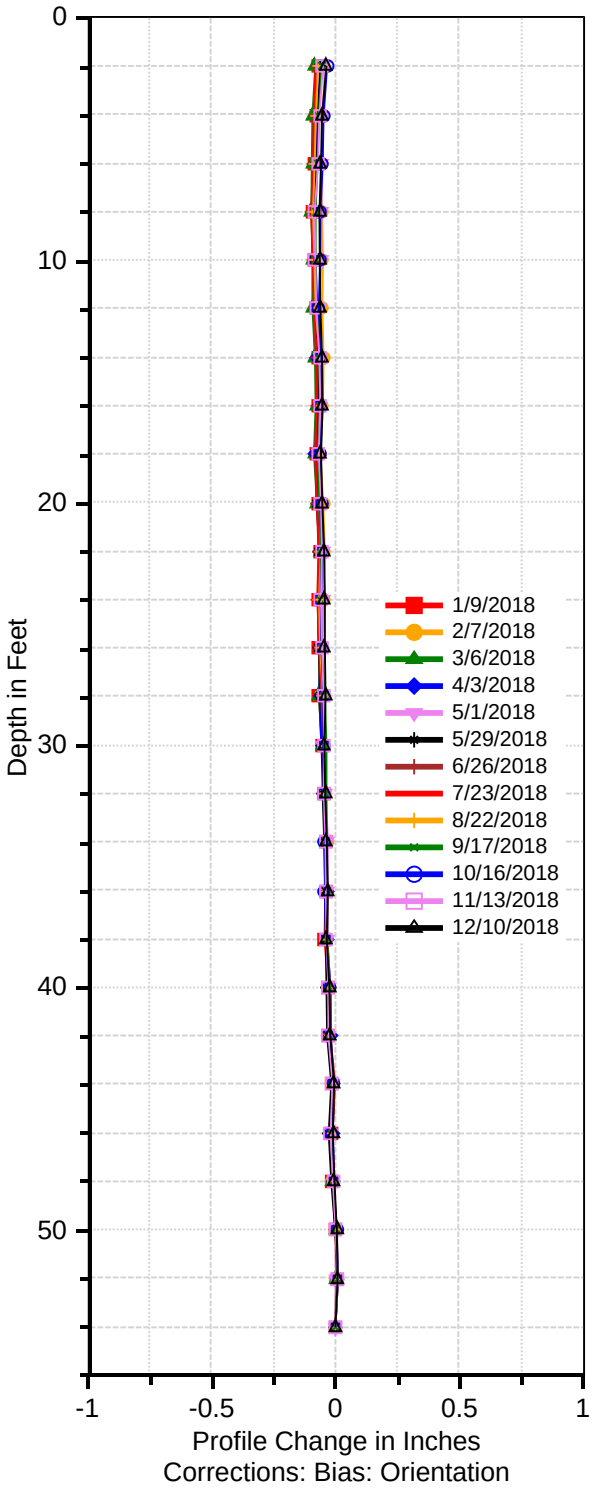
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: A-15-5INC

EHP A-15-6INC A
Initial: 12/12/2017



EHP A-15-6INC B
Initial: 12/12/2017

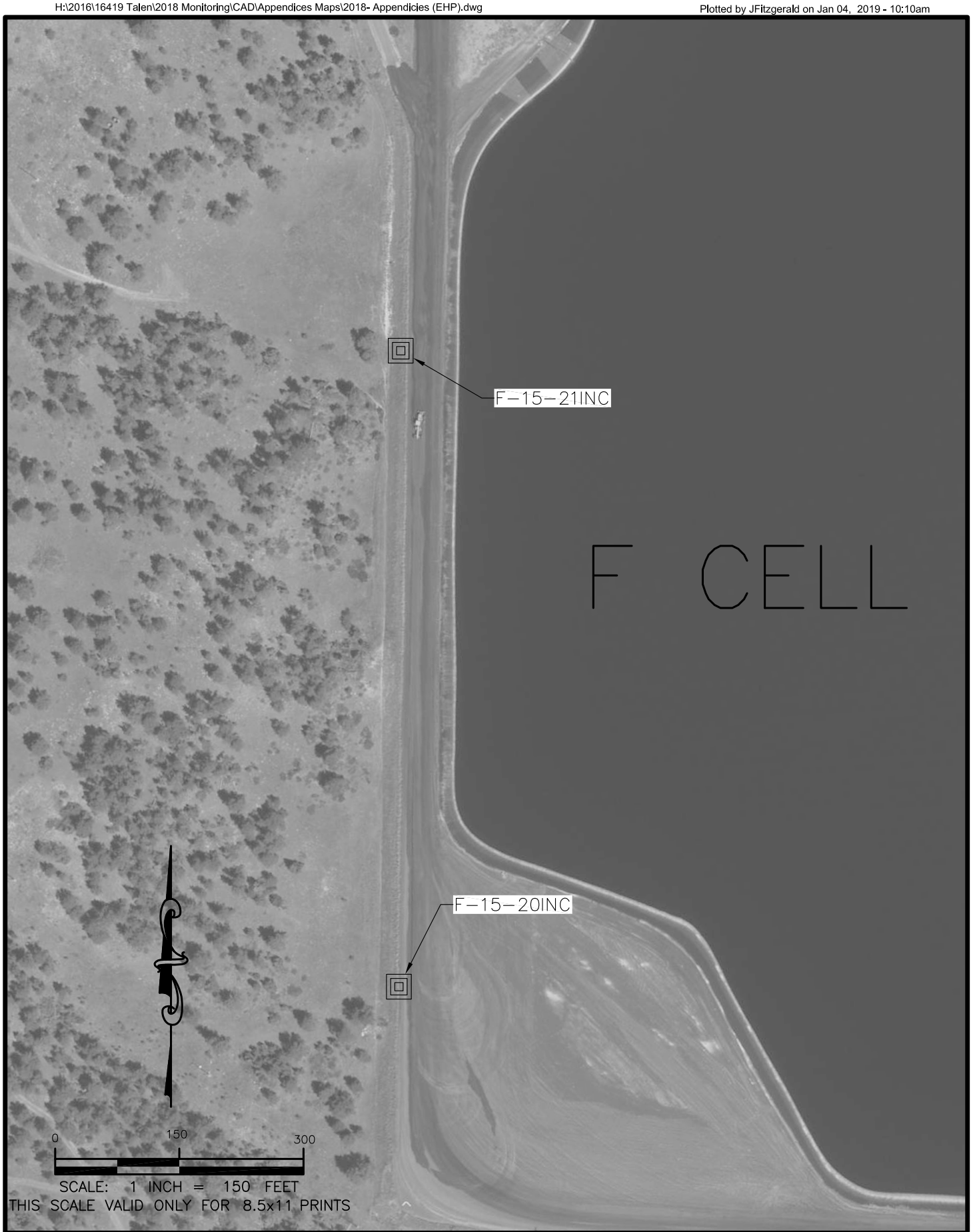


Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: A-15-6INC

APPENDIX E

Additional Units 3 & 4 EHP Area
Inclinometer Plots



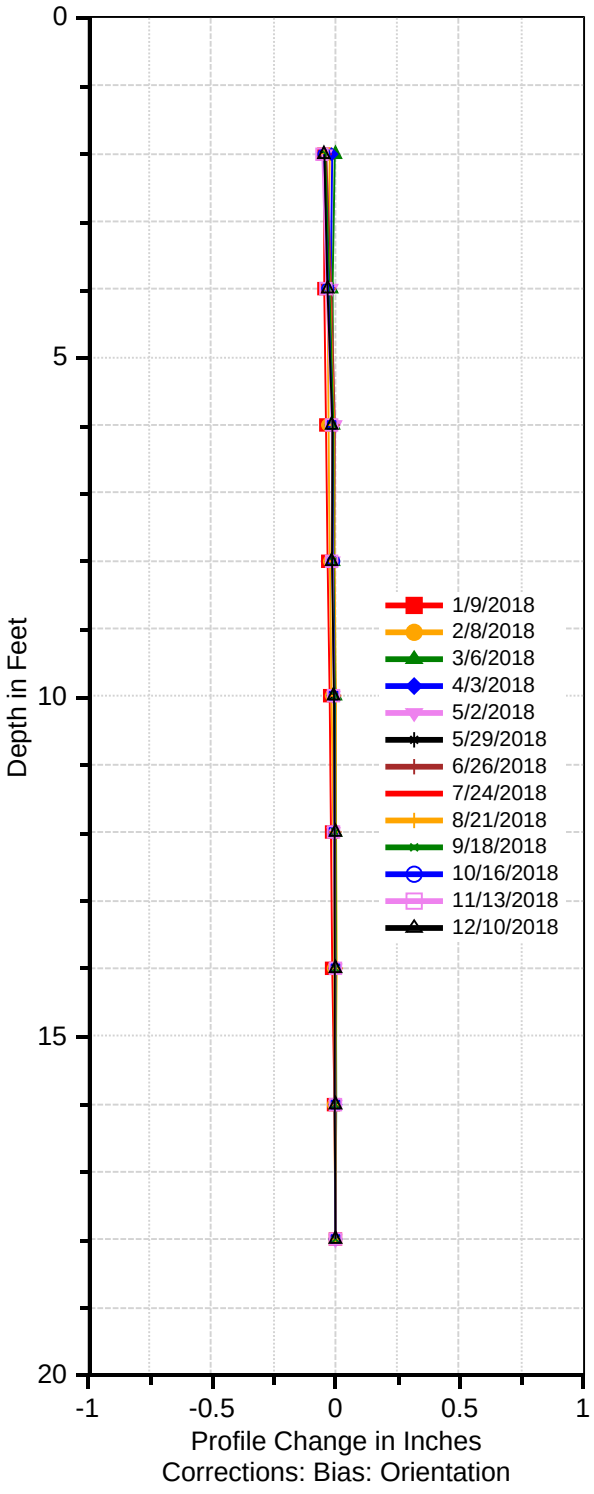
DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
F Cell
Inclinometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com

