APPENDIX C – TECHNICAL SPECIFICATIONS

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NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS – Timber Wall Facing		**SPECIFICATION NO.** **00508**

REV	DATE	PAGES	APPROVALS			REMARKS
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1	04/07/2016	2	JNM	RMS		Issued for Client Review
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SECTION 00508.0 TIMBER WALL FACING

1. PART 1: GENERAL

1.1. Scope

The **CONTRACTOR** shall be responsible for removal and salvage of existing crib wall timbers, transportation of timbers to new wall location, and installation of the timbers as a wall facing for the MSE wall. Design concepts are provided in the plan documents for timber facing connections, but the **CONTRACTOR** is responsible for the final connection scheme.

1.2. Construction Sequence

A. A pre-construction conference is required before construction begins. At this conference, the **CONTRACTOR** shall have a plan prepared for the staging/timing of the construction sequences; means, methods, and details showing the connection of the timbers to the MSE facing; details showing timber spiking plan; and product details for all steel, timber and concrete being used. The **DESIGN ENGINEER** shall approve these details prior to the **CONTRACTOR** ordering and fabricating any components.

B. After the original SH 67 is permanently closed to traffic, remove the existing crib wall, salvaging reusable timbers. During removal operations, the **CONTRACTOR** shall consider how to reassemble the timbers as shown on the plans. Consider tagging and photographing the existing wall in its current location.

1.3. Facing Requirements

A. The wall facing shall be composed of timbers salvaged from the existing crib wall on SH 67.

   a. Prior to placement, the **CONTRACTOR** shall verify that the timbers used are free of rot, deterioration, and major longitudinal or transverse cracking.

   b. Longitudinal timbers shall be at least 8 feet long and shall be connected to a minimum of two transverse timber-facing units. See the plan documents for details.

   c. Transverse timbers shall be cut from existing historic timbers and shall overhang the longitudinal members a minimum of 4 inches.

B. Connections

   a. Connect longitudinal timbers to the MSE facing in at least four locations per timber. Connections will consist of a galvanized metal strap secured to the MSE facing and to the longitudinal timbers. The ENGINEER shall approve the connection details.

   b. Transverse timber facing units shall be secured in at least one place with a drive spike to the timber below.

C. Leveling pad
   a. The leveling pad shall be continuous over the wall length.
   b. Concrete for the pad shall be per the Colorado Department of Transportation's Class B Concrete.

D. Spacer block
   a. The spacer block shall be used to secure the first row of longitudinal timber facing units.

E. Material Properties
   a. The spacer block shall be Western Larch or Coastal Region Douglas Fir No. 1 Grade or better, conforming to current WWPA grading rules for western lumber or current WCCIB standard grading rules for west coast lumber.
   b. The spacer block shall be incised and pressure treated in accordance with AWPA C-14 for solid sawn members using:
      i. Pentachlorophenal meeting AWAP P-8 using AWPA P-9 type A solvent to a net minimum retention of 0.6 lb/ft3 or
      ii. Copper naphthenate meeting AWPA P-8 using AWPA P-9 type A solvent containing a minimum of 2% copper metal to a net retention of 0.075 lb/ft3.
   c. Structural steel shall meet AASHTO M270 Grade 50W and shall be galvanized according to ASTM A153.
   d. All bolts, lag screws, dowels and spikes shall conform to ASTM A307 and shall be galvanized according to ASTM A153.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS – Construction Staking		**SPECIFICATION NO.** **01050**

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SECTION 01050.0 CONSTRUCTION STAKING AND CONSTRUCTION DOCUMENTATION

1. PART 1: GENERAL

1.1. Summary

This Section defines the control staking services required by the **CONTRACTOR**. All staking and surveying will be the responsibility of the **CONTRACTOR** unless otherwise specifically defined in this section. All grade checking and transferring of lines and grades from **CC&V**'s stakes will be the **CONTRACTOR**'S responsibility.

1.2. Control Stakes

Control stakes which are reference points for all construction work will be conspicuously marked. It shall be the responsibility of the **CONTRACTOR** to inform his employees and his subcontractors of their importance and the necessity for their preservation. At least forty-eight (48) hours written advance request for removal of control stakes shall be given to **CC&V**. A total of ten (10) control stakes will be provided to the **CONTRACTOR** by **CC&V** for this work.

Control stakes shall be set one time only.

1.3. Flagging Code

A color code will be established by the **CONTRACTOR** during the course of the project indicating specific colors for the various kinds of stakes to be set.

1.4. Staking

A. **CC&V** will provide vertical and horizontal reference control stakes in the proximity of the work as discussed in Article 1.02 of this Section.

B. The **CONTRACTOR** shall be responsible for setting construction and grade stakes and for proper preservation of control points.

C. The **CONTRACTOR** will provide as-built coordinates and elevations for the Underdrains, Leak Detection system, Low Volume Solution Collection piping and High Volume Solution Collection piping or as requested by the **MANAGER**.

1.5. Construction Certification Documentation

A. The **CONTRACTOR** shall be responsible for accurately surveying the locations and elevations, and where applicable, the type, thickness, and geometry of any and all pipes and fittings, ditches, geosynthetic materials, breaks in fill or cut slopes, general grading,

change in fill or synthetic material type, and any other aspect of the work to facilitate construction and as required by the **MANAGER**.

B. Submittals By **CONTRACTOR** Upon Completion of Work:

Within seven (7) calendar days after completion of the WORK, **CONTRACTOR** shall furnish **MANAGER** with "Record Drawings" (also referred to as "As-Built Drawings") of the Work. The Record Drawing will be drawn at a scale of 1-inch equals 100 feet with 10 foot topographic contour interval, and on a 24-inch by 36-inch sheet. All surveying Record Drawings shall be signed and sealed by the Colorado licensed surveyor who directed the work. The required surveying shall be carried out on a 100-foot by 100-foot grid with additional survey points required to define valley leach facility topographic features (i.e., toe of slope, crest of slope, breaks in grade), unless otherwise directed by **MANAGER**. The Record Drawings shall include elevations and locations for the following:

- Underdrain plan view showing the limits of the valley leach facility. Underdrain Fill and underdrain alignment, with elevations every approximately 100 feet or on every break in grade
- Diversion channel plan and profile view along the diversion channel alignment
- Leak detection trench plan view showing the limits of the valley leach facility, leak detection trench alignment, and leak detection sumps, with elevations every approximately 100-feet
- Soil Liner Fill plan view showing the limits of the valley leach facility, with contours of the Soil Liner Fill and Bedding Fill surface on a 10-foot contour interval, including the regraded ore slopes and end berms
- Low Volume Solution Collection piping plan showing the limits of the composite liner, double liner and single liner, and piping alignment with elevations every approximately 100 feet
- Perimeter access roads
- Top of Upper geosynthetics in the Pregnant Solution Storage Area, including the Vertical Riser Sump and base plates
- High Volume Solution Collection piping plan showing the limits of the VLF, and piping alignment with elevation every approximately 100-feet

In addition, the Colorado licensed surveyor will provide a surveyor's certificate to be submitted in the Construction Certification Report.

C. Submittal

CONTRACTOR will submit completed as-built documentation within seven (7) calendar days upon completion of the work in the following manner:

1. Submit two (2) hard copies to the **MANAGER**.
2. Submit two (2) non-reproducible copies to the **MANAGER** in electronic form on compact disks (CD) or DVD's and in an AutoCAD compatible format.

D. The **CONTRACTOR** will be responsible for performing the following survey activities associated with the Construction Certification Report:

1. Provide northing, easting, and elevation for all Soil Liner Fill depth verifications.
2. Provide northing, easting, and elevation for geomembrane panel intersections and destructive samples.
3. Provide continuous northing, easting, and elevation reference for field testing and sampling location identification.
4. Provide depth verification for the Low Volume Solution Collection Fill on a 50-foot by 50-foot grid with additional points at all grade breaks.
5. Provide depth verification for Drain Cover Fill on a 50-foot by 50-foot grid with additional survey points at all breaks in grade.
6. Provide northing, easting and elevation reference for any underground working confirmatory drillhole and blasthole locations.

Northings, eastings, and elevations for Items 1, 2, 3 and 6 will be performed on a daily basis and results will be provided to the **MANAGER** in both electronic and hardcopy format within 24 hours of performing the survey.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS – Earthworks Construction Quality Assurance (CQA) Plan		**SPECIFICATION NO.** **01400**

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SECTION 01400.1 EARTHWORKS CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

1. PART 1: INTRODUCTION

This plan addresses the construction quality assurance (CQA) procedures for the installation of the earthworks (soils) components of the valley leach facility at the Cresson Project, Teller County, Colorado. This program has been developed to assure that the construction of the soil components are in compliance with the project SPECIFICATIONS and to demonstrate that the regulatory requirements for the construction are achieved.

The objective of this plan is to assure that proper materials, construction techniques, and procedures are followed by the **CONTRACTOR** and that the intent of the design is met. This plan also provides the means for resolution of problems that may occur during construction.

This plan addresses quality assurance, not quality control. This CQA Plan is independent of the quality control (QC) programs conducted by **CONTRACTOR**. The intent of the CQA Plan is to provide independent third party verification and testing, to demonstrate that the **CONTRACTOR** has met its obligations in the supply and installation of earthwork (soils) materials according to the design, project SPECIFICATIONS, contractual, and regulatory requirements. Quality control is provided by **CONTRACTOR** and refers to those actions taken by the **CONTRACTOR** to ensure that materials and workmanship meet the requirements of the DRAWINGS and SPECIFICATIONS.

2. PART 2: DESCRIPTION OF PARTIES TO CONSTRUCTION QUALITY ASSURANCE

The following section provides descriptions of the parties to this CQA Plan including their responsibilities and qualifications.

2.1. CC&V

In this CQA Plan, **CC&V** refers specifically to Cripple Creek & Victor Gold Mining Company. **CC&V** owns and operates the valley leach facility.

2.2. Manager

In this CQA Plan, **MANAGER** refers to the individual appointed by the Cripple Creek & Victor Gold Mining Company. **MANAGER** is the official representative of **CC&V** and is responsible for all construction activities including oversight and direction during construction. **MANAGER** is also responsible for coordinating construction and CQA activities for the project.

MANAGER shall serve as communications coordinator for the project, initiating preconstruction and resolution meetings. As communications coordinator, **MANAGER** will serve as a liaison

between all parties involved in the project to ensure that ongoing communications are maintained. **MANAGER** and **CERTIFYING ENGINEER** shall be responsible for the resolution of all CQA issues.

Duties for this position include the following:

- review and approval of DRAWINGS and SPECIFICATIONS for all soil components of the valley leach facility;
- preconstruction coordination with the CQA Monitor to ensure that the CQA Monitor has performed similar reviews of the DRAWINGS and SPECIFICATIONS to ensure that the CQA Plan can be implemented;
- coordination of all construction activities associated with **CONTRACTOR**;
- scheduling and coordinating construction activities with required CQA testing and activities;
- overseeing the construction quality control operations performed by **CONTRACTOR**;
- approve specific corrective measures to be implemented during construction when deviations from the SPECIFICATIONS occur;
- ensure that required quality assurance testing has been performed in accordance with the CQA Plan and to the satisfaction of the CQA Monitor; and
- ensure that the CQA personnel are provided with all documentation required in the CQA Plan and project SPECIFICATIONS.

2.3. Design Engineer

In this CQA Plan the **DESIGN ENGINEER and Engineer of Record (EOR)** refers specifically to NewFields who has assumed the role of **DESIGN ENGINEER** after a thorough review of design documents to include, but not limited to, the DRAWINGS and SPECIFICATIONS. The **DESIGN ENGINEER** or the **CERTIFYING ENGINEER** identified in section 2.4 below, is responsible for approving all DRAWING and SPECIFICATION changes, modifications, or clarifications encountered during construction.

2.4. Certifying Engineer

In this plan, **CERTIFYING ENGINEER** refers specifically to NewFields. **CERTIFYING ENGINEER** is the individual or firm responsible for certifying the construction was performed in compliance with the DRAWINGS and SPECIFICATIONS. **MANAGER** and **CERTIFYING ENGINEER** shall be responsible for the resolution of all quality assurance issues.

2.5. Construction Quality Assurance Monitor

The CQA Monitor is the firm or individual responsible for performing the CQA tasks outlined in this CQA Plan. The CQA Monitor is the official CQA representative of **CC&V** and has the responsibility of overseeing the CQA aspects of the Work. In this CQA Plan the CQA Monitor is associated with the **CERTIFYING ENGINEER,** and refers specifically to (To Be Determined). The CQA Monitor has the authority to stop any aspect of the Work that is not in compliance with the CQA Plan. Work would then be resumed once corrective action has been approved by **MANAGER**. The specific responsibilities of the CQA Monitor include:

- review the DRAWINGS, SPECIFICATIONS, and related guidance documents;
- review all **CONTRACTOR** QC submittals and make appropriate recommendations;
- obtain preconstruction and construction samples and perform material evaluation testing as required;
- monitor foundation preparation activities as discussed in Section 6.02.01 and material placement as discussed in Section 6.02.02;
- assure that testing equipment used and tests performed are conducted according to SPECIFICATIONS and industry standards;
- document and report test results to **MANAGER**;
- report any deficiencies to **MANAGER** that are not corrected to the satisfaction of the CQA Monitor, including design or SPECIFICATION changes;
- prepare a Construction Certification Report describing the construction, any deviations from SPECIFICATIONS or DRAWINGS and details, details of all field and laboratory test data, tests results (both laboratory and field), professional certification that construction was completed in accordance with the DRAWINGS and SPECIFICATIONS. The Construction Certification Report will be signed and sealed by the **CERTIFYING ENGINEER** registered in the State of Colorado;
- monitor the ambient air temperature and fill temperature, as outlined in specification Section 2200; and
- maintain an on-site soils laboratory and perform regular calibration of equipment.

2.6. Earthworks Contractor

The Earthworks Contractor, also referred to as "**CONTRACTOR**", is responsible for proper processing, delivery and placement of all components as outlined in the SPECIFICATIONS.

3. PART 3: LINES OF COMMUNICATION

The CQA Monitor shall be capable of direct communication with **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER** at all times. Deficiencies that can be easily remedied, such as

unsatisfactory test results, will be dealt with directly between the CQA Monitor, and **CONTRACTOR**. The CQA Monitor will also discuss any deficiencies with the **CERTIFYING ENGINEER**.

If there is a disagreement among the **DESIGN ENGINEER, CERTIFYING ENGINEER,** and/or **MANAGER** that cannot be resolved among themselves, **MANAGER** shall present the matter to **CC&V** with **MANAGER** related recommendations and **CC&V** shall decide the matter with such decision being final.

