





# Homestake/Richmond Hill 2018 Employment and Contributions

---

Year-end employment

11 FTE's

(+1 FT contract emp  
and 1 PT emp)

2018 Contributions

(Includes Monetary & Non-Monetary)

\$15,000



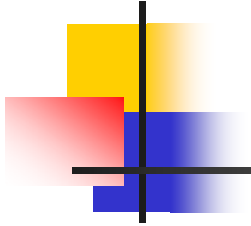
# Homestake Mine Open Cut Review

---

Reclamation has been completed at the waste rock facilities

As of the end of 2018:

- Approx. 555 Acres Released
- Approx. 87 Remaining Affected Acres
- Reclamation complete on all affected acres



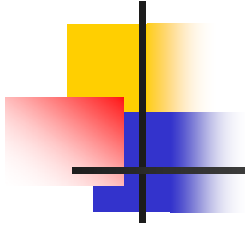
# 2018 Activities



# Homestake Mine 2018 Activities

---

- Installed new inclinometers at EWRDF
- Installed additional monitoring/pumping wells at East Ravine
- Refurbished Grizzly Gulch Seepage Collection Facility



# **Inclinometer Installations at EWRDF**



# Inclinometer Installations at EWRDF

---

New inclinometers installed at EWRDF in June to:

- provide coverage in East Ravine, Gayville Gulch and Blacktail Gulch; and,
- help determine if incremental survey monument displacements observed in 2016 and 2017 are result of survey error/inaccuracy or are reflective of subsurface shear displacements.



# Inclinometer Installations at EWRDF

---

New inclinometers installed at EWRDF include:

- ERAV I-1 in East Ravine (5100 ft. bench)
  - 150 ft. depth
  
- GAYV I-1 in Gayville Gulch (5000 ft. bench)
  - 151 ft. depth with vibrating-wire piezometer
  
- BLKTAL I-1 Blacktail Gulch (5000 ft. bench)
  - 199 ft. depth



# Locations of Newly Installed Inclinometers



## East Waste Rock Facility

BLKTAL I-1

GAYV I-1

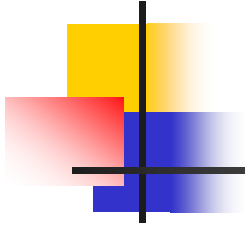
ERAV I-1



**Drilling ERAV I-1 Inclinator**



**Installed Inclinometer**



---

# **Additional Monitoring/Pumping Wells at East Ravine**



## Monitoring/Pumping Wells at East Ravine

---

- Seep identified in East Ravine down-gradient of railroad grade (Approx. 1 gpm)
- WQ analyses indicated elevated levels of TR-Se, TDS and EC
- Hydrological Study Completed
- Study concluded that source is deeper below existing collection system
- A minor portion of seep flow from EWRDF



# Pumping Well at East Ravine

---

- Three wells were drilled to intercept potential source in 2012 and 2013 (GW-3, GW-4 and GW-5)
- Pumps were installed to divert water into the collection system
- Results showed significant decreases in TR-Se, TDS and EC and very low flows at EWR-5
- Ave TR-Se: from 0.015 mg/L range to < 0.005 mg/L with occasional detectable levels
- Ave TDS: from 2550 mg/L range to 1200 mg/L
- Ave EC: from 2850  $\mu$ mhos range to 1530  $\mu$ mhos



# Pumping Well at East Ravine

---

- Two additional pumping wells (GW-6 and GW-7) were drilled in 2017
- Pumps and piping from new wells to collection system installed in 2017 and 2018
- Pumps operational in 2018
- Continuing to evaluate effectiveness of system