EHP F-15-20INC A
Initial: 12/12/2017



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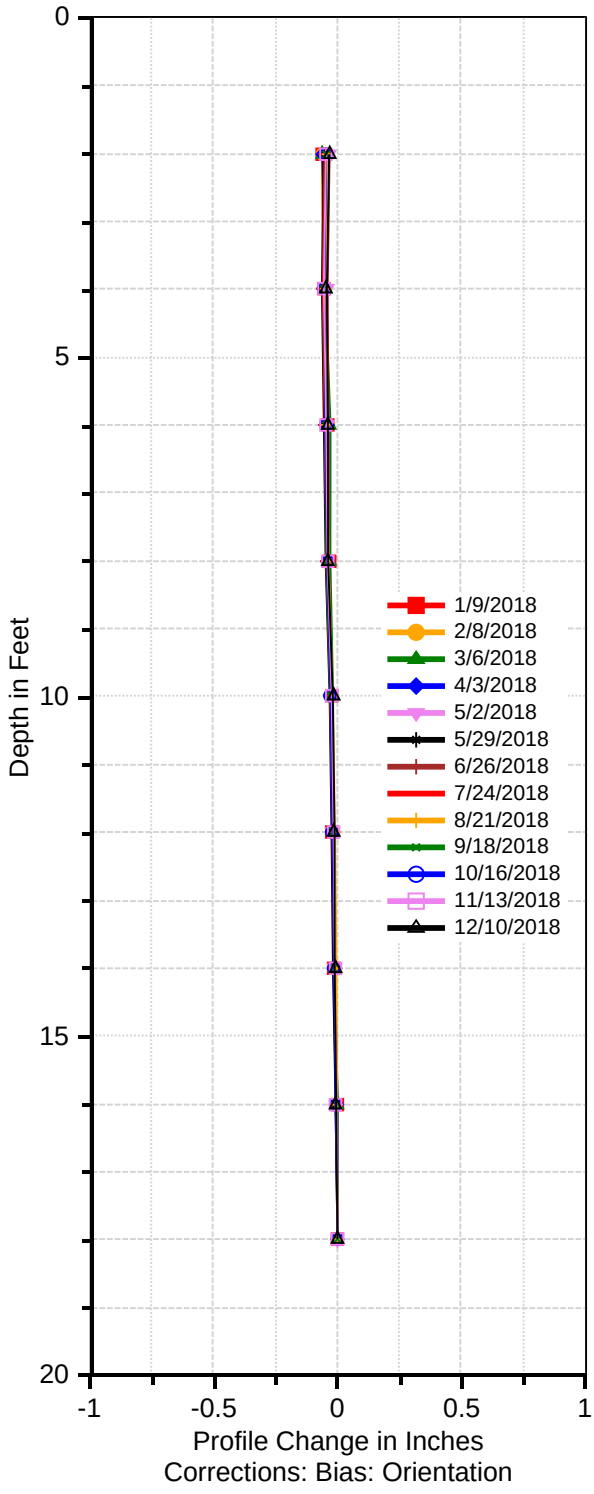
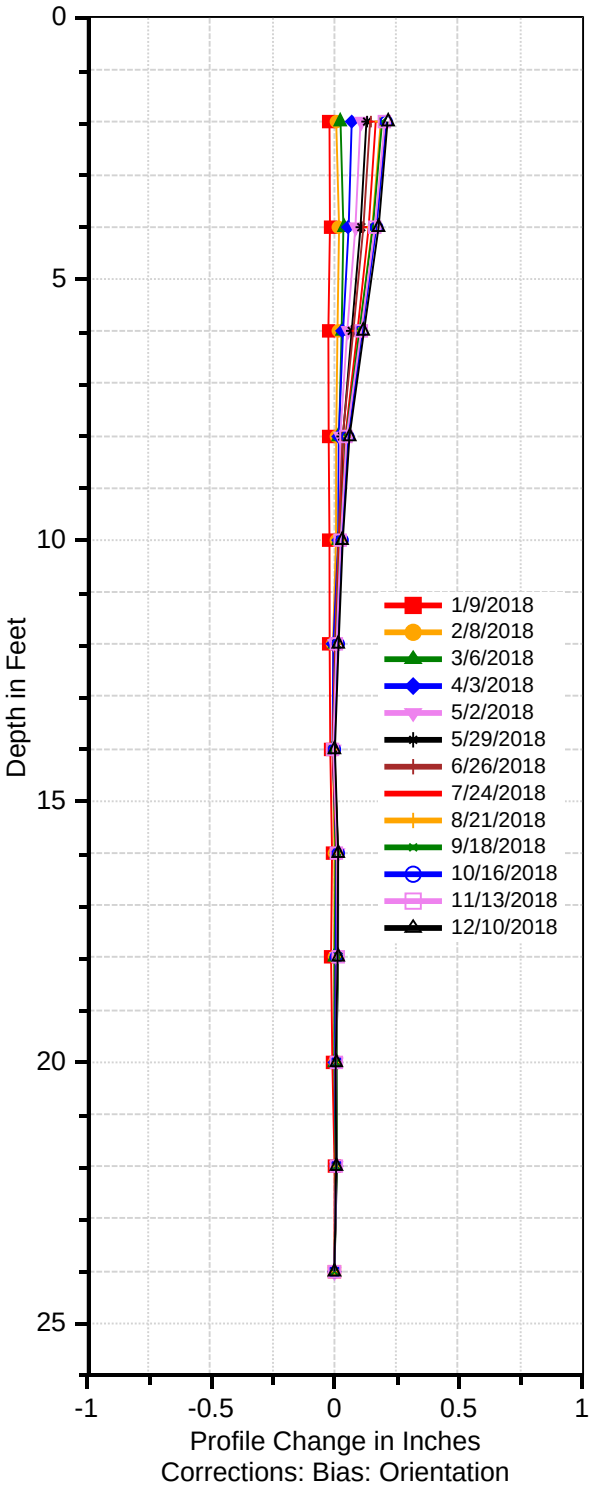


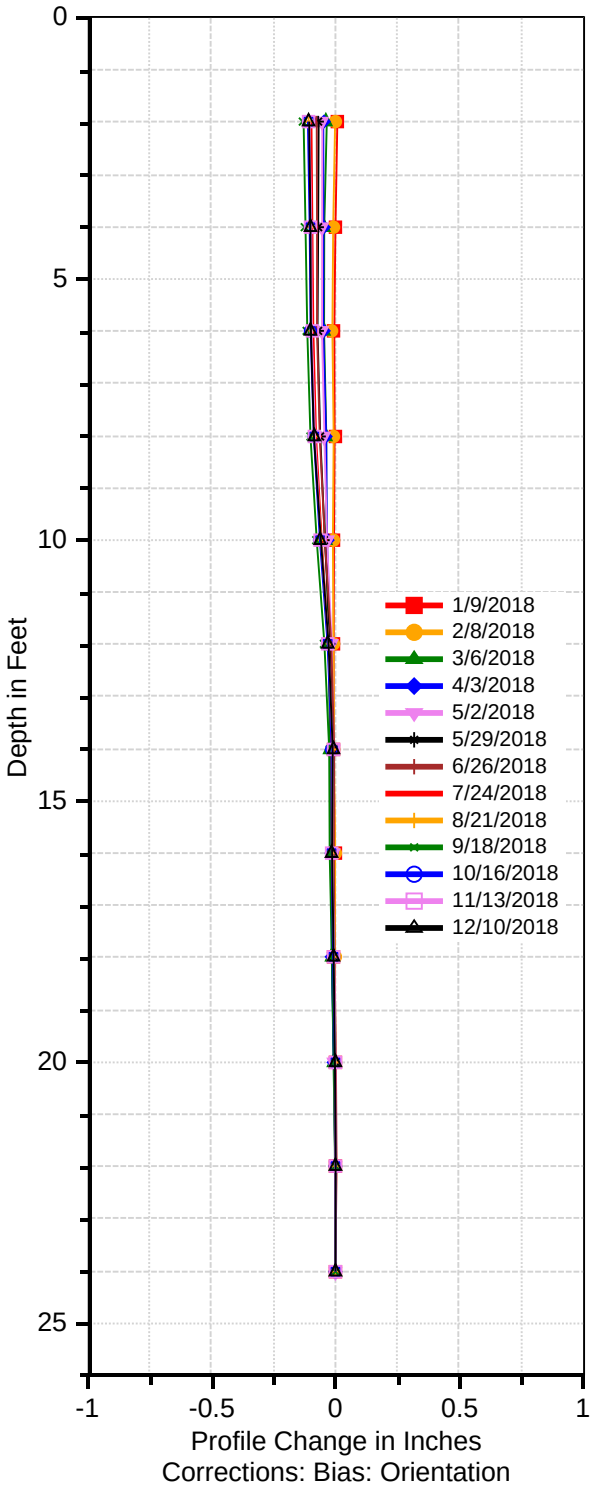
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: F-15-20INC

EHP F-15-21INC A
Initial: 12/12/2017

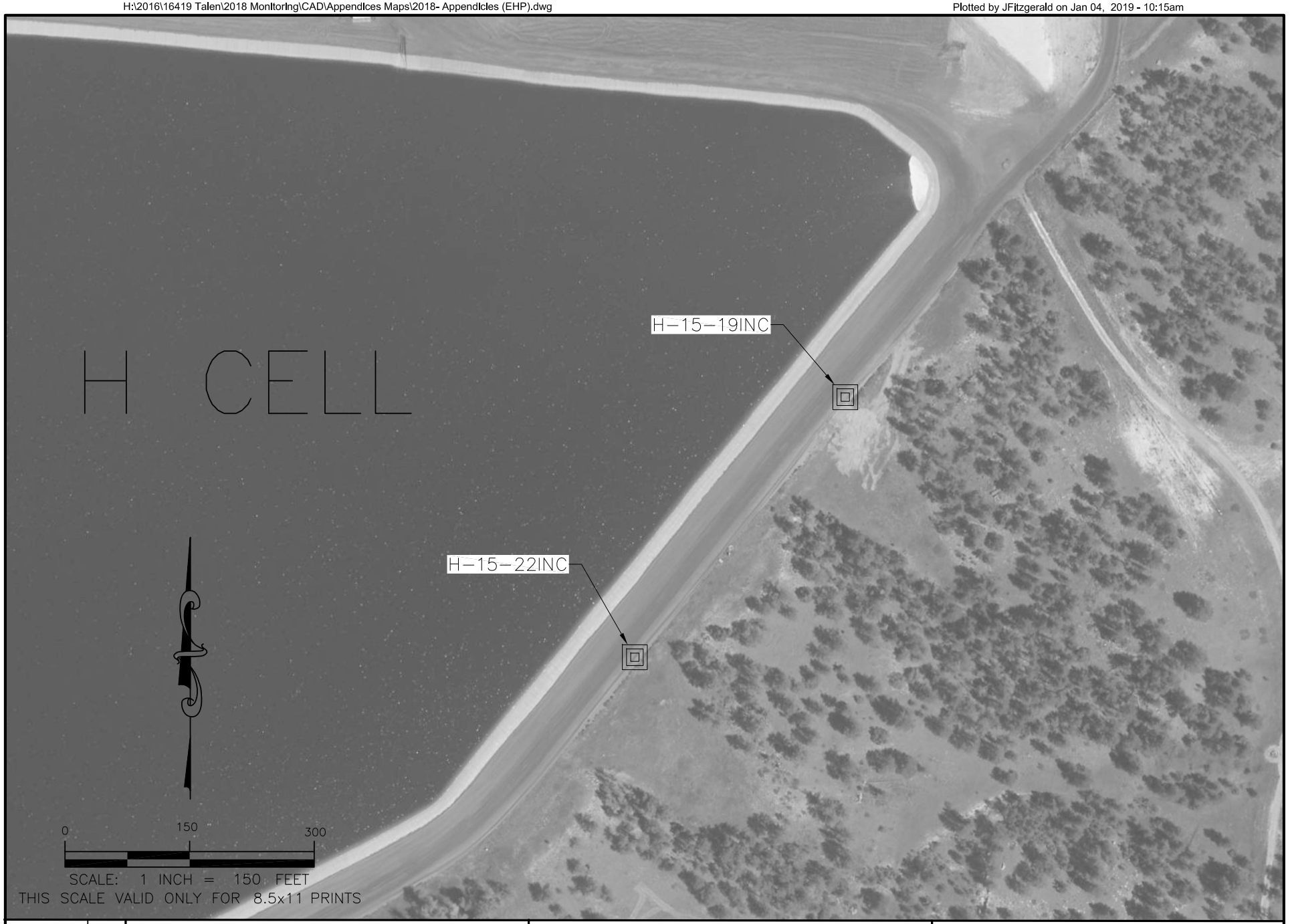


EHP F-15-21INC B
Initial: 12/12/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: F-15-21INC