4. PART 4: DEFICIENCIES

When deficiencies (items that do not meet SPECIFICATIONS or DRAWINGS) are discovered, the CQA Monitor will immediately determine the nature and extent of the problem and notify the **CONTRACTOR**. If unsatisfactory test results identify a deficiency, additional tests will be performed to define the extent of the deficient area.

CONTRACTOR shall correct the deficiency to the satisfaction of the CQA Monitor. If **CONTRACTOR** is unable to correct the problem, the CQA Monitor will notify **MANAGER** and **CERTIFYING ENGINEER** which will assist in problem resolution. If the solution involves a design revision, the **DESIGN ENGINEER** shall also be contacted.

The CQA Monitor shall retest and the **MANAGER** and **CERTIFYING ENGINEER** shall approve the corrected deficiencies before any additional related work is performed by **CONTRACTOR**. All retests and related documentation shall be recorded by the CQA Monitor and included in the Construction Certification Report.

5. PART 5: MEETINGS

This section identifies and describes the meetings to be held during the course of the construction. Meetings shall be held in order to clearly define construction activities and goals in order to facilitate construction.

5.1. Preconstruction Meeting

MANAGER will hold a preconstruction meeting at the site prior to the start of construction. **MANAGER**, **DESIGN ENGINEER, CERTIFYING ENGINEER**, CQA Monitor, **CONTRACTOR**, and others designated by **MANAGER** shall attend this meeting. The purpose of this meeting will be to:

- review the construction DRAWINGS, CQA Plan, and SPECIFICATIONS;
- define the responsibilities of each party;
- define lines of communication and authority;

- review method of documentation, testing procedures, and reporting inspection data;
- establish testing protocols and procedures for correcting and documenting construction deficiencies;
- discuss any changes that may be needed to ensure that construction will be completed in compliance with the design; and
- This meeting will be documented by **MANAGER** and copies will be distributed to all parties.

5.2. Progress Meetings

MANAGER will hold a daily progress meeting, either before the start of work or at the completion of work. At a minimum, this meeting will be attended by the CQA Monitor and **CONTRACTOR**. The purpose of this meeting will be to:

- review all the previous day's accomplishments and activities;
- review scheduled work location and activities for the day;
- discuss any problems or potential construction problems; and,
- review test data.

5.3. Deficiency Meetings

Special meetings will be held, as needed, to discuss potential problems or deficiencies. At a minimum, these meetings will be attended by the CQA Monitor and **CONTRACTOR**. If the problem relates to a design issue, **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER** should also be present. The meeting will be documented by the CQA Monitor.

6. PART 6: EARTHWORKS CONSTRUCTION QUALITY ASSURANCE

Construction of the valley leach facility or specified earthworks shall be in accordance with the DRAWINGS and SPECIFICATIONS. A CQA monitoring and testing program shall be implemented by **CC&V** to ensure construction compliance by the **CONTRACTOR**. The CQA testing program shall consist of construction testing of materials used in the valley leach facility construction. The types of materials are defined in the SPECIFICATIONS. During construction, the CQA Monitor shall sample and test these soil types to determine if they meet SPECIFICATIONS. The CQA Monitor shall obtain and test soil samples in accordance with American Society for Testing and Material standards ASTM D75 and ASTM D420. All tests shall be performed by the CQA Monitor on-site or in a geotechnical laboratory approved by the **CERTIFYING ENGINEER.**

6.1. Construction Testing

During construction, the CQA Monitor shall test all earthwork components to verify that the construction is in accordance with the SPECIFICATIONS. Testing shall be performed on all soil used in the construction to confirm the materials meet SPECIFICATIONS. The CQA Monitor shall conduct testing after final placement of the materials. The tests to be performed, and the testing frequency, for each material type are listed in Tables 1 and 2. The testing frequencies specified in Tables 1 and 2 shall be increased when the CQA Monitor determines that construction conditions (such as adverse weather, equipment breakdown, improperly ballasted compactor, excessive lift thickness, improper soil type, improper moisture conditioning and compaction) warrant additional tests. Additional tests will be approved by **MANAGER** and directed by the CQA Monitor.

6.2. Construction Monitoring

The CQA Monitor will monitor and test all earthwork quality assurance components of the construction to verify that the construction is in accordance with the SPECIFICATIONS. The CQA Monitor shall identify inadequate construction methodologies or materials that may adversely impact the performance of the facility being constructed and existing structures. The CQA Monitor will record visual observations throughout the construction process to ensure that the materials are placed to the minimum dimensions as shown on the DRAWINGS. Quality control testing will be performed by the **CONTRACTOR**.

6.2.1. Foundation Preparation

The CQA Monitor shall observe and document the foundation preparation including:

- stripping and excavation activities to ensure that **CONTRACTOR** places the material in the appropriate stockpile (Structural Fill, Select Structural Fill, Underdrain Fill, Leak Detection Fill, Low Volume Solution Collection Fill, Bedding Fill, Soil Liner Fill, Drain Cover Fill, Fine Shaft Backfill, Pipe Bedding Material and Granular Filter Material), if stockpiling is necessary;
- stockpiling activities to verify location of stockpile, material type, and dressing;
- excavations for moisture seeps, unsuitable foundation soil, elevation, and proper drainage;
- subgrade preparation to confirm that the surface of the subgrade is free of soft, organic, and otherwise deleterious materials (such as debris, branches, vegetation, mud, ice, or frozen materials); and that soil and rock surfaces that contain joints or fractures are adequately filled in accordance with the SPECIFICATIONS; and
- construction of access roads, drainage control features and erosion control features to verify compliance with the DRAWINGS and SPECIFICATIONS.

6.2.2. Placement Of Materials

During placement of Structural Fill, Select Structural Fill, Coarse Shaft Backfill, Cemented Rockfill, Underdrain Fill, Low Volume Solution Collection Fill, Bedding Fill, Leak Detection Fill, Soil Liner Fill, Drain Cover Fill, Fine Shaft Backfill, Pipe Bedding Material and Granular Filter Material, the CQA Monitor shall:

- verify the use of appropriate fills;
- monitor and document material placement, including soil type, particle size, loose lift thickness, moisture conditioning process, compaction equipment and methods used to attain compaction, including number of passes, uniformity of compaction coverage, compacted lift thickness, bonding of lifts and in-place moisture content and dry density is in compliance with the SPECIFICATIONS;
- monitor Soil Liner Fill surface preparation to verify that the surface has been proof-rolled, compacted, or hand worked so as to be in a condition suitable for geomembrane installation as discussed in Section 02200 of the SPECIFICATIONS;
- monitor Bedding Fill placement and surface preparation to verify that the surface is suitable for geomembrane installation as discussed in Section 02200 of the SPECIFICATIONS;
- monitor the placement of fill to ensure that **CONTRACTOR** exercises care in the vicinity of pipes and that the underlying geosynthetics are not damaged;
- monitor and document **CONTRACTOR** verification of in-place Soil Liner Fill, Bedding Fill, Low Volume Solution Collection Fill and Drain Cover Fill thickness;
- monitor equipment being used to place Low Volume Solution Collection Fill and Drain Cover Fill to verify that the **CONTRACTOR** places the material in accordance with the SPECIFICATIONS;
- monitor that Low Volume Solution Collection Fill and Drain Cover Fill is pushed uphill for areas in which the slope exceeds 4H:1V and that the dozer does not perform unacceptable pivot turns; and
- monitor the fill temperature as identified in Section 02200 of the SPECIFICATIONS.

7. PART 7: DOCUMENTATION

Documentation kept by the CQA Monitor shall consist of daily record-keeping, construction problem resolutions, design and SPECIFICATION changes, photographic records of construction, weekly progress reports, chain of custody forms for test sample tracking, and a Construction Certification Report.

7.1. Daily Record Keeping

Daily records kept by the CQA Monitor shall consist of field notes, observation and testing data sheets, summary of the daily meeting with **CONTRACTOR**, and reporting of construction problems and resolutions. The CQA Monitor shall submit this information on a regular basis to **MANAGER** for review.

7.2. Soils Observation and Testing Forms

The CQA Monitor will document soils observations on forms that generally include the following information:

- date, project name, location, and weather data, including high and low daily temperatures;
- a site plan showing work areas and test locations;
- descriptions of ongoing construction detailing work areas and equipment utilized by CONTRACTOR**;**
- summary of test results and samples obtained, with locations and elevations;
- resolutions of deficient test results;
- test equipment calibrations, if necessary;
- summary of meetings held; and
- signature or initials of the CQA Monitor.

7.3. Photo Documentation

The CQA Monitor shall photograph all phases of construction. Photographs shall be identified by location, time, date, and name of the CQA Monitor taking the photograph.

7.4. Design and Specification Changes

During construction, the need to address DESIGN and SPECIFICATION changes, modifications, or clarifications may arise. In such cases the CQA Monitor shall notify **MANAGER**, which shall notify the **DESIGN ENGINEER** and the **CERTIFYING ENGINEER**. DESIGN and SPECIFICATION changes shall only be made with written agreement from **MANAGER** and **DESIGN ENGINEER**.

7.5. Weekly Progress Reports

The CQA Monitor shall prepare weekly progress reports summarizing all construction and quality assurance activities. This report shall be submitted to **MANAGER** and shall include the following information:

- date, project name, and location;

- summary of construction related activities;
- summary of samples taken and test results;
- summary of deficiencies and/or defects and resolutions; and,
- signature of the CQA Monitor.

7.6. Construction Certification Report

At the completion of the project, the CQA Monitor shall submit to **MANAGER** a Construction Certification Report. This report shall certify that the work has been performed in compliance with the DRAWINGS and SPECIFICATIONS and will contain the following information:

- summary of all construction activities;
- photographic documentation;
- test data sheets;
- copies of weekly reports;
- CQA test results, including date, test locations and resolutions of deficient test results;
- copies of surveyors certificate;
- fill temperature monitoring results;
- staff schedule summary;
- a description of significant construction problems and the resolution of these problems;
- changes to the DRAWINGS or SPECIFICATIONS and the justification for these changes;
- record drawings, and
- a statement certifying that construction was completed in compliance with the DRAWINGS and SPECIFICATIONS, signed, and sealed by the **CERTIFYING ENGINEER** registered in the State of Colorado.

TABLE 1: SOIL CONSTRUCTION TESTING FREQUENCY[1] VOLUME PER TEST

Test and ASTM Designation	Subgrade (cy)	Structural Fill (cy)	Select Structural Fill (cy)	Underdrain Fill (cy)
Compaction (ASTM D698)	50,000	50,000	50,000	--
Particle Size2 (ASTM C117, C136, D1140, D6913)	50,000	50,000	50,000	5,000
Atterberg Limit (ASTM D4318)	--	50,000	--	5,000
Moisture Content3 (ASTM D2216)	2,000	2,000	2,000	5,000
Nuclear Density/Moisture (ASTM D6938)	2,000	2,000	2,000	--

1. **Tests shall be performed at the specified frequency or one per material type, whichever is greater.**
2. **Use the USCS for description and identification (ASTM D2488).**
3. **In-place moisture content.**

TABLE 2: SOIL CONSTRUCTION TESTING FREQUENCY VOLUME PER TEST

Test and ASTM Designation	Low Volume Solution Collection Fill, Bedding Fill, Leak Detection Fill, and Pipe Bedding Fill (cy)	Soil Liner Fill (cy)	Drain Cover Fill (cy)
Compaction (ASTM D698)	--	4,000	--
Particle Size2 (ASTM C117, C136, D1140) D6913	10,000	4,000	20,000
Atterberg Limit (ASTM D4318)	10,000	4,000	20,000
Moisture Content3 (ASTM D2216)	10,000	500	20,000
Permeability4 (ASTM D5084)	--	4,000	--
Nuclear Density/Moisture (ASTM D6938)	--	500	--

1. **Tests shall be performed at the specified frequency or one per material type, whichever is greater.**
2. **Use the USCS for description and identification (ASTM D2488).**
3. **In-place Moisture Content.**
4. **Permeability testing will be performed during the processing of the Soil Liner Fill material, certifying the processed stockpile.**

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS – Geosynthetic Construction Quality Assurance (CQA) Plan		**SPECIFICATION NO.** **01400-2**

REV	DATE	PAGES	APPROVALS			REMARKS
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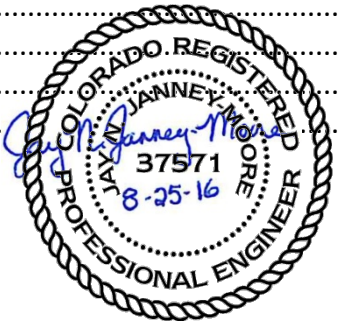

SECTION 01400.2 GEOSYNTHETIC CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

1. PART 1: INTRODUCTION

This plan addresses the construction quality assurance (CQA) procedures for the installation of the geosynthetic components used for the construction of the valley leach facility at the Cresson Project, Teller County, Colorado. This program has been developed to assure that the construction of the geosynthetic components are in compliance with the project SPECIFICATIONS and to demonstrate that the regulatory requirements for the construction are achieved.

The objective of this plan is to assure that proper materials, construction techniques, and procedures are followed by the **CONTRACTOR** and that the intent of the design is met. This program also intends to identify problems that may occur during construction and provide the means for resolution of these problems.

This program addresses quality assurance, not quality control. This CQA Plan is independent of the quality control (QC) programs conducted by the **MANUFACTURERS**, **INSTALLERS**, and **CONTRACTORS**. The intent of the CQA Plan is to provide independent third party verification and testing, to demonstrate that the **INSTALLER** and **CONTRACTORS** have met their obligations in the supply and installation of geosynthetic materials according to the design, project SPECIFICATIONS, contractual and regulatory requirements. Quality control is provided by the **MANUFACTURERS**, **INSTALLERS**, and **CONTRACTORS** and refers to those actions taken by them to ensure that their materials and workmanship meet the requirements of the plans and project SPECIFICATIONS.

2. PART 2: DESCRIPTION OF PARTIES TO CONSTRUCTION QUALITY ASSURANCE

The following section provides descriptions of the parties to this CQA plan including their responsibilities and qualifications.

2.1. CC&V

In this CQA Plan **CC&V** refers specifically to Cripple Creek & Victor Gold Mining Company. **CC&V** owns and operates the valley leach facility.

2.2. Manager

In this CQA Plan the **MANAGER** refers specifically to the individual appointed by the Cripple Creek & Victor Gold Mining Company. The **MANAGER** is the official representative of **CC&V** responsible for all construction activities including oversight and direction during construction.

The **MANAGER** is also responsible for coordinating construction and CQA activities for the project.

