Memo

To: Jeff Gaul

From: John W. Roberts

Date: 25 September 2014

Project No.: 74201125N

cc: Austin Creswell, AMEC
Paul Ivancie, AMEC
Andrea Meduna, AMEC

Subject: Squaw Gulch VLF Closure Drain Installation Summary Revised with Detailed Logging Data and Horizontal Component Installation Details (REV 2)

The Closure Drain Installation Project began with a design consisting of 12 drains to be installed into boreholes drilled with orientations ranging from 097° to 140° azimuth and -45° to -49° inclination. The boreholes were to penetrate through varying amounts of Precambrian quartz monzonite (qtzm) before being terminated at approximately 50 feet into the diatreme breccia material. Eleven drains were required to have the average draining capacity of six gallons per minute (gpm) to comply with the drainage requirements for “wettest year” that was used in the hydrology study and system design. The site was designed conservatively with 12 drains. Six of the 12 drains were going to have the drain capacity measured by performing a constant head test. Adjustments to the design would be made by adding or subtracting drains from the original 12 drains, depending on the flows measured from each installed drain as the program progressed.

The following describes the general geology and permeability test results for each borehole drilled and drain installed.

Closure Drain CD-1:

CD-1 was drilled from February 18, 2014 through February 21, 2014. CD-1 penetrated fill to a depth of 10 feet followed by a sequence of qtzm and phonolite dikes (phd) to a depth of 80 feet. Qtzm dominated the borehole from 80 to 640 feet deep. At a depth of 640 feet, the transition zone between the qtzm country rock and the diatreme breccia was penetrated before encountering the diatreme breccia material at a depth of 660 feet. The borehole was terminated at a depth of 720 feet, 80 feet into the diatreme.

The constant head test was attempted by injecting 3,500 gallons of water into CD-1. The head of water was not observed at the surface. A second attempt was made by injecting 4,000 gallons (5.9 hole volumes) of water at a rate of 67 gpm. Again, the head of water was not observed at the surface. The constant head test was unable to be completed with the equipment onsite.

This experience of unexpected hydraulic conditions caused AMEC to change the approach to the tracking and documentation of permeability testing of the drains. This involved sourcing two in situ Level Troll transducers and two 1,000 feet vented cables to perform falling head tests from the maximum head experienced in each drain. The transducer pairs recorded the rate of drainage, and monitored hydraulic connectivity between drains. Constant head tests would still be performed if conditions permitted. Tests were to be conducted on every borehole.

Closure Drain CD-2:

CD-2 was drilled from February 21, 2014 through February 24, 2014. CD-2 penetrated fill to a depth of 5 feet followed by a sequence of qtzm and phd to a depth of 80 feet. Qtzm dominated the borehole from a depth of 80 to 879 feet. The borehole was terminated at a depth of 879 feet. The borehole did not penetrate the diatreme, but was terminated near the Precambrian-Diatreme interface. At a depth of 860 feet the borehole had experienced a change in the inclination from -48° (at the surface) to -67° (delta of -19°). Considering the declination at depth in conjunction with CC&V's Exploration Group's Vulcan model, AMEC decided to terminate the borehole and complete it as a drain, provided that the hole was hydraulically connected to the adjacent holes, which terminated in the diatreme breccia.

A permeability test was completed by injecting 1,069 gallons of water into CD-2 (1.3 hole volumes) at a rate of 67 gpm. The head of water was observed at the surface; however, a constant head test could not be completed due to the capacity of the pump, which had a maximum output of 16 gpm. The equipment on-site at the time of testing prevented the precise determination of the flow rate that CD-2 was draining, with an estimate between 16 to 67 gpm.

Monitoring was performed to observe any hydraulic connectivity between CD-2 and CD-1, and to determine if the local fracture network was connected to the diatreme. A transducer was deployed in CD-1 and CD-2 during the hydraulic testing of CD-2. CD-1 showed the response of an increase in head during the test. CD-2 is in close proximity of the country rock-diatreme contact. This indicates the CD-2 local fracture network is likely interconnected with the diatreme breccia.

Closure Drain CD-3:

CD-3 was drilled from February 24, 2014 through February 27, 2014. CD-3 penetrated fill to a depth of 10 feet followed by a sequence of qtzm and phd to a depth of 197 feet. Qtzm dominated the borehole from depths of 197 to 785 feet. At 785 feet deep the borehole penetrated the transition zone between the qtzm country rock and the diatreme breccia. At 825 feet deep the diatreme was penetrated. The borehole was terminated at a depth of 885 feet.

The formation depths were determined with assistance from a CC&V geologist. Breccia fragments were observed by both AMEC and CC&V under microscope. However, after detailed logging completed by another member of the CC&V Exploration Department it was determined that the borehole did not penetrate the diatreme; the diatreme, as defined by the Exploration Group, is the Cripple Creek Breccia Formation. The detailed logging identified that phonolite breccia material was encountered from 780 to 785 feet deep before penetrating qtzm at 830 feet deep. A sequence of phonolite breccia and qtzm was penetrated from 830 to 855 feet deep before completed penetration into the phonolite breccia. The Exploration Group has identified this as the transition zone into the diatreme breccia.

A constant head test was attempted by injecting 1,970 gallons of water (2.4 hole volumes) into CD-3 at a rate of 94 gpm. The head of water was not observed at the surface. A falling head test was completed and the transducer data shows the entire column of water draining out.

Monitoring was performed to observe any hydraulic connectivity between CD-3 and CD-2, and to determine if the local fracture network was connected to the diatreme. A transducer was deployed in CD-2 during the hydraulic testing of CD-3. CD-2 showed a response of an increase in head during the test. CD-3 is in close proximity of the country rock-diatreme contact. This indicates the CD-3 local fracture network is likely interconnected with the diatreme breccia.

Closure Drain CD-4:
CD-4 was drilled from February 27, 2014 through March 1, 2014. CD-4 penetrated fill to 10 feet deep followed by a sequence of qtzm and phd to a depth of 225 feet. Qtzm dominated the borehole from depths of 225 to 450 feet. The borehole was terminated at 520 feet deep due to an excessive declination which greatly decreased the chances of diatreme penetration.

