STATE OF COLORADO

Cazier - DNR, Tim <tim.cazier@state.co.us>

Pikeview monitoring report

1 message

Kos, Paul <paul.kos@stantec.com> Tue, Jan 12, 2021 at 12:50 PM
To: "Cazier - DNR, Tim" <tim.cazier@state.co.us>
Cc: Jerald Schnabel <Jerald_Schnabel@castleaggregate.com>

Tim,

Please find attached the November monitoring report for the Pikeview Quarry. Let me know if you have any questions.

Paul Kos P.E., P.Eng.

Senior Geological Engineer

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Pikeview Monitoring Memo November.pdf
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To:	Jerald Schnabel	From:	Paul Kos
	Continental Materials Corp.		Denver, CO 80222
File:	November 2020 Monitoring Summary	Date:	December 31, 2020

Reference: November 2020 Geotechnical Monitoring Summary Pikeview Quarry

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this November 2020 Geotechnical Monitoring Summary for the Pikeview Quarry. The Pikeview Quarry is situated along the foothills of the Rocky Mountains, northwest of Colorado Springs, Colorado. Continental Materials Corp. operates the quarry, which is currently closed, pending reclamation. A geotechnical monitoring program was established to monitor reclamation activities which will affect the geotechnical performance of the existing and reclaimed slopes during and following reclamation grading. This report presents the geotechnical monitoring results for the slope reclamation activities at the site through the month of November 2020.

It is important to note that there is currently little activity at the Pikeview Quarry. Operations are limited to importing fill and preparing the growth medium, and no fill is being placed on the slopes. Continuous monitoring by the robotic survey system began in 2010 and has continued through the month of November 2020 uninterrupted. Visual inspections of the slopes were performed by Stantec engineers.

1.1 PURPOSE

The purpose of this report is to summarize the November 2020 geotechnical monitoring results and verify the geotechnical performance of the existing and reclaimed slopes with respect to the historical performance record. The goals of the geotechnical instrumentation monitoring program can be described as:

- Meet corporate risk management requirements,
- Provide ongoing slope monitoring and advance warning of any changed conditions that could pose a hazard to workers or to the public,
- Document the geotechnical performance of the slope, and
- Document monthly site grading activities and construction quality assurance.

1.2 MONITORING SUMMARY

Major components of the instrumentation monitoring program are listed in Table 1 and shown on Figure 1.

Table 1 Monitoring Frequency

Monitoring Type	Frequency
Visual inspection	Daily/Monthly
Robotic theodolite/prism	Continuous
Drone inspection	Monthly
Compaction testing	Every 5,000 yd^3 (min.)

2.0 VISUAL INSPECTIONS

Inspections are completed daily by site personnel and monthly by Stantec personnel to document visual observations of slope conditions, including conditions of instability (i.e. cracking, slumping, over-steepened slopes, seeps, perched boulders, rock falls, erosion, and areas undercut by construction or maintenance activities). Certain areas of the landslide have been designated as safety exclusion zones, and these areas are inspected from adjacent locations.

When present, site operators inspect their work areas for signs of instability on a daily basis before starting work per MSHA rules and regulations. The limited work performed in November 2020 resulted in the operator visual inspections being limited to stockpiles.

Stantec conducted visual inspections of the Pikeview Quarry slopes on December 4, 2020. The engineering inspections were conducted by traversing each area of the mine and observing the uphill slope and the downhill slope for signs of instability, and areas in need of maintenance. Slopes that have been graded and are 2 horizontal (H):1 vertical (V) or shallower are also traversed on foot. The findings are listed below, and photographs of notable observations are included on Figure 2 in Appendix A.

- Survey Station: Based on the survey data, the total station is in operating condition. This was visually confirmed during this visit.
- Prisms: Several prisms were passed along the walking route and appeared to be in their original position and operating normally. Control points are permanently cemented into the ground while some of the monitoring points are cemented into 5-gal buckets to be portable as needed.
- Several new prisms were in the process of being placed during the site visit and will appear on the next report.
- Gullies: Gullies have formed on the slopes above the slide area as well as in the burn areas above the quarry. (Note 2)
- Pooled Water: The grading at the top of the first ridge causes a small amount (0.03 ac) of water to pool. While this promotes wildlife habitat, it has been advised that the pond should be drained.
- Fresh Cracks: A crack was observed this feature is in an area where cracking is expected to occur as a result of ongoing slope settlement and relaxation. (Note 7)
- Healed Cracks: A crack was observed on the slope adjacent to the slide where cracking had previously been observed. This crack runs parallel to the slide and appears to be “healed” and did not indicate any recent movement. (Note 6)
- Crack Free: No cracking was observed on the native granite slopes above the extents of the disturbed area. The hummocky field in the area immediately above the southern extent of the slide shows shows evidence of cracking but they are not fresh or active. No new or open cracks were found immediately inside or next to the slide area.
- Fill: Fill is being imported and temporarily placed on the “production floor”. During the visit, different types of material including mulch and general fill were being deposited here for future placement. Based on the drone survey, approximately 2,240 cubic yards of temporary fill and 810 cubic yards of permanent fill were imported during the month of November. (Note 3)
- Growth Media: In the month of November stockpiles changed in the mulch pile where volumes increased and in the growth media pile where volumes decreased. Growth media was used to develop a vegetation test.

- Culverts: A 6-ft culvert was observed to be blocked on the upstream end. There is evidence that water is collecting at the inlet during rain events and likely seeping through the loose material and through the culvert. During the November visit plans were made for the clearing of the culvert inlet. (Note 1).

Visual inspections of the Pikeview Quarry did not reveal any evidence of large-scale instability outside of the landslide areas previously identified. No bulging, rippling, over-steepening, depressions, slumps, or dry slip-offs were observed in areas that have been graded and/or reclaimed.

3.0 PRISM SURVEY

A Leica Robotic station is used to continuously survey the prisms onsite to document slope movements. The station records the location of each prism every four hours. There are currently 17 prisms; 3 prisms are control points located outside the slope movement area, 13 prisms are located on the slopes surrounding the landslide area, and one prism is located at the toe of the landslide. As the slope is backfilled and graded, additional prisms will be installed. The existing prism locations are shown on the current topography in Figure 3, and the proposed prism locations are shown on the reclamation topography in Figure 4. Both figures are included in Appendix B. CMC plans to install 3 prisms near the toe of the slide area, and the approximate locations of the prisms are shown on Figure 3. The prisms were scheduled to be installed December 2020.

The monitoring software, GeoMos, has been programed to provide automatic alarms if there is a movement recorded that is greater than 0.35 feet or if a prism cannot be located. The alarm notes and actions taken are logged, and the alarms are summarized in Table 2. All alarms were determined to be caused by rain, fog, an obstruction, or temporary system malfunction. There were no alarms caused by slope movements.

Table 2 Alarm Summary

Date	Notes	Actions taken	Issue Resolved
11/1/2020	Prism at CP1 missing on scans	Prism Stolen	11/1/2020
11/2/2020	Multiple prisms missing after on scans	Testing	11/2/2020
11/9/2020	Multiple prisms missing after on scans	Frost Pending Snow	11/9/2020
11/10/2020	Multiple prisms missing after on scans	Snow and Frost	11/10/2020
11/24/2020	Multiple prisms missing after on scans	Rain and Snow	11/24/2020

The prism monitoring results for transverse and height displacements, monthly change, and cumulative change are summarized in Table 3 below. The transverse displacement measures the change in the horizontal distance from the robotic station to the prism; positive displacements indicate less distance between the station and prism (movement towards the total station). The height displacement measures the change in the vertical distance from the robotic station to the prism; positive displacements indicate upward movement. The values for the last reading in the month are included in Table 3. The monthly delta is the most recent reading cumulative delta displacement (horizontal, lateral, and vertical) subtracted from the last reading from the previous month. The cumulative delta values are a total displacement and are not

associated with a direction. The transverse, height, and cumulative delta displacements are the total displacement over the life of the monitoring, which has been several years for all the prisms except P69. Prism P69 was moved on June 20, 2020, and the displacements included in Table 3 are the displacements since that date. According to Leica documentation, the survey accuracy is +/-4 mm+1.5 ppm for prisms located greater than 500m from the station; these equates to an accuracy of +/-0.016 ft. The data show stable conditions with no movement for 16 of 17 prisms with recorded displacements limited to data scatter and not actual movements. Prism P63 is located at the toe of the landslide, and this location shows slope creep movements at slow velocities (<0.001 feet per day). Plots of the transverse and height displacements for each prism are included in Appendix B.

Table 3 Prism Summary

Prism ID	Cumulative Transverse Displacement (ft)	Cumulative Height Displacement (ft)	Monthly Delta (ft)	Cumulative Delta (ft)	Needs / Recommendations
CP1	0.007	0.006	-0.0083	0.0097	
CP2	-0.065	0.006	0.0121	0.3994	
CP3	0.276	-0.200	0.0243	0.3449	
NP1	0.048	0.021	0.0084	0.0599	
NP2	-0.001	-0.051	0.0165	0.0694	
NP66	0.073	-0.163	0.0313	0.2294	
P1	0.336	-0.031	-0.0324	0.3392	
P2	0.145	-0.011	-0.0080	0.2133	
P25	-0.012	0.051	0.0224	0.1514	
P32	-0.074	-0.084	0.0301	0.2739	
P33	-0.106	-0.039	0.0465	0.2142	
P35	0.046	-0.167	0.0237	0.4304	
P4	0.346	-0.118	-0.0071	0.4704	
P5	0.380	-0.139	0.0037	0.6096	
P63	15.240	-6.238	0.0143	16.4674	Prism at toe of slide. Movements are within expected range.
P69	-0.037	0.000	0.0288	1.9883	
P70	0.342	-0.295	0.0045	0.5745	

4.0 DRONE SURVEY

The site was flown for aerial imagery using an unmanned aircraft system (UAS or 'drone') on November 16, 2020. The imagery was inspected for signs of instability and used to supplement the onsite visual inspections. Features noted in the aerial imagery review were inspected during Stantec's engineering inspection and are summarized in Section 2 above. The imagery was also used create site topography.

The October topography was also compared to the November topography to identify changes in the site topography. Comparison of the two surveys showed that approximately 2,510 yd^3. of fill had been imported and temporarily placed. Additionally, 810 yd^3. of material have been permanently placed. No slope movements or other changes in topography were identified. The current imagery and topography are included in Figure 1, and the comparison surface is included as Figure 5 in Appendix C.

As previously reported in the September 2020 monitoring report, there are limitations with the method of comparing drone surveys from different months. The drone data indicate changes in the slopes along each of the reclamation benches, buildings, and areas with trees or shrubs. These areas are stable, and the changes are the result of survey limitations on or near vertical slopes.

5.0 COMPACTION TESTING

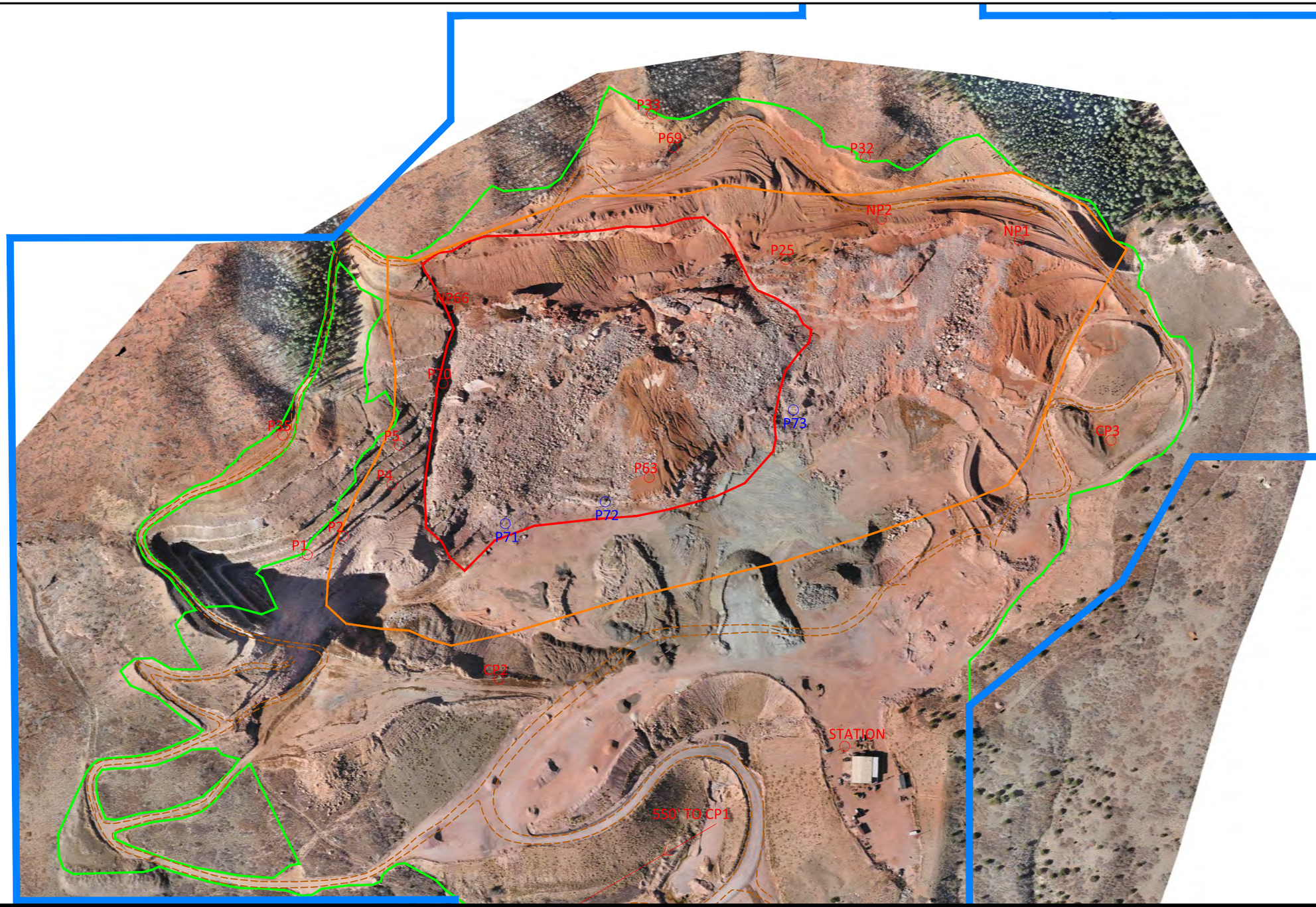
A small amount of material (810 yd^3) has been placed at the quarry. Based on communication with CMC staff, this material was dozed into approximately one-foot lifts and then compacted using the excavator bucket. The material has been placed near the landslide slope where lifts up to three feet thick are allowed. The volume is less than the compaction testing rate of one test per 5,000 yd^3; therefore, no compaction testing was required. Once fill placement starts, the fill will be placed in one-foot thick lifts, moisture conditioned as necessary, and compacted. Compaction testing will commence at the rate of at least one test per 5,000 yd^3 placed.

Per CMC, imported material is being stockpiled onsite for placement at a later date. The material will be tested for compaction level and areas failing compaction testing will either be further compacted until the specification is met or removed and replaced in a compacted manner.

6.0 CONCLUSIONS

None of the data collected in November 2020 indicate evidence of any large-scale movements that increase risk to workers or to the public. The landslide area continues to show slope creep movements with slow velocities. Shallow surface erosion continues to occur requiring ongoing maintenance and cleanup.