The **MANAGER** shall serve as communications coordinator for the project initiating preconstruction and resolution meetings. As communications coordinator, the **MANAGER** shall serve as a liaison between all parties involved in the project to ensure that ongoing communications are maintained. The **MANAGER** and **CERTIFYING ENGINEER** shall also be responsible for the resolution of all CQA issues that arise during the installation of the geosynthetics.

Duties for this position include the following:

- review and approval of design DRAWINGS and project SPECIFICATIONS for all geosynthetic components of the valley leach facility;
- preconstruction coordination with the CQA Monitor to ensure that the CQA Monitor has performed similar reviews of the design DRAWINGS and project SPECIFICATIONS to ensure that the CQA Plan can be implemented;
- coordination of all construction activities associated with the various **CONTRACTOR(S)**;
- scheduling and coordinating construction activities with required CQA testing and activities;
- overseeing the construction quality control operations performed by the **CONTRACTOR(S)**;
- approve specific corrective measures to be implemented during construction when deviations from the SPECIFICATIONS occur;
- ensure that required quality control testing has been performed in accordance with the CQA Plan and to the satisfaction of the CQA Monitor; and
- ensure that the CQA personnel are provided with all documentation required in the CQA Plan and project SPECIFICATIONS.

2.3. Design Engineer

In this CQA Plan the **DESIGN ENGINEER and Engineer of Record (EOR)** refers specifically to NewFields who has assumed the role of **DESIGN ENGINEER** after a thorough review of design documents to include, but not limited to, the DRAWINGS and SPECIFICATIONS. The **DESIGN ENGINEER** or the **CERTIFYING ENGINEER** identified in section 2.4 below, is responsible for approving all DRAWING and SPECIFICATION changes, modifications, or clarifications encountered during construction.

2.4. Certifying Engineer

In this plan, **CERTIFYING ENGINEER** refers specifically to NewFields. **CERTIFYING ENGINEER** is the individual or firm responsible for certifying the construction was performed in compliance

with the DRAWINGS and SPECIFICATIONS. **MANAGER** and **CERTIFYING ENGINEER** will be responsible for the resolution of all quality assurance issues.

2.5. Construction Quality Assurance Monitor

The Construction Quality Assurance Monitor, also referred to as the "CQA Monitor", is the firm or individual responsible for performing the CQA tasks outlined in this plan. The CQA Monitor is the official CQA representative of **CC&V** and has the responsibility of overseeing the CQA aspects of the project. In this CQA Plan the CQA Monitor is associated with the **CERTIFYING ENGINEER** and refers specifically to (To Be Determined). The CQA Monitor has the authority to stop any aspect of the work that is not in compliance with the CQA Plan. Work would then be resumed once corrective action has been approved by the **MANAGER** and **CERTIFYING ENGINEER**. The specific responsibilities of the CQA Monitor include:

- review the design DRAWINGS, project SPECIFICATIONS, and related guidance documents;
- review all **CONTRACTOR** QC submittals and make appropriate recommendations;
- observe geosynthetic material delivery, unloading, and storage;
- obtain and test geosynthetic conformance samples during geosynthetics manufacture;
- observe prepared subgrade prior to geosynthetic deployment;
- monitor and document geosynthetic material placement, trial seam testing, non-destructive testing, seaming and repair operations, and destructive testing;
- identify seam samples for CQA destructive testing;
- assure that testing equipment used, and tests performed are conducted according to project SPECIFICATIONS and industry standards;
- perform or observe, document, and report test results to **MANAGER** as required;
- report any deficiencies to **MANAGER** that are not corrected to the satisfaction of the CQA Monitor, including design or project SPECIFICATION changes; and
- prepare a Construction Certification Report describing the construction, any deviations from SPECIFICATIONS or, DRAWINGS and details, details of all field and laboratory details, subgrade acceptance forms, test data, tests results (both laboratory and field), QC submittals, geomembrane panel layout as-built prepared by the CQA Monitor, professional certification that construction was completed in compliance with the DRAWINGS and SPECIFICATIONS. The report will be signed and sealed by the **CERTIFYING ENGINEER** registered in the State of Colorado.

2.6. Geosynthetics Manufacturer

The Geosynthetics Manufacturer, also referred to as the "**MANUFACTURER**", is responsible for production of the geosynthetic components outlined in this plan. Each **MANUFACTURER**

must verify prior to construction that the MANUFACTURER can produce material that meets the requirements outlined in project SPECIFICATIONS.

2.7. Geosynthetics Installation Contractor

The Geosynthetics Installation Contractor, also referred to as the "**CONTRACTOR**" or "**INSTALLER**", is responsible for installation of the geosynthetic components, as outlined in the project SPECIFICATIONS.

The **INSTALLER** must meet the requirements outlined in the project SPECIFICATIONS.

The **INSTALLER** will be responsible for storage, handling, deploying, temporary geomembrane anchoring, seaming, repairs and non-destructive testing, in accordance with the project plans, SPECIFICATIONS and the Installer's internal quality control program. It is the Installer's responsibility to see that all submittals are received as outlined in the project SPECIFICATIONS.

2.8. Earthworks Contractor

The Earthworks Contractor, also referred to as "**CONTRACTOR**" is responsible for proper delivery and placement of earthwork components as outlined in the project SPECIFICATIONS.

3. PART 3: LINES OF COMMUNICATION

The CQA Monitor shall be capable of direct communication with the **MANAGER**, **DESIGN ENGINEER**, **CERTIFYING ENGINEER** and **CONTRACTOR** at all times. Deficiencies that can be easily remedied, such as unsatisfactory test results, will be dealt with directly between the CQA Monitor, **INSTALLER** , and/or **CONTRACTORS**.

If there is a disagreement among the **DESIGN ENGINEER**, **CERTIFYING ENGINEER** and/or **MANAGER** that cannot be resolved among themselves, **MANAGER** shall present the matter to **CC&V** with **MANAGER** related recommendations and **CC&V** shall decide the matter with such decision being final.

4. PART 4: DEFICIENCIES

When deficiencies (items that do not meet project requirements) are discovered, the CQA Monitor shall immediately determine the nature and extent of the problem and notify the **INSTALLER** or **CONTRACTOR**. If unsatisfactory test results identify a deficiency, additional tests will be performed to define the extent of the deficient area.

The **INSTALLER** or **CONTRACTOR** shall correct the deficiency to the satisfaction of the CQA Monitor. If the **CONTRACTOR** is unable to correct the problem, the CQA Monitor will

notify the **MANAGER** and **CERTIFYING ENGINEER** who will assist in problem resolution. If the solution involves a design revision, the **DESIGN ENGINEER** shall also be contacted.

The corrected deficiency shall be retested and/or approved by the **MANAGER** and **CERTIFYING ENGINEER** before any additional related work is performed by the **INSTALLER** or **CONTRACTOR**. All retests and related documentation shall be recorded by the CQA Monitor and included in the final Construction Certification Report.

5. PART 5: MEETINGS

This section identifies and describes the meetings to be held during the course of the construction. Meetings shall be held in order to clearly define construction activities and goals in order to facilitate construction.

5.1. Preconstruction Meeting

The **MANAGER** will hold a preconstruction meeting at the site prior to the start of construction. The **DESIGN ENGINEER**, **MANAGER**, **CERTIFYING ENGINEER**, CQA Monitor, **INSTALLER**, **CONTRACTOR**, and others designated by the **MANAGER** shall attend this meeting. The purpose of this meeting will be to:

- review the construction DRAWINGS, CQA Plan, and project SPECIFICATIONS;
- define the responsibilities of each party;
- define lines of communication and authority;
- review method of documentation, testing procedures, and reporting inspection data;
- establish testing protocols and procedures for correcting and documenting construction deficiencies;
- discuss any changes that may be needed to ensure that construction will be completed in compliance with the design; and
- This meeting will be documented by the **MANAGER** or his designee and copies distributed to all parties.

5.2. Progress Meetings

The **MANAGER** will hold a daily progress meeting, either before the start of work or at the completion of work. At a minimum, this meeting will be attended by the CQA Monitor, **INSTALLER** and **CONTRACTOR**. The purpose of this meeting will be to:

- review all the previous day's accomplishments and activities;
- review scheduled work location and activities for the day; and,

- discuss any problems or potential construction problems.
- This meeting will be documented by the CQA Monitor.

5.3. Deficiency Meetings

Special meetings will be held, as needed, to discuss potential problems or deficiencies. At a minimum, these meetings will be attended by the CQA Monitor and **INSTALLER** or **CONTRACTOR**. If the problem relates to a design issue, the **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER** should also be present. The meeting will be documented by the CQA Monitor.

6. PART 6: GEOSYNTHETICS CONSTRUCTION QUALITY ASSURANCE

Construction of the valley leach facility or specified geosynthetics must be in compliance with the design plans and SPECIFICATIONS. **CC&V** shall implement a CQA monitoring and testing program to ensure construction compliance by the **CONTRACTOR**. The quality assurance program shall consist of reviewing **CONTRACTOR** quality control submittals, material conformance testing, and construction monitoring and testing.

The types of geosynthetics used in the valley leach facility construction include polyethylene pipe, geomembrane and geotextile. These geosynthetics are defined in the project SPECIFICATIONS. Prior to and during construction, these geosynthetics shall be sampled and tested to determine if they meet project SPECIFICATIONS. All tests shall be performed in a geosynthetics laboratory approved by the **MANAGER** and **CERTIFYING ENGINEER**.

6.1. Review Quality Control Submittals

Prior to geosynthetic installation, the CQA Monitor shall review the **INSTALLER'S** quality control submittals to evaluate or confirm that these materials meet project requirements. The CQA Monitor shall review the QC submittals that are outlined in Section 2776 (Geomembrane) and Section 02777 (Geotextile) of the SPECIFICATIONS.

6.2. Geomembrane Conformance Testing

Prior to geosynthetic installation, the CQA Monitor shall obtain samples of the geomembrane for conformance testing to confirm that these materials meet project requirements. The conformance testing frequency shall be at a rate of 1 test per 150,000 square feet. Samples shall be taken across the entire width of the roll and shall not include the first 3 feet. The samples shall be 3 feet wide by the roll width. The CQA Monitor shall mark the machine direction, roll number on the sample, and date the sample was obtained and forward the

sample to a third party geosynthetic laboratory. As a minimum, the following conformance tests shall be conducted; with project requirements outlined in Section 02776, Article 2.01:

- Geomembrane: density (ASTM D1505)
  carbon black content (ASTM D1603) thickness (ASTM D5199/D5994)
  tensile strength (ASTM D6693)

All conformance tests shall be performed in compliance with the project SPECIFICATIONS. The CQA Monitor shall review the test results and shall report any nonconformance to the **MANAGER**, **CERTIFYING ENGINEER** and the Geosynthetics Installation **CONTRACTOR**.

6.3. Construction Monitoring And Testing

The CQA Monitor shall monitor and test all geosynthetic components of the construction to verify that the construction is in compliance with the project SPECIFICATIONS. The CQA Monitor shall identify inadequate construction methodologies or materials which may adversely impact the performance of the facility being constructed and existing structures. Visual observations throughout the construction process shall be made to ensure that the materials are placed to the lines and grades as shown on the DRAWINGS.

The CQA monitor shall review the following submittals by **INSTALLER** during the project:

- verification that a qualified land surveyor has verified all lines and grades; and
- subgrade surface acceptance certificates for each area to be covered by the lining system, signed by the **INSTALLER**.

The CQA Monitor shall:

- Inspect all geosynthetic materials delivered to site. The CQA Monitor shall document any damage and notify **MANAGER**;
- obtain geosynthetic packaging identification slips for verification and generation of an on-site materials inventory;
- observe subgrade conditions prior to geosynthetics installation and verify that any deficiencies, as defined in Section 02200 of the SPECIFICATIONS, are corrected;
- observe permanent anchoring of geosynthetics to verify that design and project SPECIFICATIONS are met; observe that required overlap distances are met;
- monitor and record ambient air temperatures;
- verify that no continuous horizontal seams are placed on slopes unless approved by
- **CERTIFYING ENGINEER**; and
- observe and document that all soil materials placed on top of the geosynthetics are done in such a manner as to ensure that the geosynthetics are not damaged.

6.3.1. Geomembrane

During geomembrane installation, the CQA Monitor shall observe and document deployment, trial seams, field seaming, non-destructive and destructive seam testing, and repairs to assure that the installation is in compliance with the SPECIFICATIONS.

Deployment - The CQA Monitor shall verify that only approved materials are used, each panel is given a unique panel number, no geomembrane is placed during unsuitable weather conditions as outlined in Section 02776, Article 1.05 of the SPECIFICATIONS, the geomembrane is not damaged during installation, and anchoring is performed in compliance with the SPECIFICATIONS and design DRAWINGS. The CQA Monitor shall record the deployment on the deployment log form.

Trial Seams - The CQA Monitor shall verify that seaming conditions are performed in compliance with SPECIFICATIONS, tests are performed at required intervals, specified test procedures are followed, and retests are performed in compliance with the SPECIFICATIONS. If the ambient air temperature measured by the CQA Monitor is above 35°F for the entire day, the **INSTALLER** shall perform trial seams at the beginning of each crew shift, and immediately following any work stoppage (i.e., for lunch, weather conditions, etc.) of for more than 30 minutes or at the discretion of the **CERTIFYING ENGINEER**, for each seaming apparatus used that day. If the ambient air temperature measured by the CQA Monitor is below 35°F for the entire day, the **INSTALLER** shall perform four (4) trial seams, at approximately the same time interval throughout the scheduled work day. Each Seamer shall make at least one trial seam each day. Seaming operation shall not commence until the CQA Monitor has determined that the seaming process is meeting the SPECIFICATION requirement and is acceptable. The CQA Monitor shall record the trial weld results on the trial seam log form.

Field Seaming - The CQA Monitor shall verify that only approved equipment and personnel perform welding, all welding is performed under suitable conditions as specified in the project SPECIFICATIONS, specified overlaps are achieved, seams are oriented in compliance to project requirements, and that grinding techniques and extrudate meet project requirements for extrusion welding. The CQA Monitor shall record all field seaming on field seaming log forms.

Non-Destructive Seam Continuity Testing - The CQA Monitor shall verify that all seams and repair are non-destructively tested in compliance with the project SPECIFICATIONS. If a seam cannot be tested, the seam shall be capped. The CQA Monitor shall observe capping operations. The CQA Monitor shall verify that test equipment and gauges are functioning properly and that test procedures are in compliance with the project SPECIFICATIONS. The CQA Monitor shall verify that all seams and repairs with failing test results are repaired and/or

re-tested until passing results are achieved. The CQA Monitor shall record all non-destructive test locations on the vacuum test and pressure test log forms.

