



STATE OF  
COLORADO

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

---

## Pikeview monitoring report

1 message

---

**Kos, Paul** <paul.kos@stantec.com>

Mon, Dec 7, 2020 at 3:53 PM

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

Cc: Jerald Schnabel <Jerald\_Schnabel@castleaggregate.com>

Tim,

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

**Paul Kos**

Senior Geological Engineer

Mobile: 303 570-9163

paul.kos@stantec.com

Stantec

2000 South Colorado Boulevard Suite 2-300

Denver CO 80222-7933



The content of this email is the confidential property of Stantec and should not be copied, modified, retransmitted, or used for any purpose except with Stantec's written authorization. If you are not the intended recipient, please delete all copies and notify us immediately.

Please consider the environment before printing this email.



**Pikeview Monitoring Memo October 11302020-final.pdf**  
5567K

To: Jerald Schnabel From: Paul Kos  
Continental Materials Corp. Denver, CO 80222  
File: October 2020 Monitoring Summary Date: November 30, 2020

---

**Reference: October 2020 Geotechnical Monitoring Summary Pikeview Quarry**

## 1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this October 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 October 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 October 2020 uninterrupted. Visual inspections of the slopes were performed by Stantec engineers.

### 1.1 PURPOSE

The purpose of this report is to summarize the October 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 <sup>3</sup> (min.)



## 2.0 VISUAL INSPECTIONS

Inspection 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 October 2020 resulted in the operator visual inspections being limited to stockpiles.

Stantec conducted visual inspections of the Pikeview Quarry slopes on November 2, 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 not checked during the November 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.
- Gullies: Gullies have formed on the slopes above the slide area as well as in the burn areas above the quarry. (Note 4)
- Pooled water: The grading at the top of the first ridge causes a small amount (0.03ac) of water to pool. While this promotes wildlife habitat, it has been advised that the pond should be drained. (Note 5)
- Fresh Cracks: A crack was observed at the crest of the slide area. This feature is located in an area where cracking is expected to occur as a result of ongoing slope settlement and relaxation.
- Healed Cracks: A crack was found on the slope adjacent to the slide where cracking had previously been observed. The crack appeared 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 this area 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 1,530 cubic yards of fill were imported during the month of October. (Note 2)
- 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 culver 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 4 to 5 prisms near the toe of the slide area, and the approximate locations of the prisms are shown on Figure 3. The prisms are scheduled to be installed in 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
10/18/2020	Multiple prisms missing on 12AM, 4AM, and 12PM scans	Heavy fog and cloud cover	10/18/2020
10/19/2020	Multiple prisms missing on 12AM scans	Heavy fog and cloud cover	10/19/2020
10/23/2020	Multiple prisms missing on all scans	Heavy fog, freezing rain, snow	10/27/2020
10/24/2020	Multiple prisms missing on all scans	Heavy fog, freezing rain, snow	10/27/2020
10/25/2020	Multiple prisms missing on all scans	Heavy fog, freezing rain, snow	10/27/2020
10/26/2020	Multiple prisms missing on all scans	Heavy fog, freezing rain, snow	10/27/2020

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  $\pm 4 \text{ mm} + 1.5 \text{ ppm}$  for prisms located greater than 500m from the station; these equates to an accuracy of  $\pm 0.016 \text{ ft}$ . 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 ft per day). Plots of the transverse and height displacements for each prism are included in Appendix B.

**Table 3 Prism Summary**

Prism ID	Transverse Displacement (ft)	Height Displacement (ft)	Monthly Delta (ft)	Cumulative Delta (ft)	Needs / Recommendations
CP1	0.005	0.028	0.0052	0.0301	
CP2	-0.062	0.005	0.0109	0.3999	
CP3	0.275	-0.199	0.0235	0.3436	
NP1	0.062	0.024	0.0517	0.0738	
NP2	-0.005	-0.036	0.0294	0.0533	
NP66	0.063	-0.136	0.0247	0.2051	
P1	0.341	-0.053	0.0435	0.3467	
P2	0.152	-0.027	0.0088	0.2181	
P25	-0.008	0.049	0.0421	0.1523	
P32	-0.065	-0.083	0.0585	0.2750	
P33	-0.098	-0.034	0.0452	0.2138	
P35	0.052	-0.17	0.0090	0.4313	
P4	0.354	-0.123	0.0129	0.4757	
P5	0.393	-0.141	0.0064	0.6117	
P63	15.222	-6.225	0.0349	16.4458	Prism at toe of slide. Movements are within expected range.
P69	-0.043	-0.006	0.0132	0.0390	
P70	0.35	-0.291	0.0057	0.5772	

## 4.0 DRONE SURVEY

The site was flown for aerial imagery using an unmanned aircraft system (UAS or 'drone') on October 9, 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 September topography was also compared to the October topography to identify changes in the site topography. Comparison of the two surveys showed that approximately 1,530 cubic yards of fill had been imported and temporarily 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

Fill is currently not being placed at the Pikeview Quarry; therefore, no compaction testing was performed in October 2020. Once fill placement starts, the fill will be placed in one-foot thick lift, moisture conditioned as necessary, and compacted. Compaction testing will commence at the rate of at least one test per 5,000 yd<sup>3</sup> 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 October 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.





c:\users\pkos\documents\projects\pkreview\monitoring\draft\_oct2020\pkreview pitans\_30nov2020

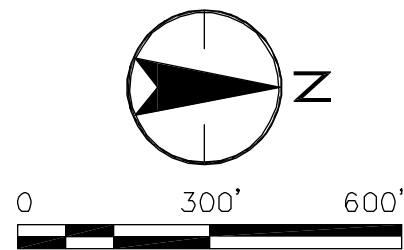
2020.11.30 2:35:19 PM



Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
www.stantec.com

LEGEND

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



Client/Project  
**CONTINENTAL MATERIALS  
CORP.  
PIKEVIEW QUARRY SLOPE  
MONITORING**

Project No.  
227419041

Title  
**SITE MAP**

Revision  
#  
Drawn By  
PK

Date  
2020.11.30  
Figure No.  
1



# Appendix A

## Visual Inspections





c:\users\pkos\documents\projects\pkreview\monitoring\draft\_oct2020\pkreview pitmng\_30nov2020 2020.11.30 3:14:05 PM



6. HEALED CRACKING ABOVE THE SLIDE AREA



5. POND AREA ON RIDGE

1. AREA UPSTREAM OF BLOCKED CULVERT



2. EROSION GULLEY



3. DEBRIS AND RUBBLE FILL AREA



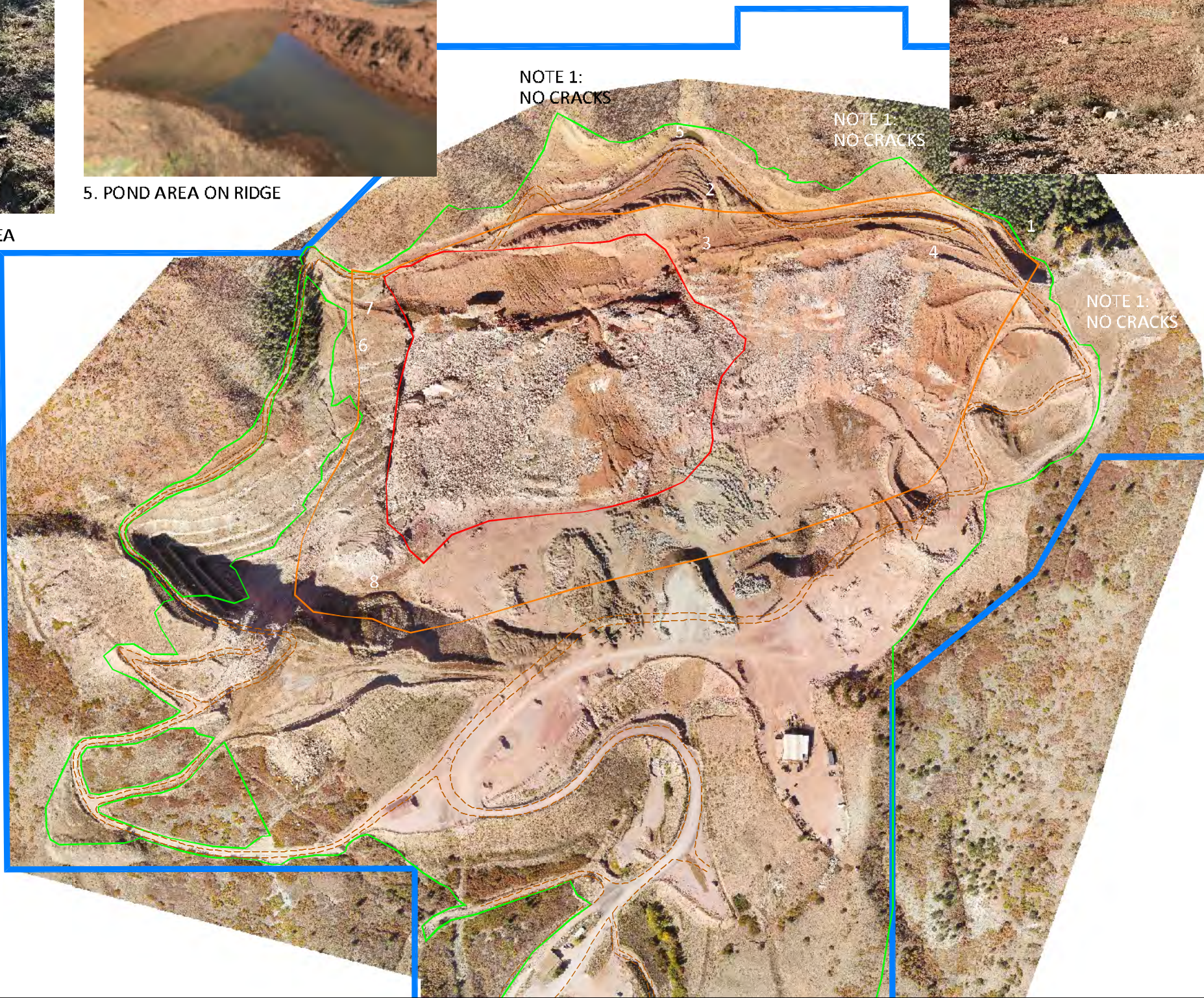
4. VIEW FROM NW TOWARD SURVEY STATION



7. GULLY DIVERTS RUNOFF TO SLIDE



8. VIEW UP SOUTH ESCARPMENT



NOTE 1:  
NO CRACKS

NOTE 1:  
NO CRACKS

NOTE 1:  
NO CRACKS



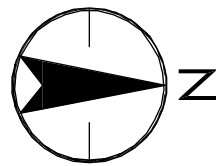
Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
www.stantec.com

LEGEND

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

NOTES

- NO CRACKS OBSERVED IN THIS AREA.
- ALL PHOTOS TAKEN NOVEMBER 2, 2020.



Client/Project

CONTINENTAL MATERIALS  
CORP.  
PIKEVIEW QUARRY SLOPE  
MONITORING

Project No.  
227419041

Title

OBSERVATIONS FROM  
OCTOBER INSPECTION

Revision  
#

Drawn By  
PK

Date  
2020.11.30

Figure No.  
2



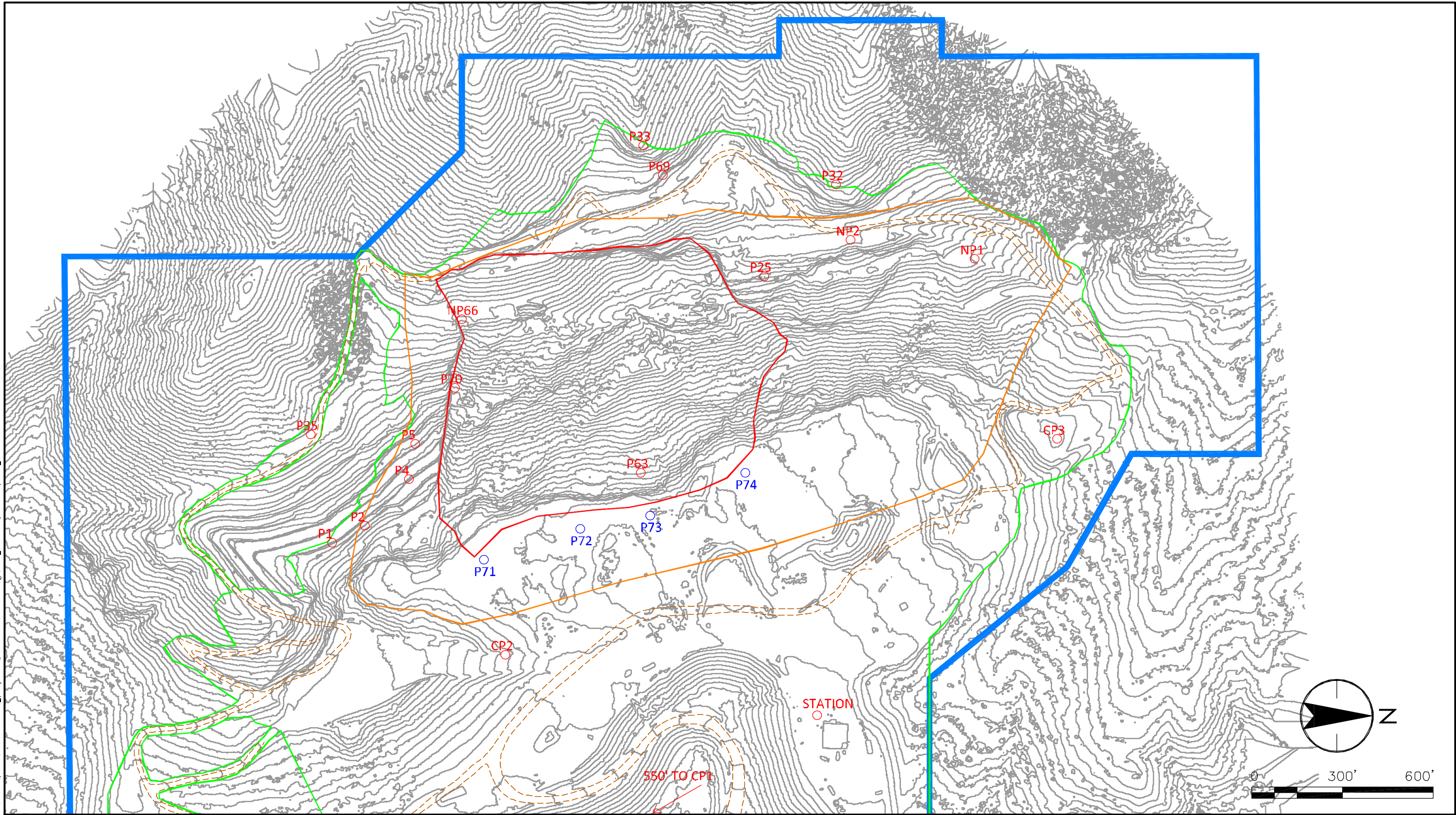
# Appendix B

## Prism Survey



c:\users\pkos\documents\projects\pikeview\monitoring\draft\_oct12020\pikeview prisms\_30nov2020