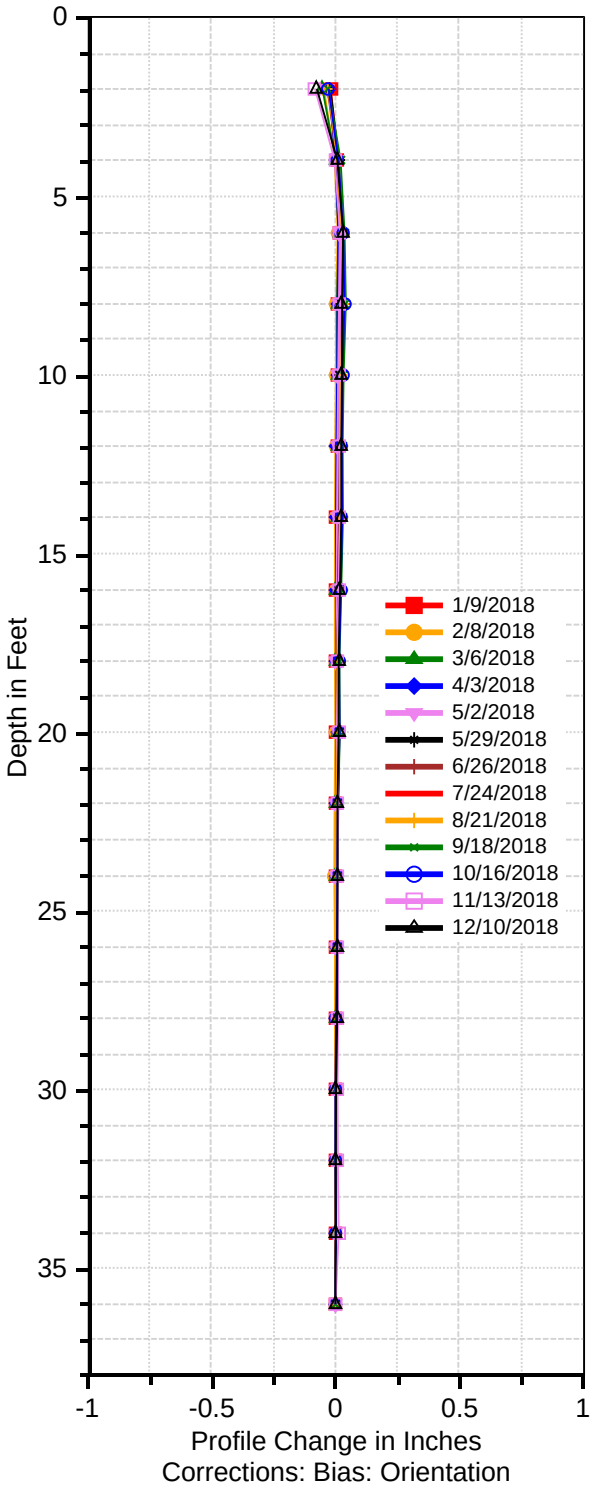
DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
H Cell
Inclinometer Location Map

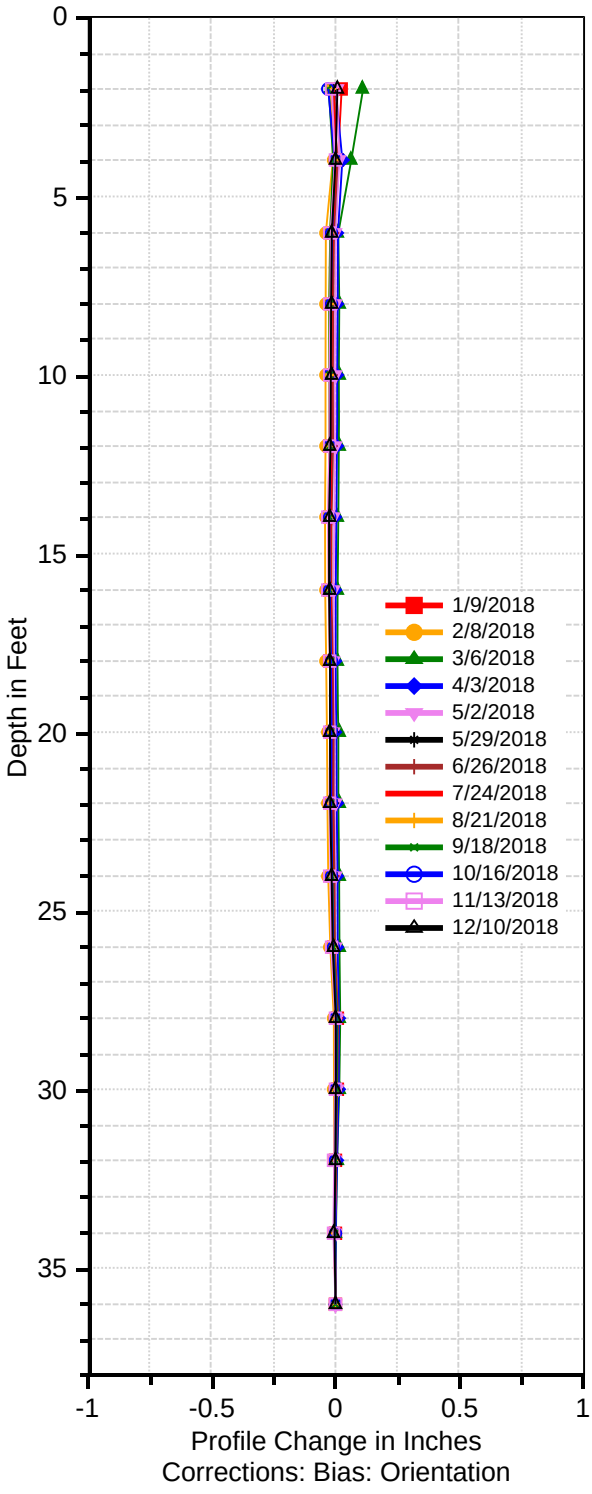
PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com