Destructive Seam Testing - The **INSTALLER** shall obtain samples, at locations selected by the CQA Monitor, of the field seamed geomembrane approximately 24 inches along and 12 inches across the seam and centered over the seam as follows:

- a minimum of one sample per day;
- a minimum of one sample for each geomembrane seamer;
- a minimum of one sample every 500 feet of seaming; and
- seams that appear suspect to the CQA Monitor.

The CQA Monitor shall witness the testing of destructive seam samples by the **INSTALLER**. The **INSTALLER** shall mark all samples with their roll and seam number, date, machine number, welding technician identification, extruder and nozzle/wedge temperature, and ambient air temperature.

The **INSTALLER** shall test all destructive samples in compliance with the project SPECIFICATIONS.

The **INSTALLER** shall be responsible for patching all areas cut for test samples in accordance with the SPECIFICATIONS and **MANUFACTURER's** requirements and performing non-destructive testing (i.e., vacuum box) of the seams. The CQA Monitor shall record test locations on the geomembrane defect log forms. Additional testing information will be recorded on the geomembrane seam destructive sample log form. The CQA Monitor shall track failing tests as described in the SPECIFICATIONS.

Repairs - The CQA Monitor shall observe and document that all repair materials, techniques, and procedures used for repairs are approved in advance and meet the requirements of the project SPECIFICATIONS. The CQA Monitor shall verify that all defects and repairs are marked, recorded, repaired, tested, and wrinkles are addressed, prior to being covered by other materials; and that repairs are performed as specified, including proper patch size or dimension. The CQA Monitor shall record defects and repairs on the defect and repair log forms.

6.3.2. Geotextile

During geotextile installation, the CQA Monitor shall observe and document deployment, field seaming, and repairs to assure that the installation is in compliance with the SPECIFICATIONS.

Deployment - The CQA Monitor shall verify that the subgrade is free of deleterious materials prior to deployment, anchoring is achieved as specified, specified methods are used to minimize wrinkles and protect underlying layers during cutting of materials, and deployment procedures are performed in compliance with the project SPECIFICATIONS.

Seams - The CQA Monitor shall verify sufficient overlap and that the specified seam procedures were followed in compliance with the project SPECIFICATIONS

Repairs - The CQA Monitor shall verify that all repairs are performed in compliance with SPECIFICATIONS.

Protection – The CQA Monitor shall observe and document that all soil materials placed on top of the geosynthetics are done in such a manner as to ensure that the geosynthetics and underlying materials are not damaged.

6.4. Polyethylene Pipe and Fittings

During polyethylene pipe installation, the CQA Monitor shall observe and document that the installation is in compliance with the project SPECIFICATIONS. CQA monitoring of the polyethylene pipe and fittings will include the following:

Placement - Observation that the handling procedures used do not damage the pipe, backfill is placed in compliance with the requirements of the project SPECIFICATIONS so as not to damage the pipe, any foreign material is removed from the interior of the pipe and indentations on the pipe are within the MANUFACTURER's allowable limits.

Joints and Connections - Monitoring of the jointing and connection operations to verify that the **CONTRACTOR** follows the SPECIFICATIONS and the pipe **MANUFACTURER's** recommendations, verification that the pipes are clean when installed, that perforated sections of pipe are aligned properly prior to connection, pipe boot connections are made in the field using the specified rings and clamps, and plastic ties are used to connect the secondary perforated pipes to primary perforated pipes.

Nondestructive Testing - Observe any required testing of the pipe to verify compliance with the project SPECIFICATIONS.

7. PART 7: DOCUMENTATION

Documentation kept by the CQA Monitor shall consist of daily record-keeping, documentation of construction problem resolutions, documentation of design and SPECIFICATION changes, photographic records, weekly progress reports, chain of custody forms for test sample tracking, and a Construction Certification Report.

7.1. Daily Record Keeping

The CQA Monitor shall keep daily records consisting of field notes, observation and testing data sheets, summary of the daily meeting with the **INSTALLER** or **CONTRACTOR**, and reporting of construction problems and resolutions. This information shall be submitted on a regular basis to the **MANAGER** for review.

7.2. Geosynthetic Observation and Testing Forms

The CQA Monitor shall document geosynthetic observations and test results on forms which include the following information:

- date, project name, location, and weather data;
- identification of panel or seam numbers;
- description of ongoing construction, detailing deployment areas;
- numbering system identifying test or sample number;
- location and identification of repairs and date of repair;
- length and/or thickness measurements for geomembrane panels or seams;
- welding machine temperatures and settings;
- welding machine and technician identifications;
- location of tests and test results;
- identification of testing technicians and time of tests; and
- signature or initials of the CQA Monitor.

7.3. Photo Documentation

The CQA Monitor shall photograph all phases of construction.

7.4. Design And Specification Changes

During construction, the need to address design and SPECIFICATION changes, modifications, or clarifications may arise. In such cases the CQA Monitor shall notify the **MANAGER**, which will notify the **DESIGN ENGINEER** and **CERTIFYING ENGINEER**. Design and SPECIFICATION changes shall only be made with written agreement from the **MANAGER** and **DESIGN ENGINEER**.

7.5. Weekly Progress Reports

The CQA Monitor shall prepare weekly progress reports summarizing all construction and CQA activities. This report shall be submitted to the **MANAGER** and shall include the following information:

- date, project name, and location;
- summary of construction related activities;
- summary of geomembrane deployed (per day);
- summary of samples taken and test results;
- summary of geomembrane areas completed, and approved for Drain Cover Fill placement;
- summary of deficiencies and/or defects and resolutions; and
- signature of the CQA Monitor.

7.6. Construction Certification Report

At the completion of the project, the CQA Monitor shall submit to the **MANAGER** a Construction Certification Report. This report shall certify that the work has been performed in compliance with the design DRAWINGS and project SPECIFICATIONS and will contain the following information:

- summary of all construction activities;
- observation and test data sheets;
- photographic documentation;
- CQA staff scheduling;
- copies of weekly reports;
- **CONTRACTOR'S** subgrade acceptance forms;
- temperature monitoring results;
- geosynthetic quality control documents;
- geosynthetic quality assurance documents;
- geomembrane installation observations, such as for deployment, trial seams, defect repair, destruct testing and non-destructive testing;
- sampling, testing locations, and test results;
- changes to the design DRAWINGS or project SPECIFICATIONS and the justification for these changes;
- record DRAWINGS; and
- a certification statement that construction was completed in compliance with the DRAWINGS and SPECIFICATIONS, signed, and sealed by the **CERTIFYING ENGINEER** registered in the State of Colorado.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –EARTHWORKS		**SPECIFICATION NO.** **02200**

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SECTION 02200.0 EARTHWORKS

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes site preparation, excavation, stockpiling of soils for earthwork if necessary, and placement of Structural Fill, Select Structural Fill, Coarse Shaft Backfill, Underdrain Fill, Low Volume Solution Collection Fill, Bedding Fill, Leak Detection Fill, Soil Liner Fill, Drain Cover Fill, Fine Shaft Backfill, Pipe Bedding Material, and Granular Filter Material for the valley leach facility.

1.2. Related Sections

Refer to the following Sections for related work:

- Section 01050.0 - Staking and Construction Certification Documentation
- Section 02776.0 - Geomembrane
- Section 02777.0 - Geotextile

1.3. Tolerances

A. Limits of excavation, Structural Fill, Select Structural Fill, Coarse Shaft Backfill, Underdrain Fill, Low Volume Solution Collection Fill, Bedding Fill, Leak Detection Fill, Soil Liner Fill, Drain Cover Fill, Fine Shaft Backfill, Pipe Bedding Material, and Granular Filter Material for the valley leach facility are defined by the lines and elevations shown on the DRAWINGS. All fill shall be placed to the minimum thicknesses shown on the DRAWINGS.

B. Finished grades shown on the DRAWINGS are given in feet, and shall slope uniformly between given spot and contour elevations, without sag or humps. All grades shall provide for natural runoff.

C. The Soil Liner Fill and Bedding Fill shall have a minimum thickness of 1.0 foot.

D. The Low Volume Solution Collection Fill will have a minimum thickness of 3.0 feet at all times, and the Drain Cover fill will have a minimum thickness of 2.0 feet at all times.

E. Clearance of pipes with respect to regulated boundaries will be checked by **MANAGER**. If clearances are inadequate, **CONTRACTOR** shall backfill trenches to compaction SPECIFICATIONS and relocate trenches at **CONTRACTOR**'s expense.

F. Correction of over-excavation and backfilling shall be to **CONTRACTOR**'s account.

1.4. Quality Assurance

A. All work shall be monitored and tested in compliance with the requirements of the CQA Plan.

B. **CONTRACTOR** shall be aware of all testing activities outlined in the CQA Plan, and shall account for these activities in the construction schedule.

C. All CQA soils testing (both field and laboratory testing) will be the responsibility of **CERTIFYING ENGINEER**, as identified in the Earthworks CQA plan. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities. Quality Control testing shall be the responsibility of the **CONTRACTOR**.

D. All excavation, backfill, and grading operations shall be carried out under the observation of MANAGER and CERTIFYING ENGINEER.

E. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**, at its sole cost.

2. PART 2: PRODUCTS

2.1. Materials

A. Fill materials will be soils, gravels, or rock fill approved by **MANAGER** and **CERTIFYING ENGINEER**. The materials shall be free of organic matter, debris, frozen material, and other deleterious materials, and shall be excavated, as required, as follows:

1. Structural Fill - material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATION:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
24 – inch	100
No. 200	0 – 25
Plasticity Index: 30 maximum	

2. Select Structural Fill - well graded granular soil or sound, hard, durable, rockfill excavated on-site or supplied from off-site mine waste rock with a maximum particle size of 3 inches as approved by **MANAGER** and **CERTIFYING ENGINEER**.

3. Underdrain Fill - granular, material approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATION.

U.S. Standard Sieve Size	Percent Passing by Dry Weight
12-inch	100
No. 200	0 – 6
Point load tensile strength:	> 300 psi
Plasticity Index: Non Plastic	

4. Leak Detection Fill - material approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATION:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
1-inch	100
⅜-inch	40 – 70
No. 4	5 – 50
No. 40	0 – 20
No. 200	0 – 10
Plasticity Index: Non Plastic	

5. Low Volume Solution Collection Fill and Bedding Fill - material approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATION:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
1-inch	100
⅜-inch	40 – 70
No. 4	5 – 55
No. 200	0 – 10
Plasticity Index: Non Plastic	

6. Soil Liner Fill - processed materials as approved by **MANAGER** and **CERTIFYING ENGINEER**, conforming to the following SPECIFICATION:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
2-inch	100
No. 200	15 – 65
Point load tensile strength:	> 300 psi
Plasticity Index: 10 Minimum Hydraulic Conductivity 1×10-6 cm/s maximum	

7. Drain Cover Fill - material approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
1½-inch	100
¾-inch	70 – 100
No. 4	5 – 50
No. 200	0 – 8
Plasticity Index: Non Plastic	

The **MANAGER** substitute crushed ore as Drain Cover Fill. The crushed ore material shall conform to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
3-inch	100
2-inch	97
¾-inch	40 – 100
No. 4	5 – 35
No. 200	0 – 8
Plasticity Index: Non Plastic	

8. Select Drain Cover Fill – material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
1½-inch	100
¾-inch	70 – 100
No. 4	5 – 50
No. 200	0 – 8
Plasticity Index: Non Plastic	

9. Coarse Shaft Backfill - material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
12-inch	100
No. 200	0 – 15
Plasticity Index: Non Plastic	

10. Fine Shaft Backfill - material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
2-inch	100
¾-inch	70 – 100
No. 40	20 – 50
No. 200	2 – 15
Plasticity Index: 15 maximum	

11. Pipe Bedding Material - material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
2-inch	100
No. 4	30 – 100
No. 200	5 – 20
Plasticity Index: 15 maximum	

12. Granular Filter Material - material as approved by **MANAGER** and **CERTIFYING ENGINEER** conforming to the following SPECIFICATIONS:

U.S. Standard Sieve Size	Percent Passing by Dry Weight
3-inch	100
2-inch	75 – 100
No. 200	0 – 15
Plasticity Index: 15 maximum	

Acceptance of non-conforming materials: In cases where non-conformance to these material specifications occur the Design Engineer in tandem with the Manager can approve the material for use, if in their opinion, the specification deviation does not diminish functionality of a given design element and/or compromise the design intent. If non-conforming materials are accepted by the Design Engineer and Manager for use during construction, the DRMS will be contacted to alert them to the acceptance and rationale behind acceptance of non-conforming materials.

3. PART 3: EXECUTION

3.1. Clearing and Grubbing

A. Clearing and grubbing shall be done within the footprint of the limits of the construction area, as delineated on the DRAWINGS. Clearing shall extend a maximum of 15 feet and a minimum of 10 feet outside of the construction limits or as directed by **MANAGER**. Areas for clearing shall be released to **CONTRACTOR** by **MANAGER**. No pioneering of roads across undisturbed areas shall be allowed without prior approval of **MANAGER**

B. No clearing shall be performed until written permission is given by **MANAGER** and until the **CONTRACTOR** has provided construction staking for the proposed work. Clearing shall consist of cutting brush to the ground level, removing such material, along with wood, rubbish, tree stumps, and any other vegetation with roots in excess of 1-inch diameter, and other deleterious materials, and disposing of all such material in the accepted manner described below.

C. In areas designated to be stripped of unsuitable or objectionable material, said materials shall be stripped to the full depth of organic or other unsuitable material as determined by **MANAGER** and **CERTIFYING ENGINEER**, whichever is greater.

D. Stripped and grubbed vegetation shall be removed and disposed in stockpiles or other approved methods in an area designated by **MANAGER**.

3.2. Topsoil Removal

Topsoil is defined as an acceptable growth medium as approved by **MANAGER** and **CERTIFYING ENGINEER** that has no chemical or physical characteristics, which will exclude its use as such.

A. Stripping of the topsoil shall be done within the entire area of the stripping limits.

B. **CONTRACTOR** shall excavate and remove topsoil in a manner that will minimize contamination with other soil horizons, and will take such measures as are necessary to ensure that the removal of topsoil does not result in erosion or excessive sedimentation.

C. **CONTRACTOR** shall stockpile topsoil at locations designated by **MANAGER**. Stored topsoil shall not be disturbed by mining, leaching operations, or construction activities, and shall be protected from wind and water erosion, compaction, and contamination.