EWR-5

East Ravine  
Collection System

Pumping Wells

East Waste Rock Facility

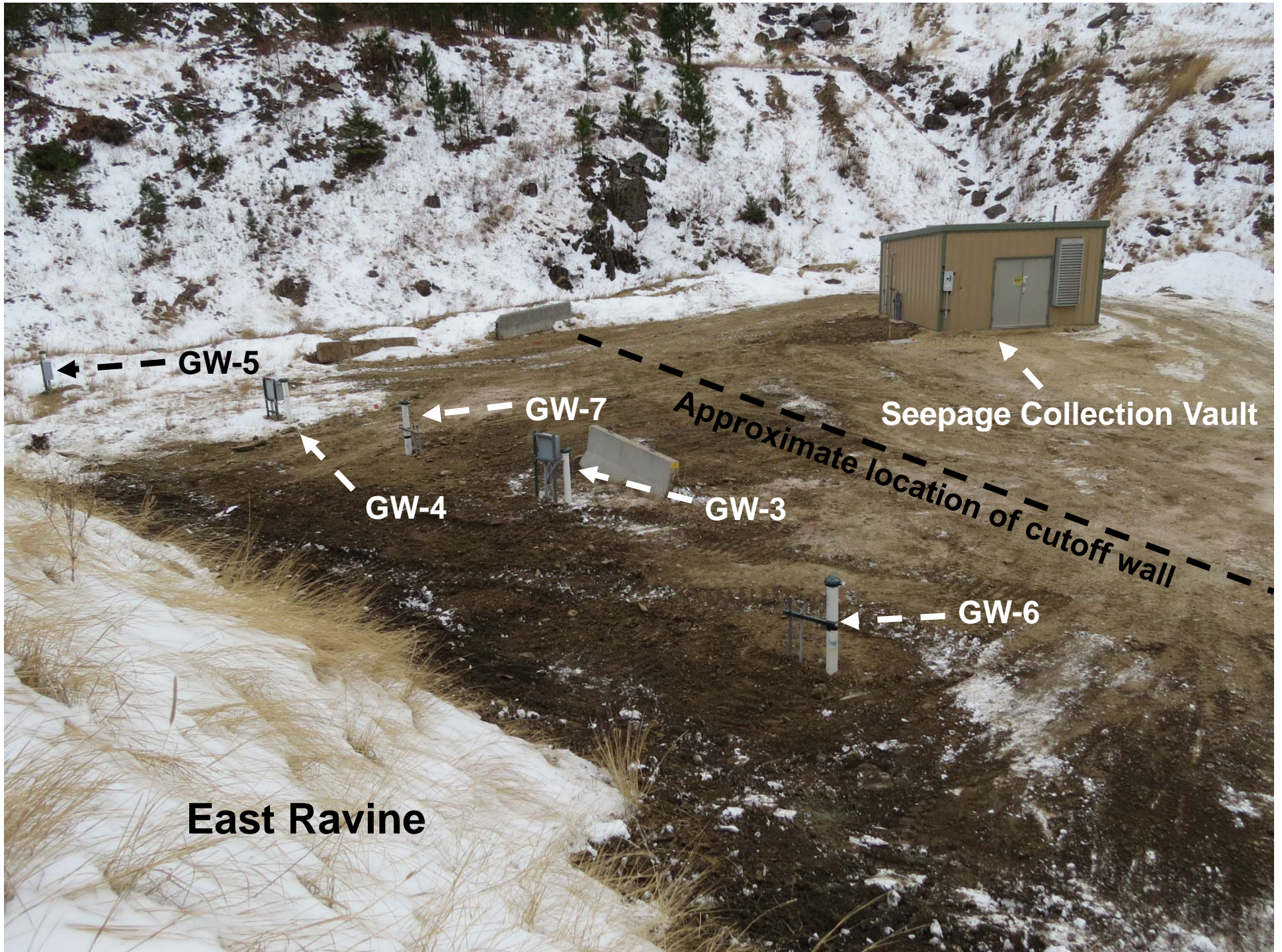
Google earth

© 2018 Google



1000 ft





GW-5

GW-7

GW-4

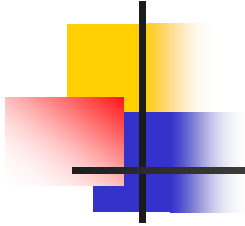
GW-3

GW-6

Seepage Collection Vault

Approximate location of cutoff wall

East Ravine



# **Grizzly Gulch Seepage Collection Facility**



# Grizzly Gulch Seepage Collection Facility Refurbishment

---

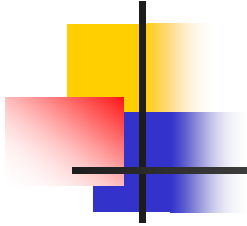
- Stainless steel pump header was installed in seepage collection building to connect the three pumps used to pump seepage back to tailings impoundment.
- 316 (grade) stainless is corrosion resistant and reduces iron buildup in pipes
- Stainless Steel or HDPE plastic piping used
- MCC replaced with digital MCC



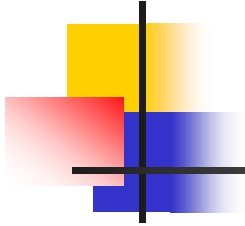
**Stainless Steel Header at Seepage Collection**