EHP H-15-19INC A
Initial: 12/12/2017



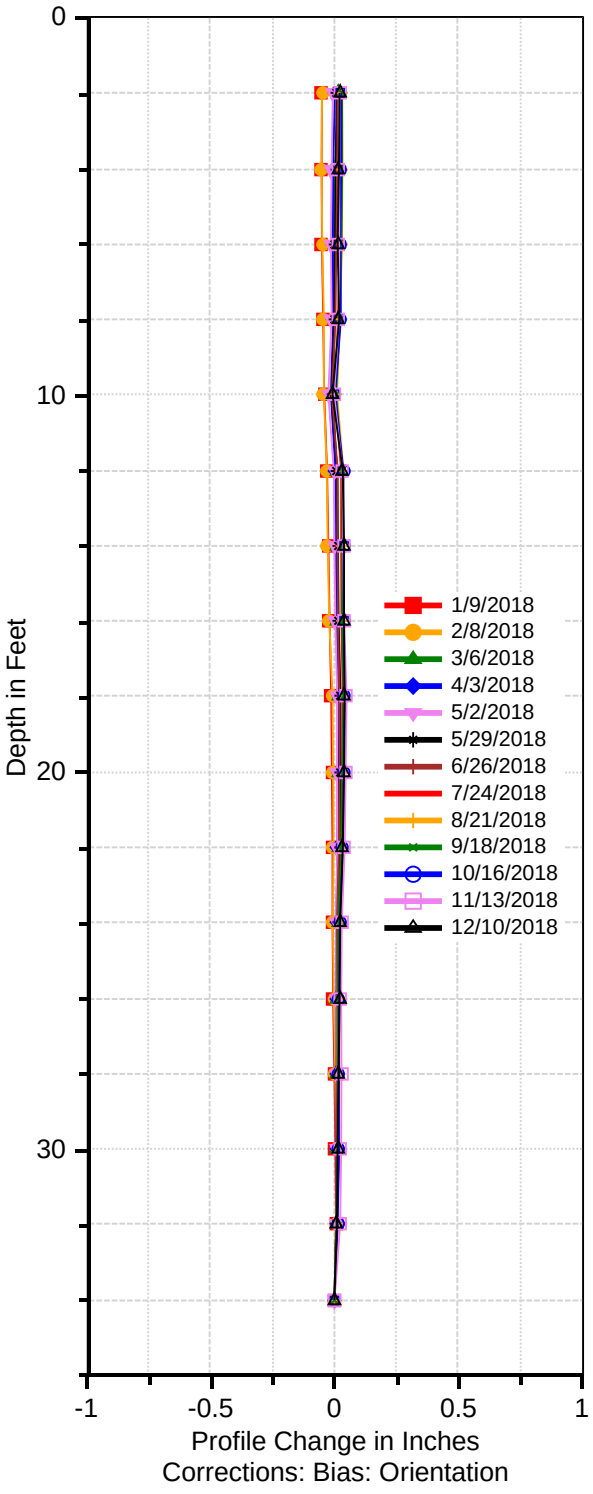
EHP H-15-19INC B
Initial: 12/12/2017



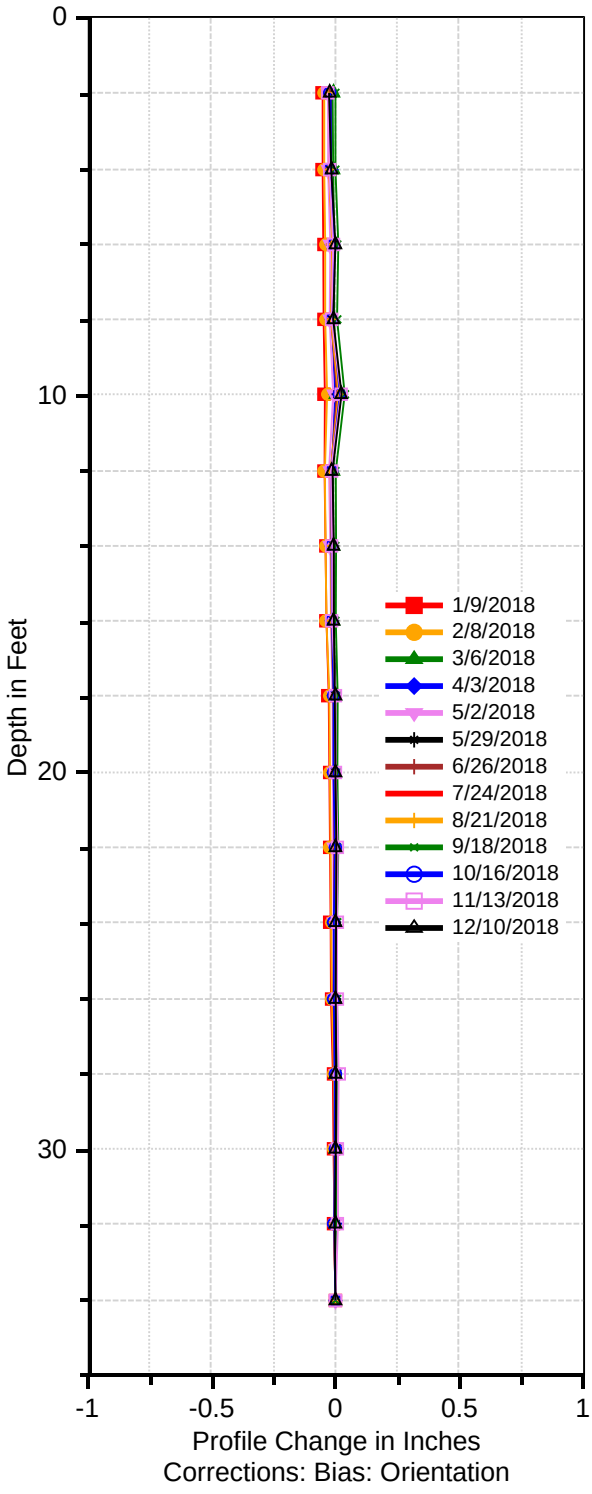
Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

Location: Units 3&4 EHP
Instrument: H-15-19INC

EHP H-15-22INC A
Initial: 12/12/2017



EHP H-15-22INC B
Initial: 12/12/2017



Talen Energy - Inclinometer Monitoring
JORGENSEN GEOTECHNICAL, LLC
Jackson, WY

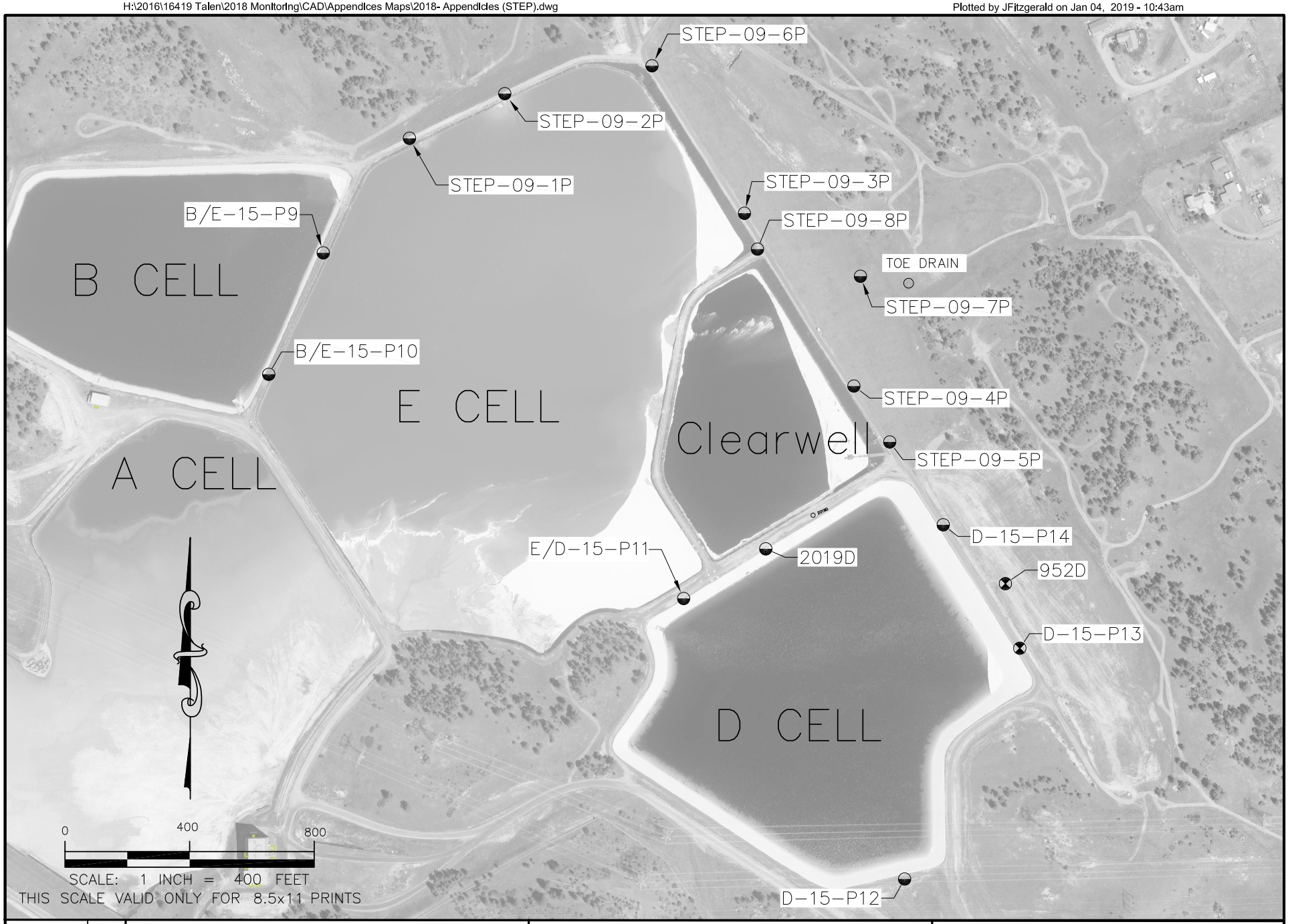
Location: Units 3&4 EHP
Instrument: H-15-22INC

APPENDIX F

Units 1 & 2 STEP
Piezometer Monitoring Plots

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendices (STEP).dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:43am