D. **CONTRACTOR** shall grade topsoil stockpiles to prevent erosion and ponding of precipitation in the stockpile areas. The maximum topsoil stockpile height will be approved by **MANAGER**. The **CONTRACTOR** shall protect stockpiled topsoil by an effective cover of non-noxious, quick- growing, annual, and perennial plants, approved by **MANAGER**, which shall be seeded or planted during the first appropriate growing season after removal.

3.3. Waste Removal

Waste material is defined as material too wet, too dry, frozen or containing ice or snow, containing organic or other deleterious matter, having poor characteristics of grading or compaction, having other characteristics that may result in undesirable settlement or other movement of the fill, or within the fill, or otherwise not meeting the requirements of the SPECIFICATIONS, provided that this definition permits drying, water, and any other processing or reprocessing to make the material stable and suitable prior to incorporating it into the fill as permitted in the SPECIFICATIONS or by the **MANAGER** and **CERTIFYING ENGINEER**.

A. **CONTRACTOR** shall excavate and remove waste in a manner that will minimize contamination with other soil horizons.

B. **CONTRACTOR** shall stockpile removed waste at locations designated by **MANAGER**

3.4. Excavation

A. **CONTRACTOR** shall perform excavation to the lines and grades shown on the DRAWINGS or as directed by **MANAGER**. No excavation shall begin until the **CONTRACTOR** has provided construction staking for the proposed work.

B. **CONTRACTOR** shall prevent the disturbance of surrounding areas during excavation. Where selective excavations are required to obtain materials for Structural Fill and Select Structural Fill, the material removed from the excavations shall be taken directly to the fill areas or, if required, stockpiled by material types. The stockpiles shall be approved by **MANAGER**.

C. **CONTRACTOR** shall grade all excavations to ensure grades are maintained to provide adequate drainage at all times. Work shall be suspended by **CONTRACTOR** when, in the

opinion of **MANAGER** and **CERTIFYING ENGINEER**, the site is overly wet, muddy, or otherwise unsuitable for proper maintenance, until directed otherwise by **MANAGER**, at no cost to **CC&V**.

D. In excavations where Structural Fill or Select Structural Fill is to be placed on slopes steeper than 3H:1V, horizontal benches shall be excavated into the slope to allow fill to be placed in horizontal lifts. The **CONTRACTOR** shall continuously bench and key embankment material into the existing material a minimum of 2 feet.

E. The **CONTRACTOR** will be responsible for the safety of temporary construction slopes. **CONTRACTOR** shall inspect all temporary and permanent open-cut excavations on a regular basis for signs of instability. Should signs of instability be noted, **CONTRACTOR** shall immediately undertake remedial measures and shall notify **MANAGER** immediately. Permanent cut slopes shall be left in smooth, safe, and stable condition at the end of the workday.

F. **CONTRACTOR** shall final grade excavations within the valley leach facility to establish positive drainage to the Pregnant Solution Storage Area. In no case will depressions or bowls be permitted in the valley leach facility area.

G. **CONTRACTOR** shall conduct all excavation and shoring operations in compliance with applicable MSHA, Colorado State and Federal government laws and regulations.

3.5. Subgrade

A. The **MANAGER** and **CERTIFYING ENGINEER** will inspect and approve the exposed subgrade prior to any fill or Soil Liner being placed. CQA Monitor will confirm that the surface of the subgrade is smooth and free of debris, grade stakes, angular rocks, roots, branches, vegetation, mud, ice, or frozen material. If the subgrade is determined to be frozen, using the criteria identified in Item 3.06.10 of Section 2200, the **CONTRACTOR** may either remove and replace the frozen subgrade or wait until subsequent temperature monitoring indicates the fill is unfrozen, at no cost to **CC&V**. The subgrade shall have no sudden sharp or abrupt changes in grade.

B. **CONTRACTOR** is responsible for maintaining subgrades in a condition satisfactory to **CERTIFYING ENGINEER**. **CONTRACTOR** shall protect prepared subgrades, including previously approved subgrade, from weather, construction equipment, or other factors as outlined in Part 3.06 of the SPECIFICATIONS. Subgrade surfaces, including previously approved subgrade, that become softened or otherwise unsuitable for placement of fill, shall be repaired to **CERTIFYING ENGINEER's** and **MANAGER's** satisfaction, at no cost to **CC&V**.

C. Prior to placement of fill materials, **CONTRACTOR** shall scarify all in-situ materials to a depth of 6-inches, moisture condition, and recompact the subgrade. Compactive effort shall be adequate to obtain a minimum of 95 percent of maximum dry density as determined by the standard Proctor test (ASTM D698) for the particular fill material.

Moisture conditioning shall be adequate to achieve a uniform moisture and density. In rock areas, the **CONTRACTOR** shall prepare the subgrade by removing loose rock fragments until competent foundation material is encountered as approved by **CERTIFYING ENGINEER**.

D. If the underlying material is unsuitable to permit proper compaction of the subgrade, **CONTRACTOR** shall loosen, aerate (or excavate and remove), and recompact the subgrade until the top layer can be compacted as required. The recompacted surface shall then be scarified, as needed, to provide a good bond between the foundation and fill materials.

3.6. Fill Placement

A. The following general guidelines shall be followed except as noted elsewhere in this Section.

1. No fill materials shall be placed until the foundation and subgrade preparations have been completed as specified herein, in Article 3.05 of this Section. The procedures for fill placement shall be approved by **MANAGER** and **CERTIFYING ENGINEER** prior to start of fill placement.

2. No brush, roots, sod, frozen material, or other deleterious or unsuitable materials shall be incorporated in the fills. The suitability of all materials intended for use in the fill shall be subject to approval by **MANAGER** and **CERTIFYING ENGINEER**. Fill placement shall be temporarily stopped by **CONTRACTOR** due to weather conditions, if materials and installation do not meet the SPECIFICATIONS, at no cost to **CC&V**. Fill shall not be placed upon frozen material, such as snow or ice.

3. If the surface of the prepared foundation or the surface of any layer of the fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, it shall be moisture-conditioned and/or worked with harrow, scarifier teeth, disc, or other suitable equipment to provide a satisfactory bonding surface before fill material is placed thereon. If the surface of the prepared foundation or the rolled surface of any layer is excessively wet for fill materials to be placed thereon, it shall be removed and allowed to dry or worked with a harrow, scarifier teeth, disc, or other suitable equipment to reduce the moisture content to an acceptable level or meet project specifications as determined by **MANAGER** and **CERTIFYING ENGINEER**. It shall then be compacted before the next layer of fill material is placed. Determination of such dry or wet conditions shall be made by **CERTIFYING ENGINEER**.

4. The distribution of materials shall be such that the fill is free from voids, lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. The material of a fill shall be as described in Article 2.01 of this Section.

5. Unless otherwise approved by **MANAGER** and **CERTIFYING ENGINEER**, the entire fill surface shall be at or near the same elevation at all times during construction. At all times during construction, the surface of the fill shall be graded and maintained by the **CONTRACTOR** to prevent ponding of water and to allow for storm water drainage.
6. Except as otherwise specified or approved by **MANAGER** and **CERTIFYING ENGINEER**, the **CONTRACTOR** shall dump and spread fill in such a manner so that no excessive gaps are left between successively dumped loads of materials. The fill shall be leveled prior to compaction by means of a dozer or grader, or other suitable approved equipment, to obtain a surface free from depressions.
7. Except in areas approved by **MANAGER** and **CERTIFYING ENGINEER** where space is limited or otherwise specified, **CONTRACTOR** shall place fill by routing the hauling and spreading units approximately parallel to the axis of the fill. As far as practical, hauling units shall be so routed that they do not follow in the same paths, but split their tracks evenly across the surface of the fill to enhance compaction.
8. **CONTRACTOR** shall apply water required for moisture conditioning on the fill or in the borrow areas.

   CONTRACTOR shall maintain fill materials within the moisture content range required to permit proper compaction to the specified density with the equipment being used. The moisture content of the fill materials, prior to and during compaction, shall be uniform throughout each layer of the material.

   Prior to mixing of wet and dry material on the fill to obtain the proper moisture content, approval shall be obtained from **CERTIFYING ENGINEER**. Mixed material shall have a uniform distribution of the moisture content prior to placement on the subsequent lift.

   When materials spread on the fill are too dry for proper compaction, **CONTRACTOR** shall spray water on each layer of the fill and shall work the moisture into the fill by harrowing or other approved means, until a uniform distribution of moisture is obtained. Material that is too wet for proper compaction, as determined by **CERTIFYING ENGINEER**, shall be removed from the fill and/or spread out and permitted to dry, assisted by disking and harrowing or mixing in dry material when permitted by **CERTIFYING ENGINEER**, if necessary, until the moisture content is reduced to an amount suitable for obtaining the specified degree of compaction, at no cost to **CC&V.**
9. After each layer of fill material has been placed, spread, and moisture-conditioned, the layer shall be compacted by passing compaction equipment over the entire surface of the layer a sufficient number of times to obtain the required density, as specified herein. Compaction shall be accomplished with equipment and by methods approved by **CERTIFYING ENGINEER**. If such equipment or methods are found

unsatisfactory for the intended use, **CONTRACTOR** shall replace the unsatisfactory equipment with other types or adjust methods until proper compaction is achieved. Prior to placement of a subsequent lift, the previous lift shall be thoroughly scarified to a nominal depth of 2-inches to provide good bonding between lifts. Scarification shall be accomplished by disking, raking with a grader, or an alternative method approved by **CERTIFYING ENGINEER**.

10. The CQA Monitor will measure the ambient air temperature on an hourly basis. If the ambient air temperature is less than thirty-two degrees Fahrenheit for more than one hour over the preceding twenty-four (24) hours, the CQA Monitor will measure the temperature of the fill to determine if the fill is frozen. "Frozen" is defined as a mean temperature of thirty-two degrees Fahrenheit (32°F) or less. The CQA Monitor will measure the temperature at a depth of three (3) inches and six (6) inches, recording the lower of the two. Six (6) measurements will be taken per acre, and if the average is below thirty-two degrees Fahrenheit (32°F), the fill will be considered frozen. If the fill is determined to be frozen the CONTRACTOR may either remove and replace the frozen fill or wait until subsequent temperature monitoring indicates the fill is unfrozen at no cost to CC&V.

11. Overburden slopes shall be compacted using a method specification and graded to meet the grades and dimensions shown on the DRAWINGS. The Bedding Fill subgrade surface will be prepared as identified in Section 2200 of the SPECIFICATIONS.

B. Structural Fill

1. Areas to receive Structural Fill will include, but are not limited to, slope reductions, and miscellaneous site grading.

2. **CONTRACTOR** shall condition Structural Fill to a moisture content that allows compaction to the required density and that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects.

3. **CONTRACTOR** shall place Structural Fill materials with less than 30 percent rock materials above 3/4-inch size in maximum 12-inch loose lifts, and compact to 95 percent of maximum dry density (ASTM D698).

4. **CONTRACTOR** shall condition, place and compact Structural Fill containing more than 30 percent rock materials above 3/4-inch size(rock fill) by a method compaction technique. The compaction equipment shall consist of a minimum 10-ton (static drum weight) vibratory smooth-drum compactor. The number of passes and loose lift thickness shall be subject to **CERTIFYING ENGINEER's** approval, at no additional cost to **CC&V**. The method SPECIFICATIONS may be changed at any time, at the discretion of **CERTIFYING ENGINEER**, based upon changes in material characteristics, field conditions, and/or compaction equipment.

5. Maximum rock size for rock fill shall be two-thirds of the compacted lift thickness, unless otherwise approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**. **CONTRACTOR** shall remove oversize materials from fills at no additional cost to **CC&V**.

C. Select Structural Fill

1. Select Structural Fill shall be placed for miscellaneous site grading as required by the MANAGER and CERTIFYING ENGINEER.
2. **CONTRACTOR** shall condition Select Structural Fill to a moisture content that allows compaction to the required density and that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects.
3. **CONTRACTOR** shall place Select Structural Fill materials with less than 30 percent rock materials above 3/4-inch size in maximum 12-inch loose lifts, and compacted to 95 percent of maximum dry density (ASTM D698).
4. **CONTRACTOR** shall condition and place Select Structural Fill containing more than 30 percent rock materials above 3/4-inch size (rock fill) in maximum 12-inch loose lifts and compact by a method compaction technique. The compaction equipment shall consist of a minimum ten 10-ton (static drum weight) vibratory smooth-drum compactor. The number of passes shall be subject to **CERTIFYING ENGINEER's** approval, at no additional cost to **CC&V**. The method SPECIFICATIONS may be changed at any time, at the discretion of **CERTIFYING ENGINEER**, based upon changes in material characteristics, field conditions, and/or compaction equipment.

D. Underdrain Fill

1. Underdrain Fill shall be placed in the Underdrains as shown in the DRAWINGS.
2. **CONTRACTOR** shall condition Underdrain Fill that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects.
3. **CONTRACTOR** shall condition, place and compact Underdrain Fill by a method compaction technique. The compaction equipment shall consist of a minimum 10-ton (static drum weight) vibratory smooth-drum compactor. The number of passes and loose lift thickness shall be subject to **CERTIFYING ENGINEER's** approval, at no additional cost to **CC&V**. The method SPECIFICATIONS may be changed at any time, at the discretion of **MANAGER**, based upon changes in material characteristics, field conditions, and/or compaction equipment.
4. Provisions shall be made by **CONTRACTOR** for removal of oversize materials from fills, at no additional cost to **CC&V**.
5. The **MANAGER** will minimize the amount of traffic over the Underdrain Fill.

E. Leak Detection Fill

1. Leak Detection Fill shall be placed in the Leak Detection Trenches as shown on the DRAWINGS.
2. **CONTRACTOR** shall condition Leak Detection Fill to allow a surface that does not cause rutting or other deleterious effects.