The borehole was abandoned with grout from 520 to 190 feet deep, where the grout was being lost to the formation through a fracture (190 feet). A shale basket was deployed to a depth of 147 feet, where the hole was grouted to the surface leaving a 53 foot void in the borehole.

Closure Drain CD-4a:
CD-4a was drilled from March 1, 2014 through March 4, 2014. It was moved 4.3 feet away from CD-4 and the inclination was decreased by -2° to -43°. The upper 450 feet did not have samples retained and are presumed to be the same as CD-4. From 450 feet deep, CD-4a penetrated qtzm to a depth of 930 feet. The borehole was terminated at 930 feet deep in qtzm due to a lost drill bit down-hole. Diatreme breccia was originally thought to have been encountered from 870 to 875 feet deep and traces of breccia material from 875 to 930 feet deep, but detailed logging by the Exploration Group after drain completion determined this was altered qtzm.

A constant head test was attempted by injecting 1,963 gallons of water (2.3 hole volumes) into CD-4a at a rate of 67 gpm. The head of water was not observed at the surface. A falling head test was completed and the transducer data shows the entire column of water draining out.

The transducer data from the adjacent drain CD-3 monitoring during the CD-4a permeability testing did not see a response, indicating they are not hydraulically connected. Due to the lack of diatreme breccia penetration and hydraulically isolated characteristics relating to the adjacent drain, CD-4a was abandoned. The borehole was abandoned with grout from 930 to 165 feet deep, where the grout was being lost to the formation through a fracture zone (150 to 170 feet). Bentonite chips were poured from the surface to where they bridged at a depth of 76 feet. The bridge was used as a plug to grout from the surface. The plug is estimated to be 9 feet thick based on the amount of bentonite placed down the hole. The hole was grouted to the surface leaving an approximate 80 foot void in the borehole.

Closure Drain CD-5:
CD-5 was drilled from March 5, 2014 through March 6, 2014. CD-5 penetrated fill to a depth of 15 feet followed by a sequence of qtzm and phd to a depth of 344 feet. The borehole encountered a stope in phd from 344 to 350 feet deep and was terminated.

The borehole was abandoned with grout from 306 feet deep to the surface on March 8, 2014.

Closure Drain CD-6:
CD-6 was drilled from March 7, 2014 through March 11, 2014. CD-6 penetrated fill to a depth of 10 feet followed by a sequence of qtzm and phd to 300 feet deep. Qtzm dominated the borehole from 300 to 927 feet deep. A phd was penetrated at 927 feet depth before encountering qtzm from 948 to 1,039 feet deep. Diatreme breccia was penetrated at 1,039 feet deep and continued to the termination at a depth of 1,090 feet.

The formation depths were determined with CC&V's Geologist's assistance, and breccia fragments were observed by both AMEC and CC&V under microscope. However, after detailed logging completed by another member of the Exploration Department it was determined that the borehole penetrated the diatreme at a depth of 925 feet.

The permeability testing in CD-6 was completed with two constant head tests. The first test ran for 11 minutes at an average rate of 27.8 gpm taking a total of 307.5 gallons of water. The second test ran for 13 minutes at an average rate of 36.2 gpm taking a total of 472.5 gallons of water.

A third test was attempted, but was unsuccessful. Constant head conditions were unable to be achieved by injecting water at 45 gpm, which was the maximum output of the equipment on-site. The transducer showed the borehole continued to drain after testing was completed.

Closure Drain CD-7:

CD-7 was drilled from March 11, 2014 through March 18, 2014. CD-7 penetrated fill to a depth of 20 feet followed by qtzm to 149 feet deep. A phd was penetrated from 149 to 160 feet deep before penetrating qtzm at a depth of 304 feet. A sequence of qtzm and phd was penetrated from 304 to 385 feet deep. Qtzm dominated the borehole from 385 to 885 feet deep. A phd was encountered from 885 to 897 feet before encountering qtzm from 897 to 980 feet deep. Diatreme breccia was encountered from 980 to 990 feet deep. Qtzm was penetrated from 990 to 1,135 feet deep. Diatreme breccia was penetrated from 1,135 to 1,260 feet deep; a qtzm block was encountered from 1,225 to 1,245 feet deep. The borehole was terminated at 1,260 feet deep in diatreme breccia.

A constant head test was attempted by injecting 1,429 gallons of water (1.2 hole volumes) into CD-7 at a rate of 64 gpm. The head of water was not observed at the surface; the transducer data indicated the maximum head of water was 488 feet deep. A falling head test was completed and the transducer data shows the entire column of water draining out.

Closure Drain CD-9:

CD-9 was drilled from March 19, 2014 through March 23, 2014. CD-9 penetrated fill to a depth of 15 feet followed by a sequence of qtzm and phd to a depth of 230 feet. Qtzm dominated the borehole from 230 to 629 feet deep. A phd was penetrated at 629 feet deep before encountering qtzm from 632 to 855 feet deep. A phd was penetrated from 855 to 880 feet deep. Diatreme breccia was penetrated at 880 feet deep and continued to the termination of at a depth of 980 feet; some small qtzm blocks (less than 10 feet) were encountered within this zone.

A constant head test was attempted by injecting 603 gallons of water (0.6 hole volumes) into CD-9 at a rate of 67 gpm. The head of water was not observed at the surface; the transducer data indicates the maximum head of water was 567 feet deep (the borehole was highly fractured from 930 to 935 feet deep). A falling head test was completed and the transducer data shows the entire column of water draining out.

Closure Drain CD-12:

CD-12 was drilled from March 23, 2014 through March 25, 2014. CD-12 penetrated fill to a depth of 15 feet followed by a sequence of qtzm and phd to 382 feet deep. Qtzm dominated the borehole from 382 to 621 feet deep. Diatreme breccia was penetrated at 621 feet deep and continued to the termination at a depth of 700 feet.

A constant head test was completed for 30 minutes at an average rate of 42.3 gpm. A total of 1,283.5 gallons of water (1.8 hole volumes) was injected during the test.