# Isolation Valve for Pump-back Line



# 2018 Monitoring



# Deadwood Creek Monitoring Results

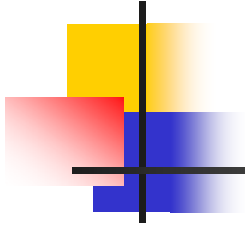


## Deadwood Creek Monitoring Results

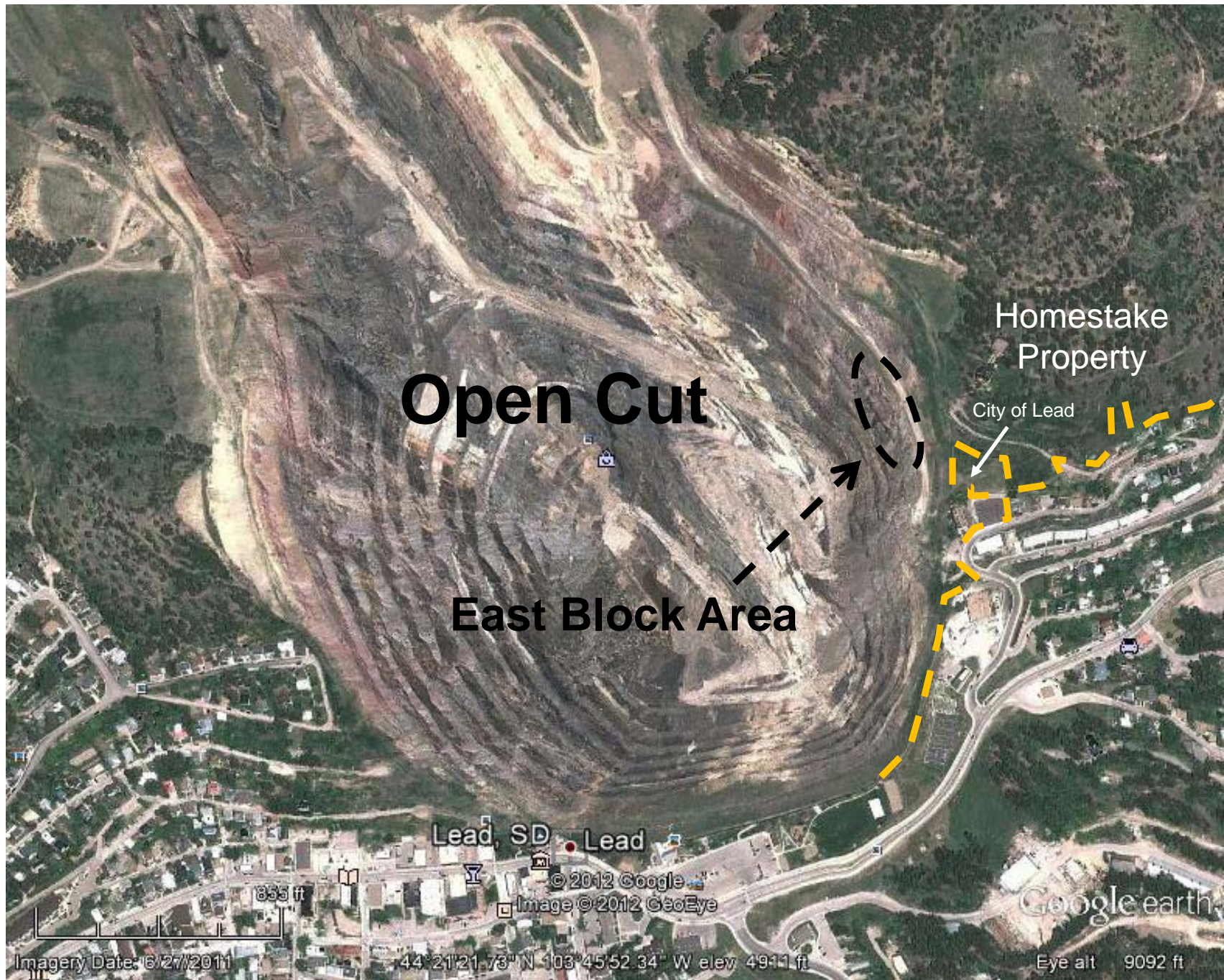
---

- Blacktail Water Treatment Plant discharge consistently meets permitted effluent limits
- Instream water quality meets all standards for coldwater marginal fish life propagation waters.





# Geotechnical Monitoring



**Open Cut**

**East Block Area**

Homestake Property

City of Lead

Lead, SD

© 2012 Google

Image © 2012 GeoEye

Google earth

Imagery Date: 6/27/2011

44° 21' 21.73" N 103° 45' 52.34" W elev 4941 ft

Eye alt 9092 ft



**ACCESS ROAD MOVEMENTS: SE VIEW OF EAST BLOCK  
(PHOTOGRAPH TAKEN ON OCTOBER 23, 2018)**

CLIENT/PROJECT



DECEMBER 2018 SEMI-ANNUAL  
GEOTECHNICAL MONITORING REPORT  
LEAD, SOUTH DAKOTA

DRAWN

AJS

DATE

11/06/2018

JOB NO.