2020.11.30 3:17:55 PM



Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
www.stantec.com

#### 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 OCTOBER 9, 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  
#

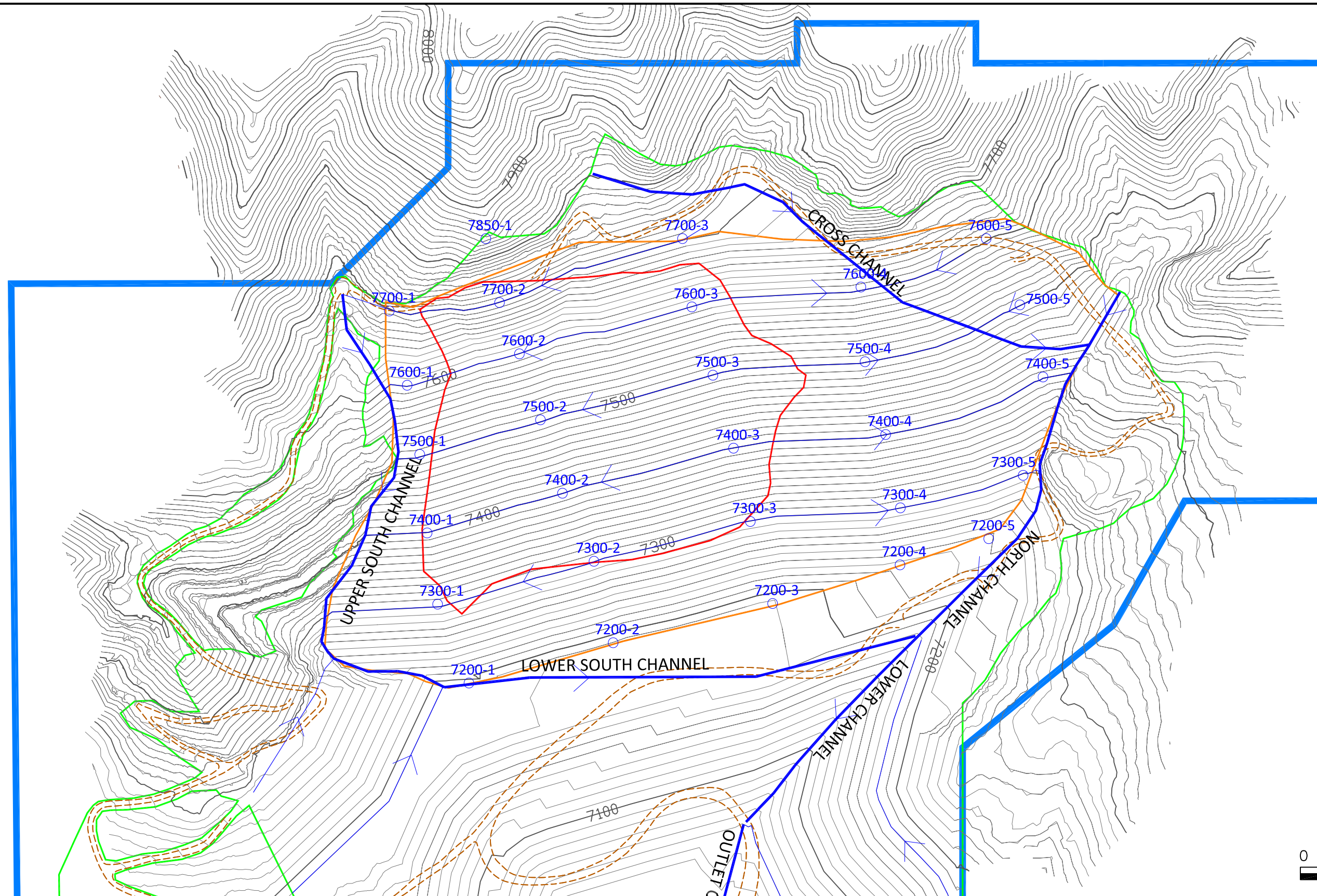
Drawn By  
PK

Date  
2020.11.30

Figure No.  
3



c:\users\pkos\documents\projects\pikeview\monitoring\draft\_oct2020\pikeview\_prisms\_30nov2020  
2020.11.30 3:18:54 PM



Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
www.stantec.com

#### 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

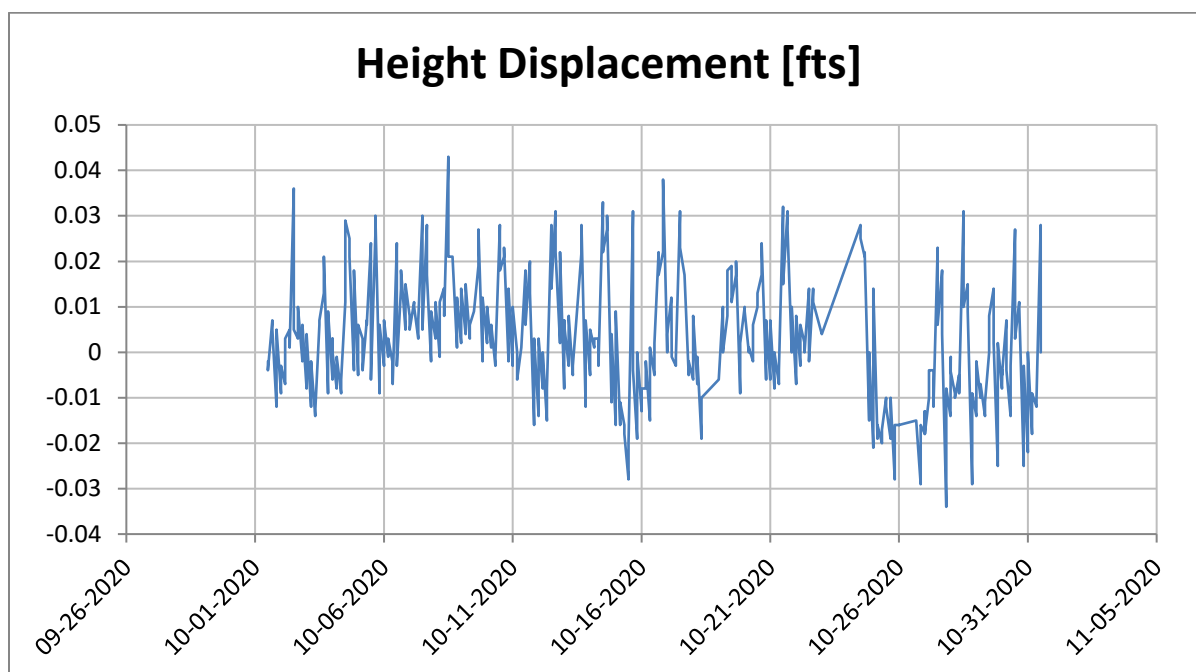
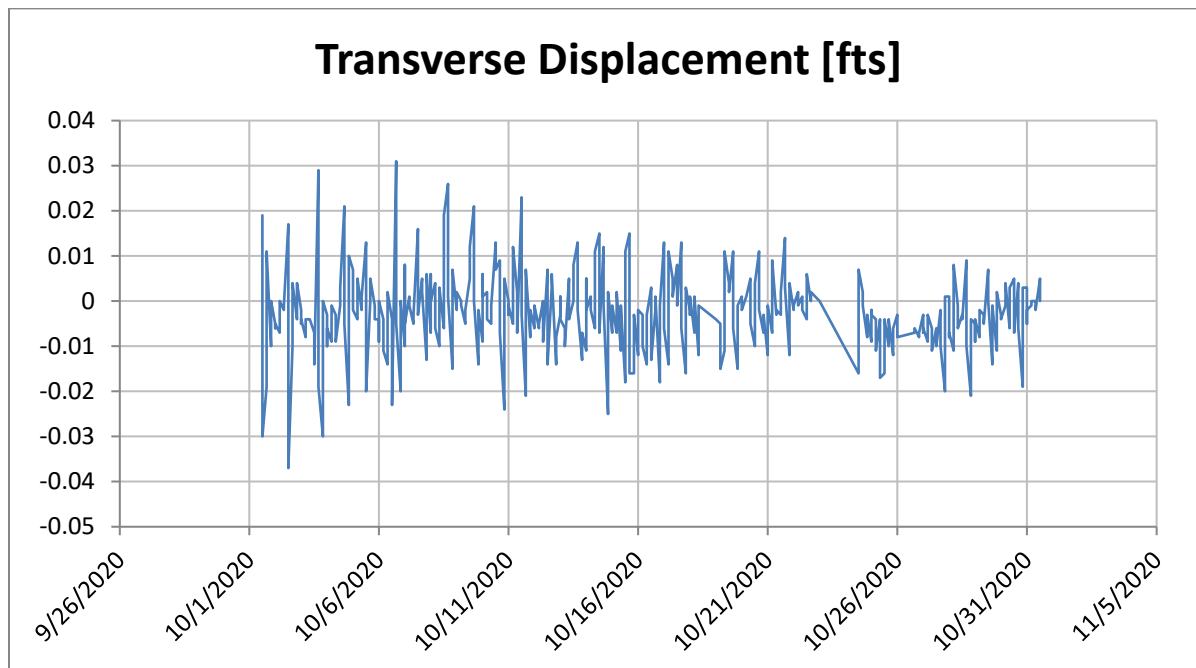
Revision  
#

Drawn By  
PK

Date  
2020.11.30

Figure No.  
4

## Prism CP1

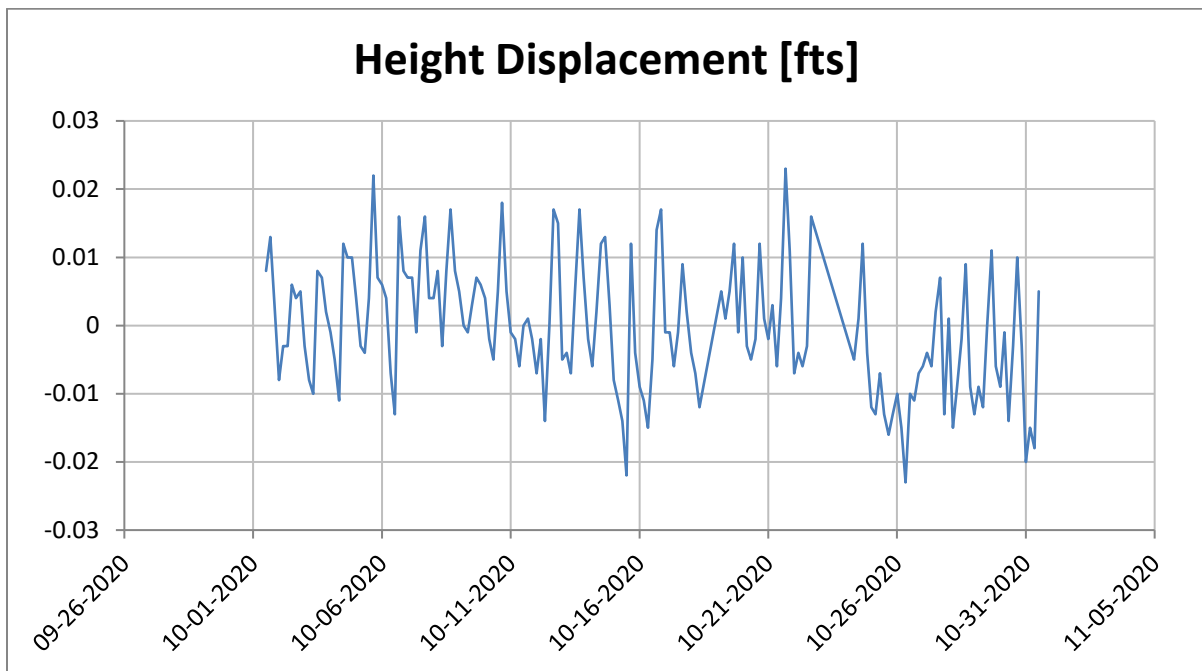
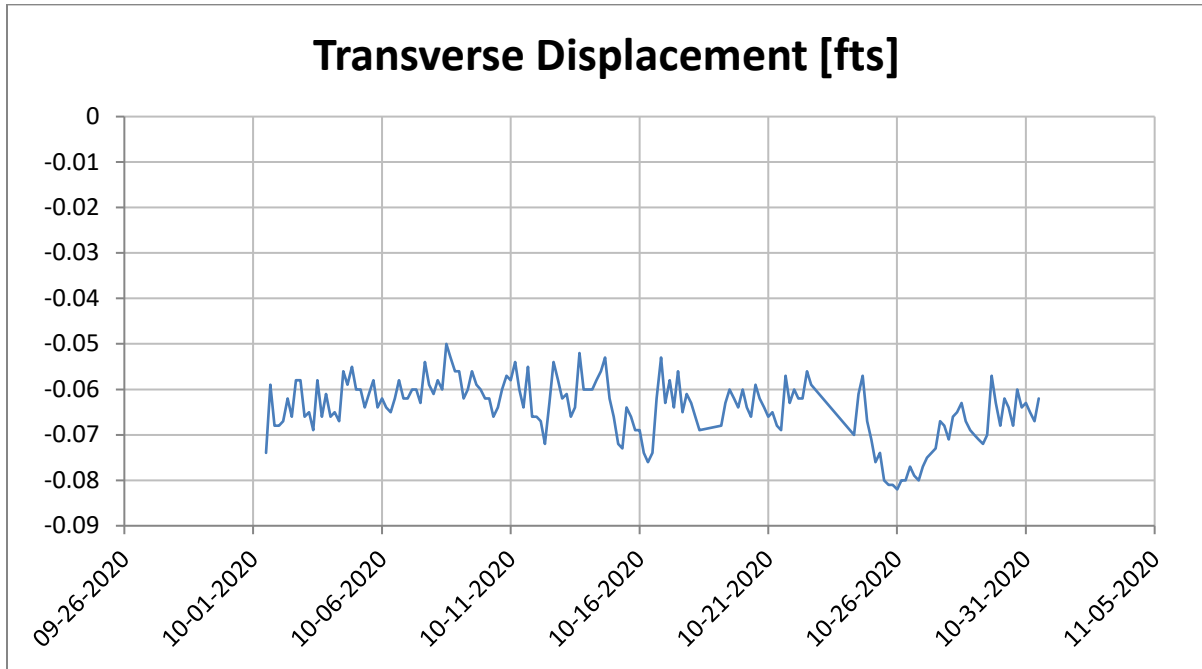