- Restricted access to the ungraded landslide slopes should continue.
- All monitoring should continue at current frequencies.



LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Existing Prism
- Proposed Prism

N

0 300' 600'

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Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
SITE MAP

Revision
#

Date
2020.12.31

Drawn By
PK

Figure No.
1

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Appendix A

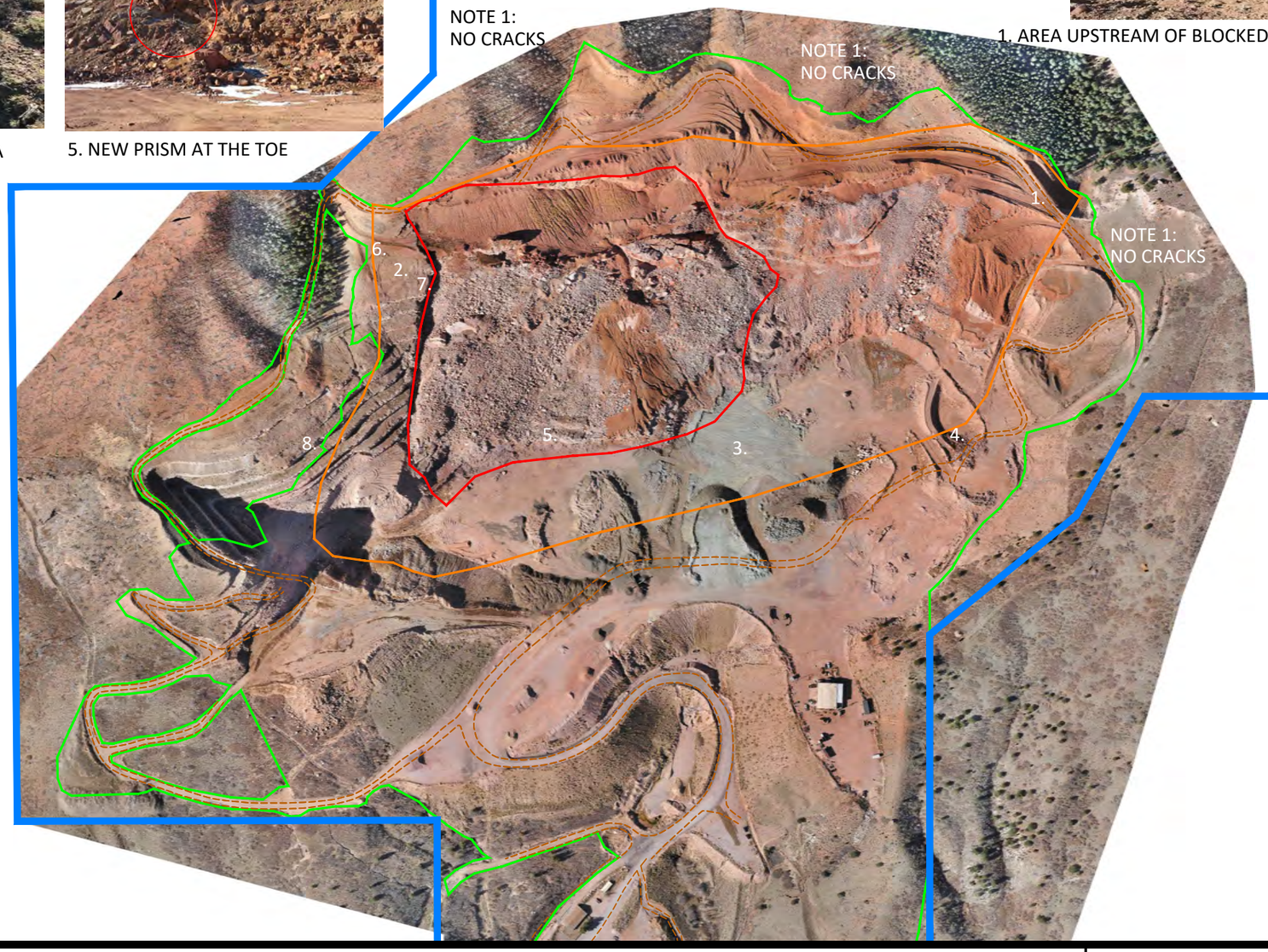
Visual Inspections

6. HEALED CRACKING ABOVE THE SLIDE AREA

5. NEW PRISM AT THE TOE

7. NEW CRACK PARALLEL TO SLIDE

8. VIEW UP SOUTH ESCARPMENT



1. AREA UPSTREAM OF BLOCKED CULVERT

2. EROSION GULLEY

3. DEBRIS AND RUBBLE FILL AREA

4. VIEW FROM NW TOWARD SURVEY STATION

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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent

NOTES

1. NO CRACKS OBSERVED IN THIS AREA.
2. ALL PHOTOS TAKEN DECEMBER 4, 2020.

N

0 400’ 800’

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
OBSERVATIONS FROM NOVEMBER INSPECTION

Revision
#

Date
2020.12.31

Drawn By
PK

Figure No.
2

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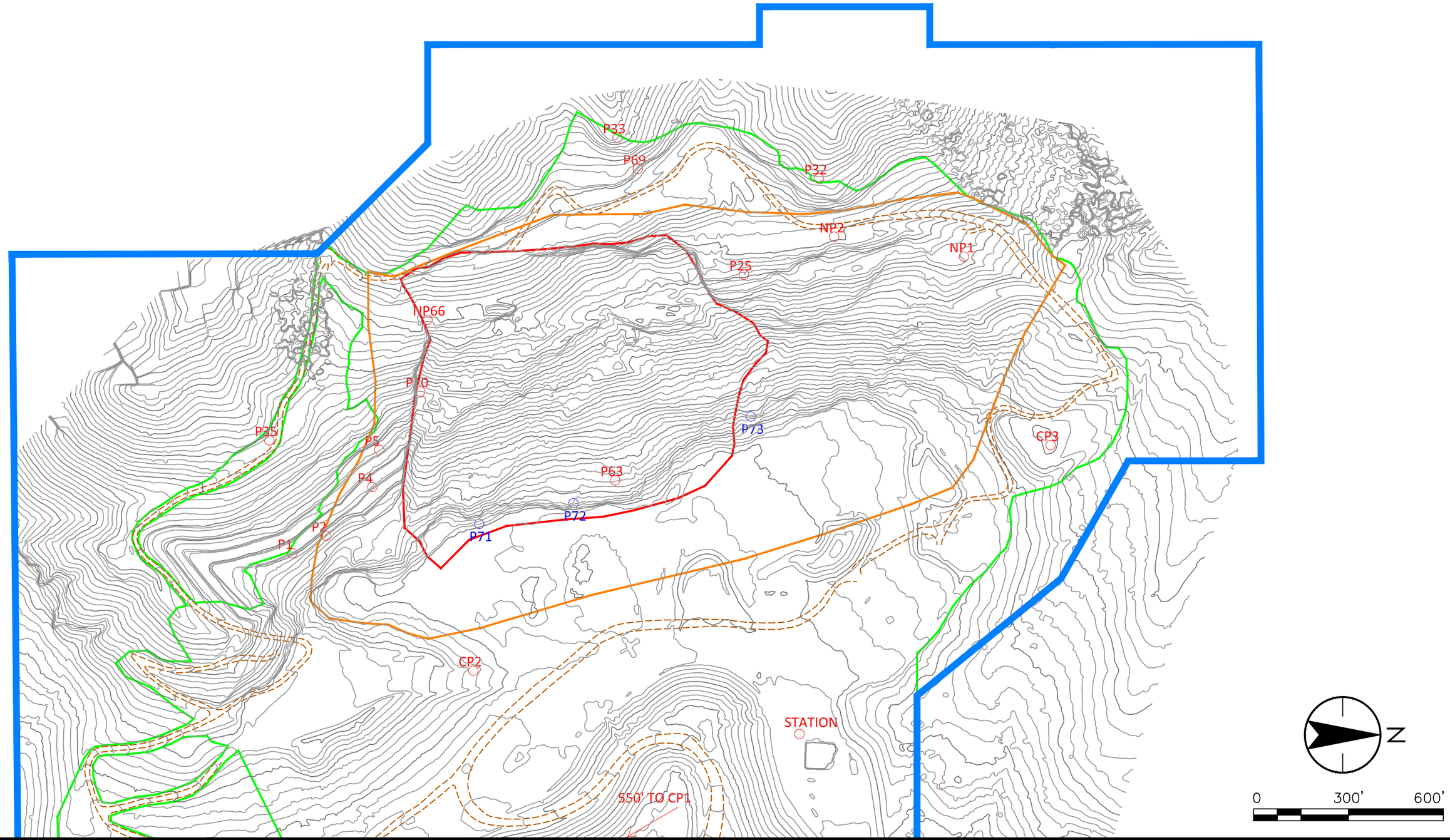
Appendix B

Prism Survey



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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Existing Prism
- Proposed Prism

1. GRADING AND MOVEMENT OF STATION WILL BE EXTENDED AS LONG AS POSSIBLE.
2. PRISMS WILL BE INSTALLED AS EACH BENCH IS FINISHED.
3. ALL PRISMS WILL BE RETAINED AS LONG AS POSSIBLE.
4. TOPOGRAPHY FROM NOVEMBER 16, 2020 DRONE SURVEY.
5. CONTOUR INTERVAL IS 10 FEET

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

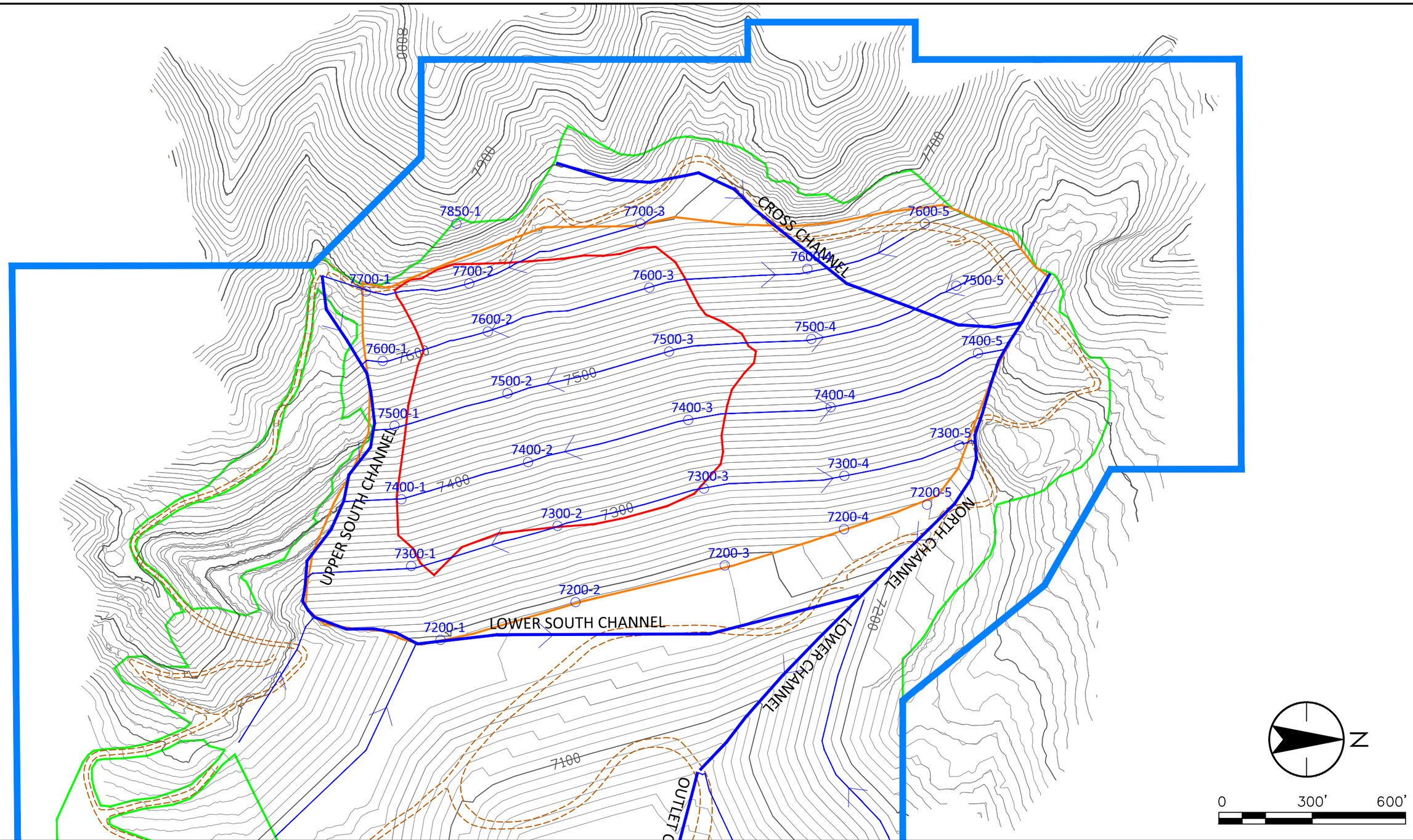
Title
EXISTING PRISMS WITH CURRENT SURFACE

Revision
#

Date
2020.12.31

Drawn By
PK

Figure No.
3



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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Proposed Prism

NOTES

1. GRADING AND MOVEMENT OF STATION WILL BE EXTENDED AS LONG AS POSSIBLE.
2. PRISMS WILL BE INSTALLED AS EACH BENCH IS FINISHED.
3. ALL PRISMS WILL BE RETAINED AS LONG AS POSSIBLE.