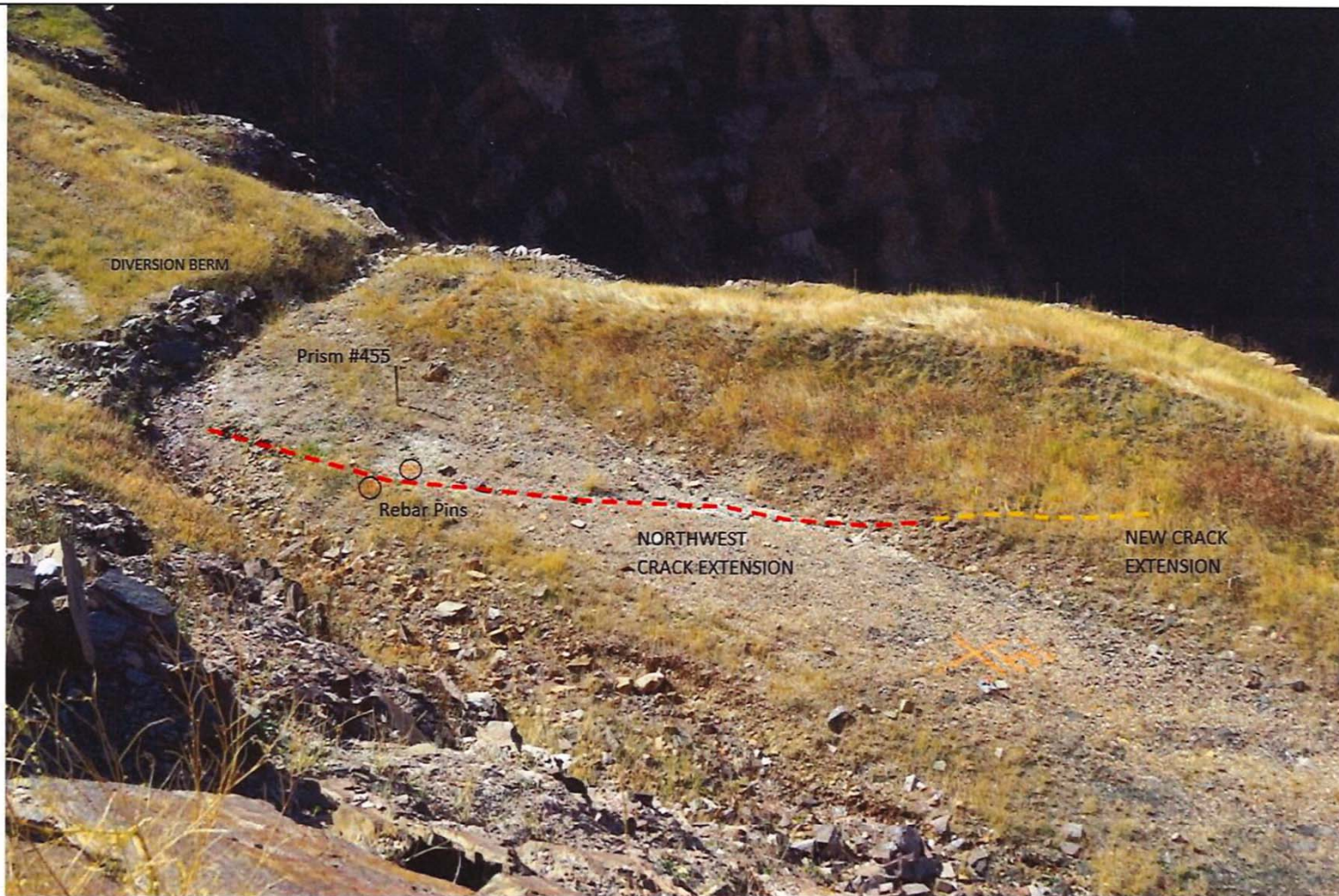
1898060.200

FILE

GL

FILE NO.

PHOTOGRAPH 2



**ACCESS ROAD MOVEMENTS: SW VIEW OF EAST BLOCK  
(PHOTOGRAPH TAKEN ON OCTOBER 22, 2018)**

CLIENT/PROJECT



**GOLDER**



**JUNE 2018 SEMI-ANNUAL  
GEOTECHNICAL MONITORING REPORT  
LEAD, SOUTH DAKOTA**

DRAWN

AJS

DATE

11/06/2018

JOB NO.

1898060.200

FOR

GL

FILE NO.

**PHOTOGRAPH 3**



# Geotechnical Monitoring

---

- Open Cut East Block
  - Could still progress to failure
  - Failure would be contained within pit boundary on Homestake-controlled property



# Geotechnical Monitoring

---

- East Waste Rock Facility (Bobtail Gulch)
  - From 1994 to 2008 showed shear movement
  - In 2009 and 2010, a buttress was installed
  - Movement has slowed following construction of buttress. It's expected to continue to slow
  - Movement is primarily settlement and relaxation of the fill



# Geotechnical Monitoring

---

- East Waste Rock Facility - 2018  
(Blacktail, Gayville and East Ravine)
  - As previously reported, readings of some monument surveys subsequent to October 2015 show possible divergence from past monitoring trends.