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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



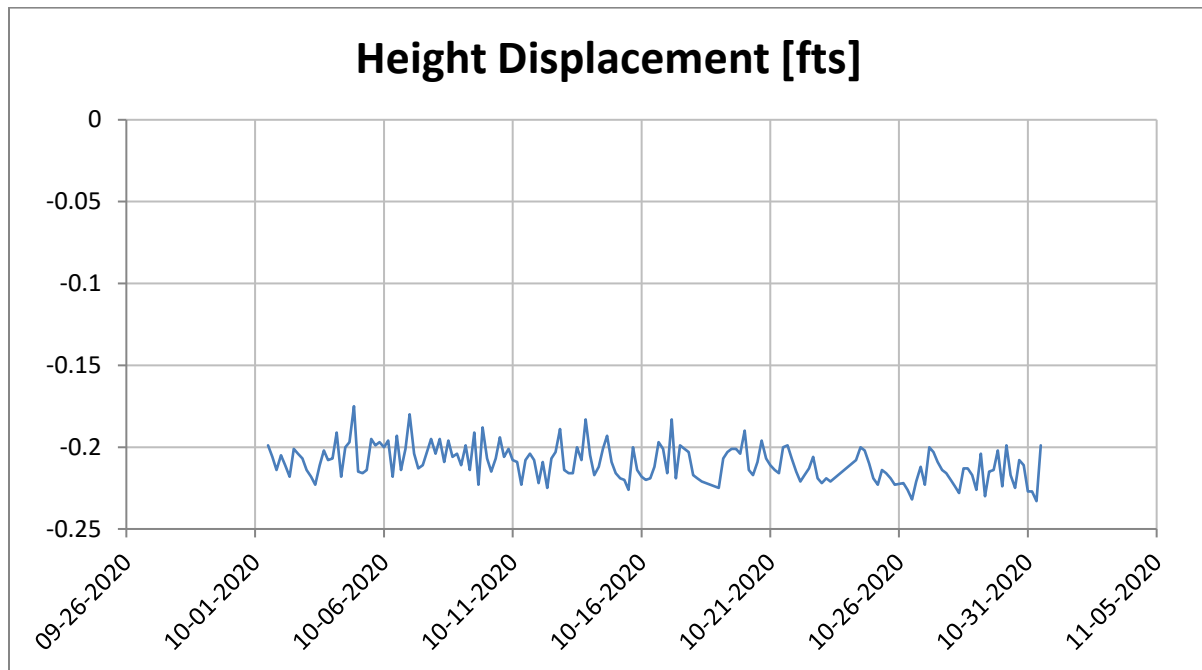
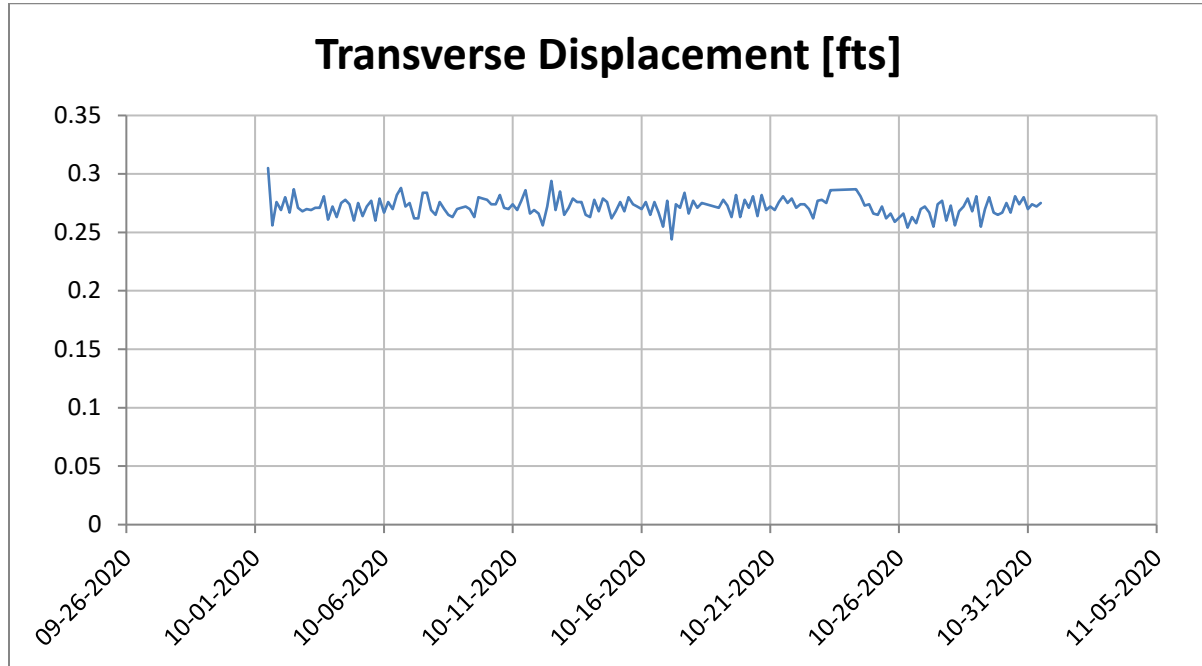
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 CP3

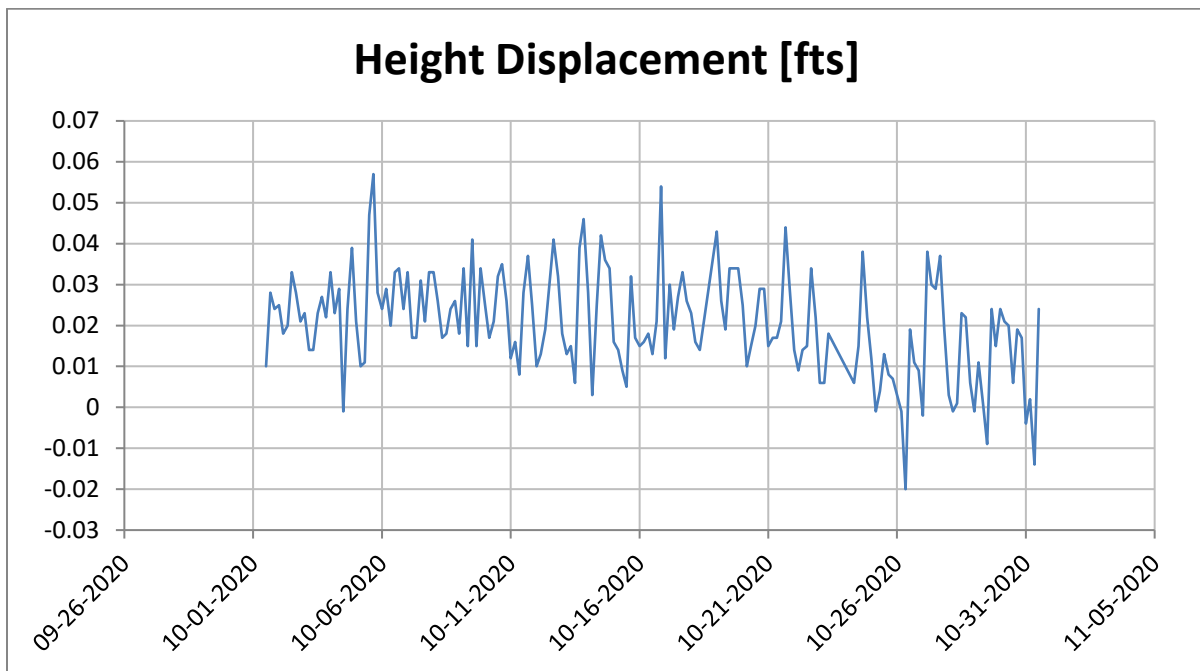
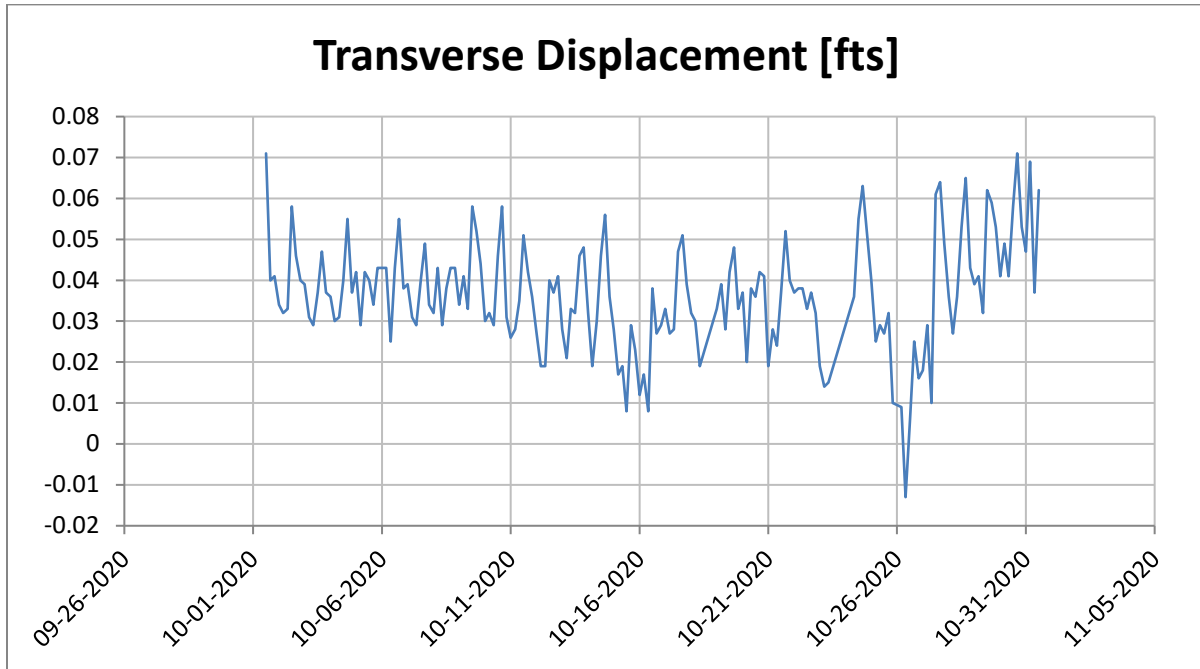