Summary

In summary, a total of ten boreholes were drilled with seven completed as drains (CD-1, CD-2, CD-3, CD-6, CD-7, CD-9, and CD-12). All but two (CD-2 and CD-3) of the seven of the drains penetrated the diatreme. Drains CD-2 and CD-3 are terminated in close proximity of the country rock-diatreme contact, and are presumed to be connected to the diatreme in the local fracture network as evidenced by hydraulic tracking and testing.

A total drainage capacity of 66 gpm was required by the hydrology study to accommodate the "wettest year". The closure drain design consisted of 12 drains which required an average 6 gpm to safely satisfy this requirement. The installation and hydraulic testing of the seven drains has yielded a cumulative minimum 395 gpm into the historic, regionally dewatered system. This cumulative gpm value is the sum of the lower flows observed during testing (i.e. 16 gpm in CD-2).

The installation of the subgrade portion of the closure drains was successful in that the achieved flows were 17 times greater than the required per the hydrology study in 58 percent of the designed drains.

Completion for the closure drains began on June 3, 2014. Concrete pads with rebar were poured around each collar per the design. A summary of test results is included in Appendix Q.1 with the individual concrete cylinder test reports presented in this Appendix Q.2.

Photo 1 Closure Drain Pads

Soil Liner Fill material was placed in the PSSA floor around the closure drains, nuclear density tests N37 through N40 presented on Table 11 of under the Tables tab portion of the Record of Construction Report. The material was compacted with a plate tamper and a smooth drum roller. The steel casing was cut flush with the concrete pads.

Photo 2 Soil Liner Fill Material Placement around Closure Drains

Non-woven geomembrane fabric was placed on the soil liner fill, and the horizontal components of the drains were constructed.

Photo 3 Placement of Non-woven Geotextile and PVC Drains

The drains horizontal components were built using 2-inch schedule 80 PVC 0.020 slotted screens, which were coupled with the downhole drain components using a 45° elbow coupler. The horizontal drains were covered with leak detection fill. A sample of the material (LDF1-R data located in Appendix H.1 and on Table 11) was collected for laboratory testing. The drains were then backfilled over with underdrain fill before having the non-woven geotextile fabric placed over the drains and their appropriate fill designs.

The As-Built Plan and Profile, and Drain Diagrams are provided in Appendix Q.

Please refer to the laboratory testing (Appendix H) and the Daily Reports (Appendix Q.3) for the called out samples and dates mentioned above for specifics.

Please contact me at (303) 935-6505 if you have any questions or concerns.