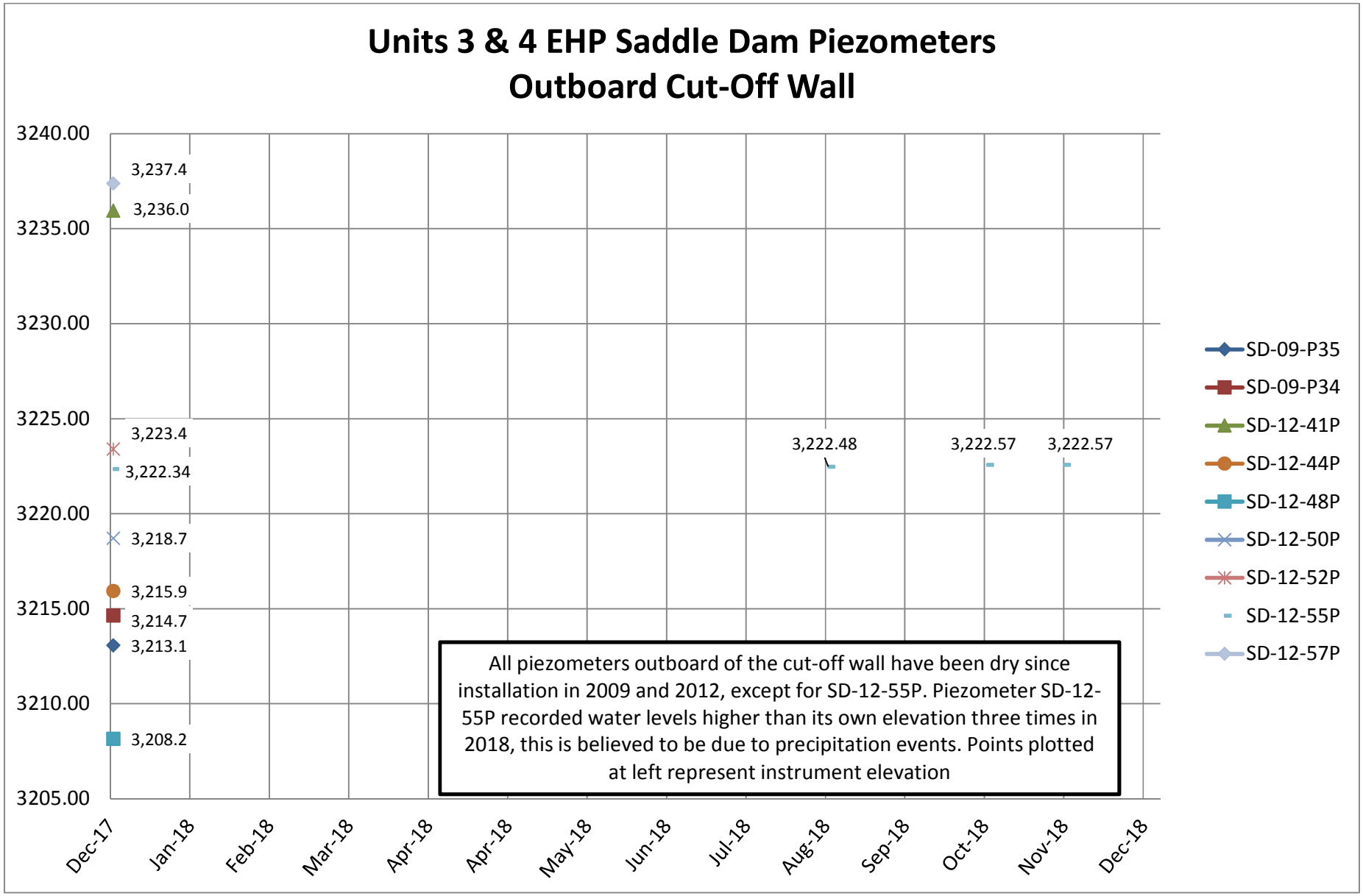


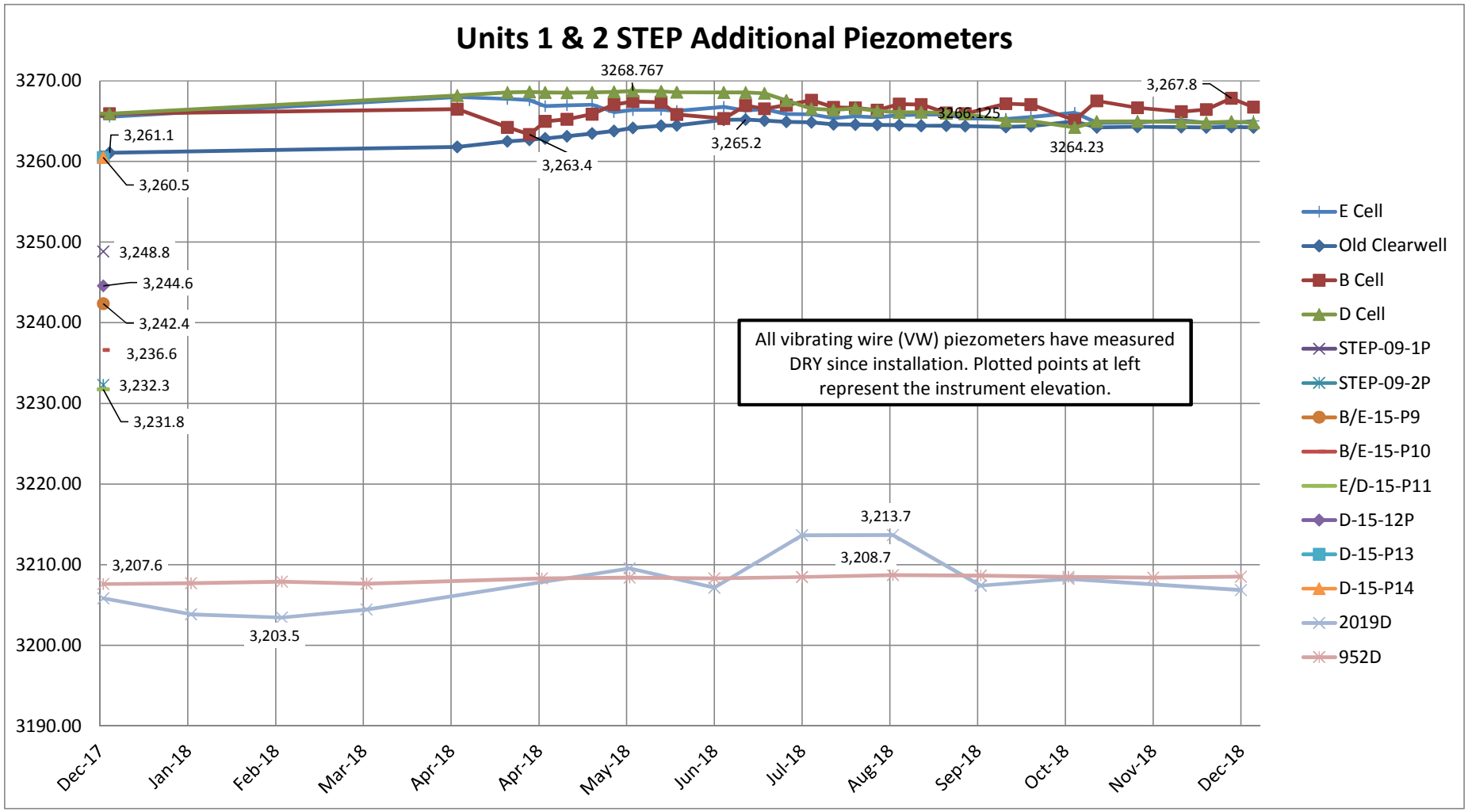
DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 1 & 2 STEP Area
Additional Piezometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com


Units 3 & 4 EHP Saddle Dam Piezometers
Outboard Cut-Off Wall
3240.00
3235.00
3230.00
3225.00
3220.00
3215.00
3210.00
3205.00
3,237.4
3,236.0
3,223.4
3,222.34
3,218.7
3,215.9
3,214.7
3,213.1
3,208.2
3,222.48
3,222.57
3,222.57
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
SD-09-P35
SD-09-P34
SD-12-41P
SD-12-44P
SD-12-48P
SD-12-50P
SD-12-52P
SD-12-55P
SD-12-57P
All piezometers outboard of the cut-off wall have been dry since installation in 2009 and 2012, except for SD-12-55P. Piezometer SD-12-55P recorded water levels higher than its own elevation three times in 2018, this is believed to be due to precipitation events. Points plotted at left represent instrument elevation


Units 1 & 2 STEP Additional Piezometers
3270.00
3260.00
3250.00
3240.00
3230.00
3220.00
3210.00
3200.00
3190.00
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
3,261.1
3,260.5
3,248.8
3,244.6
3,242.4
3,236.6
3,232.3
3,231.8
3268.767
3,263.4
3,265.2
3,266.125
3264.23
3,267.8
3,213.7
3,208.7
3,207.6
3,203.5
All vibrating wire (VW) piezometers have measured DRY since installation. Plotted points at left represent the instrument elevation.
E Cell
Old Clearwell
B Cell
D Cell
STEP-09-1P
STEP-09-2P
B/E-15-P9
B/E-15-P10
E/D-15-P11
D-15-12P
D-15-P13
D-15-P14
2019D
952D

APPENDIX G

Plantsite Units 1 & 2 Bottom Ash Pond
Piezometer Monitoring Plots

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Plantsite Map.dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:46am

DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Plantsite Units 1 & 2
Bottom Ash Pond
Piezometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
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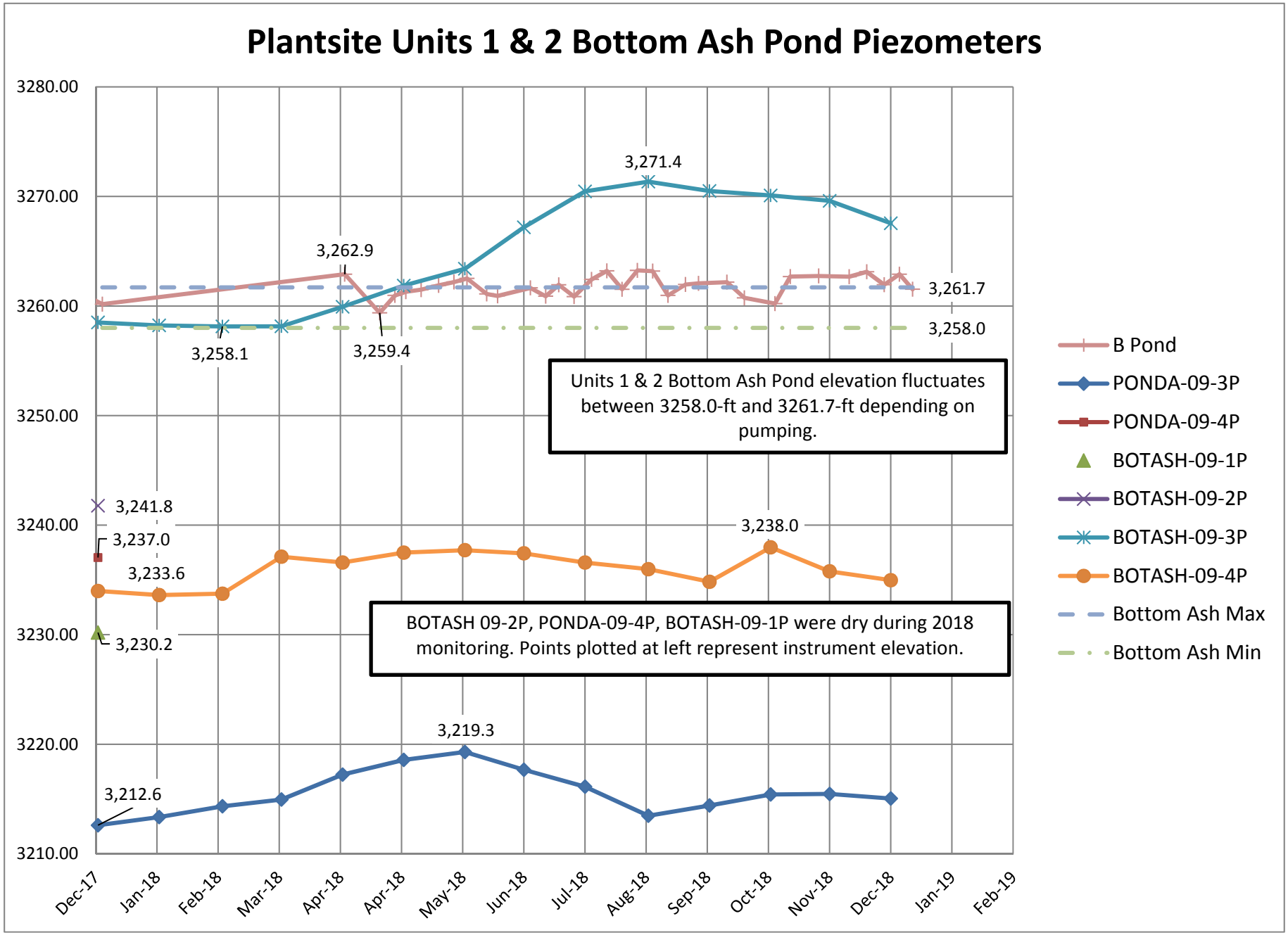
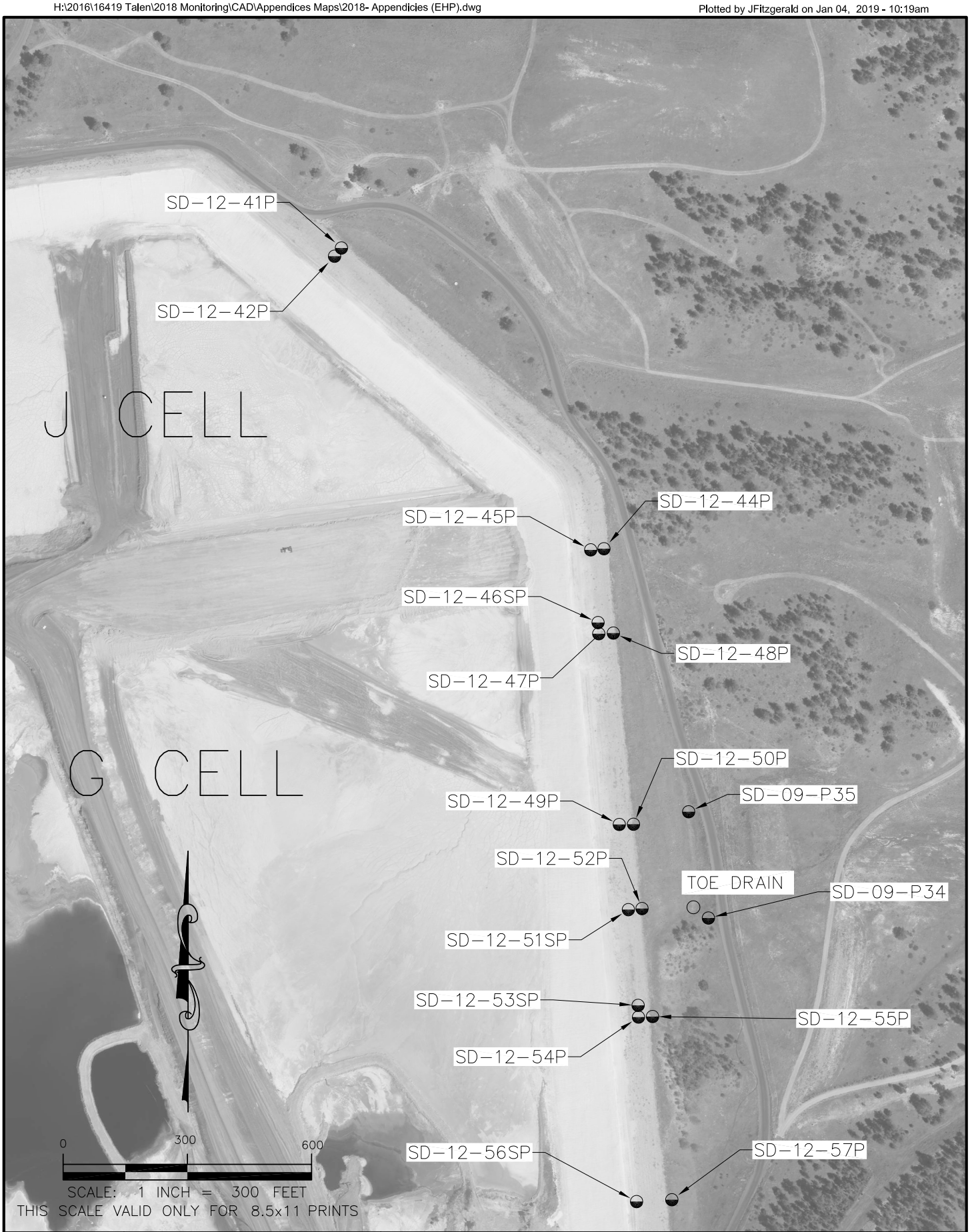