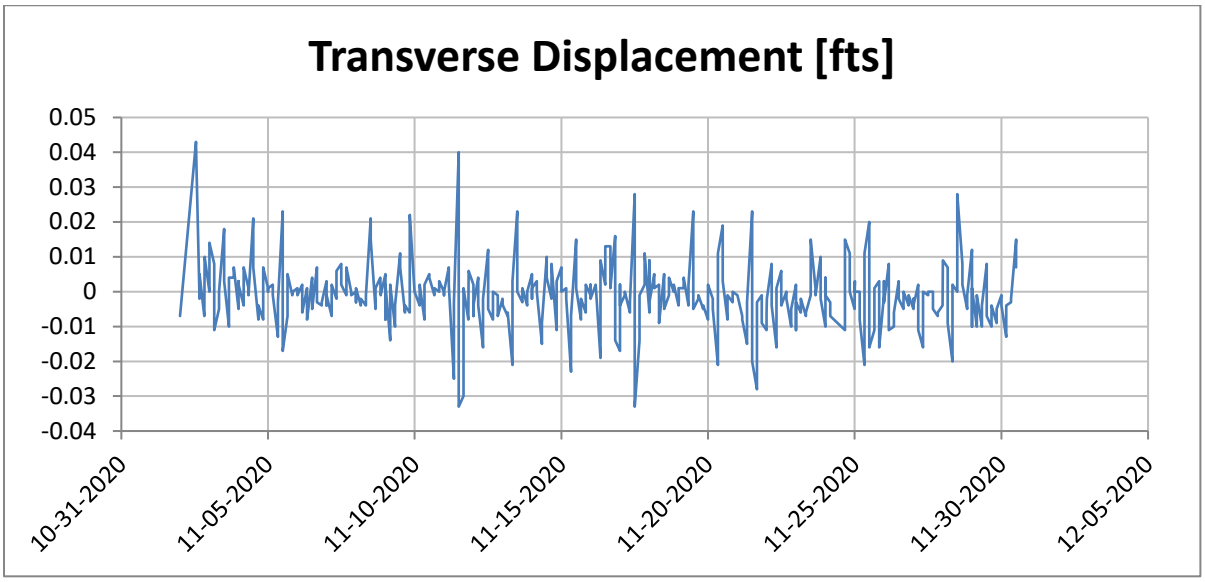
Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

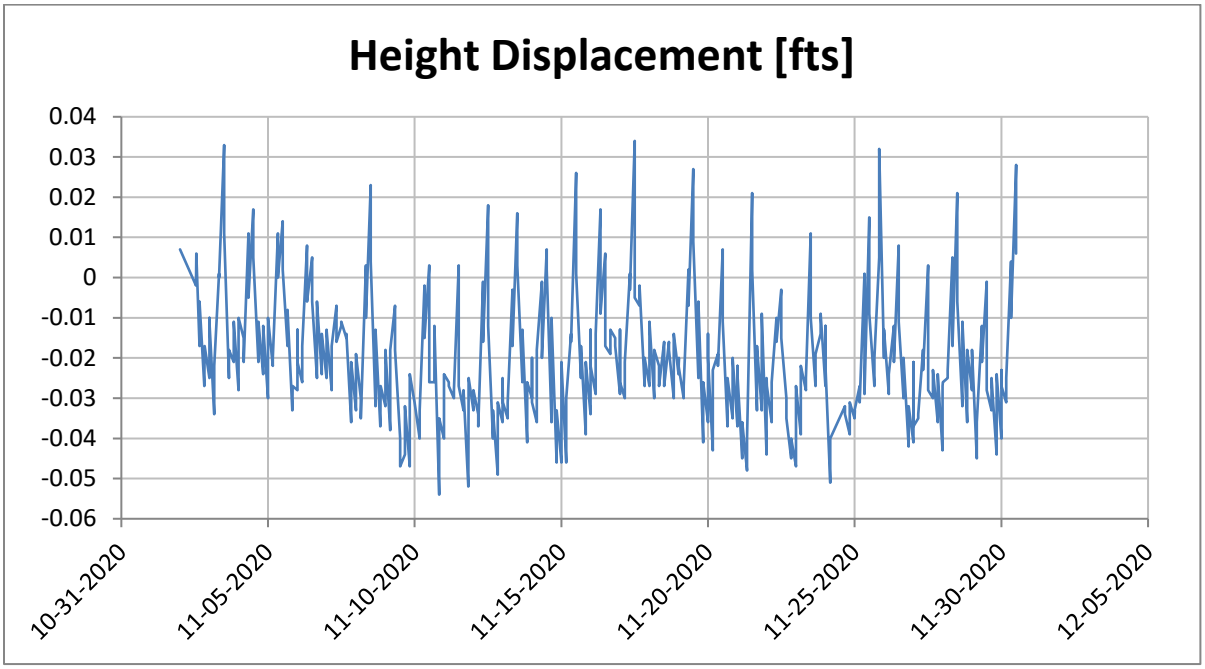
Project No.
227419041

Title
PROPOSED PRISMS WITH RECLAMATION SURFACE

Revision	Date
#	2020.12.31
Drawn By	Figure No.
PK	4

Prism CP1

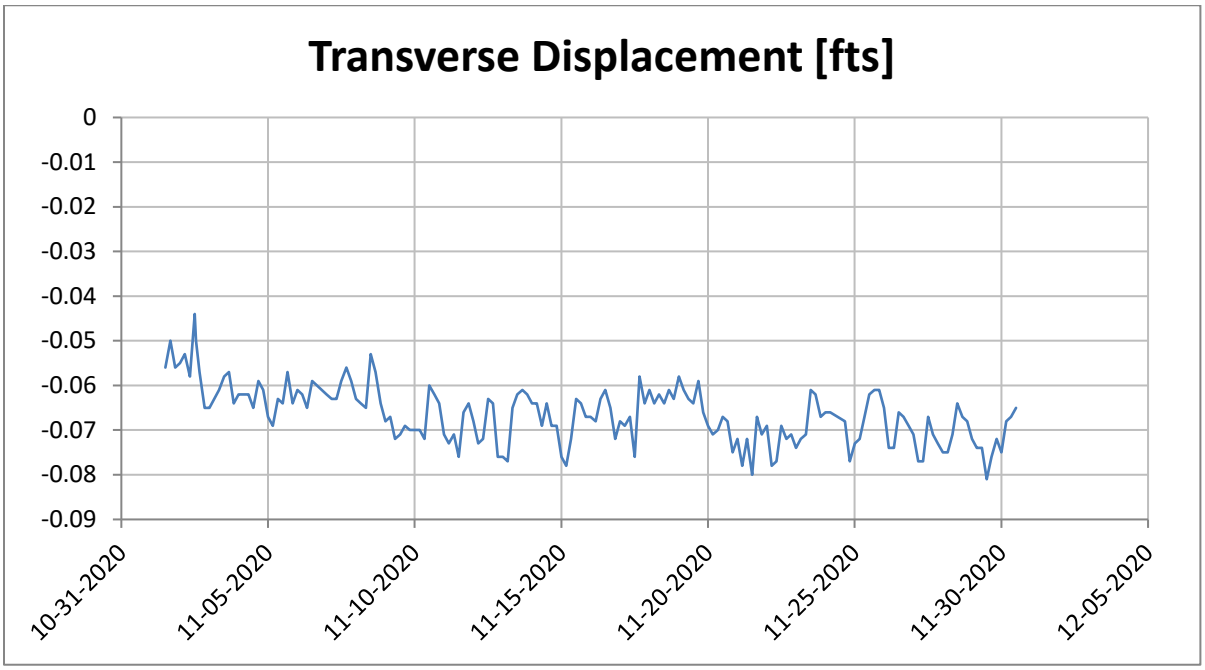


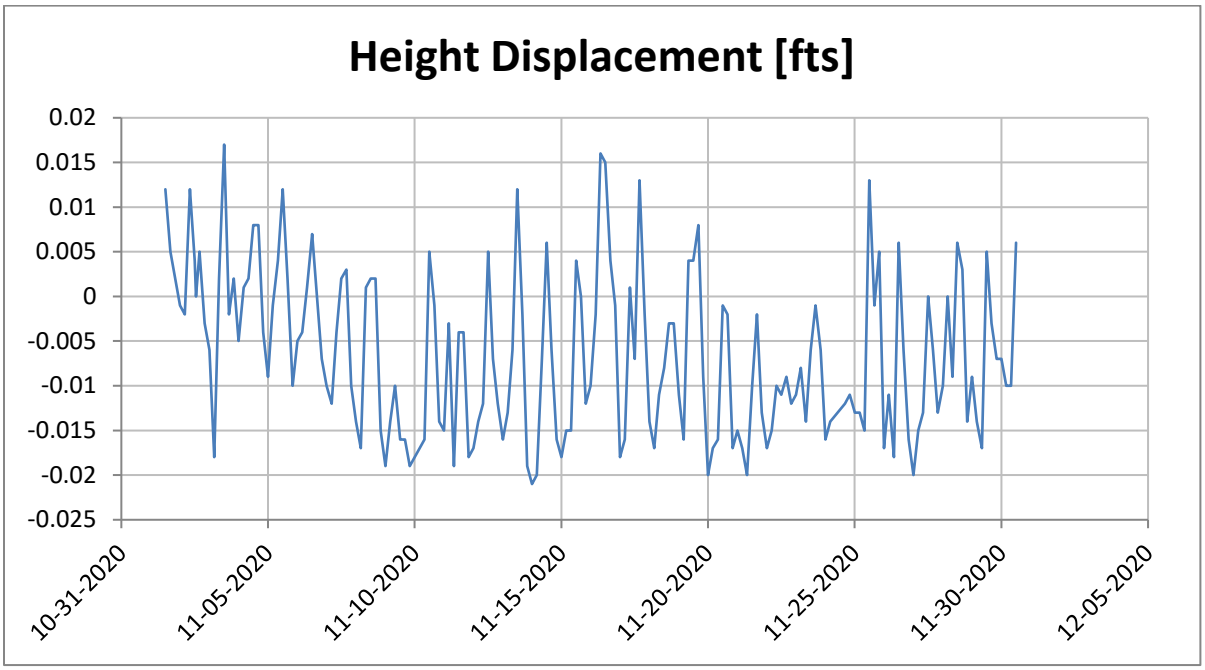


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism CP2





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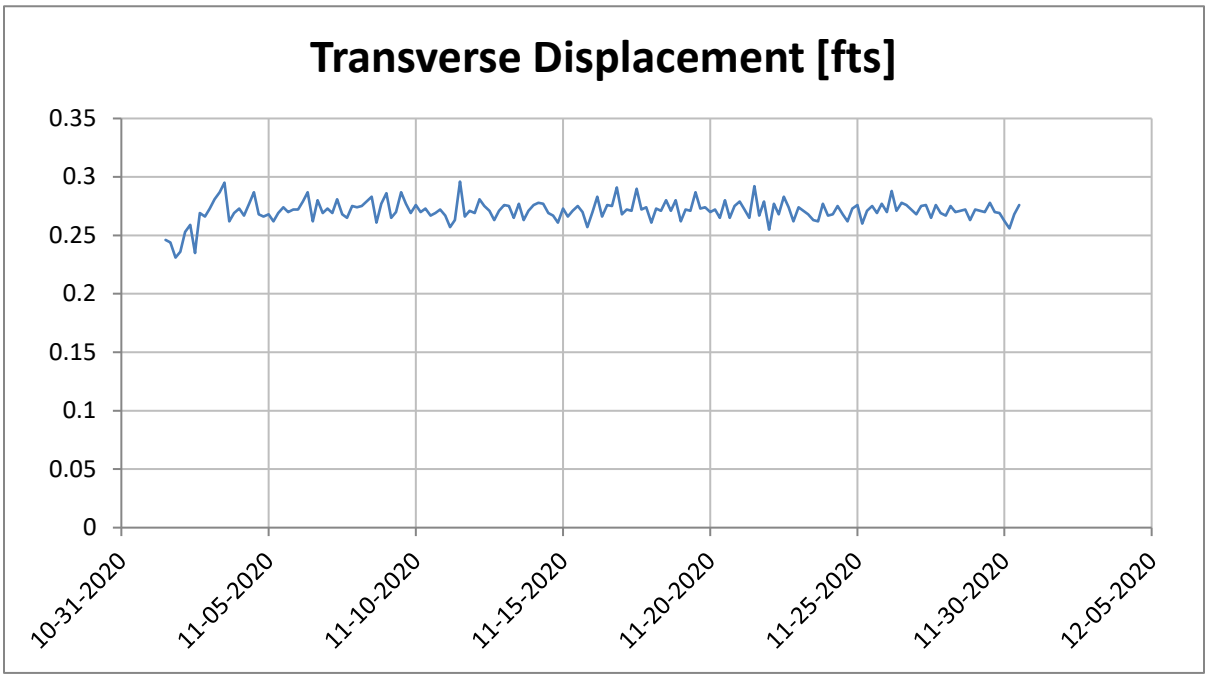
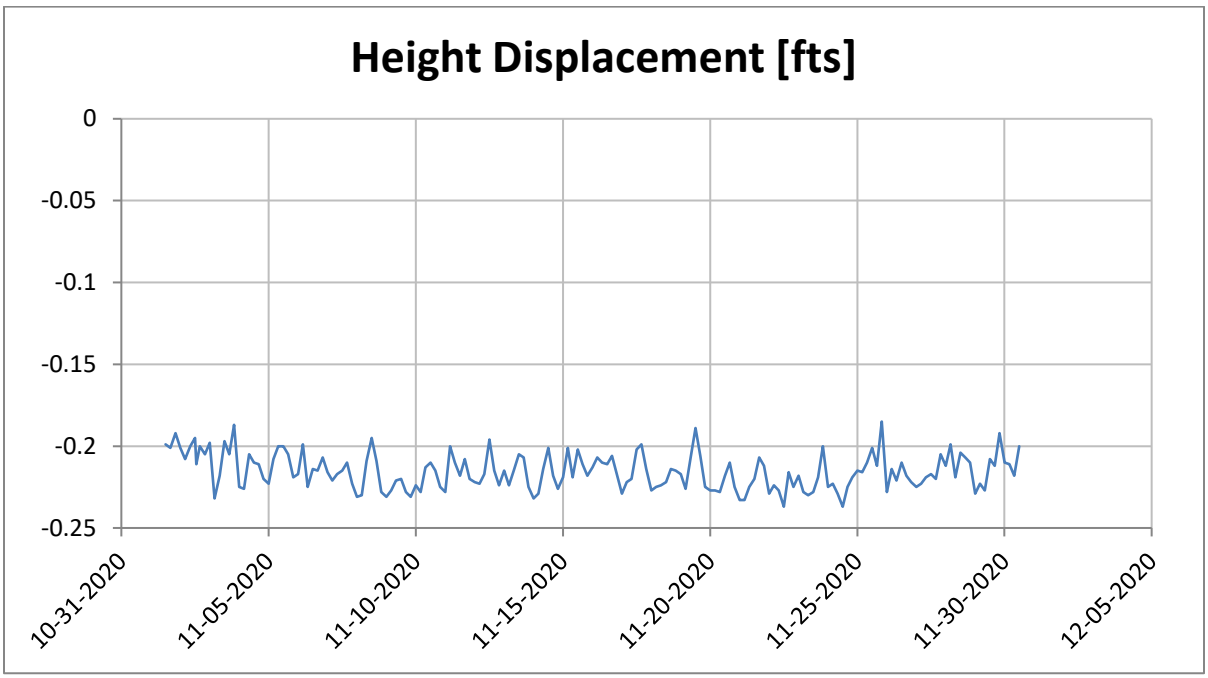
Prism CP3