F. Low Volume Solution Collection Fill

1. Low Volume Solution Collection Fill shall be placed over the geomembrane in the locations shown on the DRAWINGS.
2. **CONTRACTOR** shall condition Low Volume Solution Collection Fill to allow a surface that does not cause rutting or other deleterious effects.
3. **CONTRACTOR** shall place Low Volume Solution Collection Fill around the Low Volume Solution Collection Vertical Riser Pipes in maximum 12-inch loose lifts and compact using a hand operated vibratory plate compactor to the satisfaction of the **MANAGER** and **CERTIFYING ENGINEER**. Low Volume Solution Collection Fill shall be worked under the Low Volume Solution Collection Rise pipe haunches by hand to provide uniform support of the pipe.
4. Prior to placing the Low Volume Solution Collection Fill, **CONTRACTOR** shall verify by visual inspection that the underlying geosynthetics are free of holes, tears, wrinkles, or foreign objects. **MANAGER** and **CERTIFYING ENGINEER** will inspect the geosynthetic for wrinkles prior to placement of Low Volume Solution Collection Fill. As instructed by **MANAGER**, **CONTRACTOR** shall "work out" wrinkles to the satisfaction of **MANAGER** and **CERTIFYING ENGINEER** prior to placement of the Low Volume Solution Collection Fill. In all cases, wrinkles shall not be of a size that they could fold back on themselves. Wrinkles greater than one foot shall be removed and repaired by the **INSTALLER**.
5. **CONTRACTOR** shall place Low Volume Solution Collection Fill in a single 36-inch loose lift. The tracked equipment shall operate only over previously placed Low Volume Solution Collection Fill. **CONTRACTOR** shall not operate equipment directly on geosynthetics. Only a dozer with a ground pressure not exceeding 14.7 psi can be used to place Low Volume Solution Collection Fill. Equipment used for placement will not be allowed to pivot on one track (i.e., no abrupt or sharp turns). There shall be no downhill placement on slopes steeper than 4H:1V. Material can be placed along contours if buttressed from below.
6. Rubber tired construction equipment shall not be allowed to travel over the geomembrane or on top of Solution Collection piping unless a thickness of at least 45 inches of Low Volume Solution Collection Fill has been placed over the geomembrane and on top of Solution Collection piping. The **CONTRACTOR** will be required to demonstrate to the **MANAGER, DESIGN ENGINEER** and **CERTIFYING**

ENGINEER that the equipment and procedures used are not detrimental to the geomembrane and piping, at no cost to **CC&V**. Off road haul truck traffic shall require a minimum of 60 inches for Cat 773 (or equivalent) of Low Volume Solution Collection Fill placed over the geomembrane and solution collection piping, and a minimum of 120 inches for CAT 777 (or equivalent) of Low Volume Solution Collection Fill placed over the geomembrane and solution collection piping.

7. When placing Low Volume Solution Collection Fill the maximum acceptable drop height is 3 feet.
8. **CONTRACTOR** shall operate equipment in a manner that is protective of underlying geosynthetics. If **MANAGER** or **CERTIFYING ENGINEER** suspects the occurrence of any damage to the underlying geosynthetics, **MANAGER** will instruct **CONTRACTOR** to remove Low Volume Solution Collection Fill to expose the geosynthetics. **CONTRACTOR** shall uncover, repair any observed damage of the underlying geosynthetics, in accordance with the repair requirements of Sections 02776.0 and 02777.0 of these SPECIFICATIONS, and recover, at no cost to **CC&V**.
9. **CONTRACTOR** shall place Low Volume Solution Collection Fill at a rate such that no single area of 350,000 square feet of geomembrane liner is exposed to ultraviolet light for more than 180 days.
10. **CONTRACTOR** shall provide close continuous monitoring at the point of placement during the placement of the Low Volume Solution Collection Fill over geosynthetics.
11. **CONTRACTOR** shall verify the final thickness of Low Volume Solution Collection Fill to determine compliance with this SPECIFICATION. **CONTRACTOR** shall record verification location, elevation, and thickness. CQA Monitor shall witness all verification measurements. **CONTRACTOR** will submit a method of verifying Low Volume Solution Collection Fill depth to **MANAGER** for approval. Grade markers shall be placed on a 50- by-50-foot grid with additional points required for breaks in grade. **CONTRACTOR** shall remove all grade markers under supervision of CQA Monitor after verification measurements have been approved by **MANAGER** and **CERTIFYING ENGINEER** and will backfill holes with Low Volume Solution Collection Fill. Areas with deficient thickness shall be reworked by **CONTRACTOR**, until acceptable measurements are obtained. If **MANAGER** or **CERTIFYING ENGINEER** suspects the occurrence of any damage to the underlying geosynthetics, **MANAGER** will instruct **CONTRACTOR** to remove Low Volume Solution Collection Fill to expose the geosynthetics. **CONTRACTOR** shall uncover, repair any observed damage of the underlying geosynthetics, in accordance with the repair requirements of Sections 02776.0 and 02777.0 of these SPECIFICATIONS and recover, at no cost to **CC&V**.
12. **CONTRACTOR** will provide adequate illumination as approved by **MANAGER**, if Low Volume Solution Collection Fill placement is carried out at night. A minimum of 2-foot candles measured at the synthetic liner, shall be used when Low Volume Solution Collection Fill placement is carried out at night.

G. Soil Liner Fill

1. Soil Liner Fill shall be placed within the limits of the valley leach facility as shown on the DRAWINGS and shall begin only after completion of all, or **MANAGER** and **CERTIFYING ENGINEER** approved portion of, excavation and Structural Fill placement in the valley leach facility.
2. **CONTRACTOR** shall process, place and compact the Soil Liner Fill to achieve a coefficient of permeability of less than $1x10^{-6}$ cm/sec, measured according to ASTM Method D5084, Method D. Any Soil Liner Fill not meeting the permeability specification shall be removed and replaced with material meeting the permeability specification, at no additional cost to **CC&V**.
3. **CONTRACTOR** shall place and compact the Soil Liner Fill in loose lifts such that the compacted lift thickness is a minimum of 12-inches.
4. **CONTRACTOR** shall compact the Soil Liner Fill to at least 95 percent of the maximum dry density as determined by the Standard Proctor density test (ASTM D698). The moisture content shall be within +3% to -2% of the optimum moisture content. Both moisture and density shall be uniform throughout the lift. If the Soil Liner Fill cannot be conditioned to meet the placement specifications, the material shall be removed and replaced with new Soil Liner Fill at the **CONTRACTOR's** expense. The **CONTRACTOR** shall reduce the clod size of the soil liner fill to a size that is acceptable to the **CERTIFYING ENGINEER**, the method by which will be approved by **CERTIFYING ENGINEER** and **MANAGER** prior to implementation.
5. The moisture content of the Soil Liner Fill shall be uniform throughout prior to and during compaction of the material. **CONTRACTOR** shall be responsible for meeting moisture content and compaction SPECIFICATIONS. If the Soil Liner Fill cannot be conditioned to meet the placement SPECIFICATIONS, the material shall be removed and replaced with new Soil Liner Fill at no additional cost to **CC&V**. **MANAGER** may require **CONTRACTOR** to moisture condition Soil Liner Fill at stockpile at least 24 hours prior to the Soil Liner Fill being placed.
6. **CONTRACTOR** shall place Soil Liner Fill to form a continuous monolithic material. If a lift of compacted Soil Liner Fill dries out during placement operations, **CONTRACTOR** shall scarify, moisture condition the dry soil and recompact the lift. If a lift of compacted Soil Liner Fill becomes overly wet due to precipitation or over watering, **CONTRACTOR** shall allow the wet soil to dry to the specified moisture content range before recompaction of fill and placement of geosynthetic materials.
7. **CONTRACTOR** shall assist CQA Monitor in obtaining soil samples for CQA testing. Soil Liner Fill sampling shall be scheduled by CQA Monitor with **CONTRACTOR** to facilitate CQA field testing.
8. **CONTRACTOR** shall maintain Soil Liner Fill stockpile areas in a free-draining condition. The **CONTRACTOR** will maintain Soil Liner Fill stockpiles and Soil Liner Fill

placed within the limits of the valley leach facility to prevent the drying out of the surface.

9. **CONTRACTOR** shall compact corners and other areas inaccessible to driven compaction equipment using hand-operated 500-pound vibratory plate or vibratory smooth-drum compaction equipment approved by **MANAGER** and **CERTIFYING ENGINEER**.
10. **CONTRACTOR** shall trim the surface of the Soil Liner Fill to the design grades shown on the DRAWINGS.
11. **CONTRACTOR** shall roll the surface of the Soil Liner Fill with a smooth drum roller to remove ridges and surface irregularities greater than 0.5 inches in height. **CERTIFYING ENGINEER** shall determine if surface preparation is sufficient to place geomembrane. On areas with slopes steeper than 3H:1V, **CONTRACTOR** shall adopt methods as necessary to obtain the same final surface preparations that would be obtained by the passage of a smooth-drum roller on flat or level ground. Pushing of compaction equipment by tracked equipment shall not be performed. Wheel ruts on the surface of the Soil Liner Fill from grading equipment shall be repaired by **CONTRACTOR** prior to placement of the geomembrane by rolling the surface as approved by CQA Monitor.
12. **CONTRACTOR** will remove angular protruding rocks greater than 3/4 inches in diameter from the compacted Soil Liner Fill surface. Indentations left in the Soil Liner Fill Surface after removal of the rocks shall be filled with Soil Liner Fill or other suitable fill approved by CQA Monitor, and compacted to achieve final grade. Areas of the Soil Liner Fill surface with concentrated gravelly areas will have suitable fill approved by CQA Monitor placed on top and compacted to achieve final grade. A maximum thickness of 0.5 inches of suitable fill will be placed on the Soil Liner Fill.
13. **MANAGER** and **CERTIFYING ENGINEER** will identify any areas of significant desiccation, crusting, or erosion of a lift surface. Soil Liner Fill surfaces found to have desiccation cracks greater than 0.25-inches in width or depth, or which exhibit swelling, heaving or other similar conditions shall be replaced or reworked by **CONTRACTOR** to remove such defects. Desiccation cracks on the Soil Liner Fill surface less than 0.25-inches in width or depth shall be compacted with a smooth drum roller. **CONTRACTOR** shall take whatever steps necessary to prepare Soil Liner Fill surface to the satisfaction of **MANAGER** and **CERTIFYING ENGINEER**, at no additional cost to **CC&V**.
14. **CONTRACTOR** shall maintain the Soil Liner Fill surface in a condition suitable for geomembrane installation as specified in these SPECIFICATIONS and in the CQA Plan until the surface is covered. **CONTRACTOR** shall repair all weather related damage to Soil Liner Fill surfaces or other portions of the Work that have or have not been covered by geomembrane, at no additional cost to **CC&V** If any moisture is allowed to collect under the geomembrane prior to or after final seaming and softens the Soil

Liner Fill, the geomembrane shall be removed and **CONTRACTOR** shall recondition and recompact the Soil Liner Fill to meet all placement and trimming SPECIFICATIONS, at no additional cost to **CC&V**.

15. **CONTRACTOR** shall remove all hubs and survey stakes in the Soil Liner Fill and backfill all holes with **MANAGER** and **CERTIFYING ENGINEER** approved moisture-conditioned Soil Liner Fill or bentonite. Compact with a Proctor hammer or other suitable device that will achieve a kneading type of compaction and will achieve the required density.
16. **CONTRACTOR** shall verify the final thickness of Soil Liner Fill to determine compliance with this SPECIFICATION. Thickness verification shall be performed at a minimum frequency of two measurements per acre using a soil-coring device, unless directed otherwise by **MANAGER**. **CONTRACTOR** shall record as part of the as-built documentation the location, elevation, and thickness of each Soil Liner Fill verification test. CQA Monitor will witness all verification measurements. **CONTRACTOR** shall backfill all holes with **MANAGER** and **CERTIFYING ENGINEER** approved moisture- conditioned Soil Liner Fill compacted with a Proctor hammer or other suitable device that will achieve a kneading type of compaction and will achieve the required density, or bentonite. Areas with deficiencies shall be reworked by **CONTRACTOR**, until acceptable measurements are obtained at no additional cost to **CC&V**.
17. If tests indicate the Work does not meet the requirements of the SPECIFICATIONS, **MANAGER** and **CERTIFYING ENGINEER** will establish the extent of the nonconforming area. The nonconforming area shall be reworked by **CONTRACTOR** until acceptable test results are obtained at no additional cost to **CC&V**
18. Prior to any geosynthetics being placed on Soil Liner Fill, the area will be tested by CQA Monitor. No geosynthetics will be allowed to be placed on frozen material, as defined in Section 3.06, without the area in question being retested by the CQA Monitor.

H. Drain Cover Fill

1. Drain Cover Fill shall be placed over the geomembrane in the locations shown on the DRAWINGS.
2. Prior to placing the Drain Cover Fill, **CONTRACTOR** shall verify by visual inspection that the underlying geosynthetics are free of holes, tears, wrinkles, or foreign objects. **MANAGER** and **CERTIFYING ENGINEER** will inspect the geosynthetic for wrinkles prior to placement of Drain Cover Fill. As instructed by **MANAGER**, **CONTRACTOR** shall "work out" wrinkles to the satisfaction of **MANAGER** and **CERTIFYING ENGINEER** prior to placement of the Drain Cover Fill. In all cases, wrinkles shall not be of a size that they could fold back on themselves. Wrinkles greater than one foot shall be removed and repaired by the **INSTALLER**.

3. **CONTRACTOR** shall place Drain Cover Fill in a single 24-inch loose lift. The tracked equipment shall operate only over previously placed Drain Cover Fill. **CONTRACTOR** shall not operate equipment directly on geosynthetics. Only a dozer with a ground pressure not exceeding 8.7 psi can be used to place Drain Cover Fill. A CAT 12G motor grader, or equivalent approved by **CERTIFYING ENGINEER,** can be used for Drain Cover Fill final grading. Equipment used for placement will not be allowed to pivot on one track (i.e. no abrupt or sharp turns). There shall be no downhill placement on slopes steeper than 4H:1V. Material can be placed along contours if buttressed from below. Motor graders shall not be allowed to make abrupt turns, brake suddenly, or dig blade in which results in the tires spinning on the Drain Cover Fill surface.
4. Highway compatible Rubber tired construction equipment shall not be allowed to travel over the geomembrane or on top of Solution Collection piping unless a thickness of at least 45 inches of Drain Cover Fill has been placed over the geomembrane and on top of Solution Collection piping. The **CONTRACTOR** will be required to demonstrate to the **MANAGER, DESIGN ENGINEER** and **CERTIFYING ENGINEER** that the equipment and procedures used are not detrimental to the geomembrane and piping, at no cost to **CC&V**. Off road haul truck traffic shall require a minimum of 60 inches for Cat 773 (or equivalent) of Drain Cover Fill placed over the geomembrane and solution collection piping, and a minimum of 120 inches for CAT 777 (or equivalent) of Drain Cover Fill placed over the geomembrane and solution collection piping.
5. When placing Drain Cover Fill the maximum acceptable drop height is 3 feet.
6. **CONTRACTOR** shall operate equipment in a manner that is protective of underlying geosynthetics. If **MANAGER** or **CERTIFYING ENGINEER** suspects the occurrence of any damage to the underlying geosynthetics, **MANAGER** will instruct **CONTRACTOR** to remove Drain Cover Fill to expose the geosynthetics. **CONTRACTOR** shall uncover, repair any observed damage of the underlying geosynthetics, in accordance with the repair requirements of Sections 02776.0 and 02777.0 of these SPECIFICATIONS, and recover, at no cost to **CC&V**.
7. **CONTRACTOR** shall place Drain Cover Fill at a rate such that the geomembrane liner is not exposed to ultraviolet light for more than 180 days.
8. **CONTRACTOR** shall provide close continuous monitoring at the point of placement during the placement of the Drain Cover Fill over geosynthetics.
9. **CONTRACTOR** shall verify the final thickness of Drain Cover Fill to determine compliance with this SPECIFICATION. **CONTRACTOR** shall record verification location, elevation, and thickness. CQA Monitor shall witness all verification measurements. **CONTRACTOR** will submit a method of verifying Drain Cover Fill depth to **MANAGER** for approval. Grade markers shall be placed on a 50-by-50-foot grid with additional points required for breaks in grade. **CONTRACTOR** shall remove all grade markers under supervision of CQA Monitor after verification measurements have been

approved by **MANAGER** and **CERTIFYING ENGINEER** and will backfill holes with Drain Cover Fill. Areas with deficient thickness shall be reworked by **CONTRACTOR**, until acceptable measurements are obtained. If **MANAGER** or **CERTIFYING ENGINEER** suspects the occurrence of any damage to the underlying geosynthetics, **MANAGER** will instruct **CONTRACTOR** to remove Drain Cover Fill to expose the geosynthetics. **CONTRACTOR** shall uncover, repair any observed damage of the underlying geosynthetics, in accordance with the repair requirements of Sections 02776.0 and 02777.0 of these SPECIFICATIONS and recover, at no cost to **CC&V**.