# East Waste Rock Disposal Facility



Bobtail  
Gulch

Blacktail  
Gulch

Gayville  
Gulch

East  
Ravine

© 2018 Google

Google earth

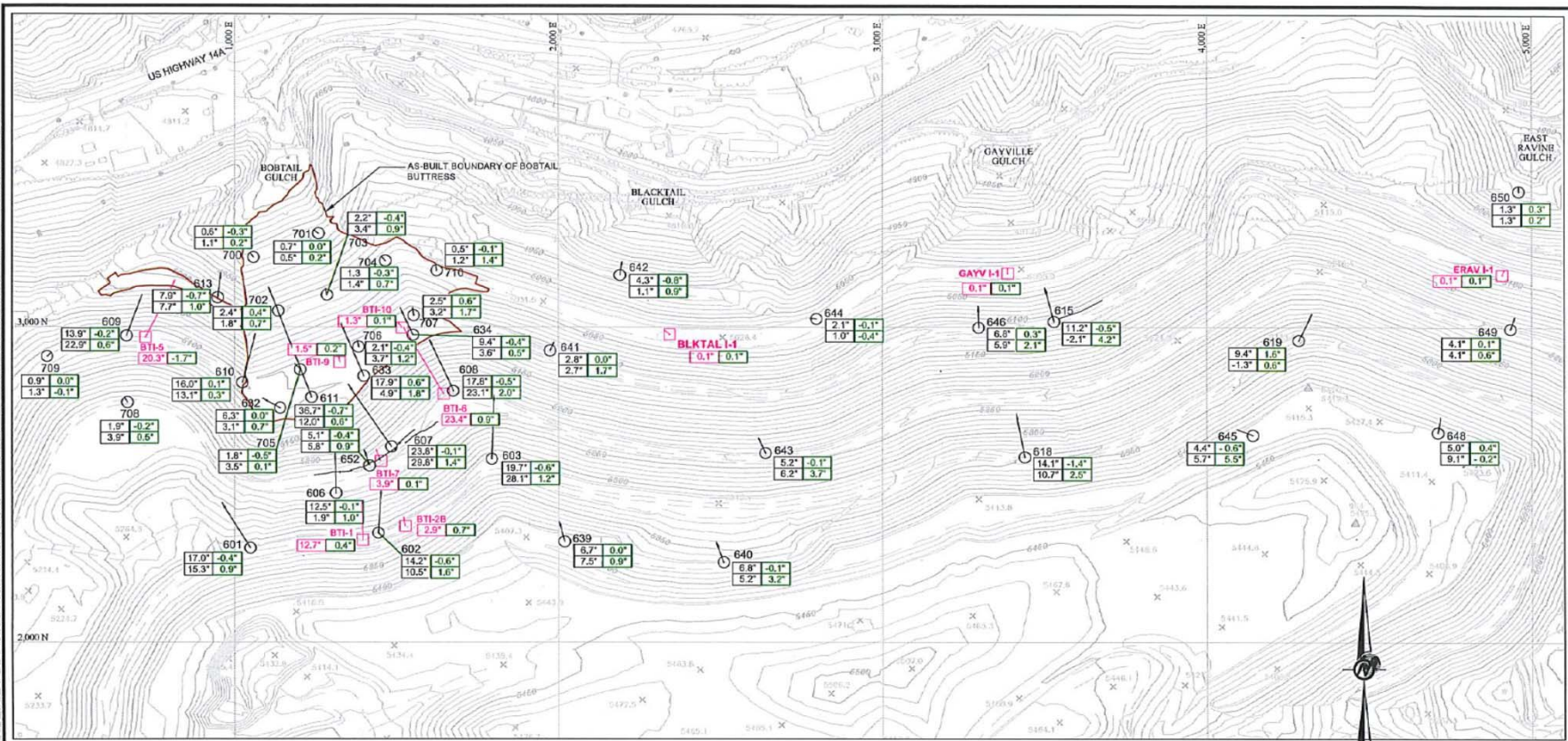
Imagery Date: 6/21/2016 1995

lat 44.366303° lon -103.755293° elev 5233 ft

Eye alt 10000 ft



FILE: C:\Users\j\Documents\10889920 - Lead 2018 - Homestake Mine\Reports\2018\10889920\10889920.mxd, 10/11/2018 10:51:10 AM  
 This drawing was prepared by GOLDER ASSOCIATES INC. and is the property of GOLDER ASSOCIATES INC. and shall not be used for any other purpose than that for which it was prepared.  
 The information shown on this drawing is based on the data provided to GOLDER ASSOCIATES INC. and is not intended to be used for any other purpose than that for which it was prepared.