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 NP1

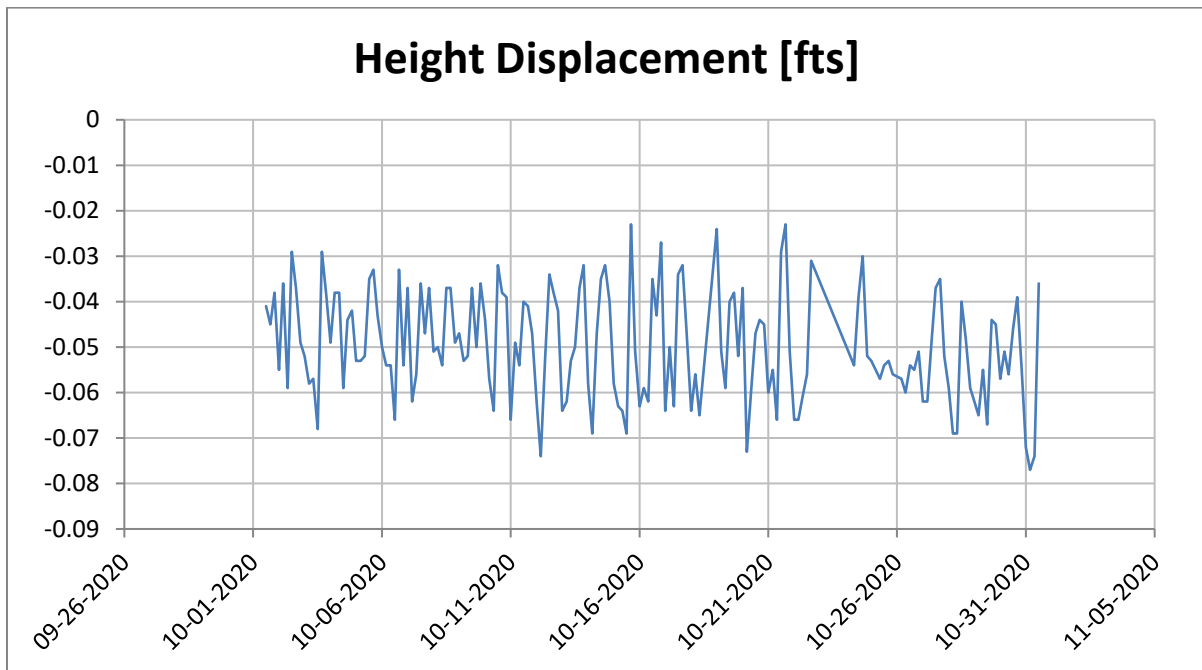
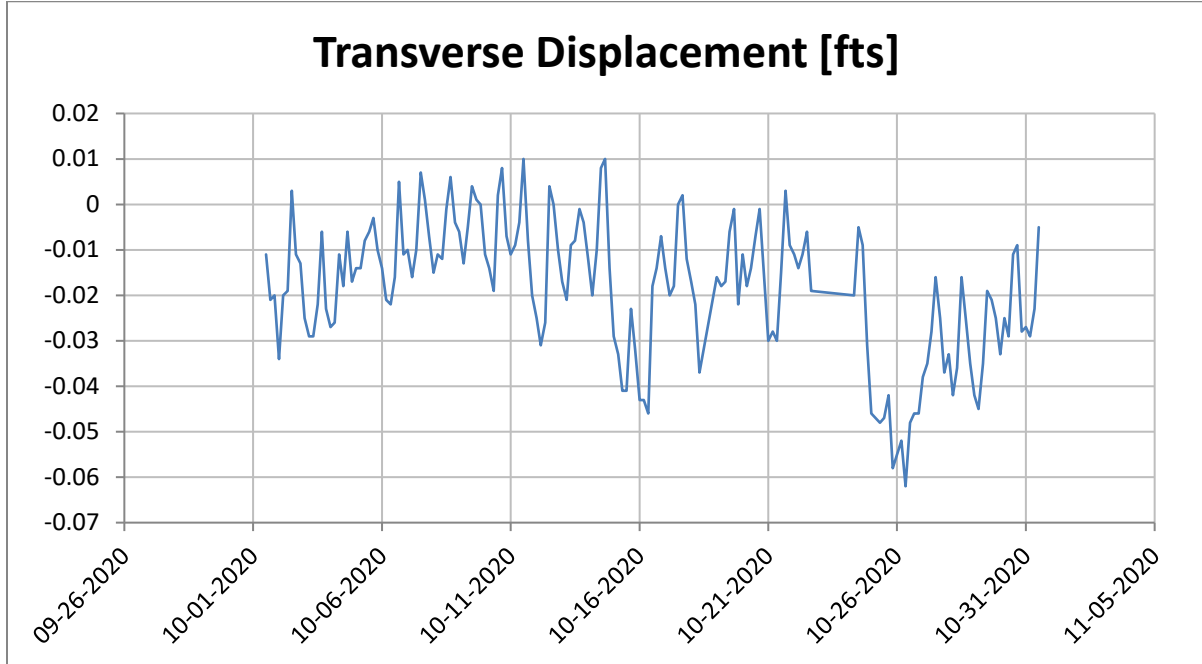


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 NP2



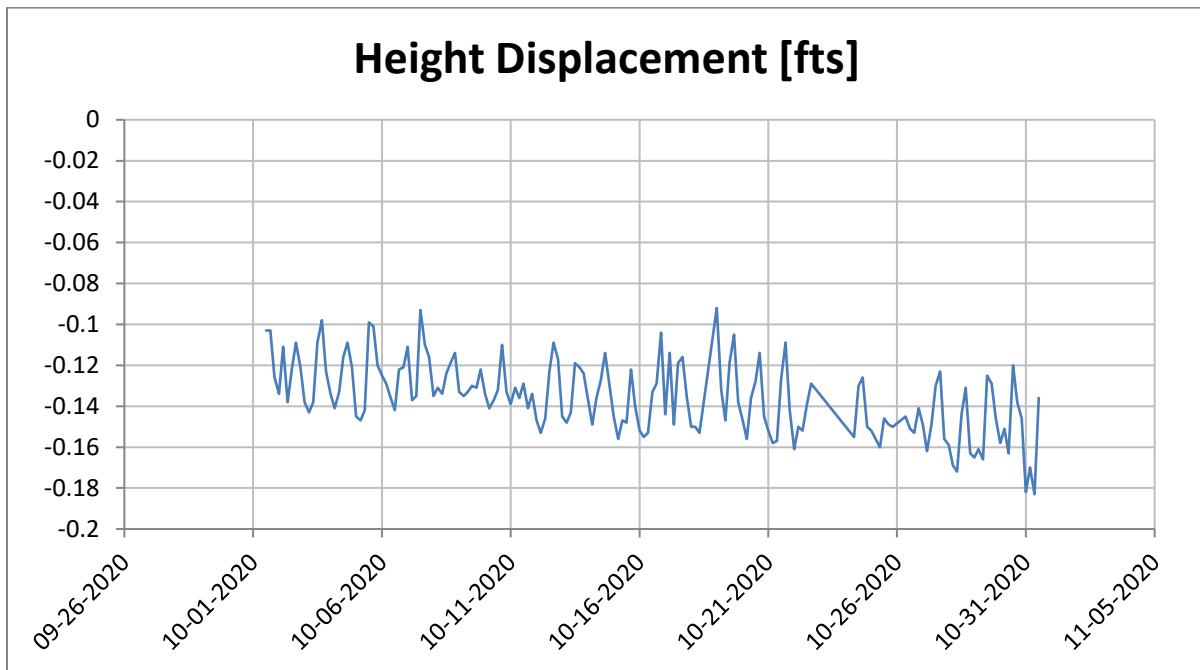
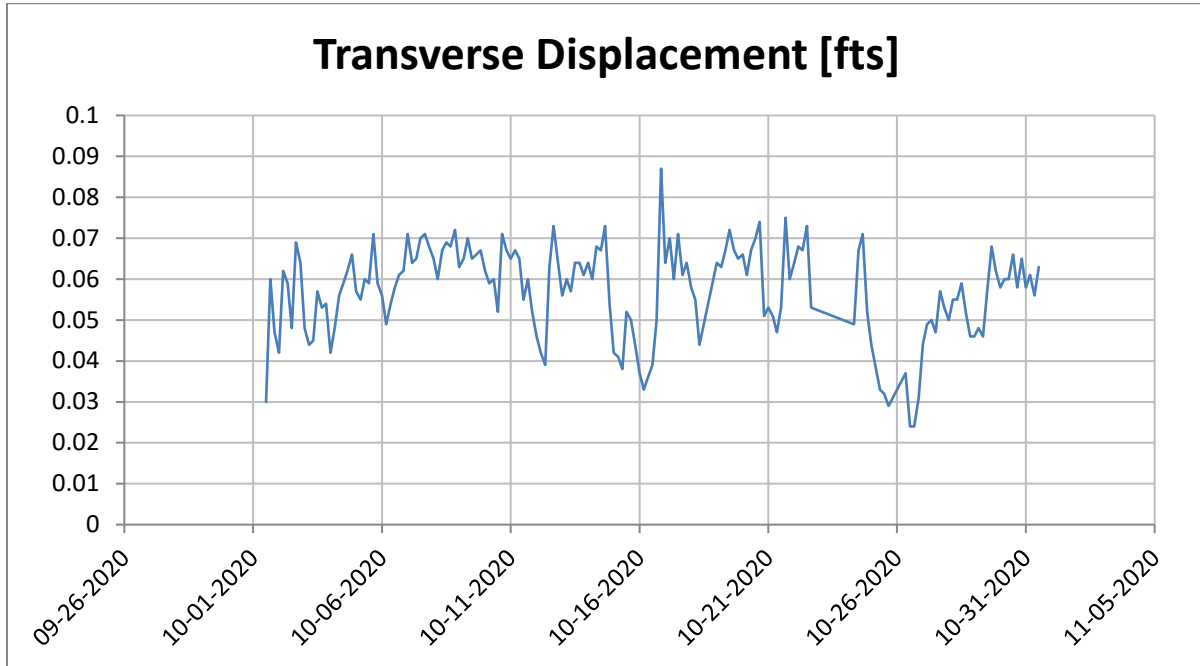
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 NP66

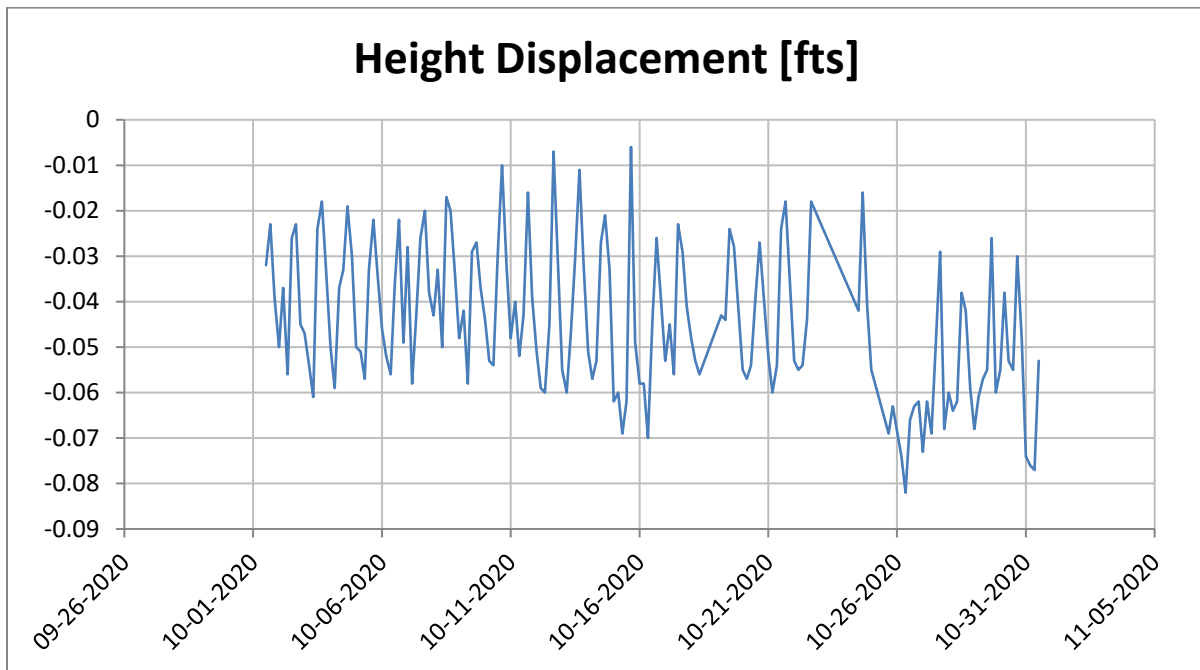
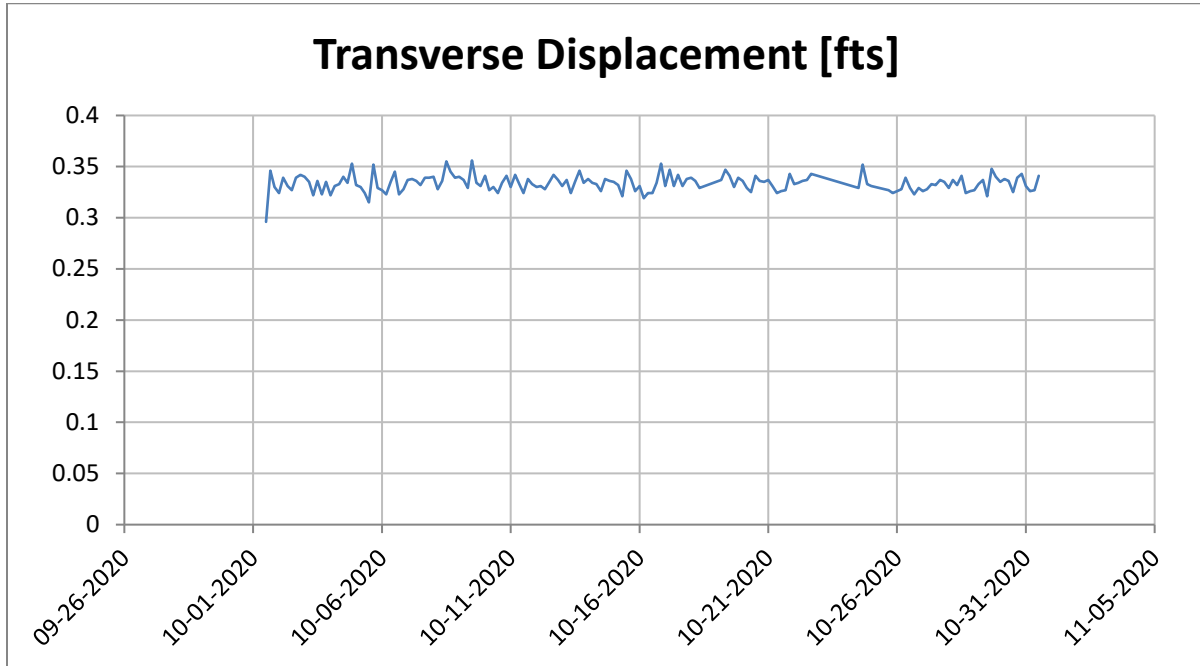