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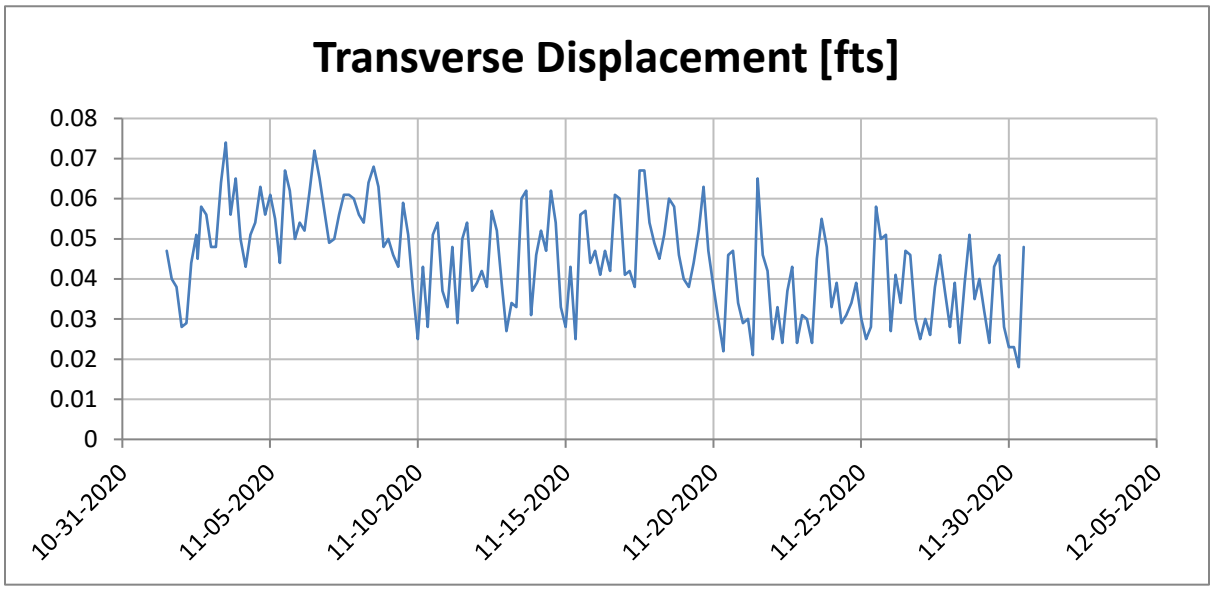
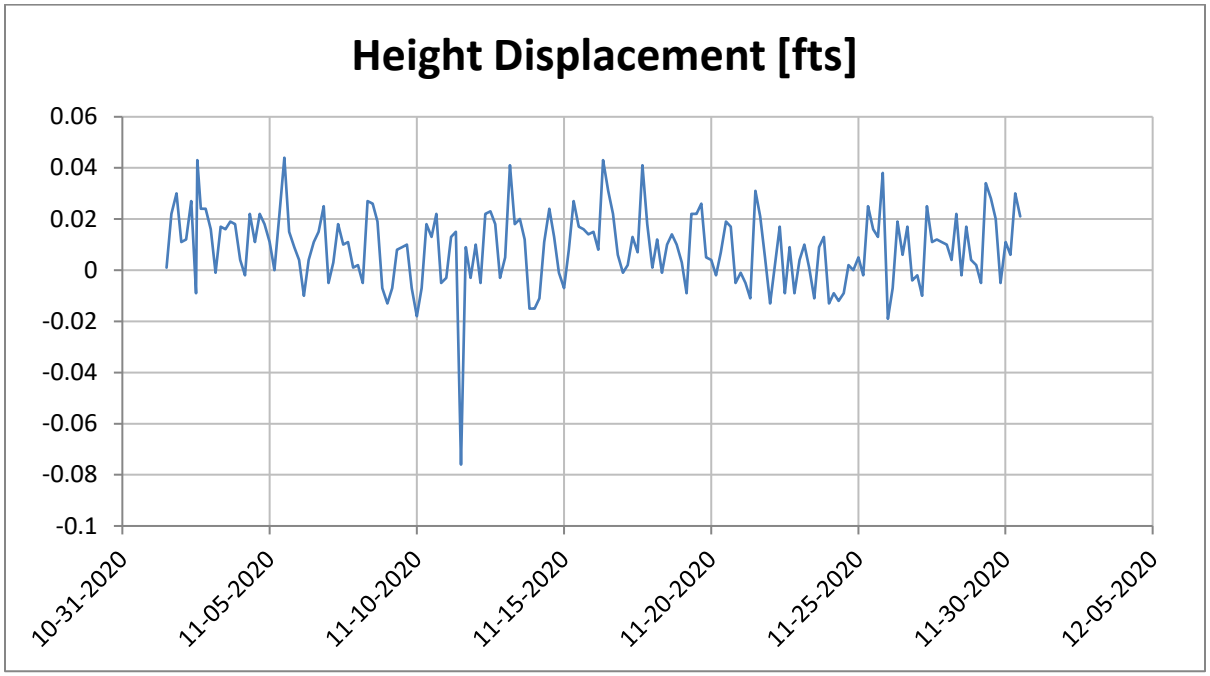
Prism NP1





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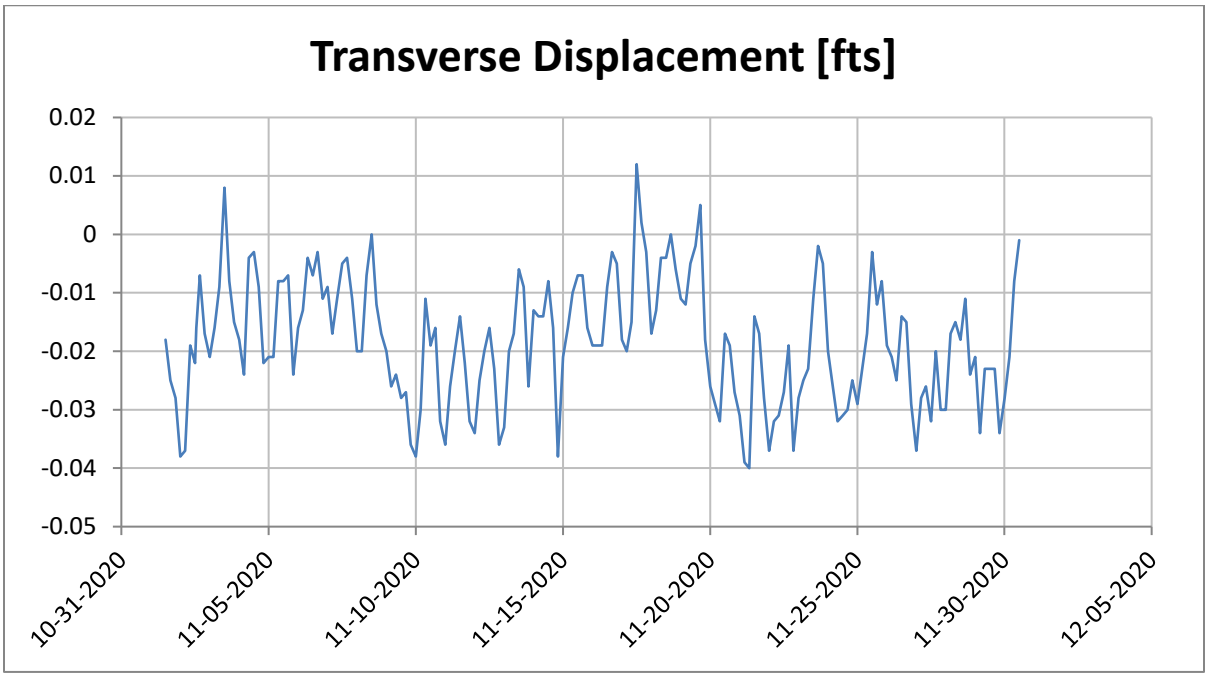
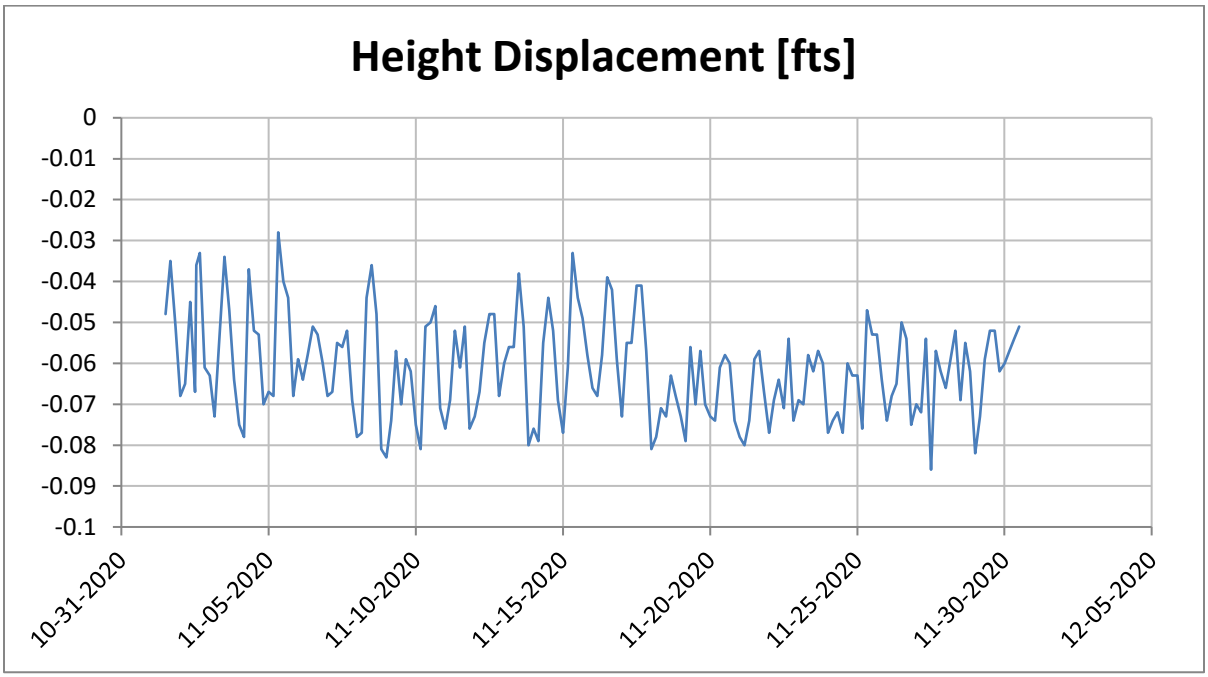
Prism NP2





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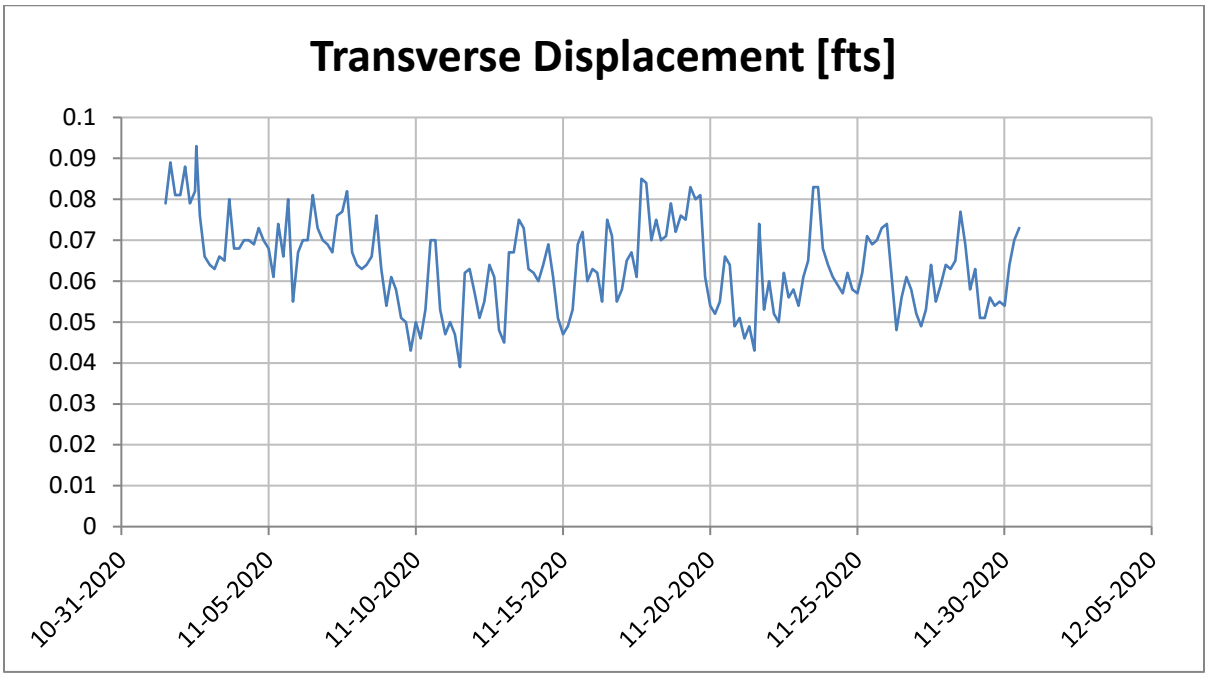
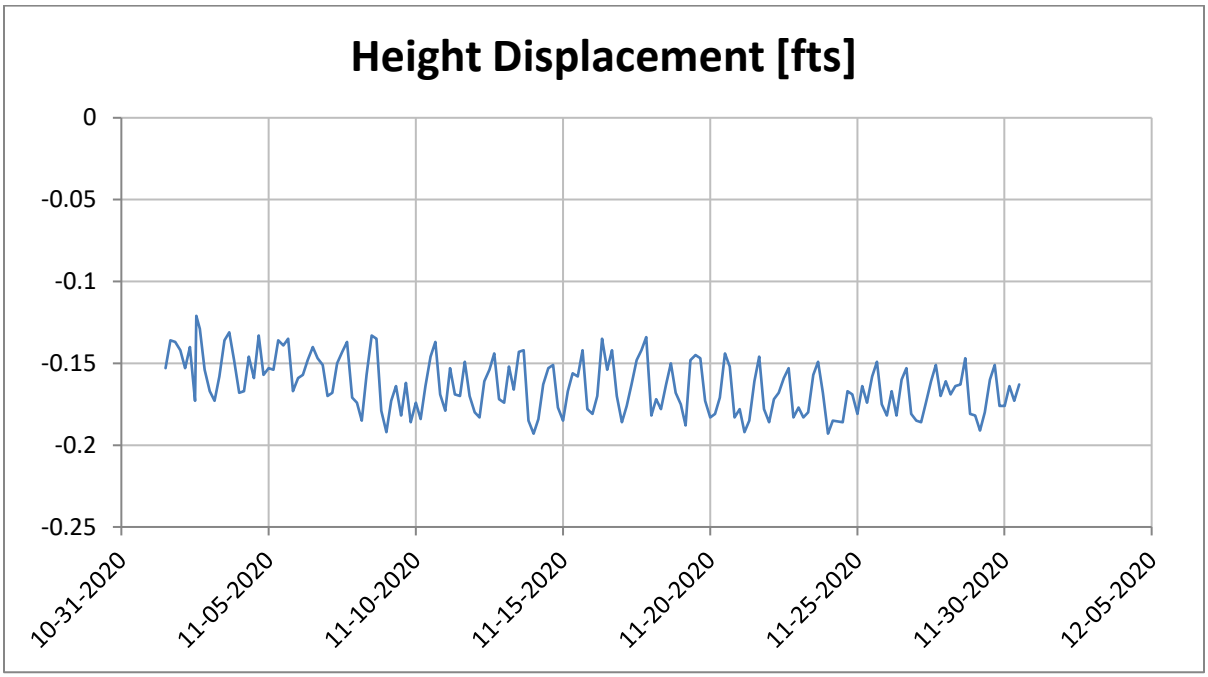
Prism NP66