**LEGEND**

- SURFACE SURVEY MONUMENT**
- CUMULATIVE HORIZONTAL MOVEMENT VECTOR
  - SURVEY MONUMENT ID
  - HORIZONTAL MOVEMENT MAGNITUDE
  - VERTICAL MOVEMENT MAGNITUDE (POSITIVE NUMBER INDICATES DOWNWARD MOVEMENT)
- INCLINOMETER**
- CUMULATIVE HORIZONTAL SURFACE MOVEMENT VECTOR
  - INCLINOMETER ID
  - HORIZONTAL MOVEMENT MAGNITUDE AT SURFACE

**NOTES**

1. LEFT BOXES INDICATE THE TOTAL CUMULATIVE DISPLACEMENT; THE RIGHT GREEN BOXES INDICATE THE CHANGE IN CUMULATIVE DISPLACEMENT SINCE LAST READING.
2. SURVEY POINTS 601-614: STARTED MONITORING IN 1997; SURVEY POINT 618: REACTIVATED JUNE 2009; SURVEY POINT 619: STARTED MONITORING IN 2006; SURVEY POINTS 630-633: STARTED MONITORING IN 2005; SURVEY POINTS 606, 616: RE-ESTABLISHED IN 2007; REFERENCE POINT 616 IS THE "117, 5420 MINUTE 'PEAK' BASE STATION AND NOT SHOWN IN THIS FIGURE; SURVEY POINTS 700-710: STARTED MONITORING IN 2010; SURVEY POINT 615: REACTIVATED IN JUNE 2016; INCLINOMETERS B11-1 AND B11-2: STARTED MONITORING IN 1994; INCLINOMETER B11-3: STARTED IN 1994 AND PINCHED IN 1998; INCLINOMETER B11-3A: STARTED IN 1998 AND PINCHED IN 2003; INCLINOMETER B11-4: STARTED IN 2005 AND PINCHED IN 2007; INCLINOMETER B11-5: STARTED MONITORING IN 1998; INCLINOMETER B11-6: STARTED MONITORING IN 1998; INCLINOMETER B11-7: STARTED MONITORING IN 1998; INCLINOMETER B11-8: STARTED MONITORING IN 2005; INCLINOMETER B11-9, B11-10: STARTED MONITORING IN 2010; INCLINOMETER B11-11, B11-12, B11-13: STARTED MONITORING IN JUNE 2016; SURVEY POINT 618: SURVEYED THIS READING PERIOD.
3. CRACK MONITORING PIN SETS #1, #2, #3, AND #4 WERE INSTALLED ON 11/1/2007. CRACK MONITORING PIN SETS #5 AND #6 WERE INSTALLED ON 0/16/2009. CRACK MONITORING PIN SET #7 WAS INSTALLED ON 10/2/2006. THE ONLY REMAINING ACTIVE CRACK MONITORING PIN SETS ARE #5, #6, AND #7. ALL REMAINING MONITORING PIN SETS ARE REDUNDANT.
4. SURVEY MONUMENTS 612, 614, 630, 631, 635, 636, 637, 638, 639 AND INCLINOMETER B11-4 WERE REMOVED DUE TO THE CONSTRUCTION OF THE BUTTRESS.
5. REACTIVATED MONITORING POINTS SINCE THE LAST READING PERIOD (JUNE 2016): NONE; DEACTIVATED POINTS SINCE THE LAST READING PERIOD (JUNE 2016): NONE.



PROJECT: **GEOTECHNICAL MONITORING DATA REVIEW  
HOMESTAKE MINE  
LEAD, SOUTH DAKOTA**

FILE: **MOVEMENT VECTORS  
ON EWRF**

	PROJECT No. 10889920	FILE No. 200806130F03C
	DESIGN A.S. 11/19/18	SCALE AS SHOWN   REV. 0
	CADD JH 11/19/18	
REVIEW RAB 11/19/18	<b>FIGURE 3C</b>	



# Geotechnical Monitoring

---

- East Waste Rock Facility - 2018  
(Blacktail, Gayville and East Ravine)
  - Homestake has employed multiple displacement monitoring techniques to better evaluate the EWRF and determine the cause of the apparent divergence
    - Survey Monuments
    - Piezometers
    - Inclinometers
    - Visual Inspections
    - Drone surveys - **new**
    - Migrated to InSAR Monitoring - **new**



# Geotechnical Monitoring

---



- East Waste Rock Facility

- (Blacktail, Gayville and East Ravine)