10. **CONTRACTOR** will provide adequate illumination as approved by **MANAGER**, if Drain Cover Fill placement is carried out at night. A minimum of 2-foot candles measured at the synthetic liner shall be used when Drain Cover Fill placement is carried out at night

I. Pipe Bedding Material

1. Pipe bedding material shall be placed around the CSP as shown on the drawings.
2. For piping external to the valley leach facility, **CONTRACTOR** shall compact the Pipe Bedding Material requiring compaction to at least 95 percent of the maximum dry density as determined by the Standard Proctor density test (ASTM D698), and a moisture content 3 percent below and 3 percent over the optimum moisture content.
3. **CONTRACTOR** shall place Pipe Bedding Material in maximum 12-inch loose lifts. Pipe Bedding Material will be worked under pipe haunches by hand to provide uniform support of the CSP.
4. Native material used for backfilling CSP excavation shall be placed in 12-inch to 18-inch loose lifts, and compacted by wheel rolling with light, rubber tired or other light compaction equipment, as approved by **CERTIFYING ENGINEER.**

J. Granular Filter Material

1. Granular Filter Material shall be placed beneath the Riprap as shown on the drawings.

K. Bedding Fill

1. Bedding Fill shall be placed within the limits of the valley leach facility as shown on the DRAWINGS.
2. **CONTRACTOR** shall place and compact the Bedding Fill in loose lifts such that the compacted lift thickness is a minimum of 12-inches. **CONTRACTOR** shall condition the Bedding Fill to allow a surface that does not cause rutting or other deleterious effects. The moisture content and density shall be uniform throughout the lift. If a lift of compacted Bedding Fill dries out during placement operations, **CONTRACTOR** shall scarify, moisture condition the dry soil and recompact the lift. If a lift of

compacted Bedding Fill becomes overly wet due to precipitation or over watering, **CONTRACTOR** shall allow the wet soil to dry to the specified moisture content range before recompaction of fill and placement of geosynthetic materials.

3. **CONTRACTOR** shall assist CQA Monitor in obtaining soil samples for CQA testing. Bedding Fill sampling shall be scheduled by CQA Monitor with **CONTRACTOR** to facilitate CQA field testing.
4. **CONTRACTOR** shall trim the surface of the Bedding Fill to the design grades shown on the DRAWINGS.
5. **CONTRACTOR** shall roll the surface of the Bedding Fill with a smooth drum roller to remove ridges and surface irregularities greater than 0.5 inches in height. **CERTIFYING ENGINEER** shall determine if surface preparation is sufficient to place geomembrane. On areas with slopes steeper than 3H:1V, **CONTRACTOR** shall adopt methods as necessary to obtain the same final surface preparations that would be obtained by the passage of a smooth-drum roller on flat or level ground. Pushing of compaction equipment by tracked equipment shall not be performed. Wheel ruts on the surface of the Bedding Fill from grading equipment shall be repaired by **CONTRACTOR** prior to placement of the geomembrane by rolling the surface as approved by CQA Monitor. **CONTRACTOR** shall take whatever steps necessary to prepare Soil Liner Fill surface to the satisfaction of **MANAGER** and **CERTIFYING ENGINEER**, at no additional cost to **CC&V**.
6. **CONTRACTOR** shall maintain the Bedding Fill surface in a condition suitable for geomembrane installation as specified in these SPECIFICATIONS and in the CQA Plan until the surface is covered. **CONTRACTOR** shall repair all weather related damage to Bedding Fill surfaces or other portions of the Work that have or have not been covered by geomembrane, at no additional cost to **CC&V**.

   If any moisture is allowed to collect under the geomembrane prior to or after final seaming and softens the Bedding Fill, the geomembrane shall be removed and **CONTRACTOR** shall recondition and recompact the Soil Liner Fill to meet all placement and trimming SPECIFICATIONS, at no additional cost to **CC&V**.
7. **CONTRACTOR** shall remove all hubs and survey stakes in the Bedding Fill and backfill all holes with **MANAGER** and **CERTIFYING ENGINEER** approved material.
8. **CONTRACTOR** shall verify the final thickness of Bedding Fill to determine compliance with this SPECIFICATION. **CONTRACTOR** shall record as part of the as-built documentation the location, elevation, and thickness of each Bedding Fill verification test. CQA Monitor will witness all verification measurements. Areas with deficiencies shall be reworked by **CONTRACTOR**, until acceptable measurements are obtained at no additional cost to **CC&V**. If tests indicate the Work does not meet the requirements of the SPECIFICATIONS, **MANAGER** and **CERTIFYING ENGINEER** will establish the extent of the nonconforming area. The nonconforming area shall be

reworked by **CONTRACTOR** until acceptable test results are obtained at no additional cost to **CC&V**

9. Prior to any geosynthetics being placed on Bedding Fill, the area will be tested by CQA Monitor. No geosynthetics will be allowed to be placed on frozen material, as defined in Section 3.06, without the area in question being retested by the CQA Monitor.

3.7. Equipment

CONTRACTOR may use any type of earthmoving or excavating equipment unless otherwise noted in the SPECIFICATIONS, provided the equipment is in a satisfactory condition, complies with applicable rules and regulations, is of such capacity that the construction schedule can be maintained as planned by **CONTRACTOR**, and is approved by **MANAGER.**

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –UNDERGROUND WORKING REMEDIATION		**SPECIFICATION NO.** **02210**

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SECTION 02210.0 UNDERGROUND WORKING REMEDIATION

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes the activities associated with the remediation of the underground workings located within the limits of the valley leach facility.

1.2. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks
- Section 03300.0 - Cast In Place Concrete
- Section 03310.0 - Cemented Rockfill

1.3. Quality Assurance

A. All work shall be monitored and tested in compliance with the requirements of the SPECIFICATIONS.

B. All CQA soils testing (both field and laboratory testing) will be the responsibility of CQA Monitor, as identified in the Earthworks CQA plan. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities. Quality Control testing shall be the responsibility of the **CONTRACTOR**.

C. All excavation, backfill, and grading operations shall be carried out under the observation of MANAGER and CERTIFYING ENGINEER.

D. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance isgranted shall be corrected by **CONTRACTOR**, at its sole cost.

1.4. Submittals

A. **CONTRACTOR** shall provide method of Coarse Shaft Backfill and Select Structural Fill placement.

B. **CONTRACTOR** shall provide method of compacting Native material, Coarse Shaft Backfill, and Select Structural Fill, to meet the compaction requirements identified in Sections 3.02 and 3.03.

C. **CONTRACTOR** shall provide blasting design for approval by **MANAGER**.

2. PART 2: PRODUCTS

2.1. Materials

A. Fill materials will consist of Structural Fill, Select Structural Fill, and Coarse Shaft Backfill identified in Section 2200.0, Cast-In-Place Concrete identified in Section 3300.0 and Cemented Rockfill identified in Section 3310.0.

3. PART 3: EXECUTION

3.1. Excavation

A. The **CONTRACTOR** will be responsible for the safety of temporary construction slopes. **CONTRACTOR** shall inspect all temporary and permanent open-cut excavations on a regular basis for signs of instability. Should signs of instability be noted, **CONTRACTOR** shall immediately undertake remedial measures and shall notify **MANAGER** immediately. Permanent cut slopes shall be left in smooth, safe, and stable condition at the end of the workday.

B. **CONTRACTOR** shall conduct all excavation and shoring operations in compliance with applicableColorado State and Federal government laws and regulations.

3.2. Fill Placement

A. Structural Fill

1. **CONTRACTOR** shall condition, place and compact Structural Fill by a method compaction technique, as discussed in Section 2200.0.

   Maximum rock size for rock fill shall be two-thirds of the compacted lift thickness, unless otherwise approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**. **CONTRACTOR** shall remove oversize materials from fills at no additional cost to **CC&V**.

B. Select Structural Fill

2. **CONTRACTOR** shall condition and compact the Select Structural Fill using a method specification on 3-foot thick lifts that result in a firm surface that will be approved by the **CERTIFYING ENGINEER**.

C. Coarse Shaft Backfill

1. Coarse Shaft Backfill shall be placed in the underground workings as part of remediation, as shown in the DRAWINGS.
2. **CONTRACTOR** shall compact and condition the final surface of the Coarse Shaft Backfill using a method specification that results in a firm surface that will be approved by **CERTIFYING ENGINEER.**

3.3. Native Material

For the remediation of shafts greater than 25 feet, which are currently backfilled with native material, **CONTRACTOR** shall excavate the current native backfill to a depth of 25 feet below Soil Liner Fill subgrade elevation. The surface of the native material at this elevation will then be compacted using a method specification that results in a firm surface that will be approved by **CERTIFYING ENGINEER. CONTRACTOR** shall then remediate the underground working using Coarse Shaft Backfill, Cement Plug, and Cemented Rockfill as shown on the DRAWINGS.

3.4. Blasting

The **CONTRACTOR** shall compact the surface of the area that has been blasted. If the blasted surface is below the Soil Liner subgrade elevation, the **CONTRACTOR** shall compact the blasted surface using a method specification approved by the **CERTIFYING ENGINEER**, and then remediate according to the DRAWINGS to achieve the design grades and elevations. If the blasted surface is above the Soil Liner subgrade elevation, the **CERTIFYING ENGINEER** assess the foundation conditions and recommend whether the **CONTRACTOR** shall over excavate and backfill with Cemented Rockfill and Structural Fill, or if the **CONTRACTOR** shall remove excess material and compact the final grade surface using a method specification approved by the **CERTIFYING ENGINEER**.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –RIPRAP		**SPECIFICATION NO.** **02271**

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SECTION 02271.0 RIPRAP

1. PART 1: GENERAL

1.1. Description

All work shall be carried out in compliance with these SPECIFICATIONS and in conformance with the lines, grades, and dimensions as shown on the DRAWINGS.

1.2. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 Earthworks
- Section 03300.0 Cast-in-place Concrete

2. PART 2: SPECIFICATIONS AND INSTALLATION

2.1. Material Specifications

A. Rip rap shall consist of hard, dense, and durable stone, angular in shape, and resistant to weathering. Rounded stone or boulders will not be accepted as riprap material. The stone shall have a specific gravity of at least 2.5. Each piece shall have its greatest dimension not greater than three times its least dimension. If approved by **CERTIFYING ENGINEER**, removed concrete may be used for riprap provided it meets the other requirements of this section.

B. Material used for riprap will be approved by **CERTIFYING ENGINEER** if, by visual inspection, the rock is determined to be sound and durable. **MANAGER** and **CERTIFYING ENGINEER** may require **CONTRACTOR** to furnish laboratory results to verify that the material meets SPECIFICATIONS. At the request of **MANAGER, CONTRACTOR** shall furnish laboratory test results indicating that the material meets the requirements for strength as indicated in the following table.

Test Description	Test Method	Specification Requirement
Point Load Tensile Strength	ISRM RTH 325-89/ASTM D5731	300 psi (min)

C. Rip rap shall conform to the gradation requirements given in the following table:

Stone Sized [1] (in)	Percent of Material Smaller than Typical Stone[2]	Typical Stone Dimensions[3] (in)
6	70 – 100	12
	50 – 70	9
	35 – 50	6
	2 – 10	2

Stone Size d [1] (in)$_{50}$	Percent of Material Smaller than Typical Stone[2]	Typical Stone Dimensions[3] (in)
15	70 – 100	26
	50 – 70	21
	35 – 50	15
	2 – 10	5

Notes:

1. d_{50} = average stone size
2. based on typical rock weight
3. equivalent spherical diameter
4. 4) based on a specific gravity of 2.5

D. Nominal stone size and total thickness of the riprap shall be as shown on the DRAWINGS.

2.2. Installation

Stones with typical stone dimensions that are equal to d_{50} and larger shall be placed at the top surface with faces and shapes matched to minimize voids and form as smooth a surface as practical. Dumping and backhoe placement alone is not sufficient to ensure a properly interlocked system. The material may be machine- placed to form a substantial bond as approved by **MANAGER** and **CERTIFYING ENGINEER**.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –PIPE BOLLARDS		**SPECIFICATION NO.** **02608**

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SECTION 02608.0 PIPE BOLLARDS

1. PART 1: GENERAL

1.1. Summary

Pipe guards shall consist of steel pipe backfilled with concrete.

1.2. Related Sections

Refer to the following Sections for related work:

- Section 03300.0 - Cast-in-Place Concrete

1.3. Submittals

A. **CONTRACTOR** shall abide by all qualification and submittal requirements in Section 01300.0.

B. CONTRACTOR shall provide product data to allow evaluation by MANAGER and CERTIFYING ENGINEER.

1.4. Tolerances

Pipe bollards shall be constructed and placed as shown on the DRAWINGS.

1.5. Quality Assurance

Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR** as directed by **MANAGER**.

2. PART 2: PRODUCTS

2.1. Materials

A. Cast-in-place concrete used to fill pipe bollards shall be concrete as specified in Section 03300.0.

B. Pipe shall be 36 kips per square inch (ksi) standard steel pipe, with a nominal diameter of 6-inches, and a minimum wall thickness of 0.28-inches.