Plantsite Units 1 & 2 Bottom Ash Pond Piezometers
3280.00
3270.00
3260.00
3250.00
3240.00
3230.00
3220.00
3210.00
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
3,271.4
3,262.9
3,261.7
3,258.0
3,258.1
3,259.4
3,241.8
3,237.0
3,233.6
3,238.0
3,230.2
3,219.3
3,212.6
Units 1 & 2 Bottom Ash Pond elevation fluctuates between 3258.0-ft and 3261.7-ft depending on pumping.
BOTASH 09-2P, PONDA-09-4P, BOTASH-09-1P were dry during 2018 monitoring. Points plotted at left represent instrument elevation.
B Pond
PONDA-09-3P
PONDA-09-4P
BOTASH-09-1P
BOTASH-09-2P
BOTASH-09-3P
BOTASH-09-4P
Bottom Ash Max
Bottom Ash Min

APPENDIX H

Units 3 & 4 EHP
Piezometer Monitoring Plots

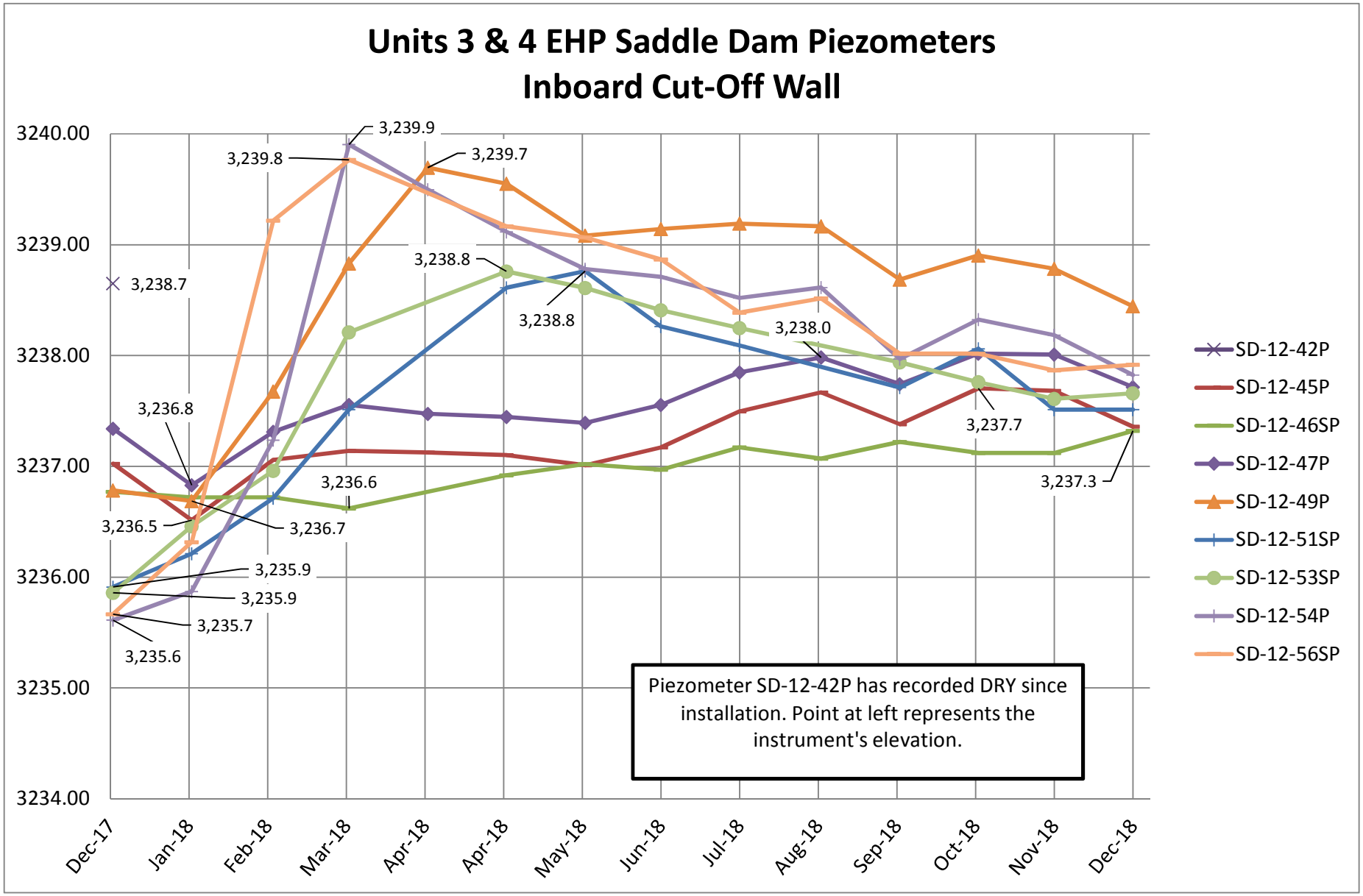
H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendicies (EHP).dwg

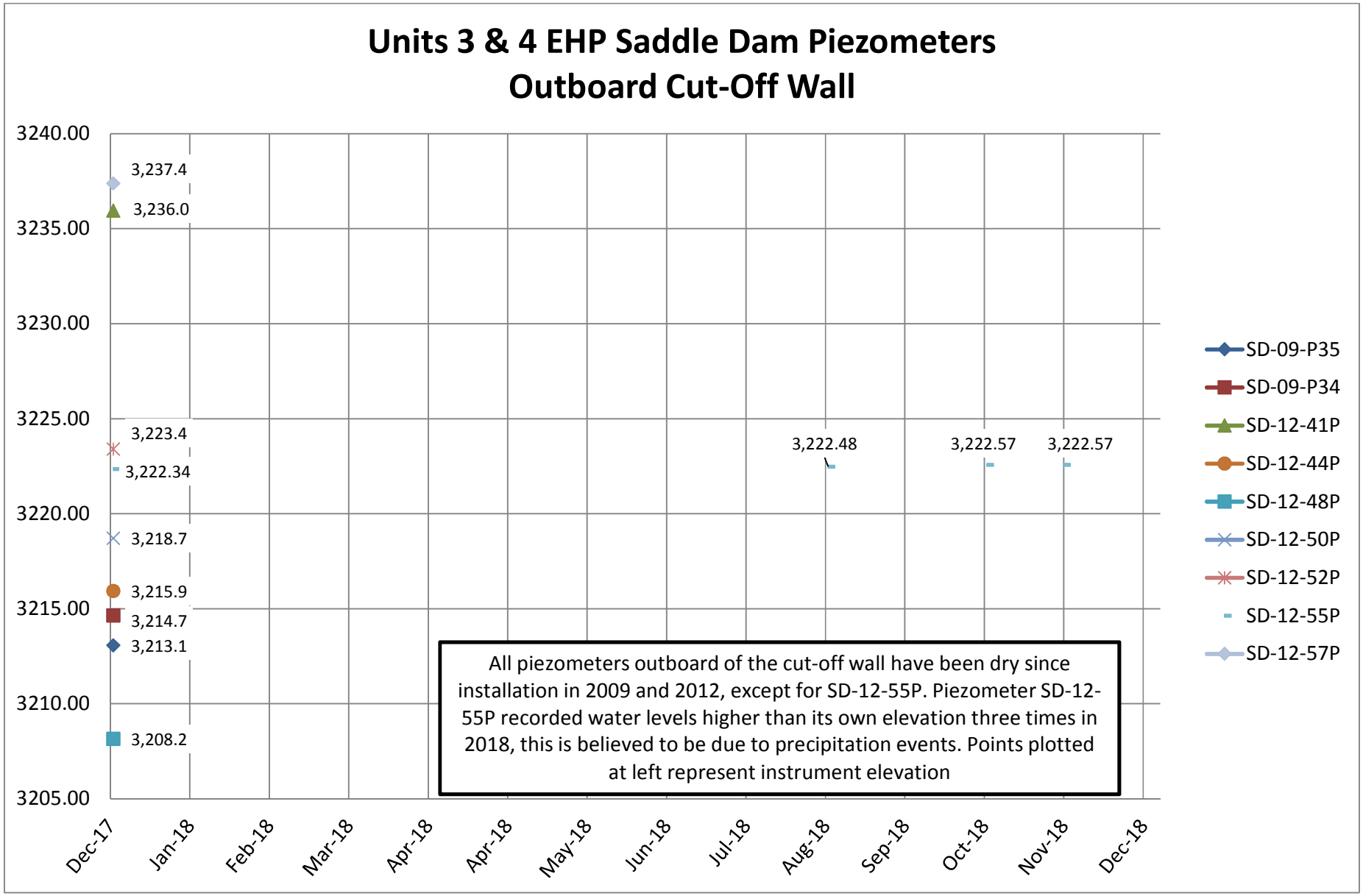
Plotted by JFitzgerald on Jan 04, 2019 - 10:19am