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 P1

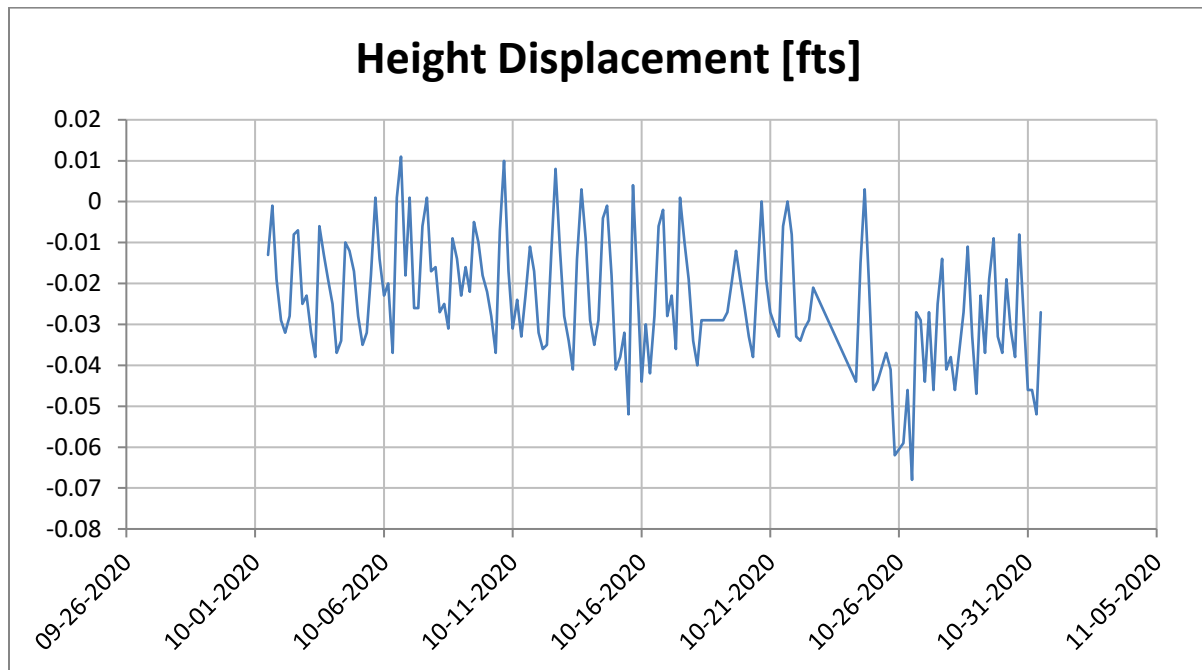
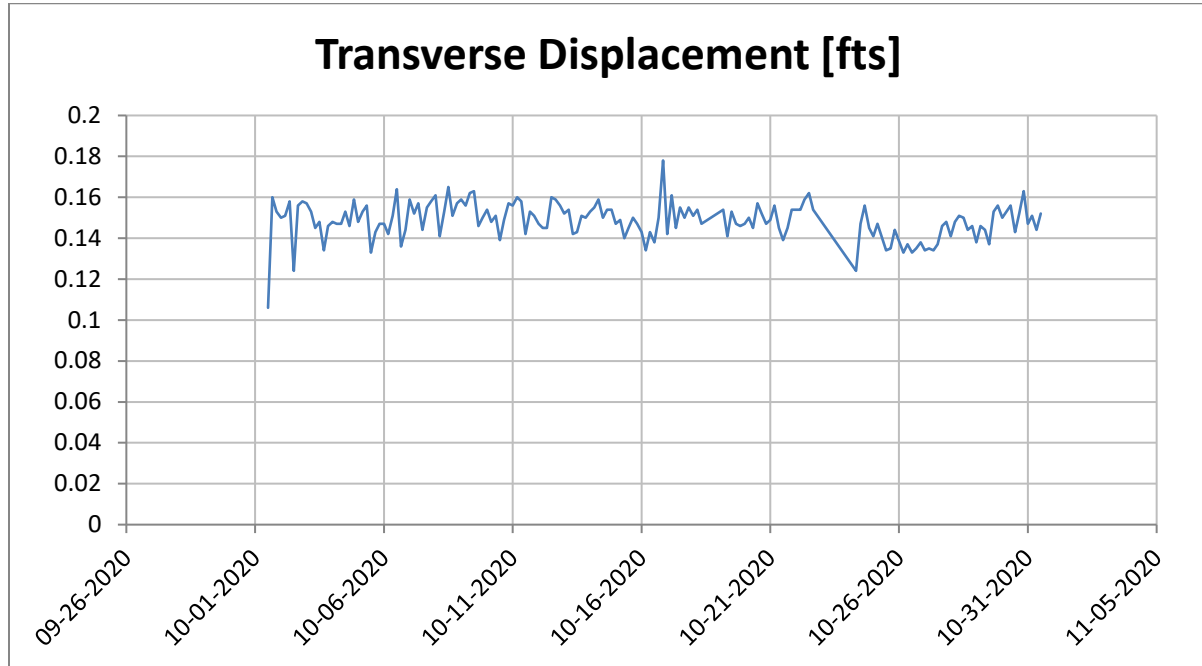


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 P2

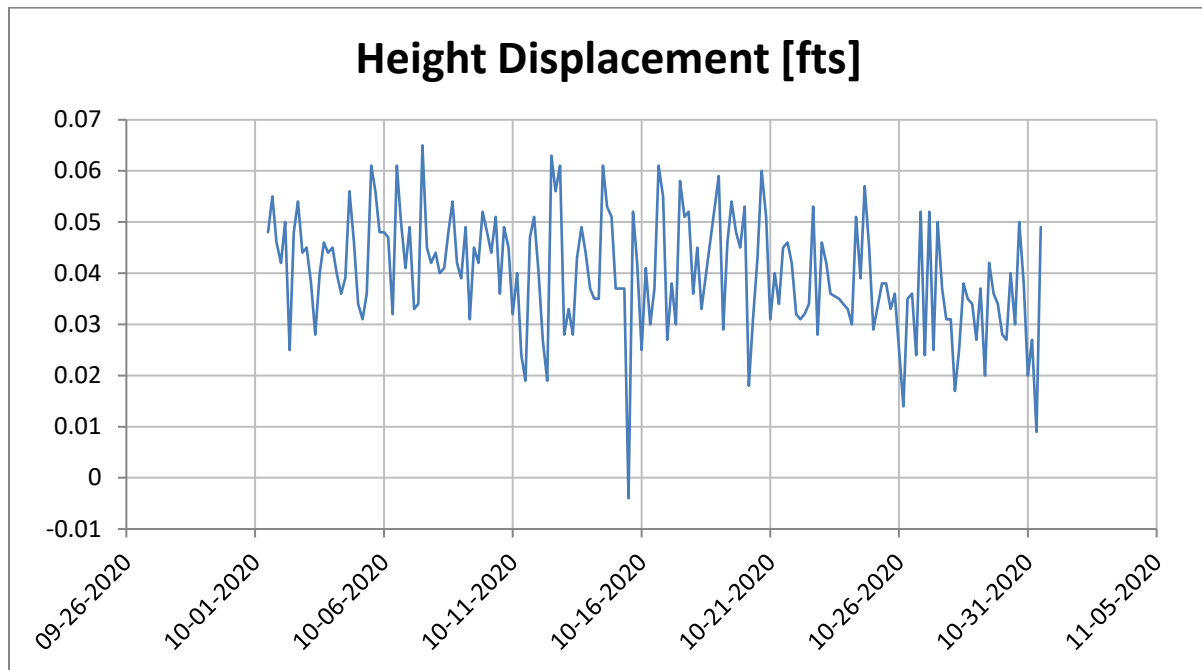
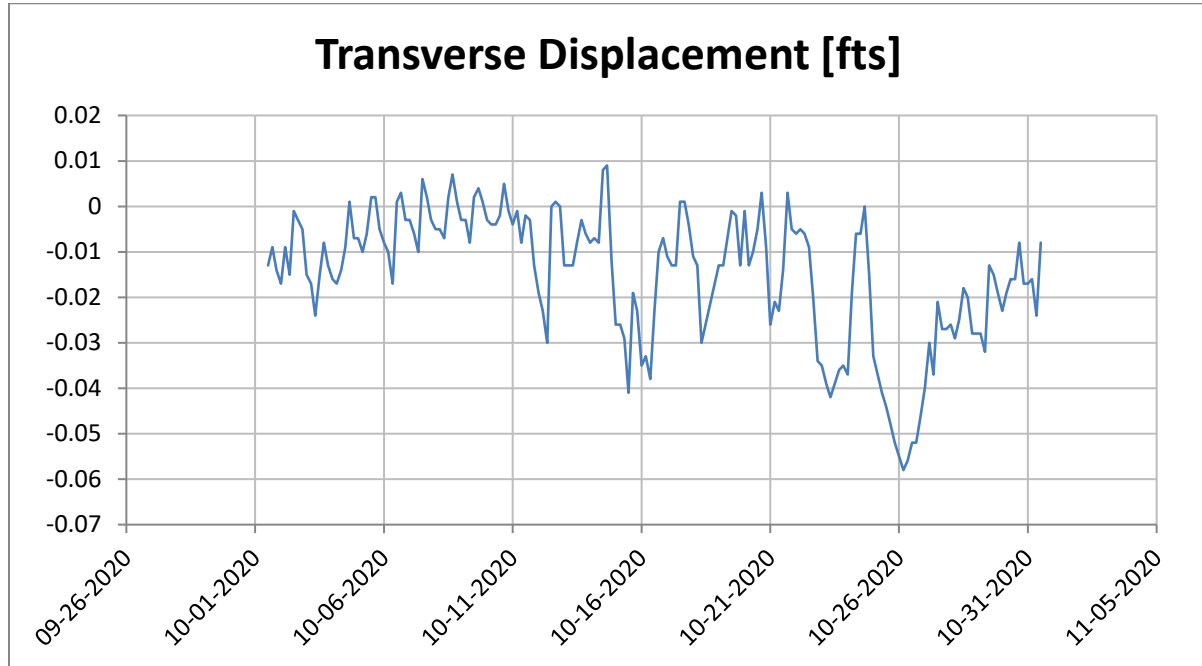


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 P25



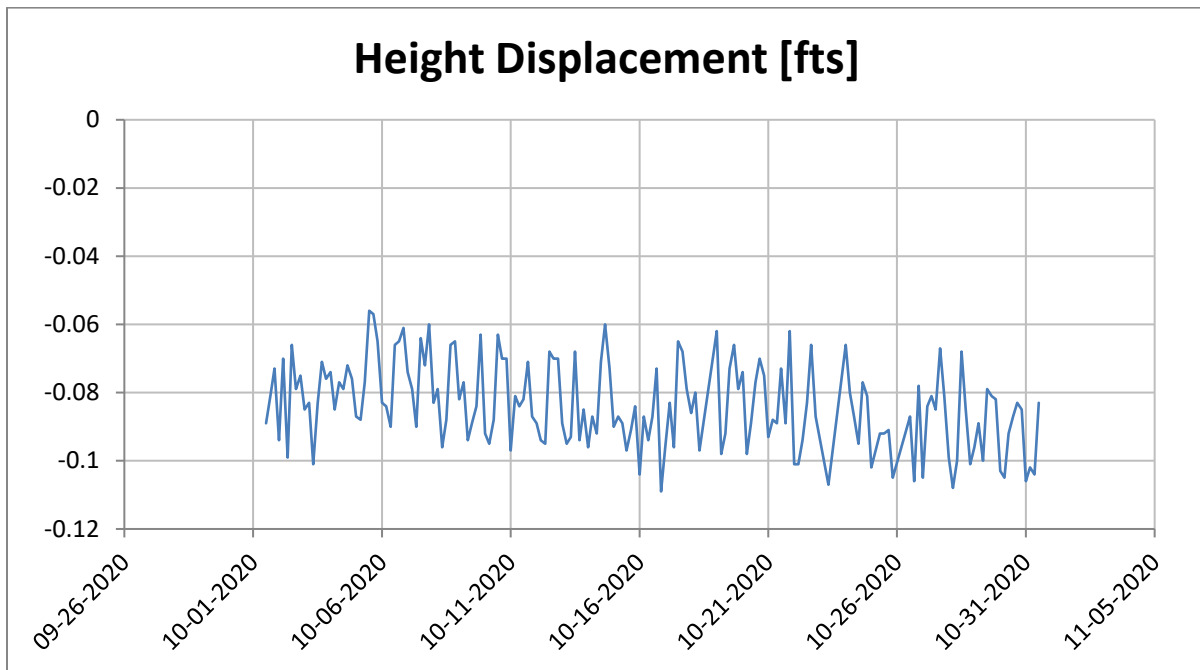
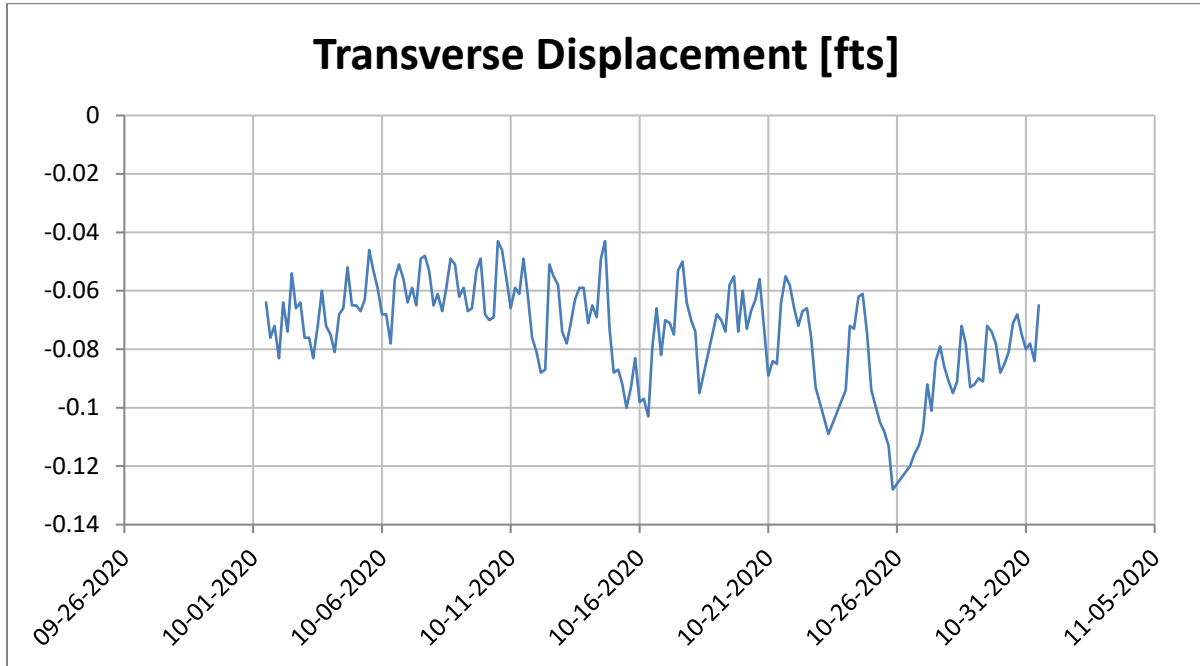
#### Notes:

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

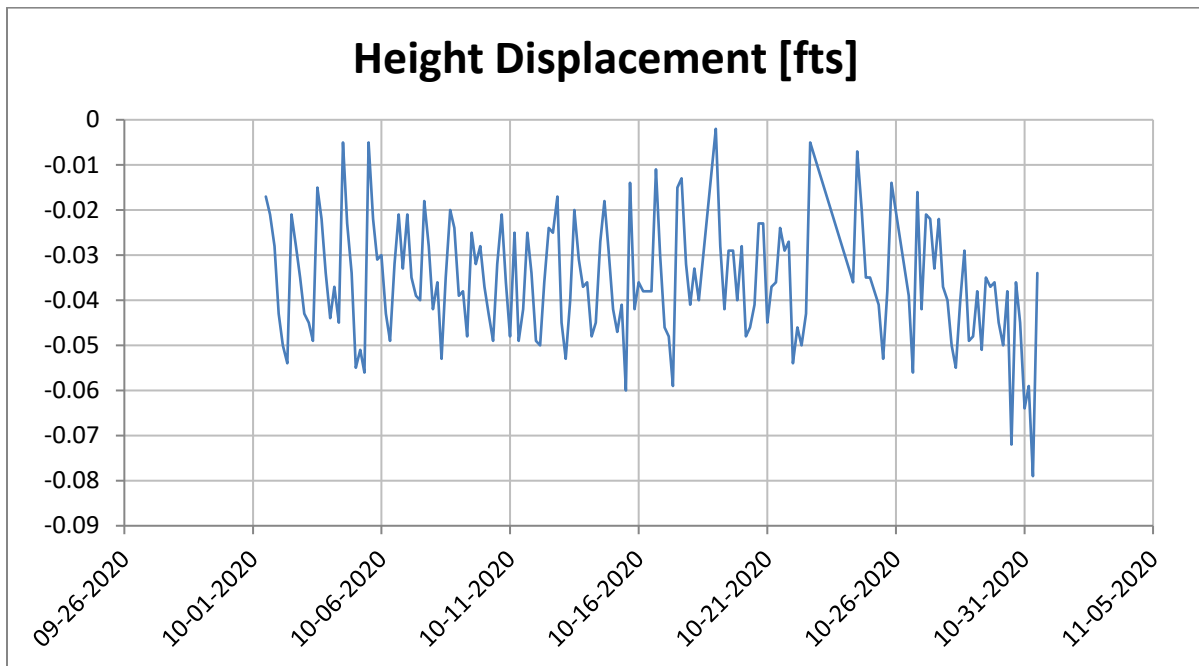
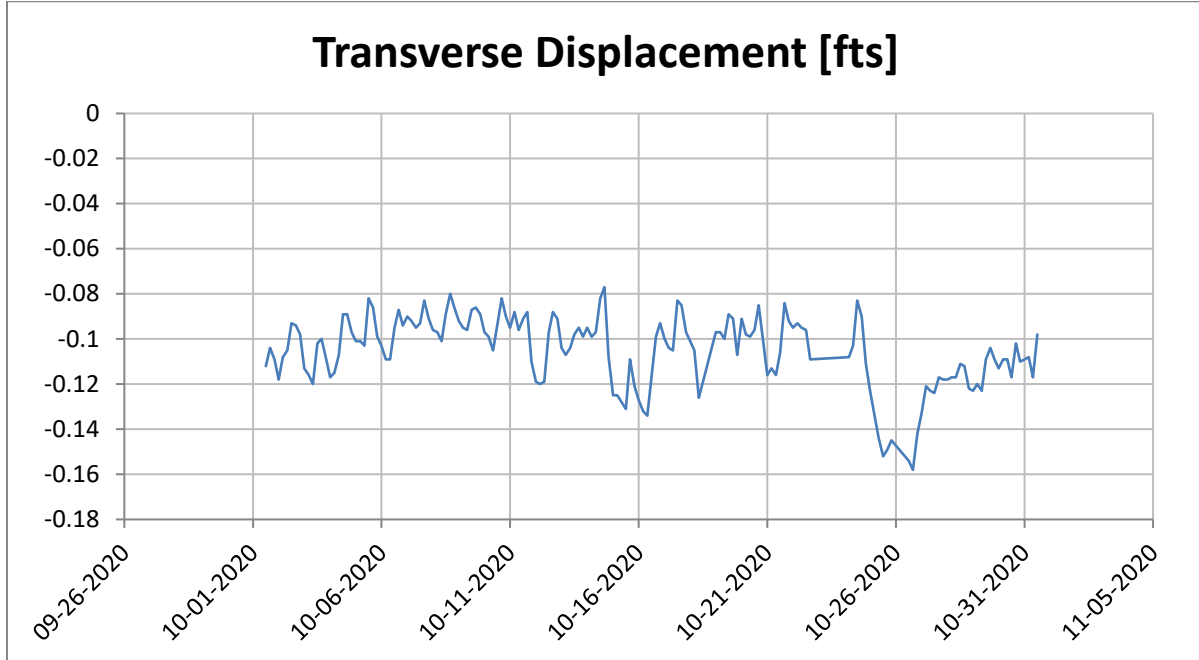


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

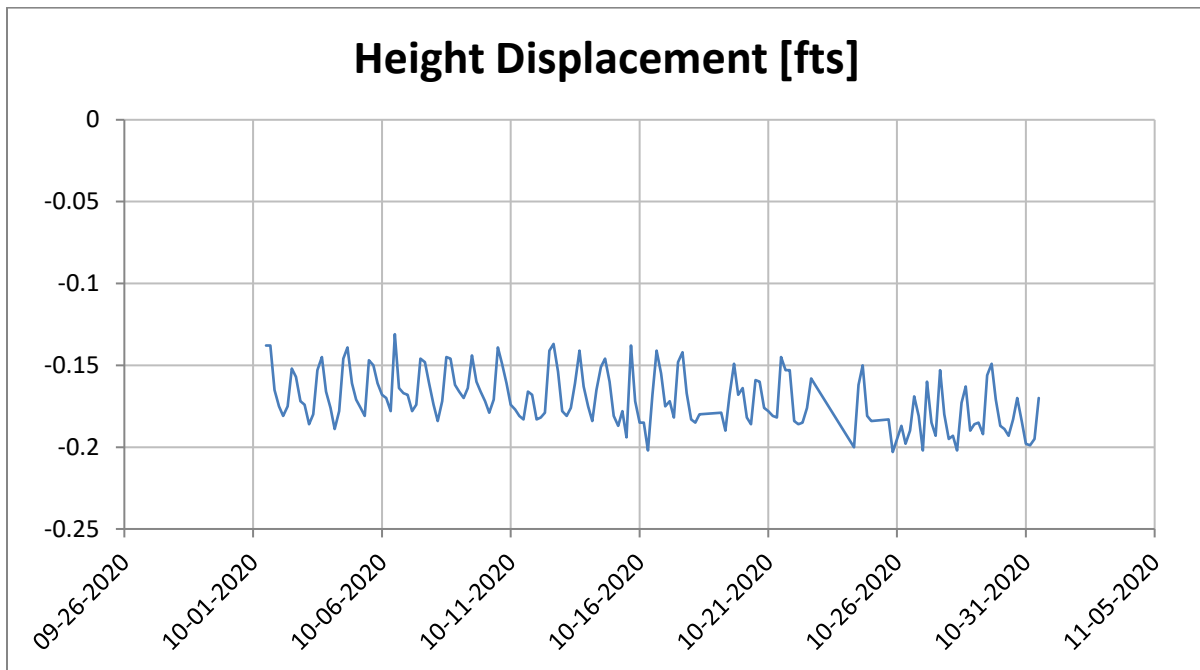
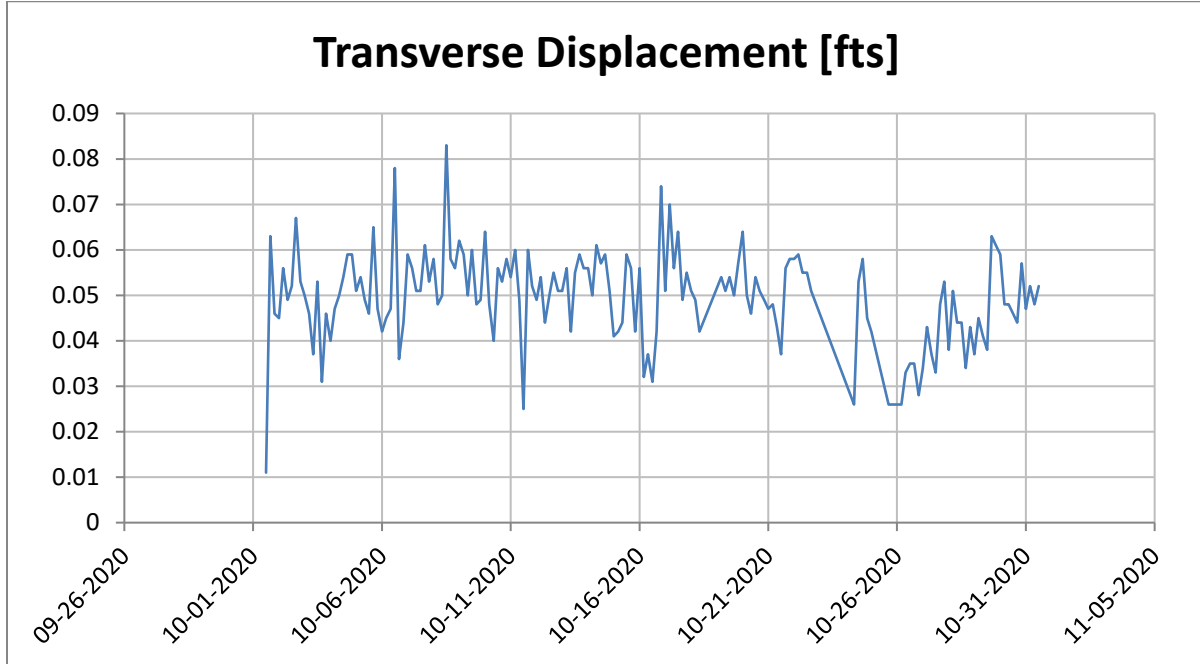


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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