- Piezometers
  - No significant buildup of water pressures in waste rock facility
- Inclinometers
  - The new inclinometers installed in June 2018 have indicated only 0.1 inches of northward surficial movement with no shear displacement
- Visual Inspections
  - Tension crack at 5100 bench at Gayville is the only surficial change observed. No significant change to crack within last year
  - Tension crack appears to be associated with topsoil slumping



**TENSION CRACK AT THE CREST OF THE 5100 BENCH IN GAYVILLE GULCH LOOKING WEST  
(PHOTOGRAPH TAKEN ON OCTOBER 30, 2018)**

<small>CLIENT/PROJECT</small>  <b>GOLDER</b> 	<b>DECEMBER 2018 SEMI-ANNUAL GEOTECHNICAL MONITORING REPORT LEAD, SOUTH DAKOTA</b>	<small>DRAWN</small> <b>AJS</b>	<small>DATE</small> <b>11/06/2018</b>	<small>JOB NO.</small> <b>1898060.200</b>
		<small>FOR</small> <b>GL</b>	<small>FILE NO.</small>	<b>PHOTOGRAPH 5</b>



# Geotechnical Monitoring

---

- East Waste Rock Facility

(Blacktail, Gayville and East Ravine)

- Drone Surveys

- Drone Surveys have been conducted since 2017. The surveys show no significant divergent movement from past monitoring trends

- InSAR Monitoring (Interferometric Synthetic Aperture Radar)

- Biannual Monitoring



# Geotechnical Monitoring

---

- East Waste Rock Facility

## InSAR Technology

- InSAR technology (TRE Altamira) was employed by Homestake in 2019 to determine displacements using historical data back to 2007
- InSAR technology is used to extract very precise displacement measurements from satellite data (i.e. millimeter precision)
- Results in a much higher density of survey points
- Monitored area includes the Open Cut, waste rock facilities and Grizzly Gulch Tailings Dam