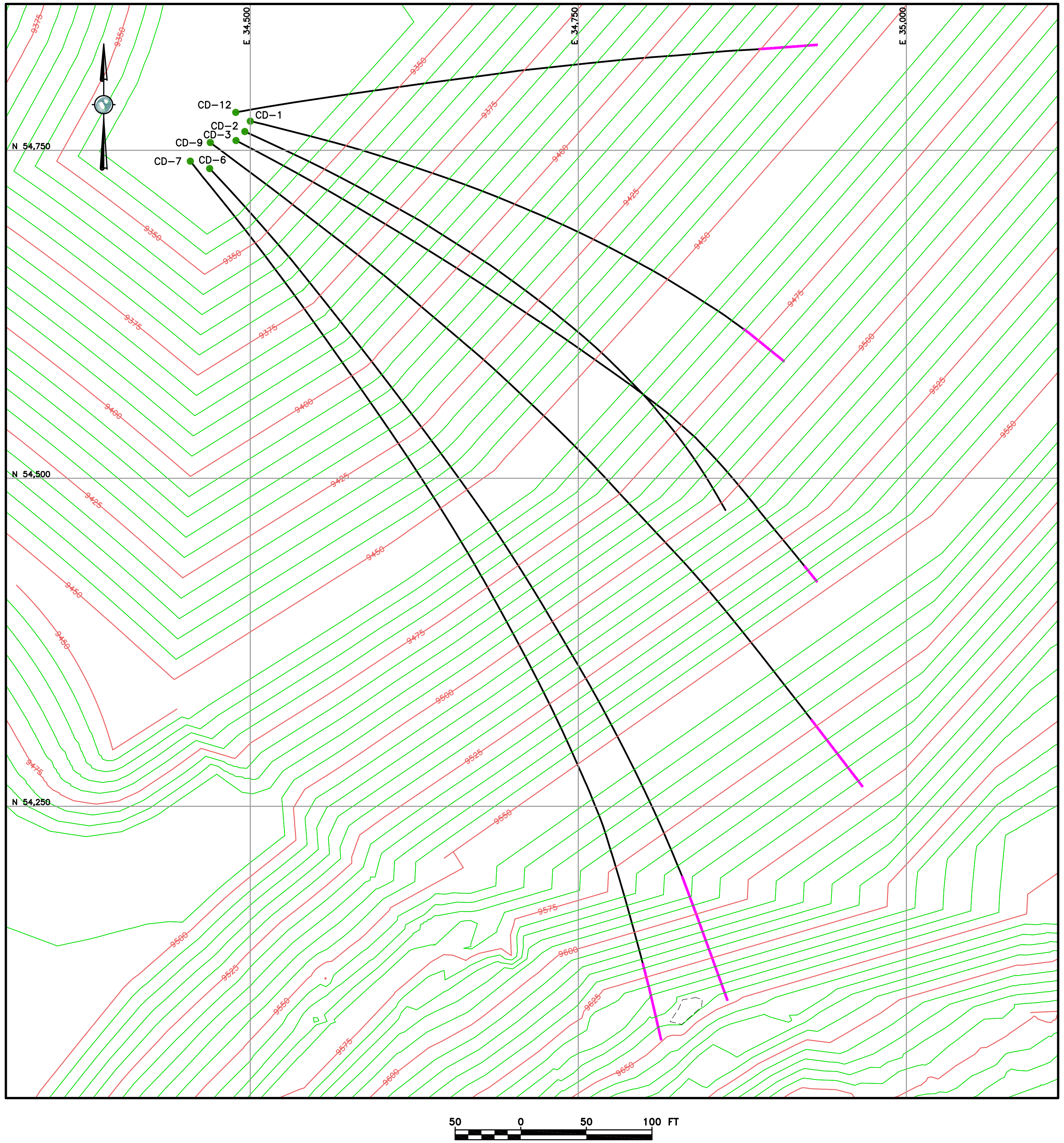
Sincerely,

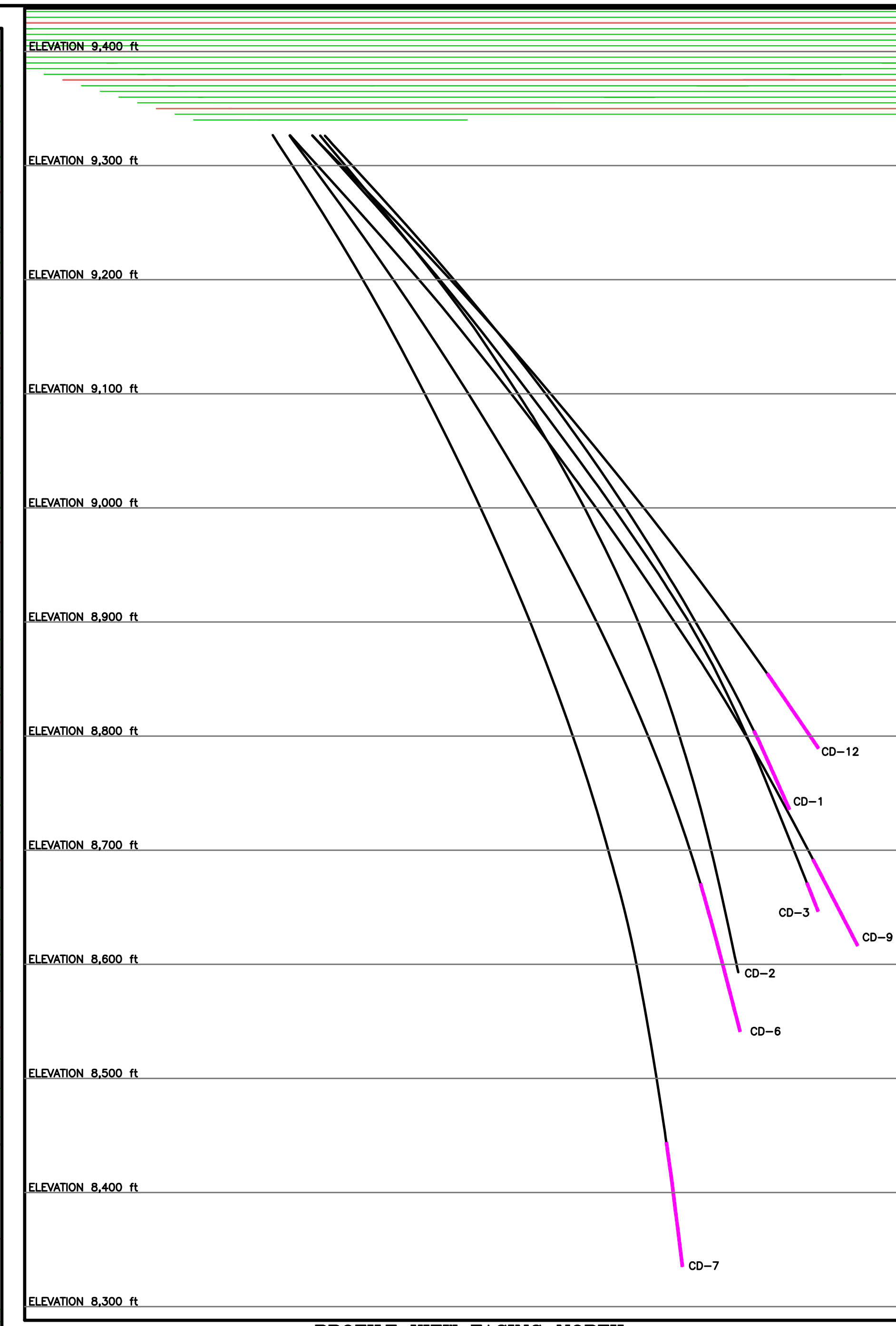
AMEC Environment & Infrastructure, Inc.

John W. Roberts, PG
Project Geologist

Reviewed by:

Paul Ivancie, PG
Senior Associate Hydrogeologist





PROFILE VIEW FACING NORTH

80 0 80 160 FT
HORIZONTAL

80 0 80 160 FT
VERTICAL

LEGEND:

- 9500 — PROPOSED GROUND SURFACE CONTOUR EL, FEET
- BOREHOLE
- DIATREME PENETRATED LENGTH
- CD-1 ● BOREHOLE COLLAR LOCATION

NOTES:

1. THE CD-2 EXACT FLOW WAS UNABLE TO BE DETERMINED WITH THE EQUIPMENT ONSITE AND IS BETWEEN 16 gpm TO 67 gpm. THE TOTAL gpm SUM IN THE TECHNICAL MEMO WAS CALCULATED USING 16 gpm.
2. DRAIN HOLES CD-4, CD-4a, AND CD-5 WERE ALL ABONDONED AND DID NOT HAVE DRAINS INSTALLED AND ARE NOT SHOWN.
3. DRAIN HOLES CD-3 AND CD-6 WERE REVISED REGARDING THE DIATREME PENETRATION DEPTH AFTER THE CC&V DETAILED LOGGING WAS COMPLETED.
4. AS-BUILT COORDINATES SURVEYED BY AMES.
5. AS-BUILT DEVIATION SURVEYED BY ELK CREEK GYRO.
6. BOREHOLES/DRAINS CD-8, CD-10, AND CD-11 WERE NOT DRILLED.
7. BOREHOLE PROJECTIONS FROM CC&V EXPLORATION GROUP VULCAN MODEL.
8. CONTOURS SHOWN ARE TOP OF SOIL LINER FILL.