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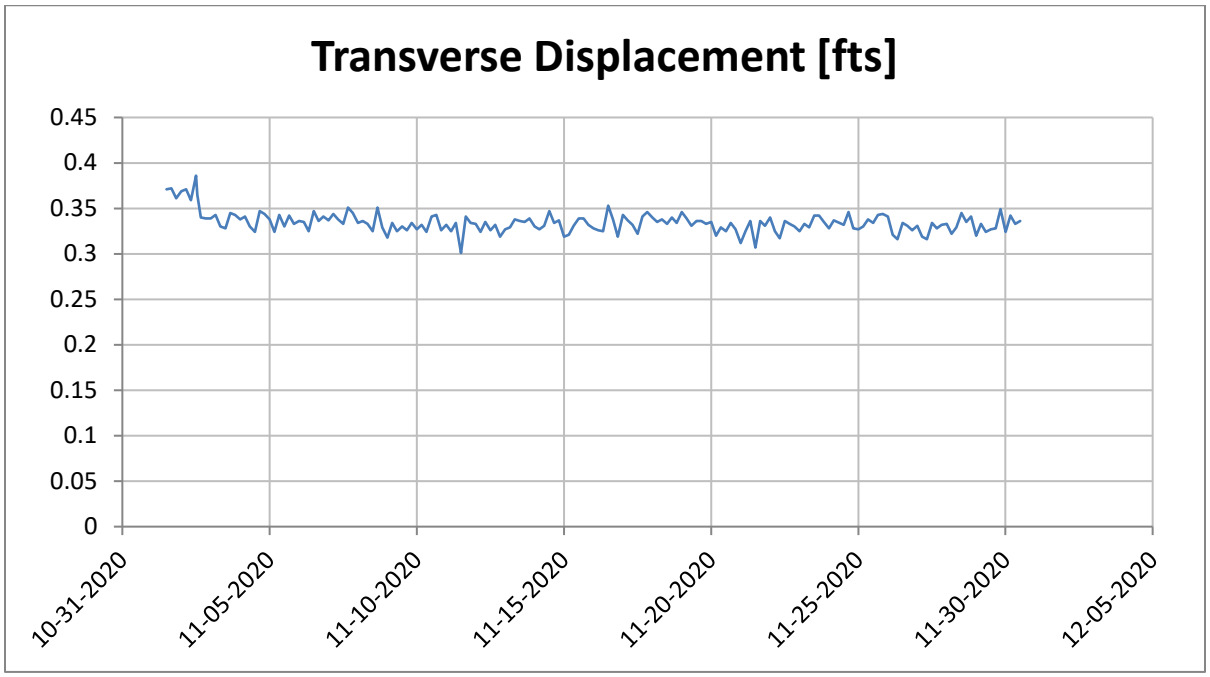
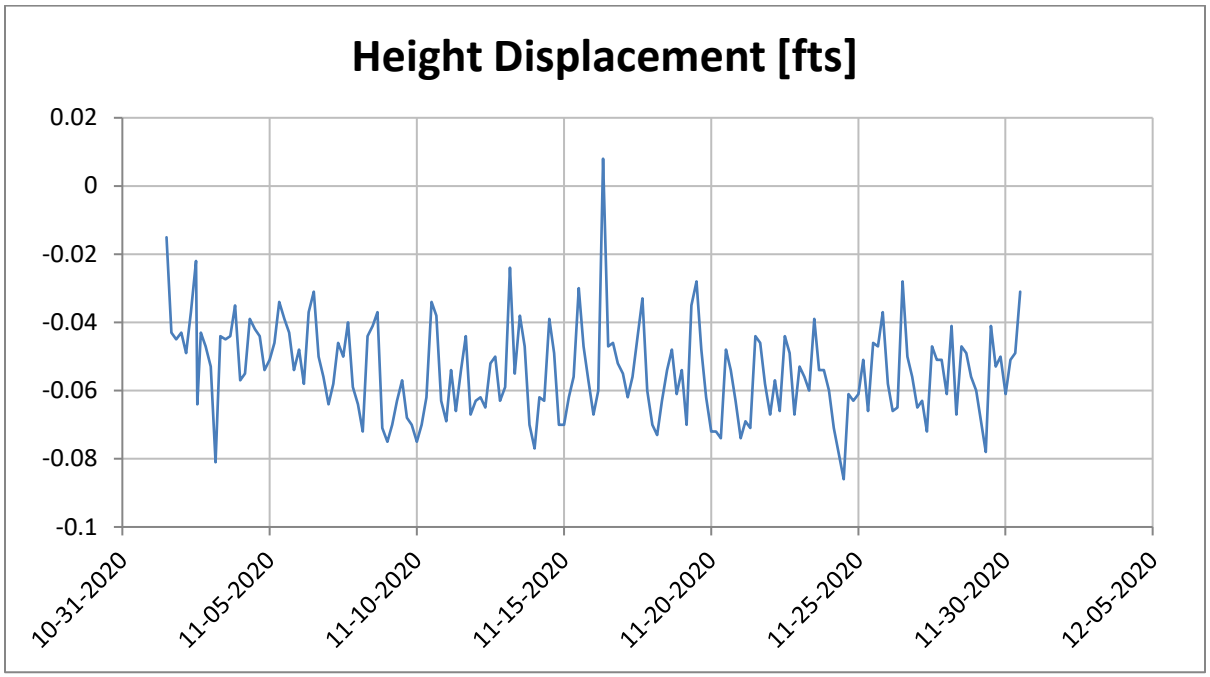
Prism P1





Notes:

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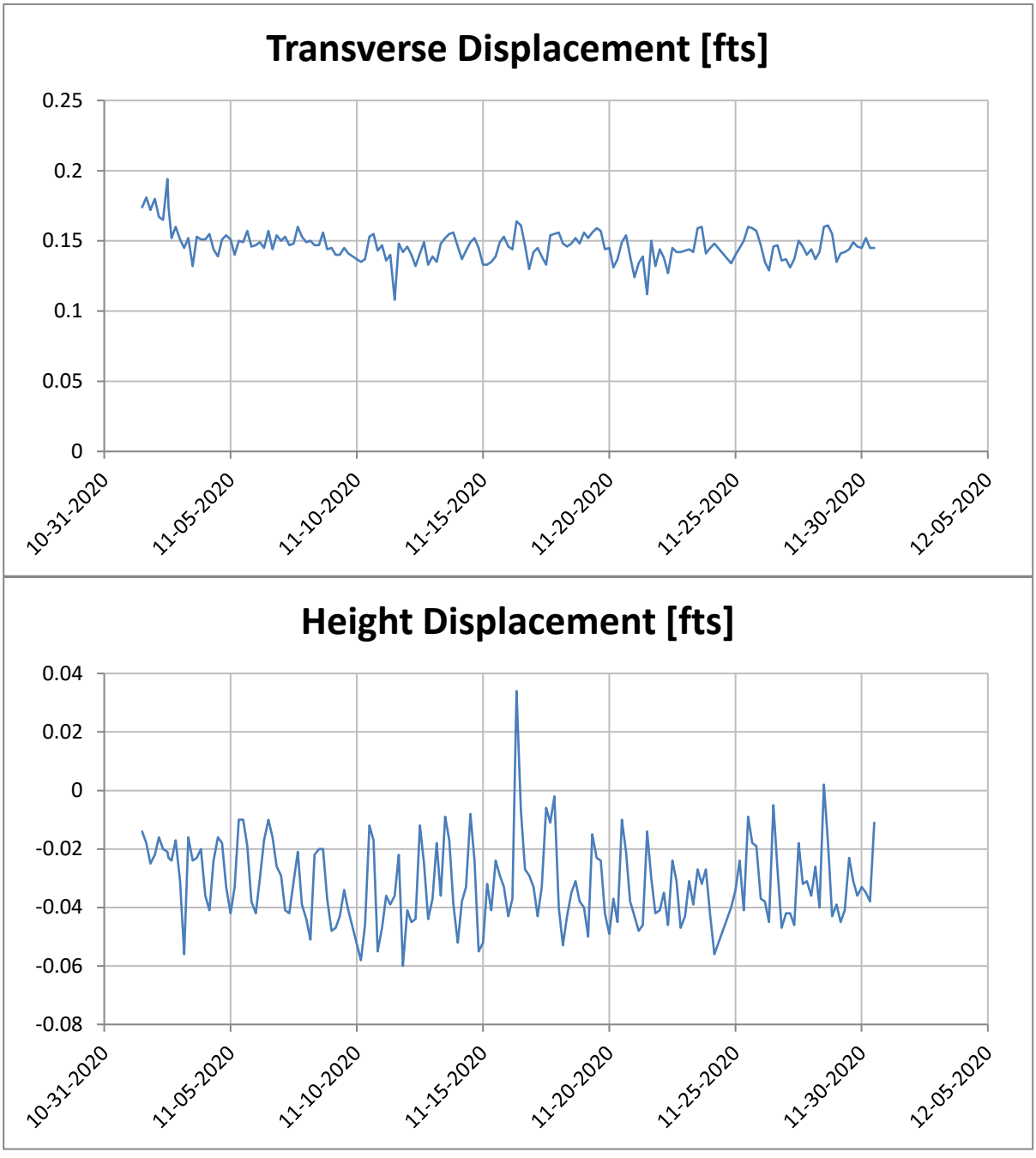
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P2



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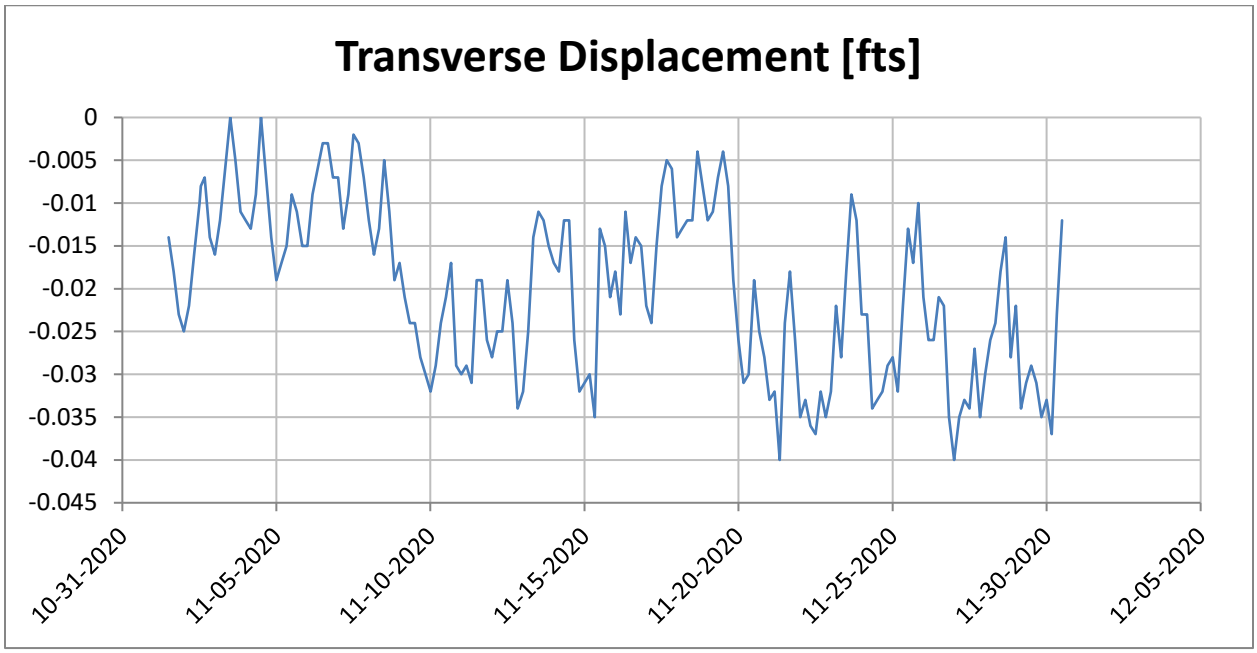
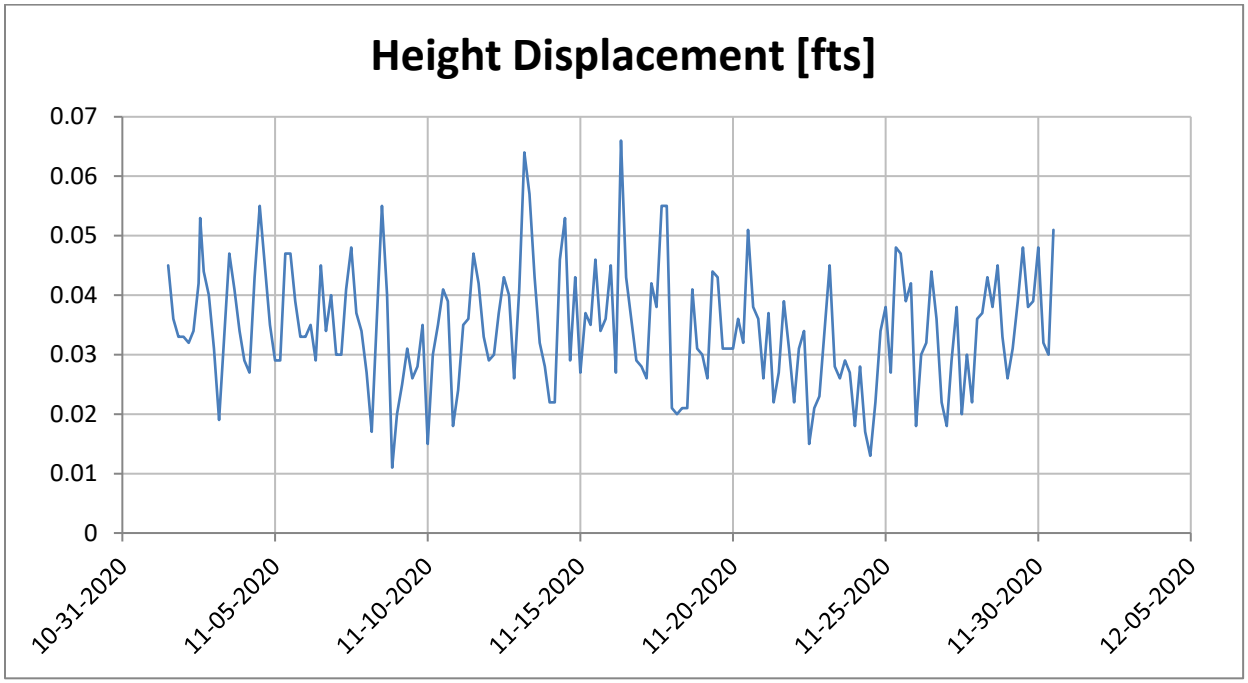
Prism P25