SCALE: 1 INCH = 300 FEET
THIS SCALE VALID ONLY FOR 8.5x11 PRINTS

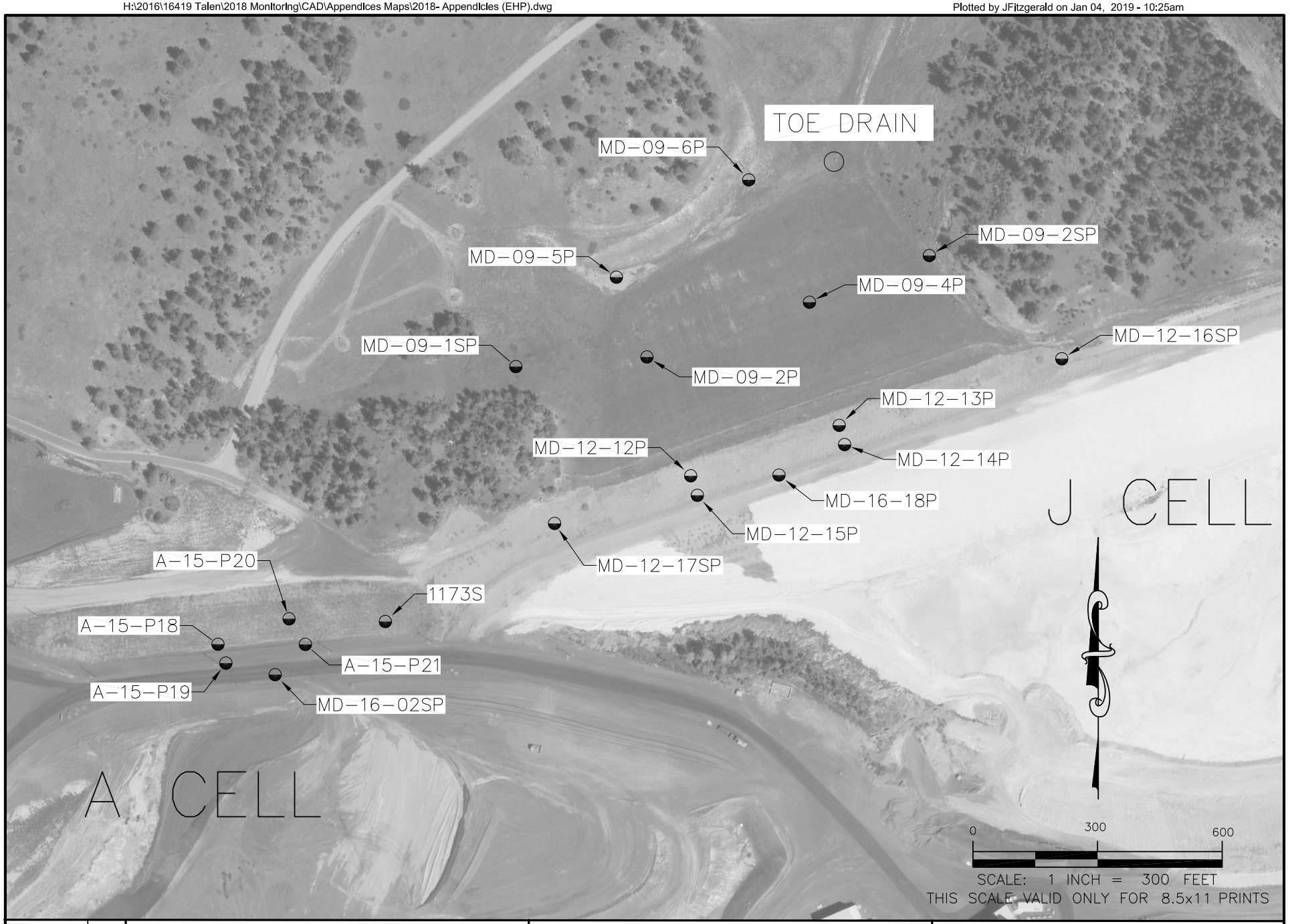
DRAFTED BY: JWF REVIEWED BY: CHL PROJECT NUMBER 16419	SHEET TITLE: Units 3 & 4 EHP Saddle Dam Piezometer Location Map	PROJECT TITLE: 2018 Annual Inspection Report Talen Energy Colstrip, Montana	JORGENSEN Geotechnical, LLC 307-733-5150 www.jorgeng.com


Units 3 & 4 EHP Saddle Dam Piezometers
Inboard Cut-Off Wall
3240.00
3239.00
3238.00
3237.00
3236.00
3235.00
3234.00
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
3,239.9
3,239.8
3,239.7
3,238.8
3,238.8
3,238.7
3,238.0
3,236.8
3,237.7
3,236.6
3,237.3
3,236.5
3,236.7
3,235.9
3,235.9
3,235.7
3,235.6
Piezometer SD-12-42P has recorded DRY since installation. Point at left represents the instrument's elevation.
SD-12-42P
SD-12-45P
SD-12-46SP
SD-12-47P
SD-12-49P
SD-12-51SP
SD-12-53SP
SD-12-54P
SD-12-56SP


Units 3 & 4 EHP Saddle Dam Piezometers
Outboard Cut-Off Wall
3240.00
3235.00
3230.00
3225.00
3220.00
3215.00
3210.00
3205.00
3,237.4
3,236.0
3,223.4
3,222.34
3,218.7
3,215.9
3,214.7
3,213.1
3,208.2
3,222.48
3,222.57
3,222.57
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
SD-09-P35
SD-09-P34
SD-12-41P
SD-12-44P
SD-12-48P
SD-12-50P
SD-12-52P
SD-12-55P
SD-12-57P
All piezometers outboard of the cut-off wall have been dry since installation in 2009 and 2012, except for SD-12-55P. Piezometer SD-12-55P recorded water levels higher than its own elevation three times in 2018, this is believed to be due to precipitation events. Points plotted at left represent instrument elevation

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendicies (EHP).dwg

Plotted by JFitzgerald on Jan 04, 2019 - 10:25am



DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
Main Dam and A Cell
Piezometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
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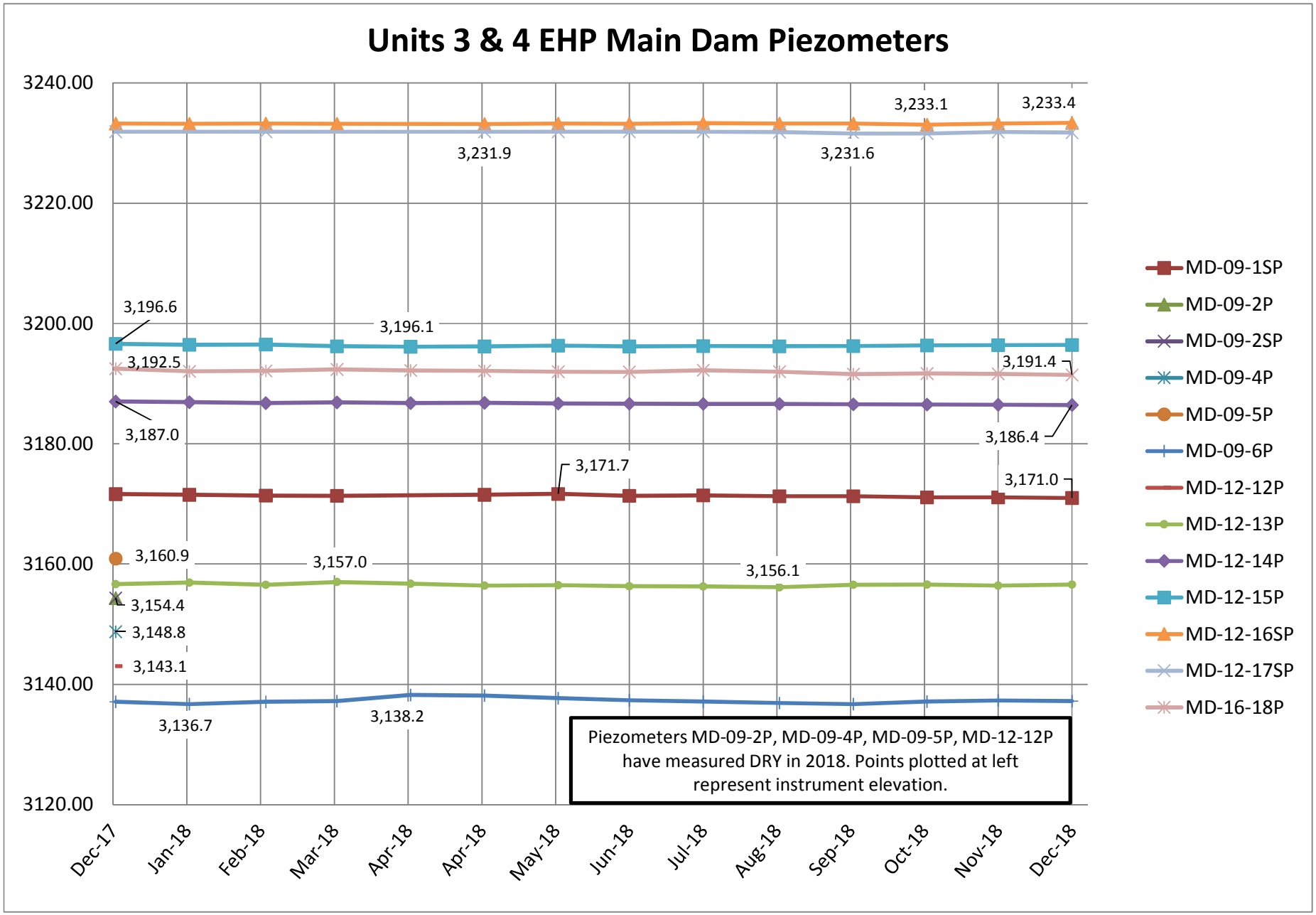
Units 3 & 4 EHP Main Dam Piezometers
3240.00
3220.00
3200.00
3180.00
3160.00
3140.00
3120.00
3,233.1
3,233.4
3,231.9
3,231.6
3,196.6
3,196.1
3,192.5
3,191.4
3,187.0
3,186.4
3,171.7
3,171.0
3,160.9
3,157.0
3,156.1
3,154.4
3,148.8
3,143.1
3,136.7
3,138.2
Piezometers MD-09-2P, MD-09-4P, MD-09-5P, MD-12-12P have measured DRY in 2018. Points plotted at left represent instrument elevation.
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
MD-09-1SP
MD-09-2P
MD-09-2SP
MD-09-4P
MD-09-5P
MD-09-6P
MD-12-12P
MD-12-13P
MD-12-14P
MD-12-15P
MD-12-16SP
MD-12-17SP
MD-16-18P