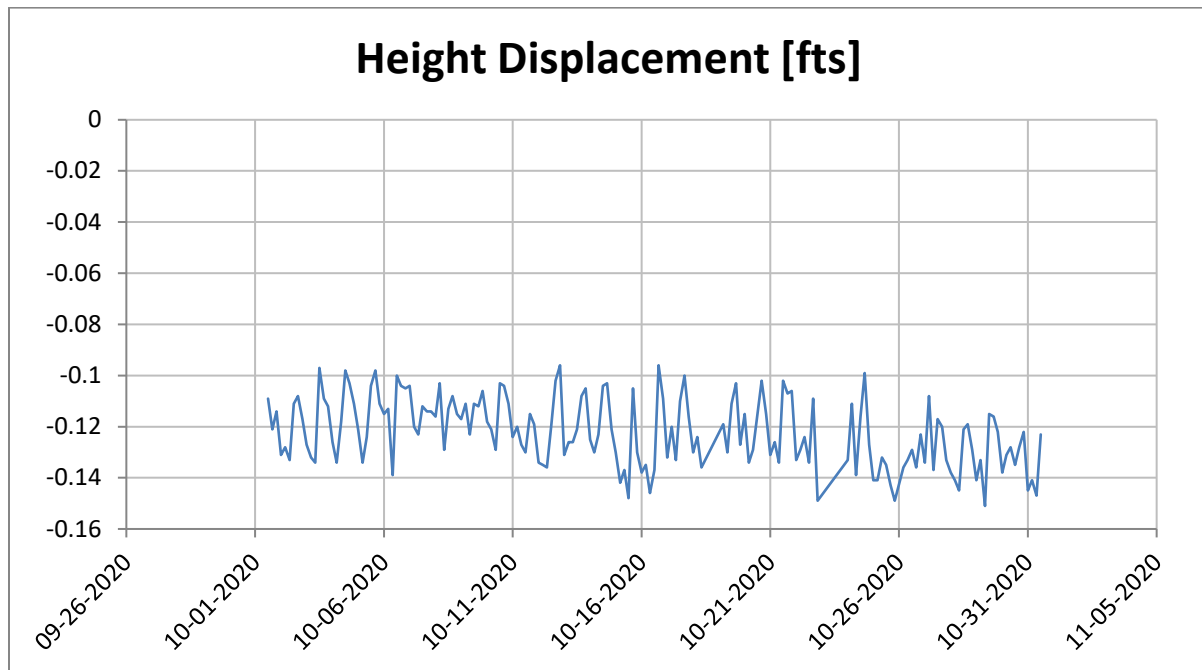
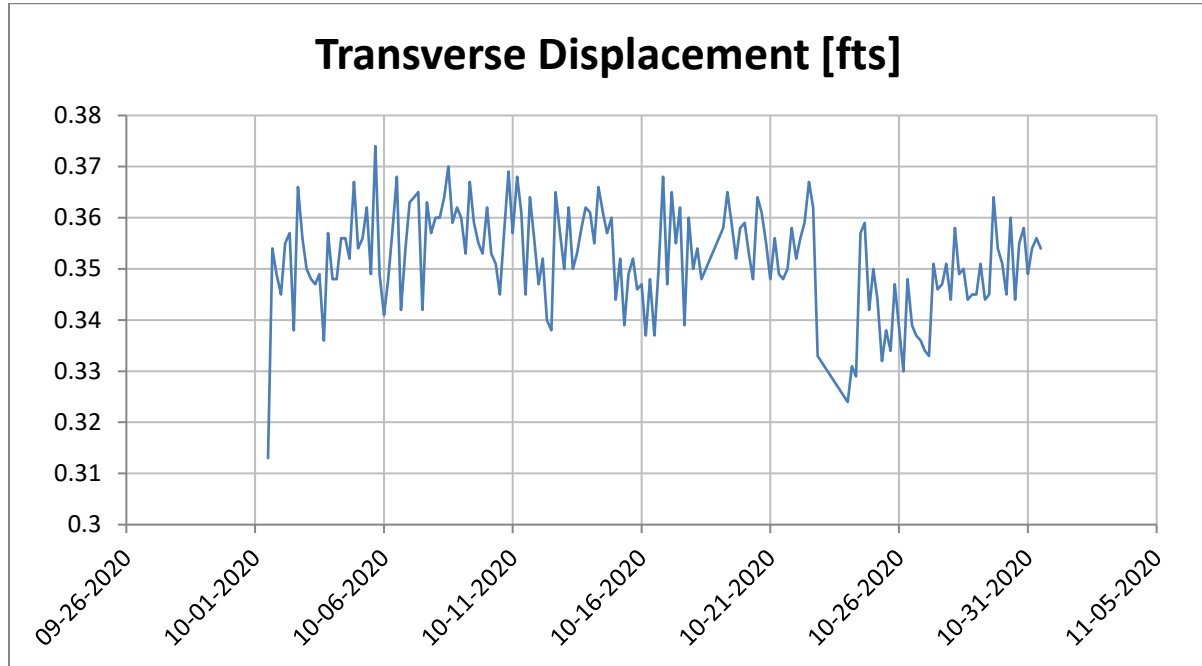
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

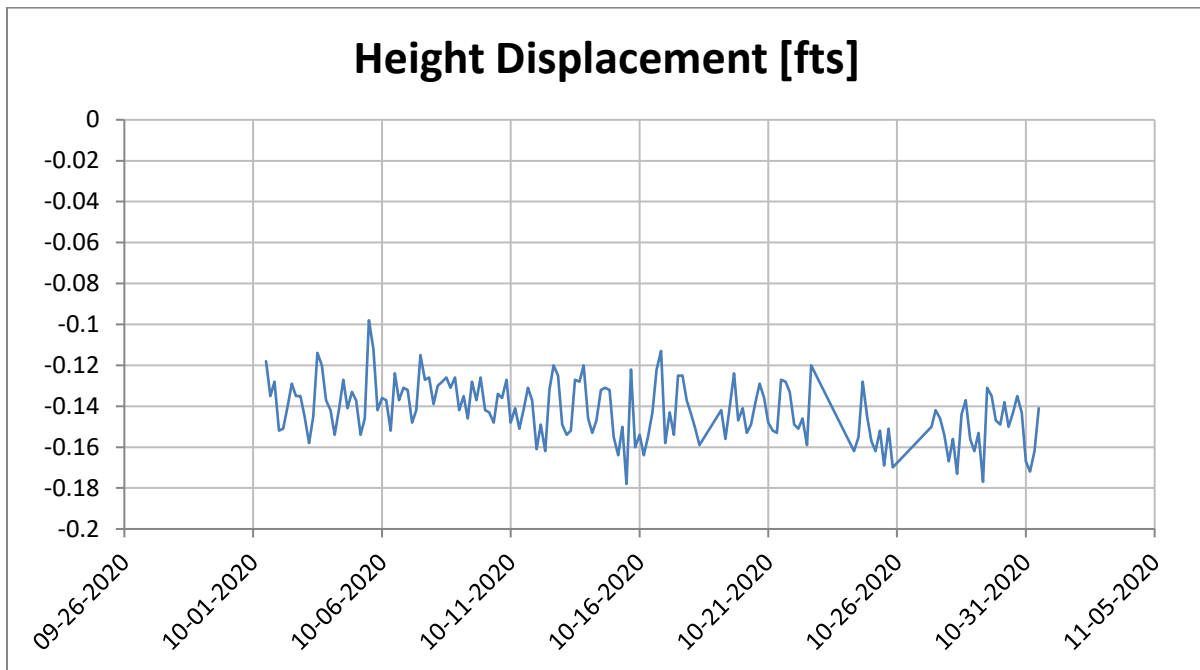
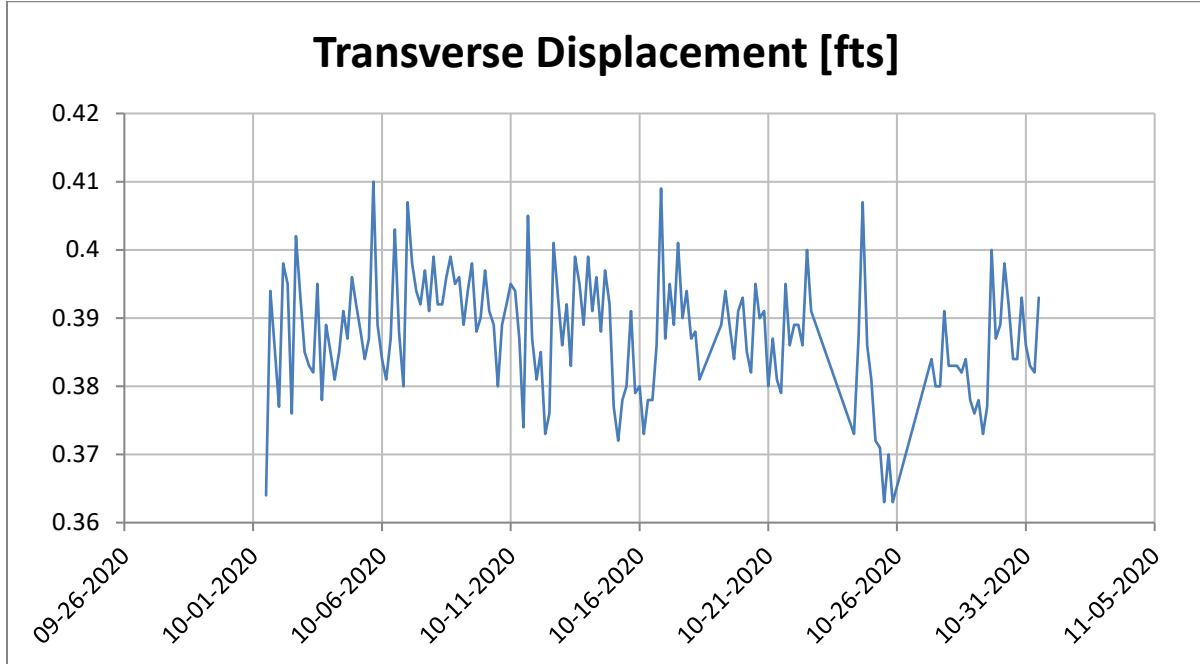


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

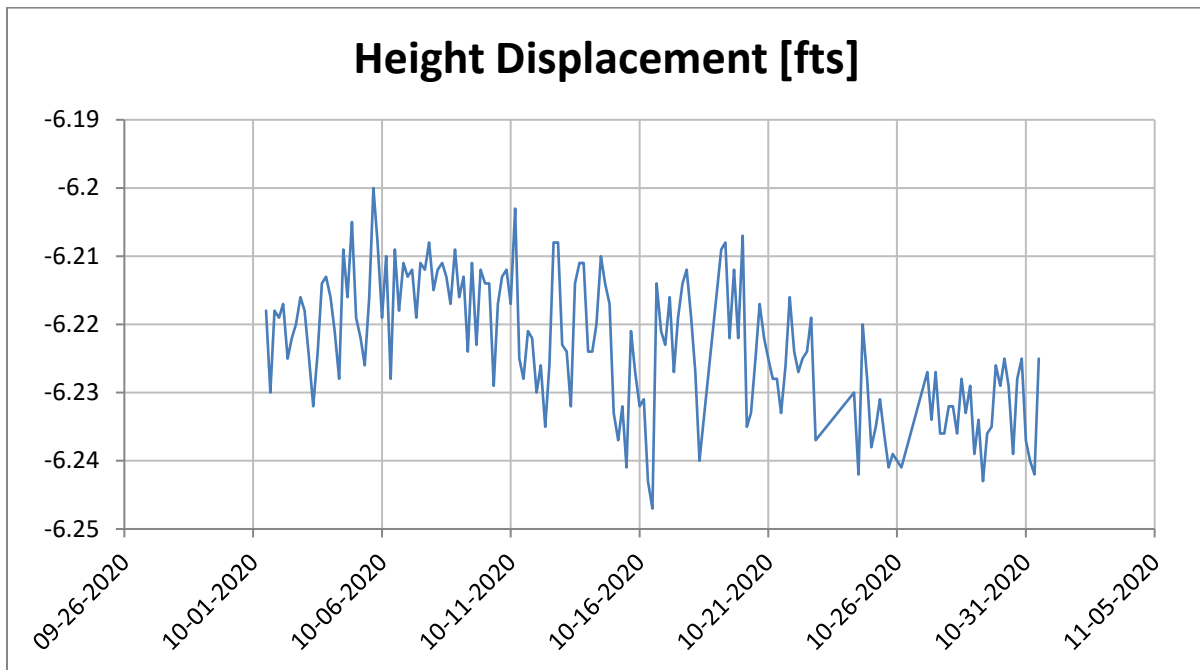
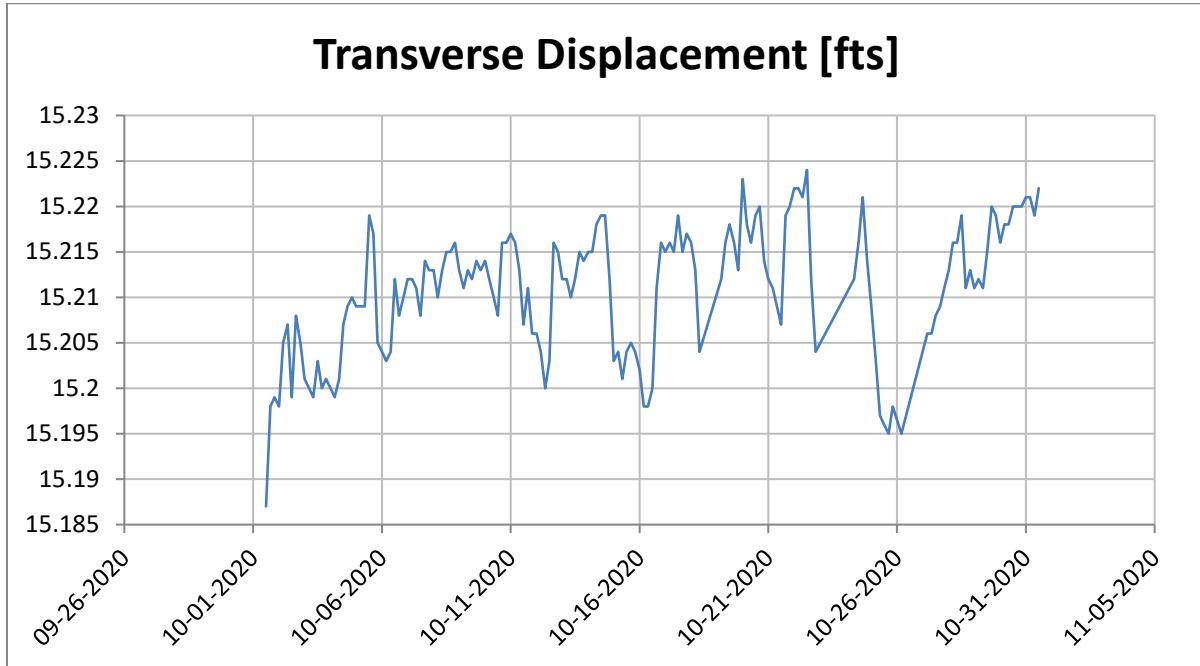


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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