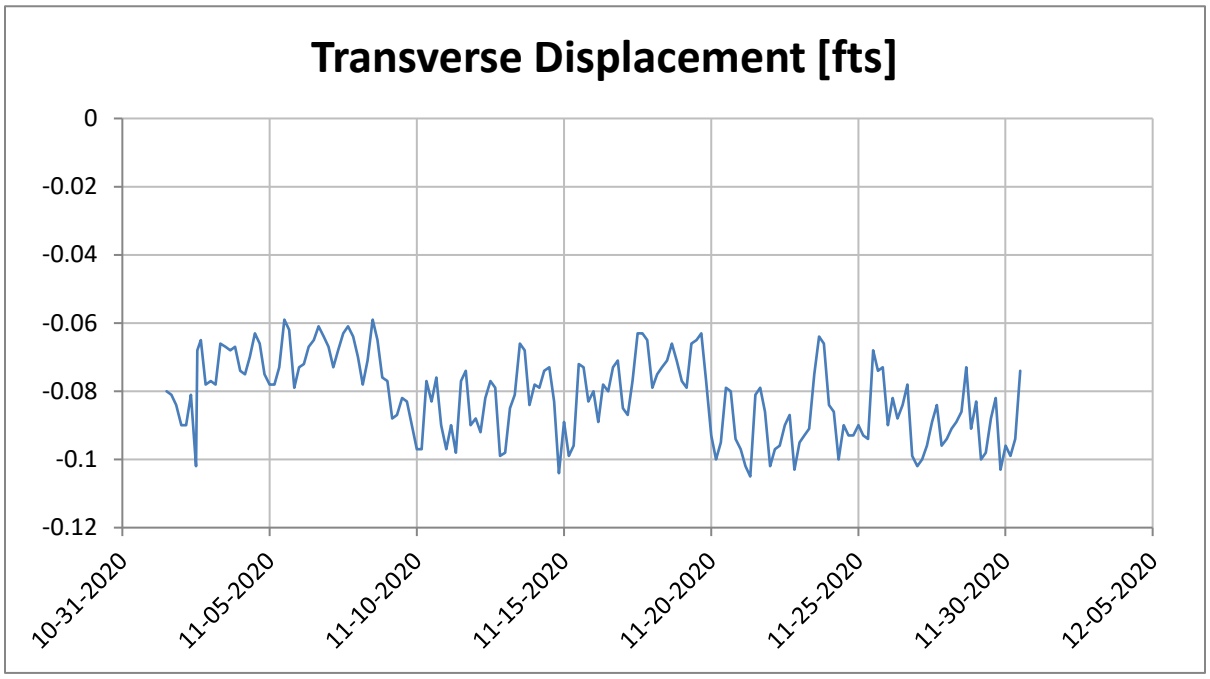


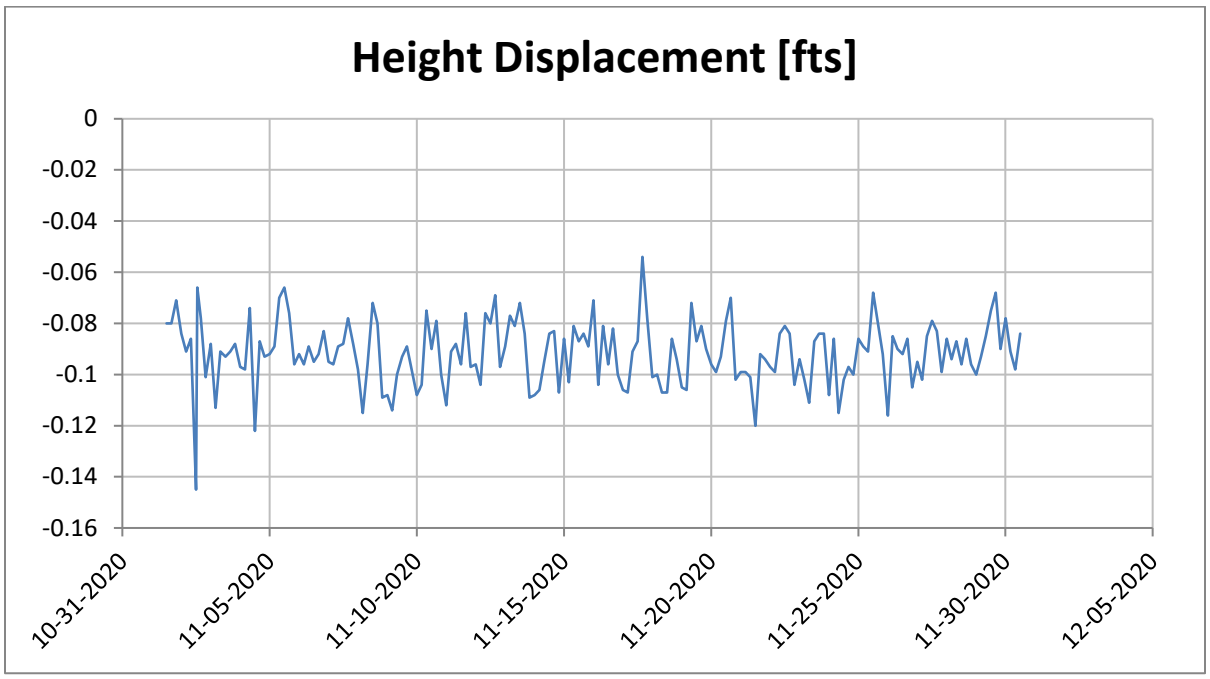


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P32

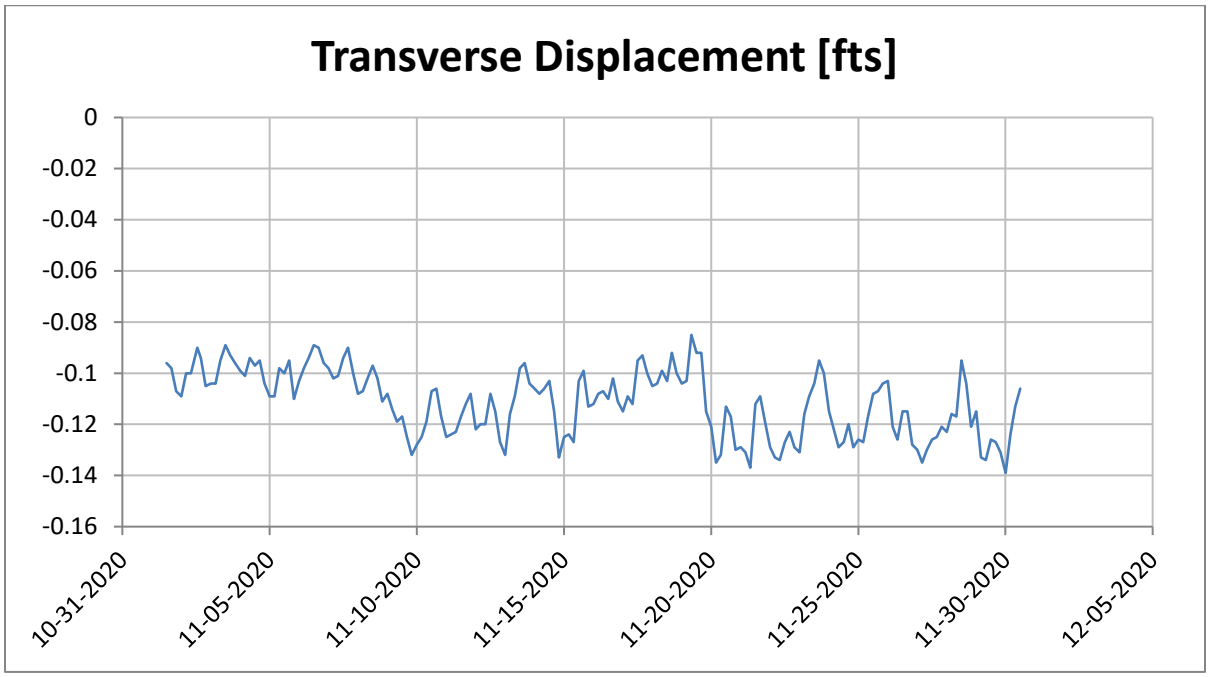


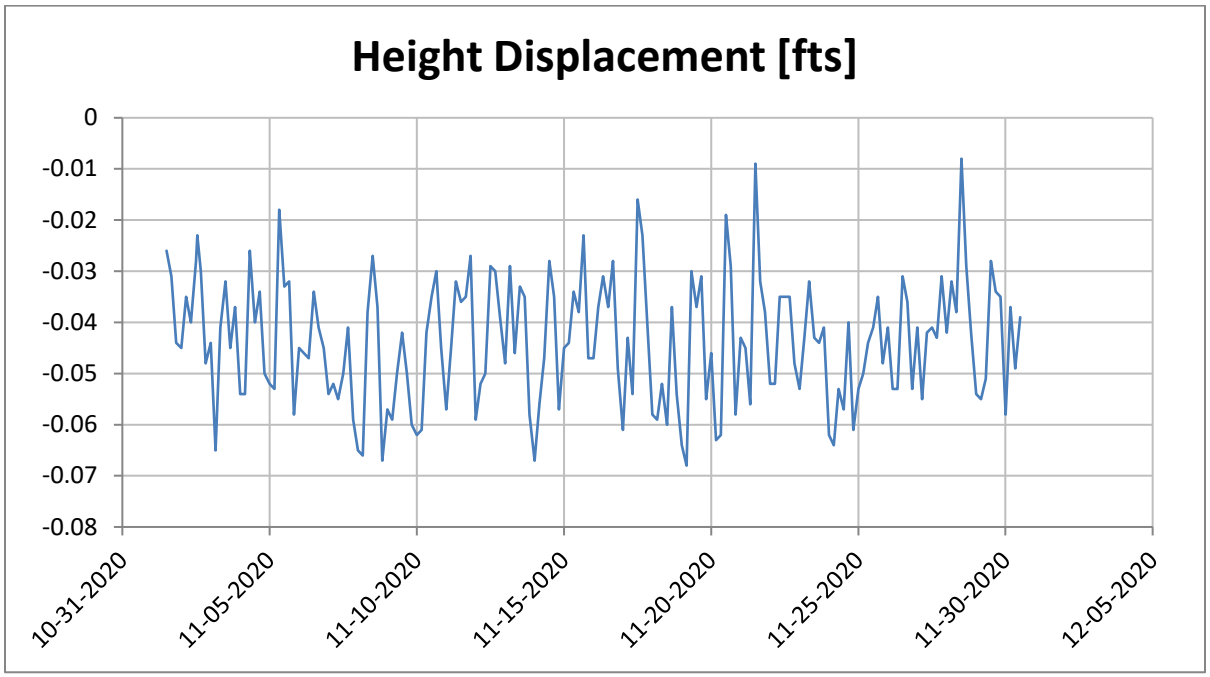


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P33

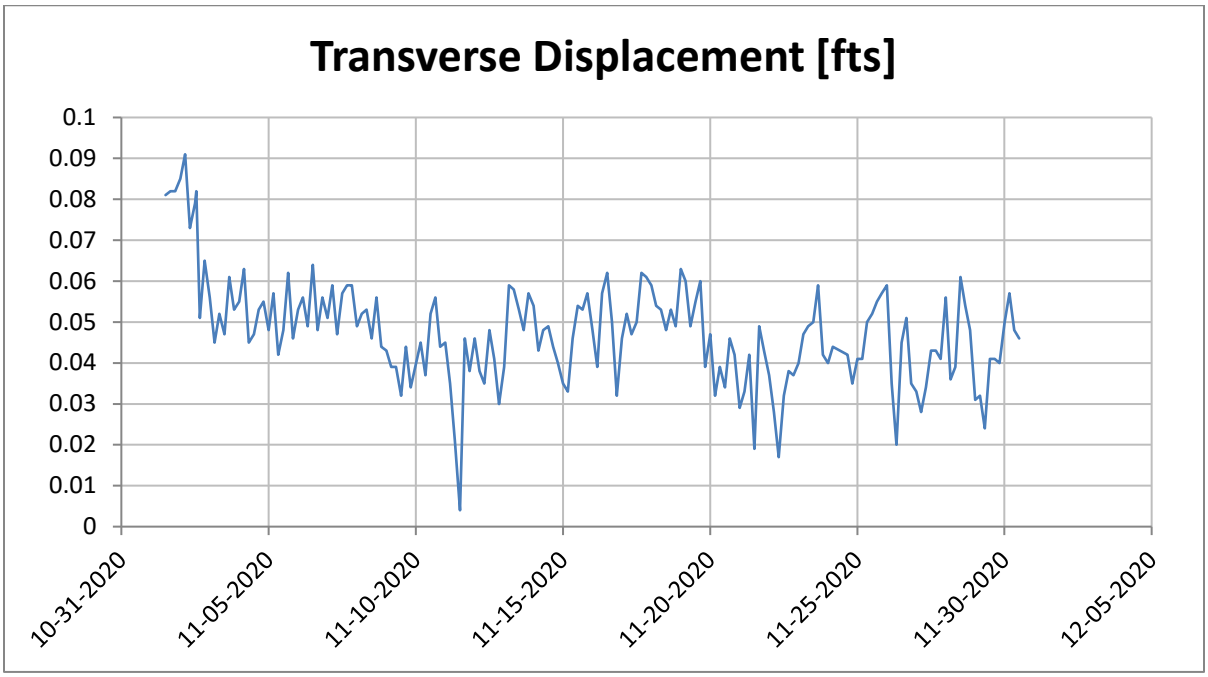


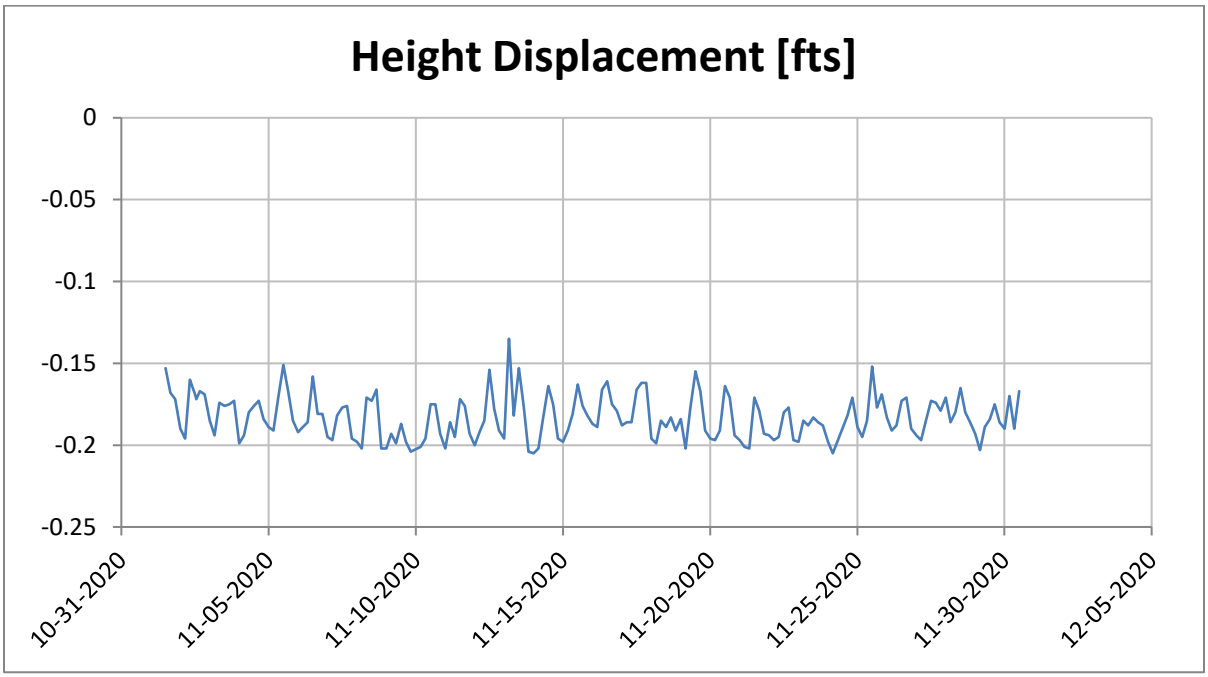


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P35

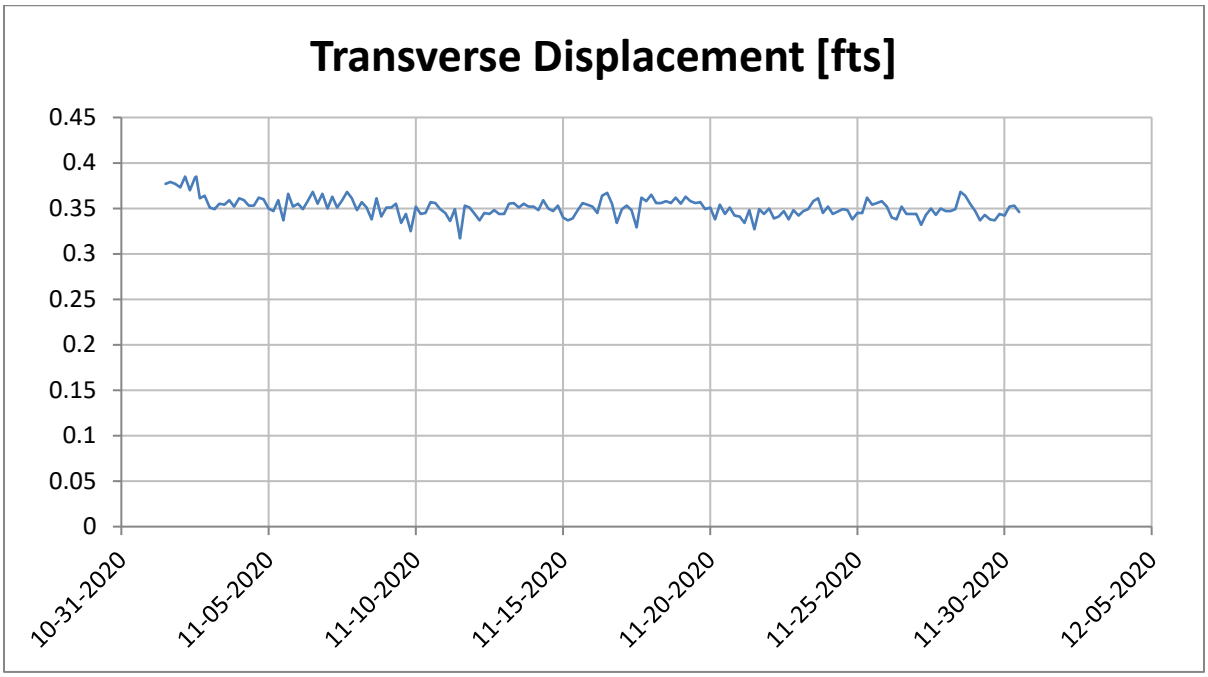


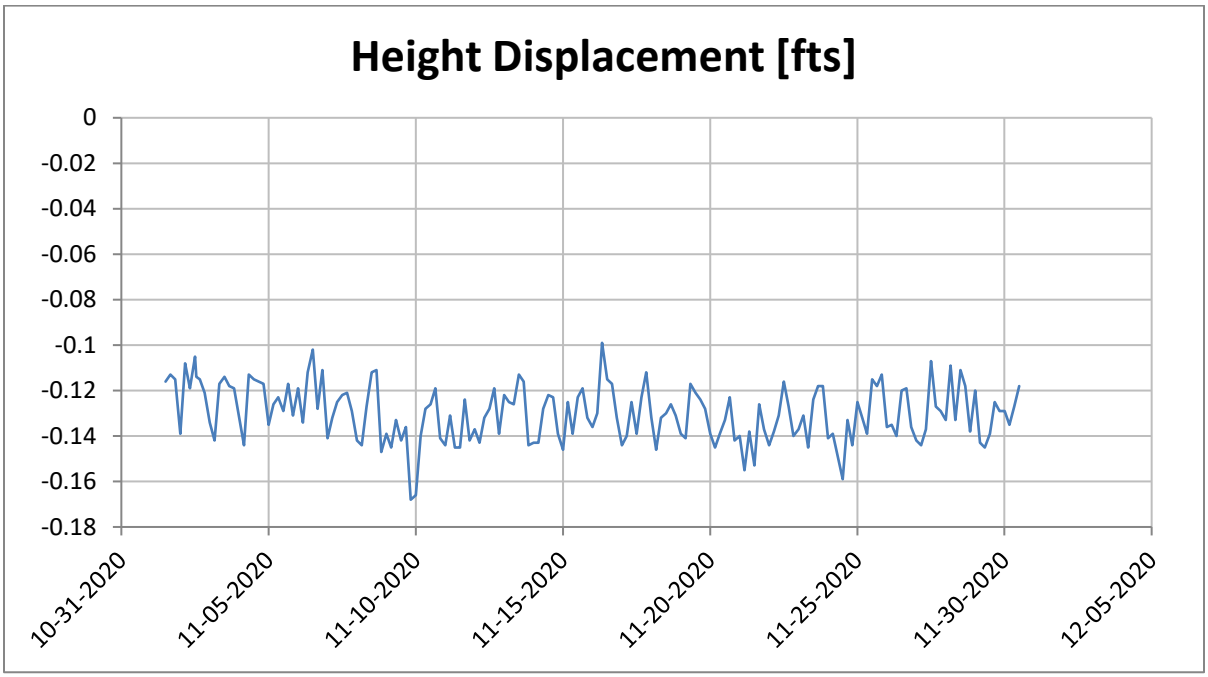


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P4