H:\2016\16419 Talen\2018 Monitoring\CAD\Appendices Maps\2018- Appendicies (EHP).dwg

Plotted by JFItzgerald on Jan 04, 2019 - 10:28am

DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
F Cell
Piezometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

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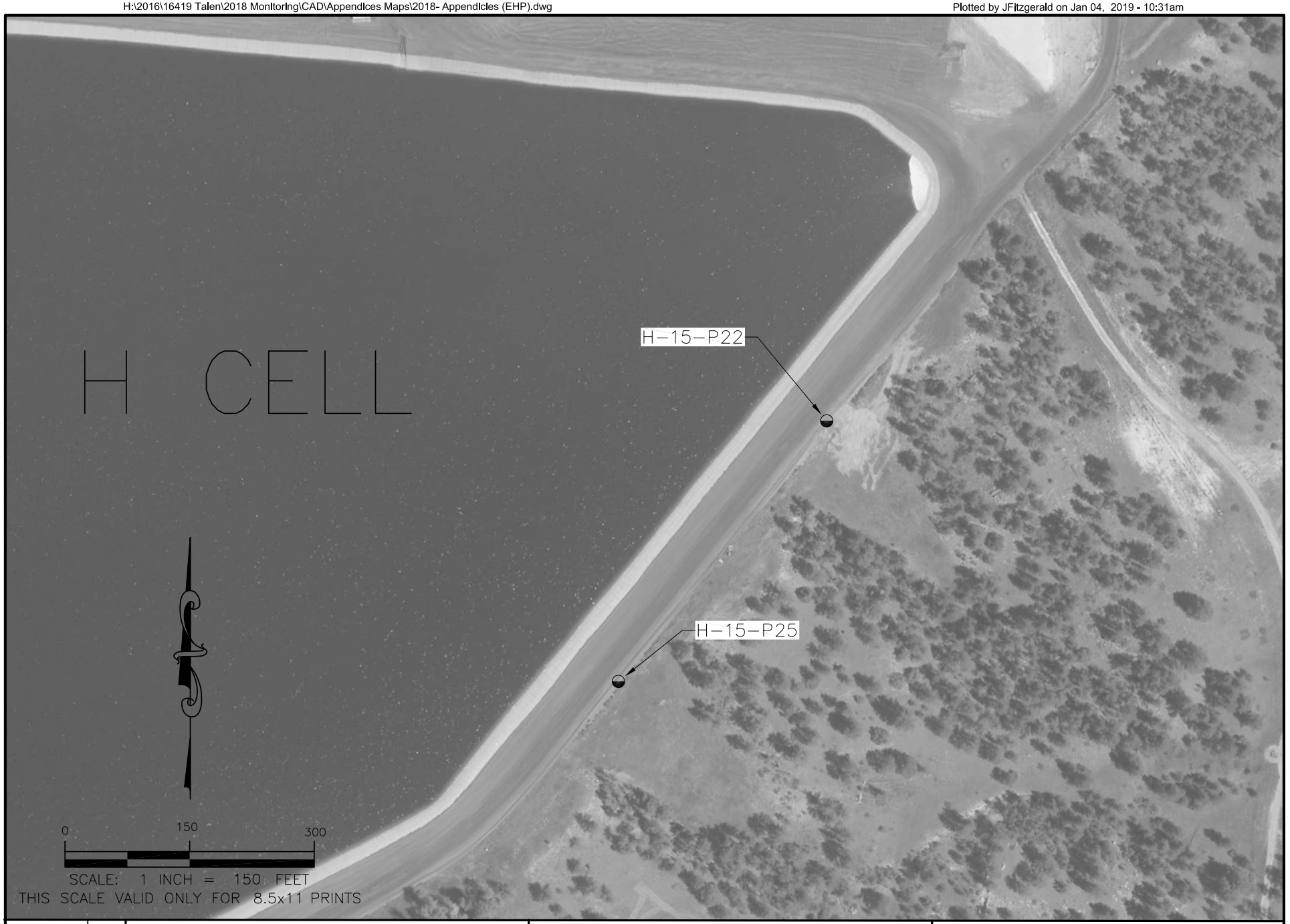
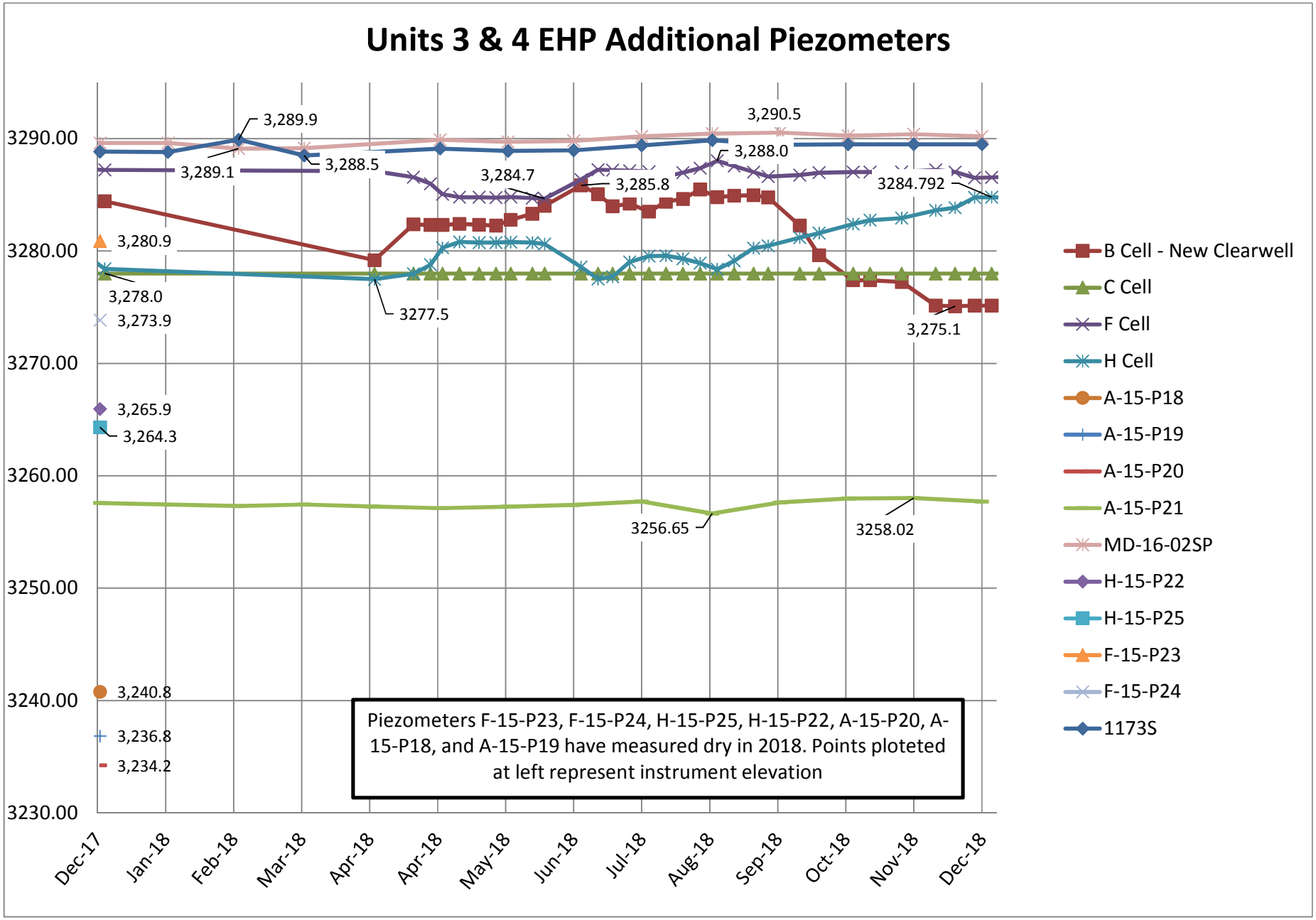


DRAFTED BY:	JWF
REVIEWED BY:	CHL
PROJECT NUMBER	16419

SHEET TITLE:
Units 3 & 4 EHP
H Cell
Piezometer Location Map

PROJECT TITLE:
2018 Annual Inspection Report
Talen Energy
Colstrip, Montana

JORGENSEN
Geotechnical, LLC
307-733-5150 www.jorgeng.com


Units 3 & 4 EHP Additional Piezometers
3290.00
3280.00
3270.00
3260.00
3250.00
3240.00
3230.00
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
3,289.9
3,289.1
3,288.5
3,290.5
3,288.0
3,284.7
3,285.8
3284.792
3,280.9
3,278.0
3,273.9
3277.5
3,275.1
3,265.9
3,264.3
3256.65
3258.02
3,240.8
3,236.8
3,234.2
Piezometers F-15-P23, F-15-P24, H-15-P25, H-15-P22, A-15-P20, A-15-P18, and A-15-P19 have measured dry in 2018. Points ploteted at left represent instrument elevation
B Cell - New Clearwell
C Cell
F Cell
H Cell
A-15-P18
A-15-P19
A-15-P20
A-15-P21
MD-16-02SP
H-15-P22
H-15-P25
F-15-P23
F-15-P24
1173S