AS-BUILT INFORMATION

AMEC ID	COLLAR NORTHING (ft)	COLLAR EASTING (ft)	COLLAR ELEVATION (ft)	TOTAL BOREHOLE LENGTH (ft)	ATTITUDE COLLAR (inc., azi)	ATTITUDE TOTAL DEPTH (inc., azi)	DIATREME PENETRATION	DIATREME ENCOUNTERED DOWN HOLE LENGTH (ft)	HYDRO TEST RATE WATER TAKEN (gpm)
CD-1	54,772.259	34,500.021	9,326.141	720	-47, 103	-60, 129	YES	660	67
CD-2	54,764.352	34,495.873	9,326.214	879	-48, 115	-67, 150	NO	NA	16
CD-3	54,757.493	34,489.135	9,326.318	885	-44, 118	-58, 141	YES	855	94
CD-4	54,752.071	34,480.909	9,326.333	450	-46, 125	-57, 132	NO	NA	NA
CD-4a	54,747.839	34,481.384	9,326.416	930	-42, 125	-64, 148	NO	NA	67
CD-5	54,739.994	34,479.256	9,326.324	350	-44, 129	-44, 134	NO	NA	NA
CD-6	54,736.125	34,469.055	9,326.219	1,090	-43, 137	-53, 160	YES	1039	45
CD-7	54,741.739	34,454.318	9,326.602	1,260	-45, 142	-61, 167	YES	1135	64
CD-9	54,755.963	34,469.525	9,326.493	980	-45, 127	-61, 143	YES	880	67
CD-12	54,778.943	34,488.922	9,326.345	704	-46, 080	-56, 086	YES	621	42

REV	DATE	DESCRIPTION	ENGR / CADD
1	12/19/2014	ISSUED FOR RECORD OF CONSTRUCTION	ALM / ALM

CLIENT: CRIPPLE CREEK & VICTOR GOLD MINING COMPANY

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ISSUED FOR: R.O.C.

PROVIDED BY: amec

DATUM: DATUM
PROJECTION: PROJECTION
DRN BY: DRN
DSN BY: AC
CHK BY: AC
APR BY: MEN

PROJECT: SQUAW GULCH VALLEY LEACH FACILITY

TITLE: CLOSURE DRAIN RECORD OF CONSTRUCTION PLAN AND PROFILE

ISSUED DATE: 4/8/2014

PROJECT No.: 1125N

DRAWING No.: 1 | REV: 0

S:\Projects\1125N Squaw Valley\9.0 CADD\9.1 Plan Sheets\Closure Drain Asbuilt\F001 CLOSURE DRAIN ASBUILT PLAN.dwg-12/19/2014 3:34 PM

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

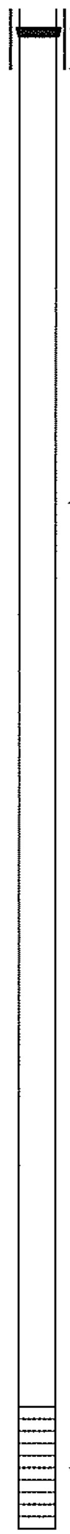
amec

Drain ID:	CD-1 (SGR-850)	**Northing:**	54772.259	**Date Installed:**	2/20/2014
Ground Surface Elevation (ft):	9326.141	**Easting:**	34500.021	**Casing Depth (ft):**	18.5
Azimuth Surface:	103.23	**Inclination Surface:**	-47.18	**Borehole TD (ft):**	720
Azimuth TD:	129.01	**Inclination TD:**	-60.09	**Drain TD (ft):**	720

BOREHOLE LITHOLOGY

Fill	10 ft
Quartz Monzonite - Phonolite Dike Sequence	
Quartz Monzonite	80 ft
Transition zone between Quartz Monzonite and Diatreme Breccia	640 ft
	660 ft
Diatreme Breccia	
End Borehole	720 ft

DRAIN CONSTRUCTION



COLORADO LICENSED PROFESSIONAL ENGINEER
AUSTIN CRESWELL III
40684

Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

amec

Drain ID:	CD-2 (SGR-835)	**Northing:**	54764.352	**Date Installed:**	2/23/2014
Ground Surface Elevation (ft):	9326.214	**Easting:**	34495.873	**Casing Depth (ft):**	20
Azimuth Surface:	114.88	**Inclination Surface:**	-47.59	**Borehole TD (ft):**	879
Azimuth TD:	150.21	**Inclination TD:**	-66.47	**Drain TD (ft):**	879

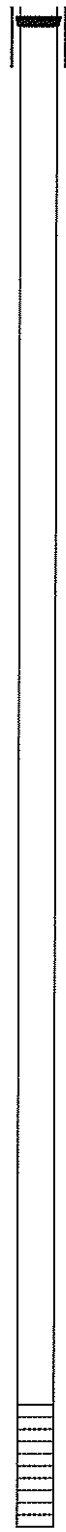
BOREHOLE LITHOLOGY

Fill — 5 ft

Quartz Monzonite - Phonolite Dike Sequence — 80 ft

Quartz Monzonite

End Borehole — 879 ft



DRAIN CONSTRUCTION

Shale basket at 10 ft, cemented to surface

20.7 ft 6" surface casing set to 20 ft

1.5" Schedule 80 PVC Riser

849 ft

30 ft 1.5" Schedule 80 PVC 0.030 Slotted Screen and 2" End Cap

879 ft

COLORADO LICENSED
AUSTIN CRESWELL
40684
PROFESSIONAL ENGINEER

Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

amec

Drain ID:	CD-3 (SGR-836)	**Northing:**	54757.493	**Date Installed:**	2/26/2014
Ground Surface Elevation (ft):	9326.318	**Easting:**	34489.135	**Casing Depth (ft):**	18.7
Azimuth Surface:	117.49	**Inclination Surface:**	-44.25	**Borehole TD (ft):**	885
Azimuth TD:	141.33	**Inclination TD:**	-57.80	**Drain TD (ft):**	885

BOREHOLE LITHOLOGY

Fill — **10 ft**

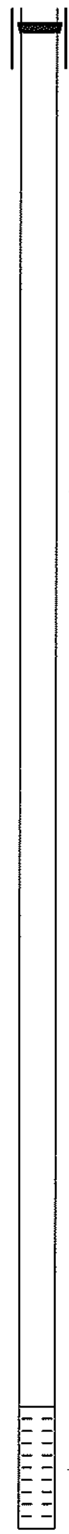
Quartz Monzonite - Phonolite Dike Sequence — **197 ft**