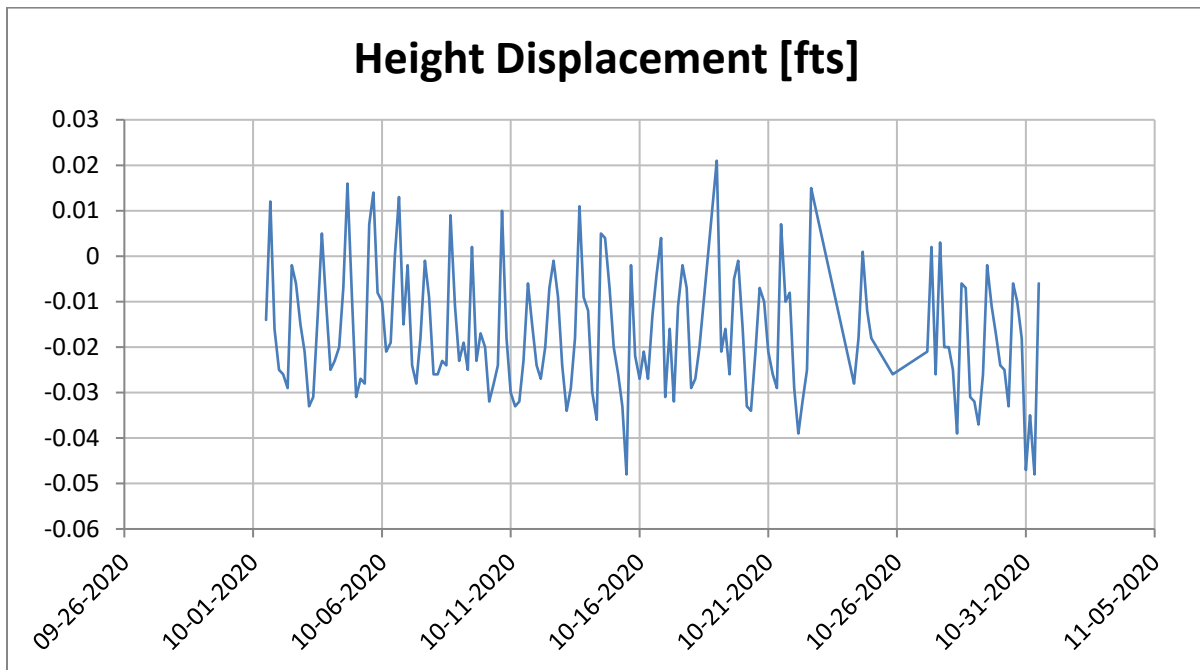
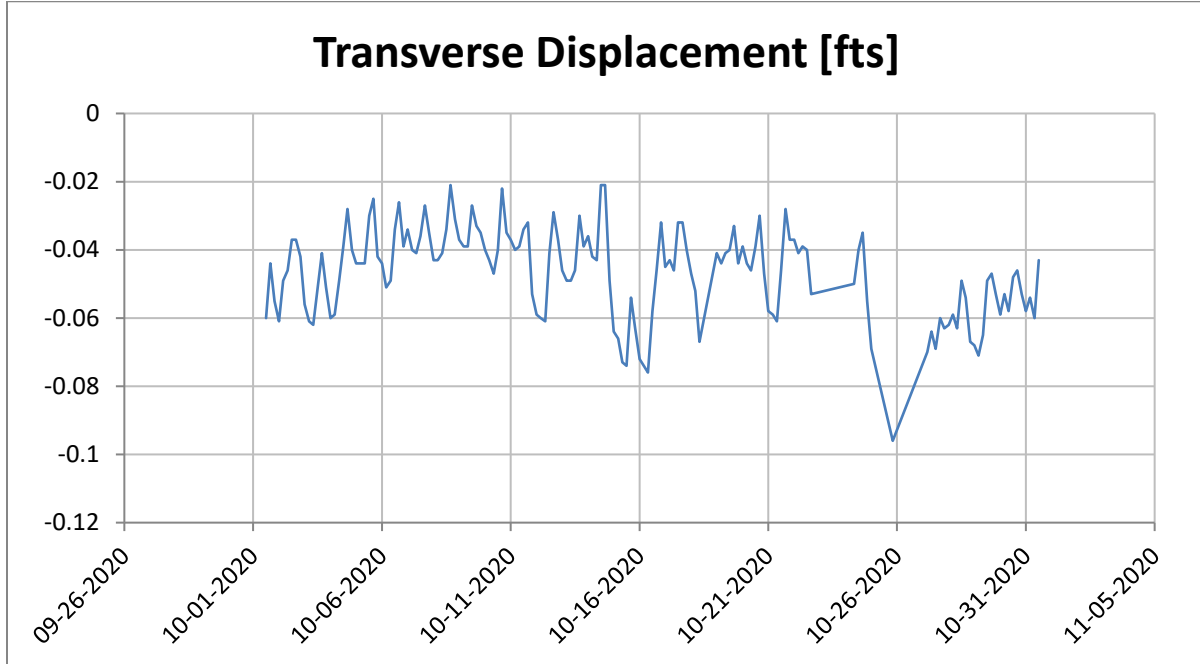
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

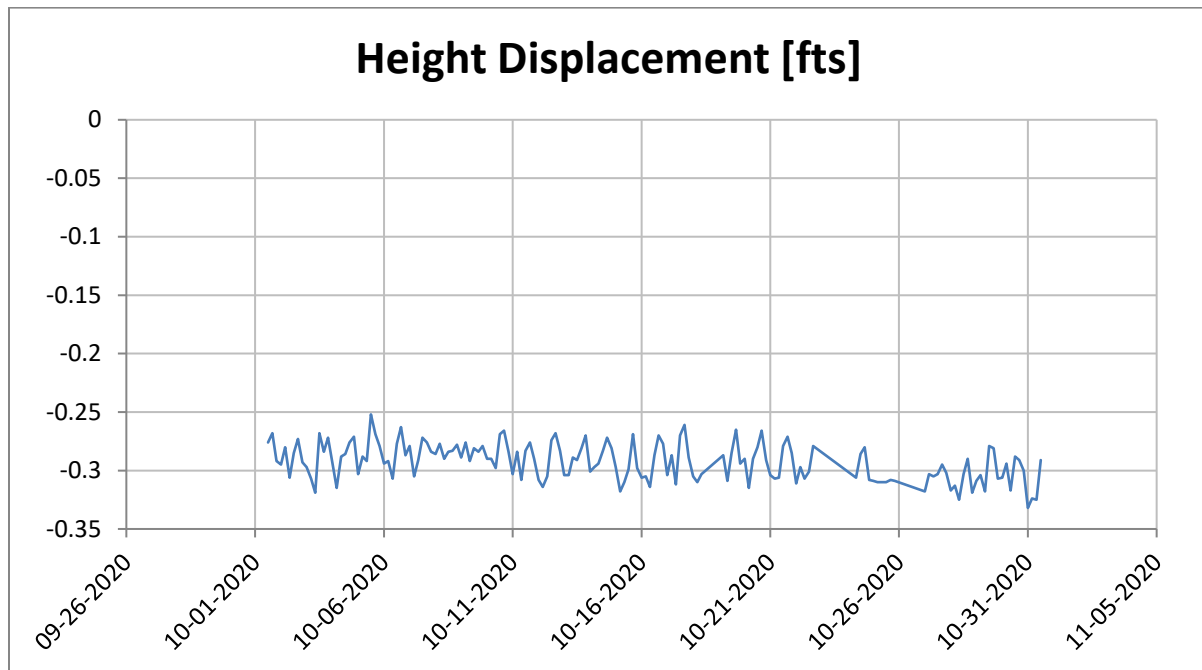
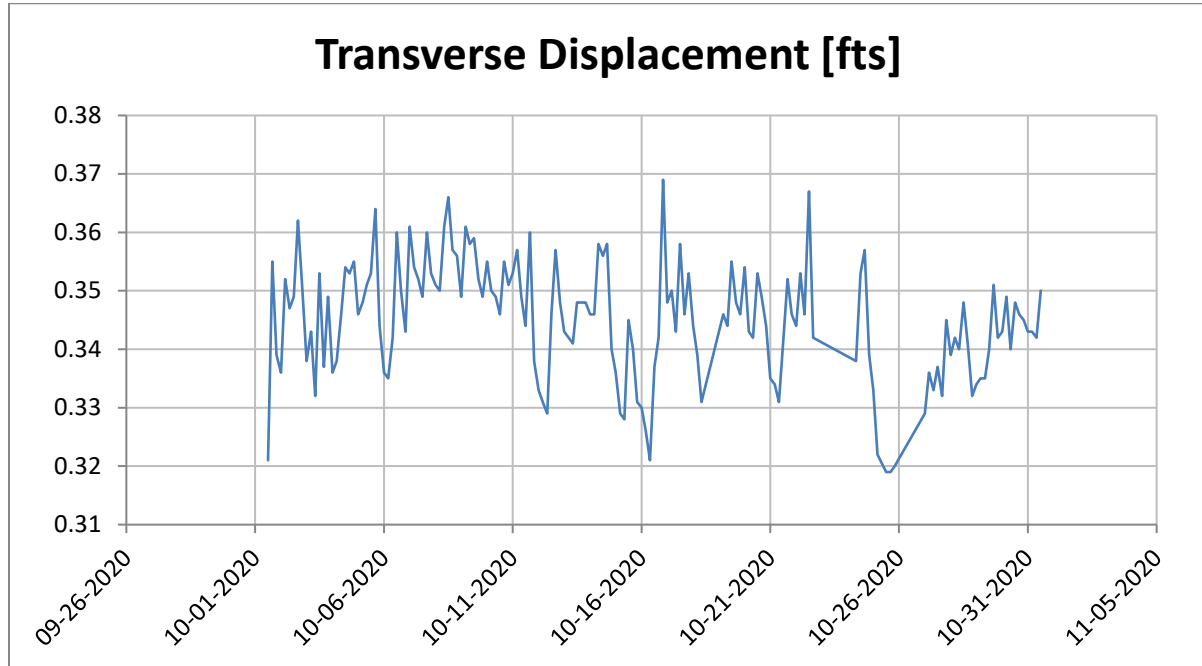


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

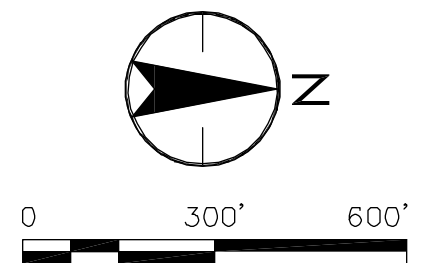
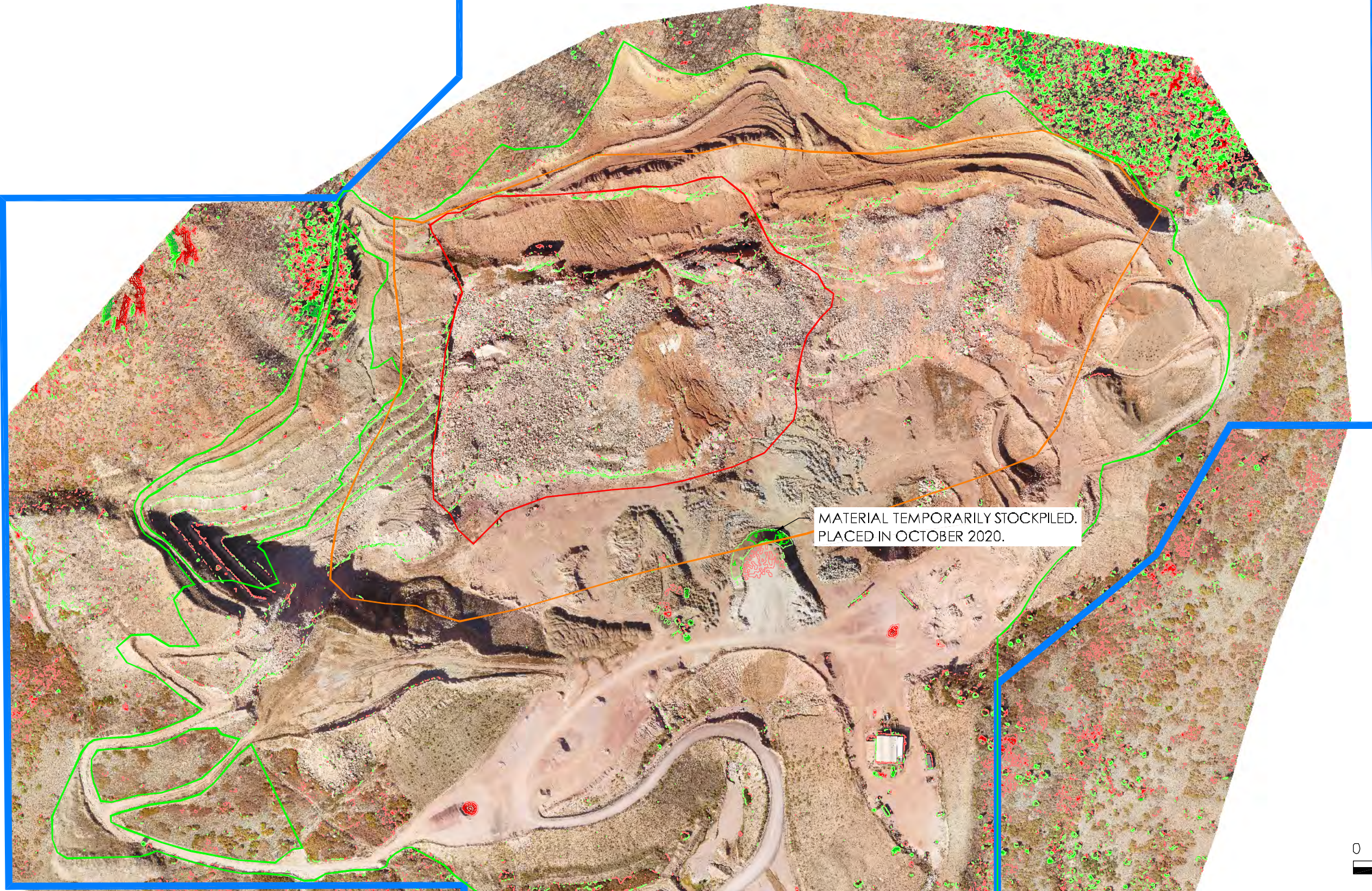
## Drone Survey





c:\users\pkos\documents\projects\pkreview\monitoring\draft\_oct12020\pkreview pitms\_30nov2020

2020.11.30 3:24:25 PM



Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
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 9/12/20 and 10/9/20.

Client/Project  
**CONTINENTAL MATERIALS CORP.  
PIKEVIEW QUARRY SLOPE MONITORING**

Project No.  
227419041

Title  
**EXISTING PRISMS WITH CURRENT SURFACE**

Revision #	Date
3	2020.11.30
Drawn By PK	Figure No. 3