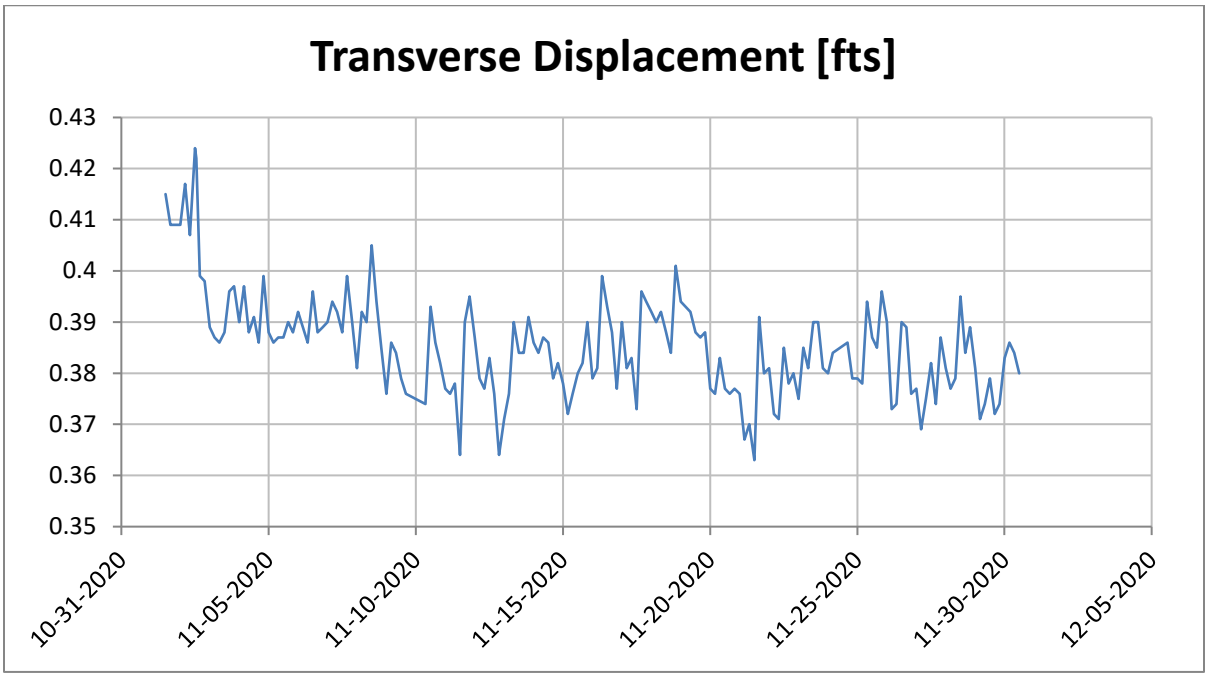


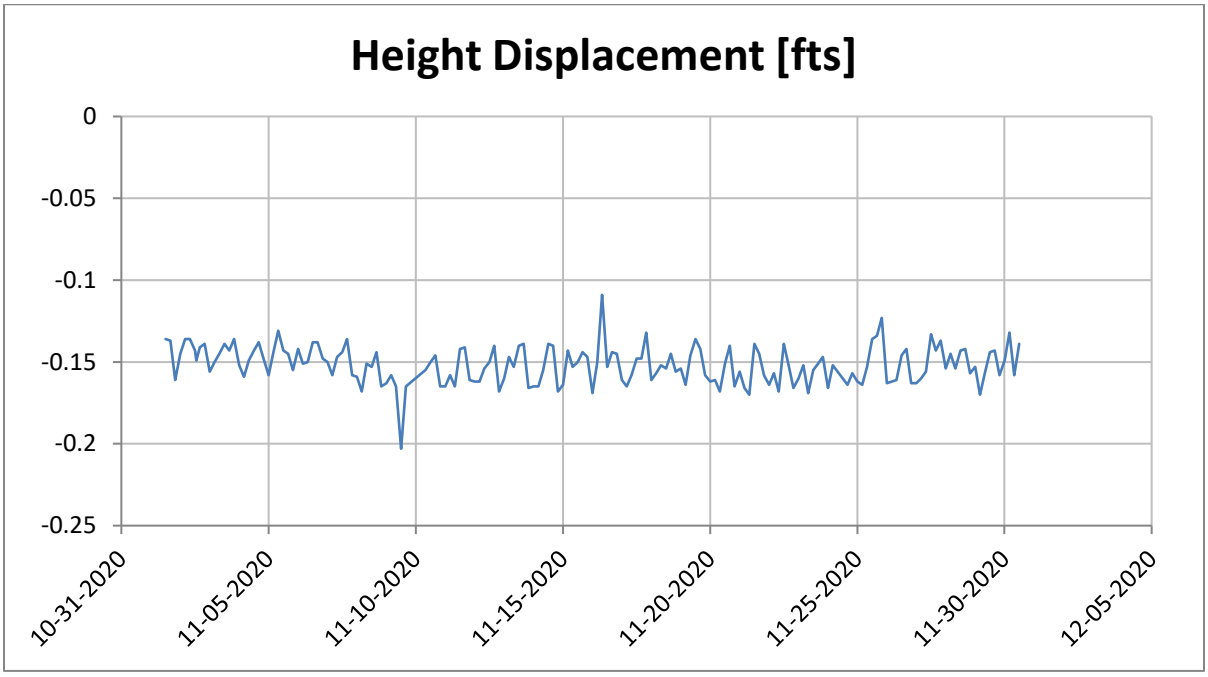


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P5

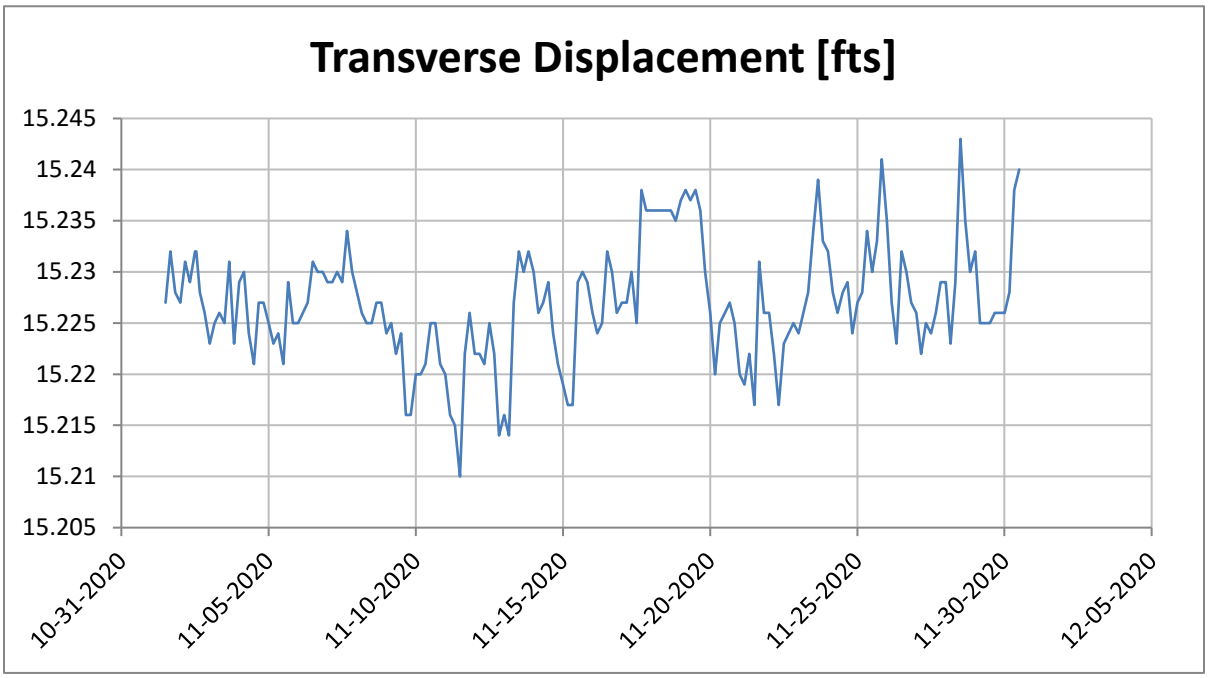


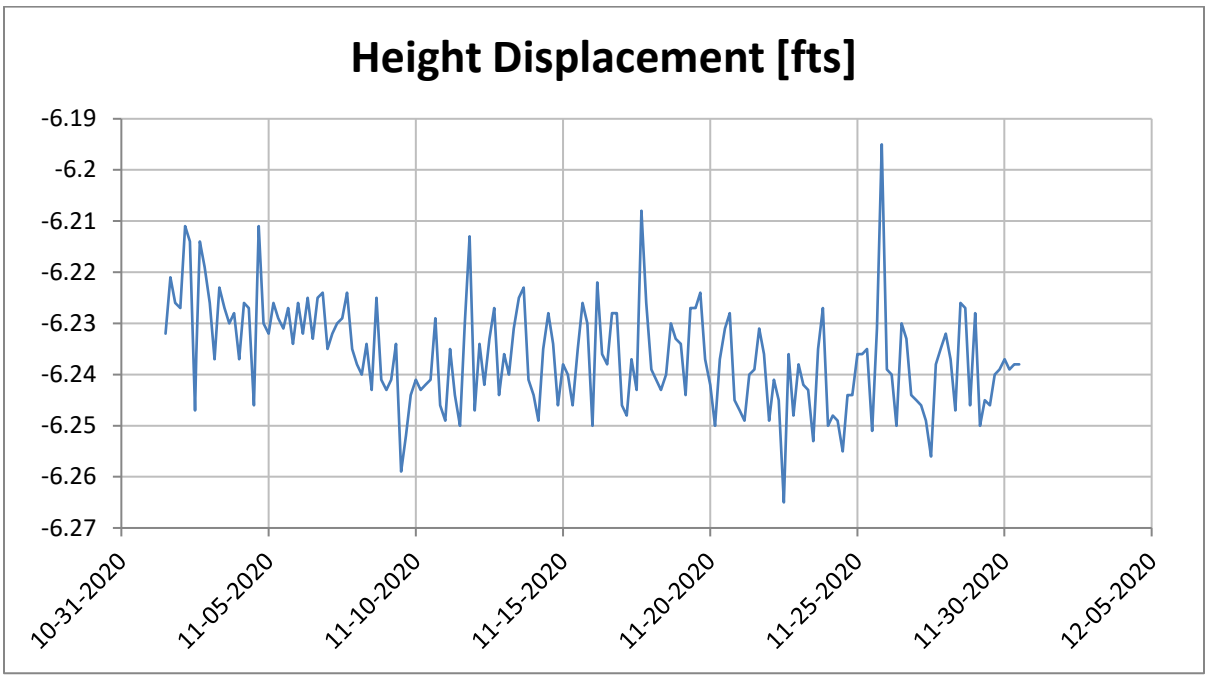


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P63

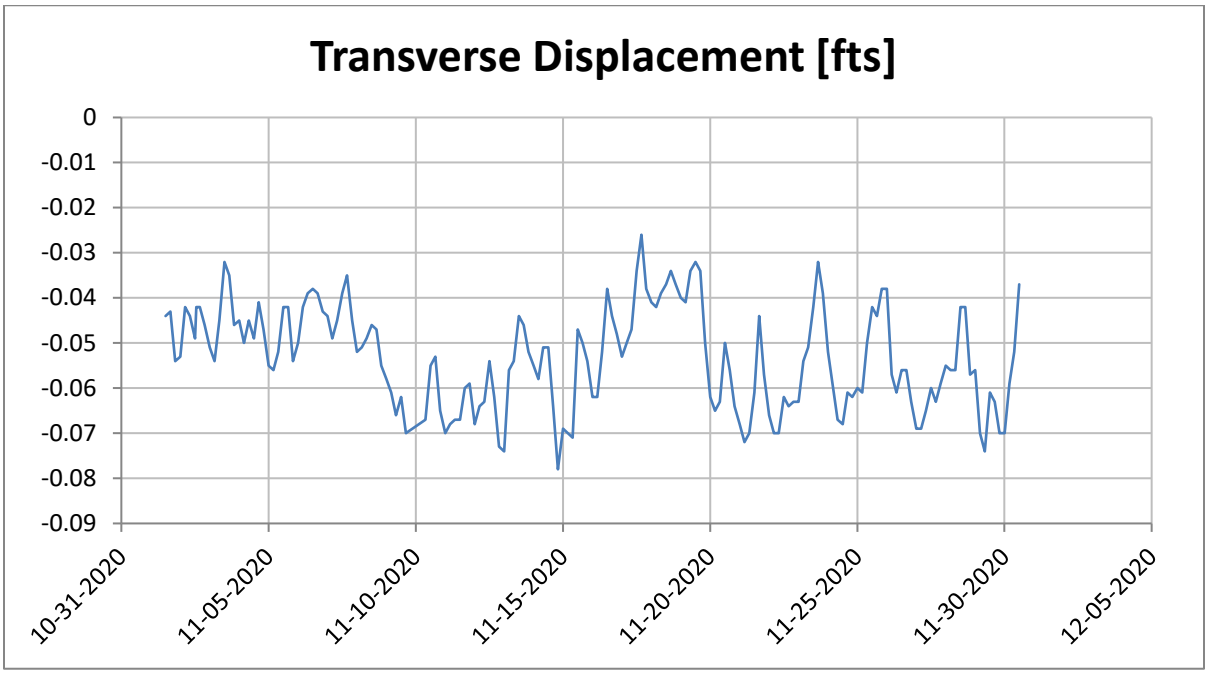


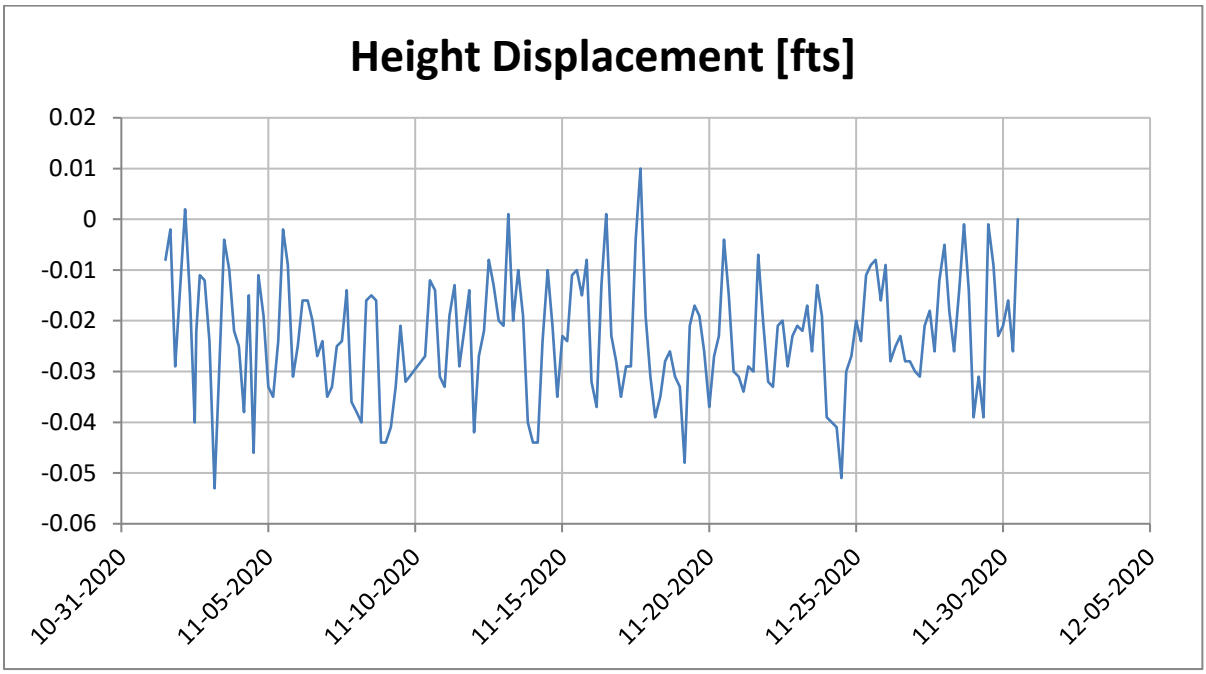


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P69

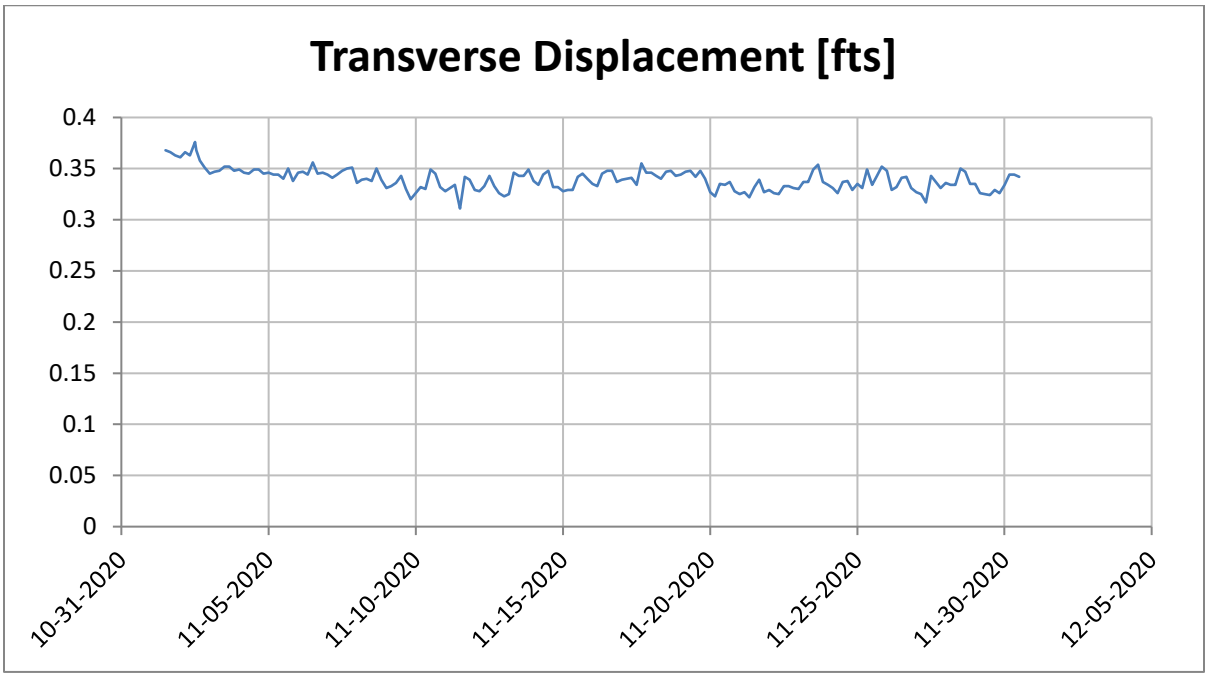


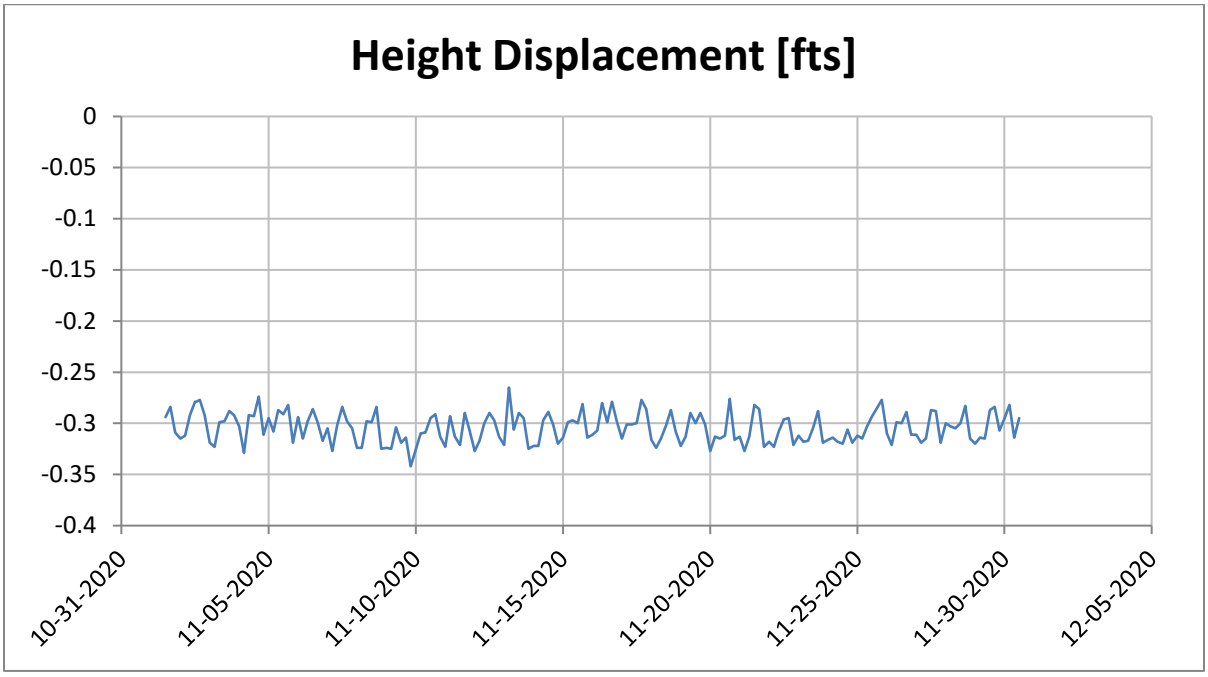


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P70