Quartz Monzonite

Diatreme Breccia

End Borehole — **885 ft**

DRAIN CONSTRUCTION



Shale basket at 10 ft, cemented to surface

20 ft 6" surface casing set to 18.7 ft

1.5" Schedule 80 PVC Riser

30 ft 1.5" Schedule 80 PVC 0.030 Slotted Screen and 2" End Cap

COLORADO LICENSED
W. AUSTIN CRESWELL III
40684
PROFESSIONAL ENGINEER

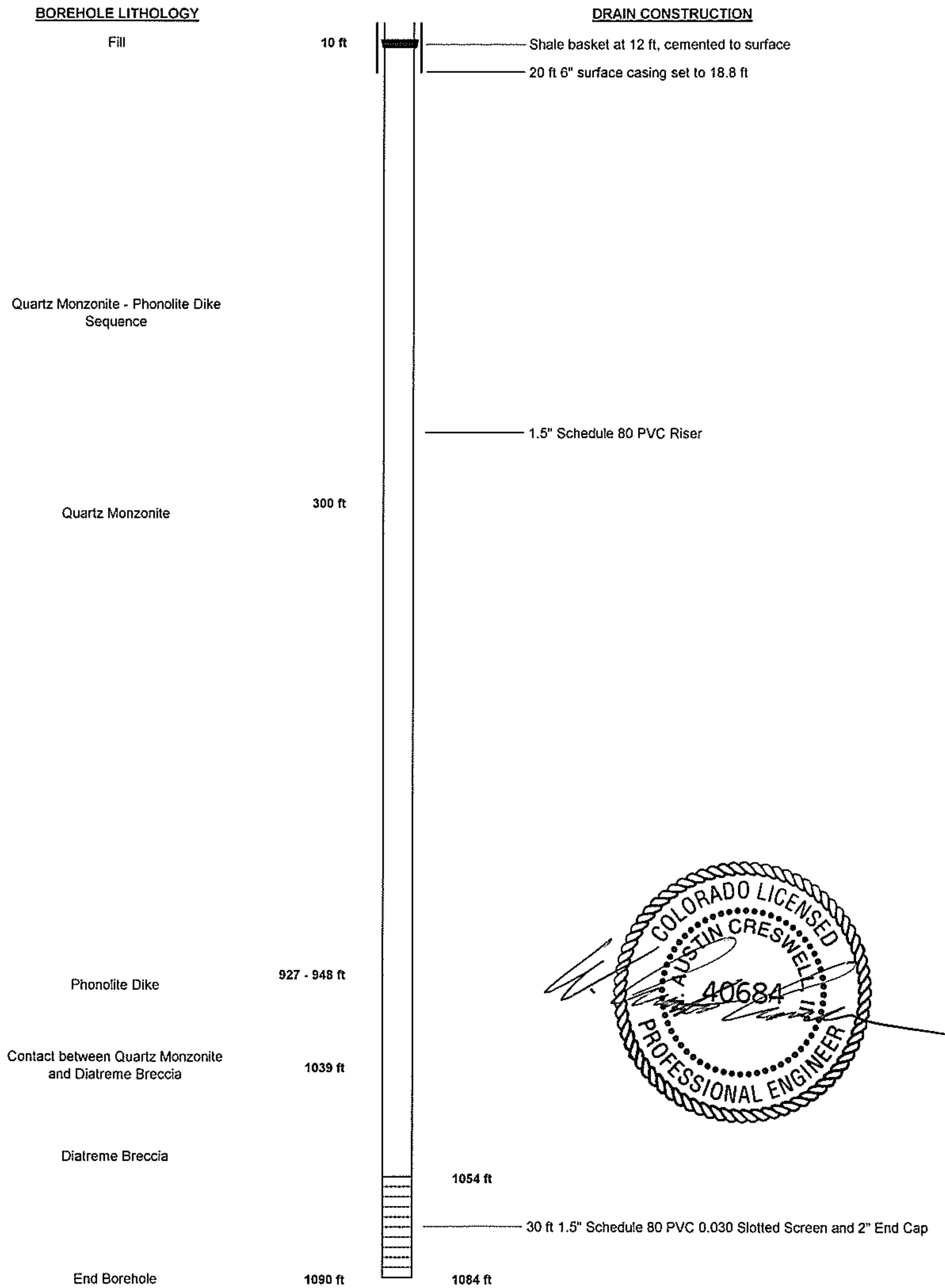
Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.

SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

amec

Drain ID:	CD-6 (SGR-843)	**Northing:**	54736.125	**Date Installed:**	3/10/2014
Ground Surface Elevation (ft):	9326.219	**Easting:**	34469.055	**Casing Depth (ft):**	18.8
Azimuth Surface:	136.63	**Inclination Surface:**	-43.30	**Borehole TD (ft):**	1090
Azimuth TD:	160.09	**Inclination TD:**	-52.66	**Drain TD (ft):**	1084



COLORADO LICENSED AUSTIN CRESWELL III 40684 PROFESSIONAL ENGINEER

Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

amec

Drain ID:	CD-7 (SGR-844)	**Northing:**	54741.739	**Date Installed:**	3/16/2014
Ground Surface Elevation (ft):	9326.602	**Easting:**	34454.318	**Casing Depth (ft):**	28.8
Azimuth Surface:	141.59	**Inclination Surface:**	-44.50	**Borehole TD (ft):**	1260
Azimuth TD:	166.97	**Inclination TD:**	-61.17	**Drain TD (ft):**	1260

BOREHOLE LITHOLOGY

Fill	**20 ft**
Quartz Monzonite	
Phonolite Dike	**149 - 160 ft**
Quartz Monzonite	
Quartz Monzonite - Phonolite Dike Sequence	**304 ft**
Quartz Monzonite	**385 ft**
Phonolite Dike	**885 - 897 ft**
Quartz Monzonite	
Diatreme Breccia	**980 - 990 ft**
Quartz Monzonite	
Diatreme Breccia	**1135 ft**
End Borehole	**1260 ft**