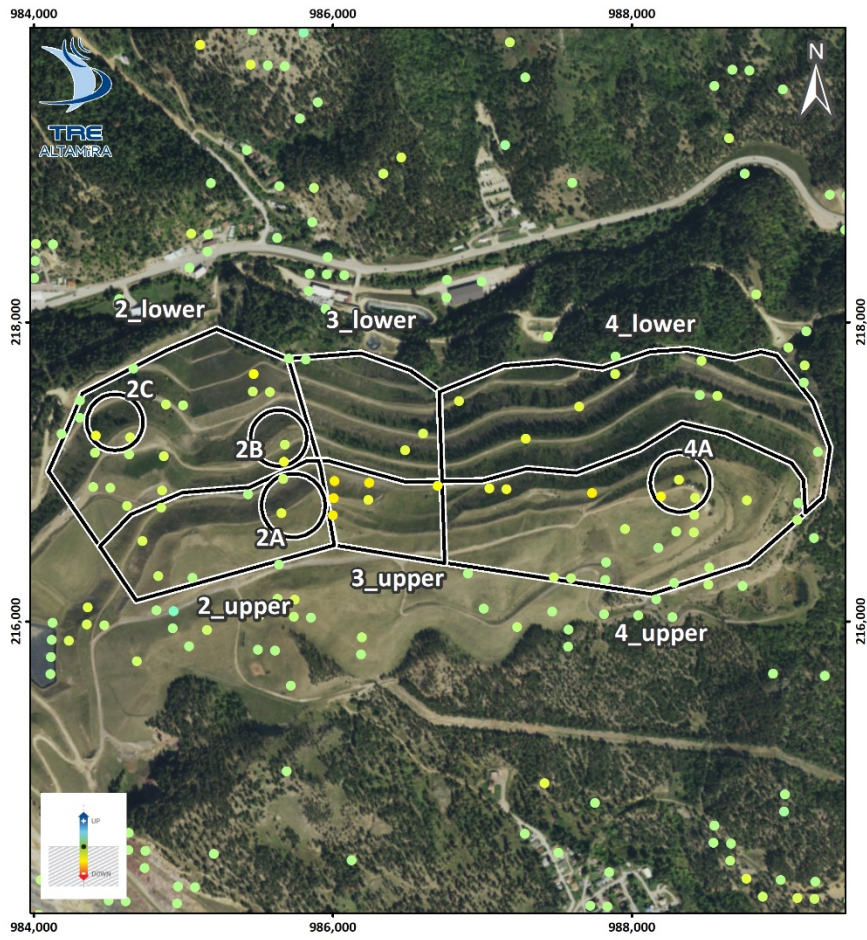
# Geotechnical Monitoring

---

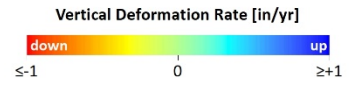
- East Waste Rock Facility

## InSAR Technology Results

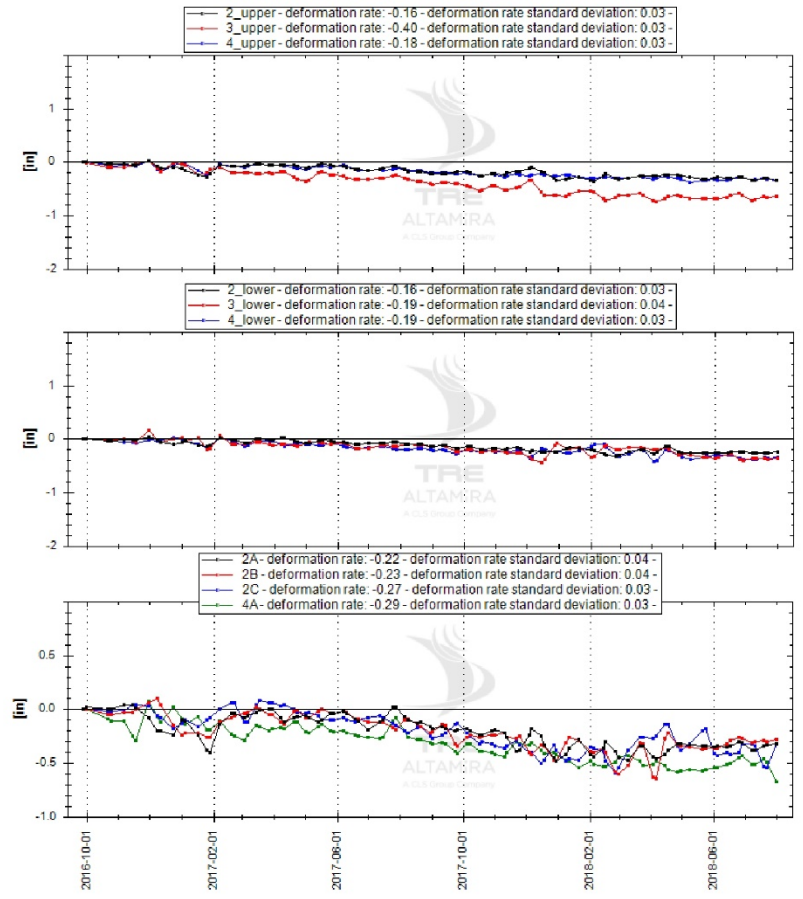
- Data for the Homestake Mine was evaluated for historic and current data.
- Data indicates that Blacktail, Gayville and East Ravine are behaving as expected
- No areas of concern were noted at the open cut, waste rock facilities or tailings dam.



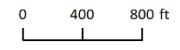
**SqueeSAR® Analysis**  
**Sentinel Vertical**  
**Sep 2016 - Aug 2018**



## EAST WASTE ROCK FACILITY



□ Average Time Series (ATS)



Background: ESRI World Imagery  
 Map Projection:  
 NAD 1983 State Plane South Dakota  
 North FIPS 4001 Feet  
 © TRE ALTAMIRA 2019





# Geotechnical Monitoring

---

- East Waste Rock Facility  
(Blacktail, Gayville and East Ravine)
  - Homestake is continuing to monitor and evaluate the data from monument surveys, piezometers, inclinometers visual surveys, drones and InSAR.



# Geotechnical Monitoring

---

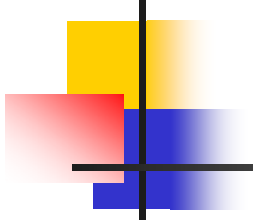
- East Waste Rock Facility  
(Blacktail, Gayville and East Ravine)
  - Additional ongoing work:
    - Perform base station surveys before each biannual monitoring review to measure any movement of base stations
    - Inspect benches and slopes bimonthly, as weather allows
    - Visually monitor the tension crack at the crest of the 5100 Bench in Gayville Gulch at least quarterly



# Geotechnical Monitoring

---

- East Waste Rock Facility  
(Blacktail, Gayville and East Ravine)
  - Additional ongoing work:
    - Monitor new inclinometers in Blacktail Gulch, Gayville Gulch and East Ravine quarterly
    - Migrated to InSAR monitoring bi-annually



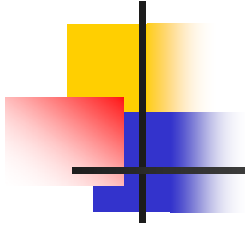
# 2019 Projects



# Homestake Mine 2019 Projects

---

- Complete transition to all stainless steel at GG seepage collection facility
- Continue Water Treatment Agreement with SDSTA
- Continue Water Treatment



End of Presentation  
Thank You