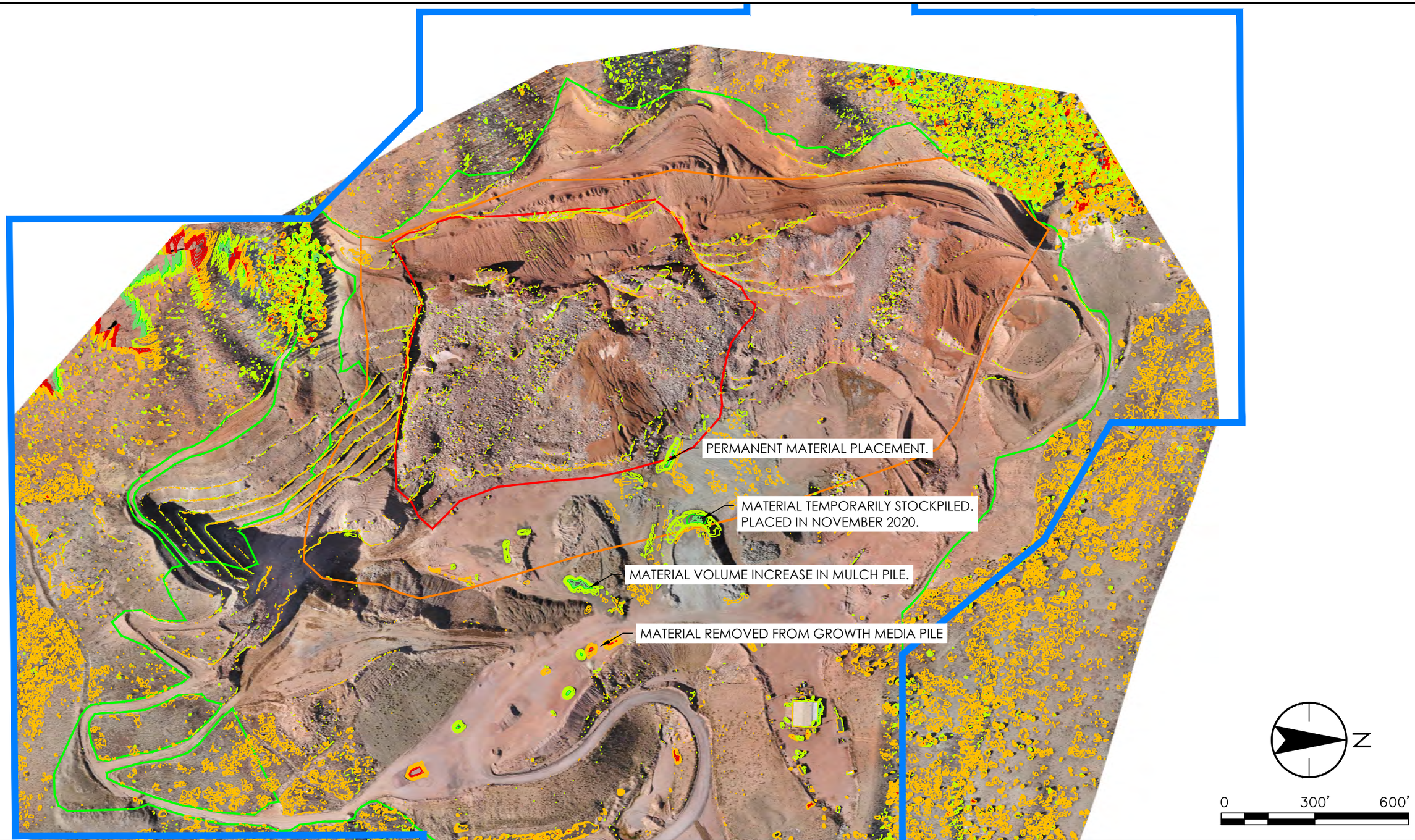


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Appendix C

Drone Survey



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Tel: (303) 758-4058
www.stantec.com

LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Comparison Contour. Increase in elevation. (CI=2')
- Comparison Contour. Decrease in elevation. (CI=2')

1. COMPARISON OF DRONE FLIGHTS FROM 10/09/20 and 11/16/20.

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
EXISTING PRISMS WITH CURRENT SURFACE

Revision	Date
#	2020.12.31
Drawn By	Figure No.
PK	5