DRAIN CONSTRUCTION

Shale basket at 11 ft, cemented to surface

30 ft 6" surface casing set to 28.8 ft

1.5" Schedule 80 PVC Riser

1230 ft

30 ft 1.5" Schedule 80 PVC 0.030 Slotted Screen and 2" End Cap

1260 ft

COLORADO LICENSED AUSTIN CRESWELL 40684 PROFESSIONAL ENGINEER

Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

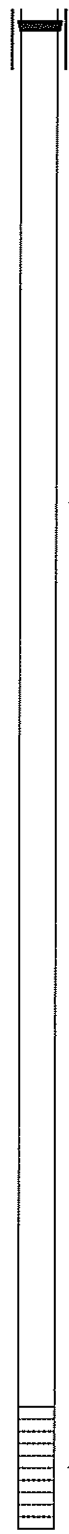
amec

Drain ID:	CD-9 (SGR-846)	**Northing:**	54755.963	**Date Installed:**	3/23/2014
Ground Surface Elevation (ft):	9326.493	**Easting:**	34469.525	**Casing Depth (ft):**	19.6
Azimuth Surface:	126.89	**Inclination Surface:**	-44.50	**Borehole TD (ft):**	980
Azimuth TD:	142.55	**Inclination TD:**	-61.17	**Drain TD (ft):**	970

BOREHOLE LITHOLOGY

Fill	**15 ft**
Quartz Monzonite - Phonolite Dike Sequence	
Quartz Monzonite	**230 ft**
Phonolite Dike	**629 - 632 ft**
Phonolite Dike	**855 - 880 ft**
Contact between Quartz Monzonite and Diatreme Breccia	**880 ft**
Diatreme Breccia	
End Borehole	**980 ft**

DRAIN CONSTRUCTION



Shale basket at 6 ft, cemented to surface

6" surface casing set to 19.6 ft

1.5" Schedule 80 PVC Riser

940 ft

30 ft 1.5" Schedule 80 PVC 0.030 Slotted Screen and 2" End Cap

970 ft (10 ft cave-in at bottom of hole)

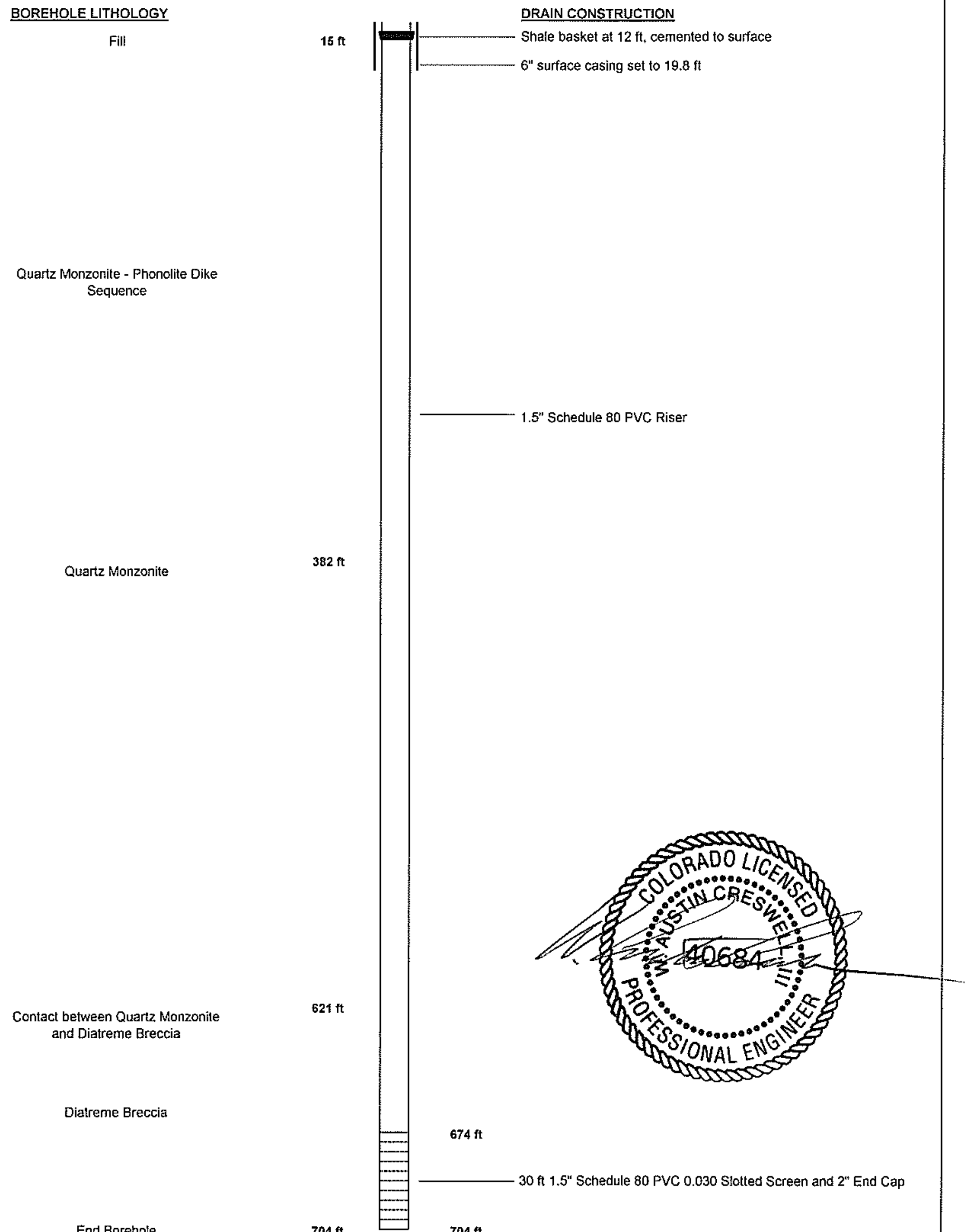
COLORADO LICENSED PROFESSIONAL ENGINEER
W. AUSTIN CRESWELL, III
40684

Notes: Not to Scale
Depths in ft downhole

CRIPPLE CREEK & VICTOR GOLD MINING Co.
SQUAW GULCH VALLEY LEACH FIELD CLOSURE DRAIN AS-BUILT

amec

Drain ID:	CD-12 (SGR-849)	**Northing:**	54778.943	**Date Installed:**	3/23/2014
Ground Surface Elevation (ft):	9326.345	**Easting:**	34488.922	**Casing Depth (ft):**	19.8
Azimuth Surface:	079.75	**Inclination Surface:**	-45.46	**Borehole TD (ft):**	704
Azimuth TD:	085.70	**INclination TD:**	-55.73	**Drain TD (ft):**	704



Notes: Not to Scale
Depths in ft downhole

Appendix Q.1

Summary of Closure Drain Concrete Test Results

Cripple Creek & Victor Mining Company
Squaw Gulch VLF Pregnant Solution Storage Area
Closure Drain Concrete Testing Summary

SPECIMEN NO.	DATE PLACED	TIME BATCHED	TIME SAMPLED	LOCATION	MIX DESIGN NUMBER	FIELD TEST RESULTS				LABORATORY TEST RESULTS						
						SLUMP (in)	AIR CONTENT (%)	UNIT WEIGHT (pcf)	SAMPLE TEMP. (ºF)	CURING AGE AT TIME OF TEST (days)	LOAD (pounds)	AREA (in^2)	DESIGN STRENGTH (psi)	COMPRESSIVE STRENGTH (psi)	PERCENT OF DESIGN (%)	FRACTURE TYPE
CD-1	6/3/2014	10:07 AM	10:37 AM	Closure Drain	4001	5.00	NT	NT	68	3	24,955	12.57	4,000	1,990	50%	2
CD-1										7	30,595	12.57	4,000	2,430	61%	3
CD-1										28	36,645	12.57	4,000	2,920	73%	2
CD-1										28	40,085	12.57	4,000	3,190	80%	2
CD-1*										56	42,120	12.57	4,000	3,351	84%	2

Notes:
* Non-structural, accepted by Engineer, see accptance letter in Appendix Q.1 in the Record of Construction Report

December 12, 2014

Mr. Ron Roberts
Construction Manager
Cripple Creek & Victor Gold Mining Company
Post Office Box 191
100 North 3rd Street
Victor, Colorado 80860

RE: SGVLF PSSA Closure Drain Concrete Acceptance

Dear Mr. Roberts,

During construction of the Closure Drain portion of the Process Solution Storage Area (PSSA) in the Squaw Gulch Valley Leach Facility (SGVLF), AMEC sampled the concrete used to construct the collars around the closure drain pipes. A section of the concrete collars is shown in Detail 6 on Drawing A362 of the Issued for Construction Drawings. The concrete is specified to have a 28-day unconfined compressive strength (UCS) of 4,000 psi. The one concrete sample tested for the 28-day UCS had a result of 3,190 psi, which is about 20 percent less than the required strength. AMEC considers that although the concrete in the closure drain collars did not meet the specification for UCS, the concrete still will adequately perform according to the design intent.

The main purpose of the concrete collars was not structural, it was to prevent movement of the steel casing and the Schedule 80 pipe for the closure drains during construction of the PSSA sump area and provide a consistent location for record drawings. However, to alleviate concern, a calculation of the maximum vertical stress anticipated at the concrete collar is as follows:

Vertical Stress at Concrete Collar from Saturated Ore = (131.9 lb/ft^3 x 126 ft) = 16,620 psf (115.4 psi)

where:

- 131.9 pcf is the saturated ore unit weight conservatively assuming the entire PSSA is filled with solution
- 126 feet = height of ore above concrete collars
  - 9452.14 ft (elevation of top of ore above the concrete collar) - 9,327 ft (top of concrete collar) = 126 ft

The typical design dead load factor is 1.4*DL, in accordance with American Concrete Institute (ACI) 318-11, Chapter 9. Using this design factor,

Total maximum design vertical stress = 1.4 x 115.4 psi = 161.6 psi.

Since the maximum vertical stress acting on the concrete collar is 161.6 psi and the measured 28-day compressive strength of the concrete was 3,190 psi, the factor of safety with respect to compressive failure of the concrete is approximately 20, which is considered acceptable.

Additionally, the shear strength capacity of the concrete was calculated using ACI 318-11, Equation 11-3 and Φ = 0.75 in accordance with ACI 318-11, 9.3.2.3.

$$\emptyset Vc = 0.75 \times 2\sqrt{f'c} \times b_w \times d$$

$$\emptyset Vc = 0.75 \times 2\sqrt{(3200\,psi)} \times 12in \times (12in - 3in - 0.125in) = 9{,}037\ lbs$$

where:

- $f'c$ = in situ concrete value (28-day)
- b_w = width of concrete section analyzed
- d = thickness of concrete – cover over rebar - value of a #4 rebar

The capacity of the concrete is 9,037 lbs, per foot of collar. This capacity does not include the additional capacity of the reinforcement in the concrete collar which would also resist the applied loading. Failure of the concrete due to shear is highly unlikely.

Additionally, the Schedule 80 PVC pipe is sleeved in a steel casing penetrating the concrete collar which protects the PVC from potential damage from cracking or other degradation of the concrete collar.

AMEC considers the 28-day UCS test results of concrete sampled from the concrete collars to be acceptable and will not affect the design intent.

The Air Content for this concrete was not tested as it is not considered exposed concrete. ACI (ACI 201.2R-08) recommends air is added to concrete when it is exposed to freezing and thawing conditions to allow for a more durable concrete. The closure drain concrete will not be exposed to these conditions and was not exposed to freezing and thawing when it was placed.

Please do not hesitate to contact me at 303-975-2192 or Andrea.Meduna@amec.com with any questions.

Sincerely,

AMEC Environment & Infrastructure, Inc.

COLORADO LICENSED PROFESSIONAL ENGINEER
ANDREA L. MEDUNA
48325
12/12/2014

Andrea L. Meduna, PE
Project Engineer

Cc: Ms. Katie Holybee, Document Control, CC&V
Ms. Meghan Duck, Document Control, CC&V
Mr. Ron DiDonato, Project Superintendent, CC&V
Mr. Scott Redabaugh, Project Superintendent, CC&V
Mr. Jeff Gaul, Project Superintendent, CC&V
Mr. Marc Tidquist, Sr. Environmental Coordinator, CC&V.
Mr. Tim Burkhard, Project Resident, AMEC

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