3. PART 3 SUMMARY

3.1. Execution

A. Install pipe bollards to depths and in locations as shown on DRAWINGS.

B. Backfill pipe bollards with lean concrete to the lines and grades shown on DRAWINGS.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –PIPING		**SPECIFICATION NO.** **02710**

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SECTION 02710.0 PIPING

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks
- Section 02776.0 - Geomembrane
- Section 02777.0 - Geotextile

1.2. Submittals

A. **CONTRACTOR** shall abide by all qualification and submittal requirements.

B. **CONTRACTOR** shall provide product data including MANUFACTURER's technical data (resin), test data (strength), and SPECIFICATIONS sufficient to allow evaluation by **MANAGER** and **CERTIFYING ENGINEER**.

1.3. Quality Assurance

A. All work shall be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.

B. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR** as directed by **MANAGER** at no additional cost to **CC&V**.

2. PART 2: PRODUCTS

2.1. Materials

A. High Volume Solution Collection Pipe:

1. 4-inch "Highway Grade" perforated corrugated polyethylene (CPe) pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

2. 8-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

3. 12-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

4. 15-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.
5. 18-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.
6. 24-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.
7. 28-inch diameter solid SDR 11 HDPE pipe, as manufactured by DRISCOPIPE or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

B. Leak Detection Pipe:

1. 3-inch diameter, "Highway-Grade" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.
2. 3-inch diameter, solid SDR 13.5 HDPE pipe or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

C. Low Volume Solution Collection Pipe:

1. 18-inch diameter solid SDR 11 HDPE pipe or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.
2. 4-inch "Highway Grade" perforated corrugated polyethylene (CPe) pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER.**

D. Underdrain Pipe:

1. 4-inch diameter "N-12" perforated CPe pipe, as manufactured by Advanced Drainage Systems, Inc., or an equivalent approved by **MANAGER**, **DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

3. PART 3: EXECUTION

3.1. Installation

A. **CONTRACTOR** shall install pipe according to MANUFACTURER's recommendations.

B. **CONTRACTOR** shall take all precautions necessary to not damage the pipe during material placement. **CONTRACTOR** may periodically be requested by **MANAGER** to verify that covered pipe has not been crushed. Costs associated with proving pipes have not been crushed shall be borne by **CONTRACTOR**.

C. Piping shall be placed to the lines and elevations shown on the DRAWINGS, with no sags or humps, as approved by **MANAGER** and **CERTIFYING ENGINEER**.

3.2. Pipe Connections

A. All connections for non-perforated pipe shall be watertight under maximum anticipated pressure head.

B. The ends of all pipe shall be capped with a manufactured pipe cap.

C. HDPE pipe will be butt-heat-fusion welded in accordance with the MANUFACTURER's guidelines.

D. CPe pipe joints shall conform to MANUFACTURER's recommendations.

3.3. Bedding and Backfill

A. **CONTRACTOR** shall place and compact Leak Detection Fill in accordance with Item 3.06.E of Section 02200.0.

B. **CONTRACTOR** shall bed and backfill Leak Detection piping with Leak Detection Fill.

C. Low Volume and High Volume Solution Collection pipe shall be placed on top of the geosynthetics, as shown on the DRAWINGS.

D. Placement of Low Volume and High Volume Solution Collection and High Volume Solution Collection pipes shall be coordinated with other operations such as Low Volume Solution Collection Fill, Bedding Fill, Soil Liner, and Drain Cover fill placement. Equipment access directly on geosynthetics is expressly prohibited. Any damage to the geosynthetics caused by **CONTRACTOR** during pipe placement shall be repaired at the expense of **CONTRACTOR**.

E. A minimum of 5 feet of Low Volume Solution Collection Fill and Drain Cover Fill shall be placed over the top of the pipe before crossing with rubber-tired construction equipment. If pipe becomes crushed during or after installation by **CONTRACTOR**'s equipment or methods of construction, the pipe shall be replaced by **CONTRACTOR**, at no additional cost to **CC&V**. The **CONTRACTOR** will be required to demonstrate to **MANAGER** that the equipment and procedures used are not detrimental to the piping, at no additional cost to **CC&V**.

F. **CONTRACTOR** shall hold pipes in place with sand bags, or other methods approved by MANAGER, until the Low Volume Solution Collection Fill and Drain Cover Fill has been placed. Directly before placement of the Low Volume Solution Collection Fill and Drain Cover Fill, the sand bags will be removed.

G. Secondary or tertiary High Volume Solution Collection pipes will be attached to the primary pipes with plastic ties or other method approved by **MANAGER** and **CERTIFYING ENGINEER**.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –CORRUGATED STEEL PIPE		**SPECIFICATION NO.** **02711**

REV	DATE	PAGES	APPROVALS			REMARKS
			AUTHOR	REVIEW	CLIENT	
1	04/07/2016	2	JNM	RMS		Issued for Client Review
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SECTION 02711.0 CORRUGATED STEEL PIPE

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks
- Section 02271.0 - Rip Rap
- Section 03300.0 - Cast-in-Place Concrete

1.2. Submittals

A. **CONTRACTOR** shall abide by all qualification and submittal requirements.

B. **CONTRACTOR** shall provide product data including Manufacturer's technical data and specifications sufficient to allow evaluation by **MANAGER**.

1.3. Tolerances

Corrugated Steel Pipe (CSP) shall be placed to the lines and elevations shown on the DRAWINGS, with no sags or humps exceeding 5 percent slope change as approved by **MANAGER**.

1.4. Quality Assurance

A. All work shall be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.

B. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance isgranted shall be corrected by **CONTRACTOR,** at no additional cost to **CC&V**.

2. PART 2: PRODUCTS

2.1. Materials

A. Corrugated Steel Pipe:

1. All CSP 48 inches in diameter and smaller shall be 16 gage galvanized, and all CSP larger than 48 inches in diameter shall be 12 gage galvanized, or equivalent, as approved by **MANAGER** and **CERTIFYING ENGINEER**

2. Galvanized sheet for the manufacture of the CSP shall be produced in accordance with ASTM A444 or AASHTO M-218 with a coating weight of 2.00 ounces per square foot of sheet (total both sides).

2.2. Installation

A. Install according to manufacturer's recommendations.

B. Pipe shall be unloaded and handled with reasonable care to prevent damage.

C. Circumferential seams shall be installed with their inside circumferential sheet laps pointing downstream.

D. The completed trench bottom shall be firm for its full length and width or as approved by CERTIFYING ENGINEER.

2.3. Field Connections

A. All connections for CSP shall be corrugated bands or other equally effective types of field joints as approved by the **CERTIFYING ENGINEER**.

2.4. Bedding And Backfill

A. Backfill and compact Pipe Bedding Material in accordance with Section 02200.0.

2.5. Thrust Blocks

Thrust blocks shall be lean concrete without reinforcement placed as shown on the DRAWINGS.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –GEOMEMBRANE		**SPECIFICATION NO.** **02776-0**

REV	DATE	PAGES	APPROVALS			REMARKS
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SECTION 02776.0 GEOMEMBRANE

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes requirements for the manufacture, fabrication (if needed), supply, and installation of polyethylene geomembrane for lining of the valley leach facility, as shown on the DRAWINGS; and construction quality control monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the SPECIFICATIONS, Construction Quality Assurance Plan, and the DRAWINGS.

1.2. Submittals

A. **CONTRACTOR** shall provide the following information relating to the geomembrane MANUFACTURER and **INSTALLER** with its proposal.

1. Information from the MANUFACTURER including company name, address, telephone number, the names of the company president and quality control manager, and narrative of the company history.
2. Information from the MANUFACTURER on factory size, equipment, personnel, number of shifts per day, and capacity per shift.
3. Quality Control Manuals from the MANUFACTURER and **INSTALLER** for the installation and testing of the geomembrane, including trial seams, seaming, nondestructive testing, destructive testing procedures, repair procedures and in-field quality control forms. Upon review of the Quality Control Manuals, **MANAGER** may request additional testing during the manufacturing process at no additional cost to **CC&V**.
4. A list of at least five completed facilities from the MANUFACTURER totaling a minimum of 5 million (5,000,000) square feet between all five facilities of the type of geomembrane that is being installed at the Cresson Project. Each entry in this list should specify the name and purpose of the facility, its location and date of installation, the name of the owner, the project manager, designer, fabricator (if any), and the geosynthetics installation contractor and the name and telephone number of the contact at the facility who can discuss the project. In addition, the geomembrane thickness and total square footage of the installation surface should be included.
5. Installation capabilities of the **INSTALLER**.
6. Information on equipment and personnel from the **INSTALLER**.
7. A list of at least five completed facilities, totaling five million (5,000,000) square feet for which **INSTALLER** has installed the type of geomembrane that is being installed at the Squaw Gulch VLF Project. For each installation, the following information shall be provided:

    a. Name and purpose of facility, its location, and date of installation.

b. Name of owner, Design Engineer, MANUFACTURER, Fabricator, if applicable, and name and telephone number of contact at the facility who can discuss the project. Thickness of geomembrane and surface area of the installed geomembrane.

c. Type of seaming, patching, and tacking equipment.

d. A copy of the MANUFACTURER's and/or Fabricator's approval letter(s) and/or license(s), if applicable.

B. **CONTRACTOR** shall provide the following information after contract award but within ten (10) days prior to geomembrane arrival on-site and prior to commencement of the Work:

1. A copy of each of the Quality Control Certificates on each lot of resin issued by the resin Supplier for the specific material for this project including certification of the resin for extrusion welding.
2. The results of Quality Control testing conducted by the MANUFACTURER on the resin used in manufacturing the specific material for this project.
3. A listing that correlates the resin to the individual geomembrane rolls and welding rods.
4. A copy of the geomembrane roll Quality Control Certificates. These certificates shall be supplied at a minimum frequency of one (1) per every fifty thousand (50,000) square feet of geomembrane material produced. These certificates shall be issued only for the individual geomembrane rolls sampled and tested by the MANUFACTURER or its representative. The certificates will contain test results of properties outlined in Article 2.01 of this Section. **MANAGER** reserves the right to refuse use of any geomembrane supplied without the proper quality control documentation at no cost to **CC&V**.
5. A detailed list of performance criteria for the geomembrane material being produced for this project. (Note: Performance criteria are sometimes referred to as "minimum property values." Refer to Articles 2.01 and 2.02 of this Section for geomembrane properties and Test Methods.)
6. Resume from the INSTALLER of the Installation Superintendent, Master Seamer, and Quality Control Inspector to be assigned to the work, including dates and duration of employment.
7. Certification from the INSTALLER that both the Installation Supervisor, Quality Control Inspector, and Master Seamer have reviewed the SPECIFICATIONS, Construction Quality Assurance Plan, and the DRAWINGS.
8. A panel layout drawing showing the proposed installation layout identifying field seams and including areas such as sumps, trenches and pipe penetrations as well as any variance or additional details that deviate from the DRAWINGS. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc. Any proposed variance or deviation from these documents shall be submitted to **MANAGER** in writing a minimum of seven (7) Working days prior to the scheduled

start of geomembrane installation and will be accepted/rejected by **CERTIFYING ENGINEER** prior to start of installation.

9. A list of personnel performing field-seaming operations along with pertinent experience information.
10. All geosynthetic Quality Control Certificates required by these SPECIFICATIONS. Certification that extrudate to be used is composed of the same resin as the geomembrane to be used.

C. Submittals by **CONTRACTOR** to **MANAGER** during the course of the work.

1. Daily reports detailing arrival and departure times, the personnel present on-site, the progress of the Work, the arrival of materials, daily square footage deployed and seamed, daily square footage of geomembrane approved by the CQA Monitor and any problems encountered.
2. Subgrade surface acceptance certificates for each area to be covered by the lining system, signed by **CONTRACTOR**.

D. Without limiting the provisions of the Contract, the **CONTRACTOR** shall warrant the Work to **MANAGER** in accordance with the following:

1. The geomembrane supplied is suitable for the environmental conditions at the site and the service conditions as described in this SPECIFICATION.
2. The geomembrane supplied meets or exceeds all published SPECIFICATIONS as referenced by the SPECIFICATION.
3. The geomembrane are free of defects in materials and workmanship.
4. The **CONTRACTOR** shall repair or replace all defects in the material detected on-site, including uncovering and recovering the work, in compliance with the **SPECIFICATIONS** at no additional cost to **CC&V**.
5. The **CONTRACTOR** shall repair any detected leaks in any seams (Manufactured or field joined), including uncovering and recovering the work, in compliance with the SPECIFICATIONS at no additional cost to **CC&V**.

1.3. Quality Assurance

A. Manufacturing Qualifications

1. The MANUFACTURER(s) shall have experience in the manufacture of the type of geomembrane that is being installed at the Squaw Gulch VLF Project totaling at least five completed facilities totaling a minimum of 5,000,000 square feet between all five facilities.
2. The MANUFACTURER shall provide sufficient production and qualified personnel to meet the demands of the work and shall have an internal quality control program for its product.

3. The MANUFACTURER shall permit **MANAGER**, **DESIGN ENGINEER**, and/or **CERTIFYING ENGINEER** or their authorized representative to visit the manufacturing plant.

B. Geomembrane Installation Qualifications (**INSTALLER**)

1. **INSTALLER** shall be the MANUFACTURER or an approved **CONTRACTOR** trained and licensed to install the MANUFACTURER's geomembrane. Installation shall be performed under the constant direction of single Installation Superintendent who shall remain on-site and be responsible, throughout the geomembrane installation, for geomembrane layout, seaming, patching, testing, repairs, and all other activities by **INSTALLER**.
2. The Installation Superintendent shall have installed or supervised, at a minimum three installation projects that entailed the installation of at least a total of 1,000,000 square feet of the type of geomembrane that is being installed at the Squaw Gulch VLF Project.
3. Actual seaming shall be performed under the direction of a Master Seamer (who may also be the Installation Superintendent) who has seamed a minimum of 1,000,000 square feet of the type of geomembrane that is being installed at the Squaw Gulch VLF Project, using the same type of seaming apparatus specified for the Work.
4. The Installation Superintendent and/or Master Seamer shall be present whenever seaming is performed.

C. Quality Assurance Program

1. All WORK shall be constructed, monitored, and tested in compliance with the requirements of the Construction Quality Assurance Plan (Section 01400.2). **CONTRACTOR** and MANUFACTURER shall participate in and comply with all items in these SPECIFICATIONS and requirements of the CQA plan.
2. **CONTRACTOR** shall ensure that each geomembrane MANUFACTURER that supplies materials to this project has an internal product quality control program that meets SPECIFICATIONS.
3. During manufacturing of the geomembrane, samples of geomembrane shall be removed for laboratory testing to ensure compliance with this SPECIFICATION. Conformance sampling and testing will be performed in accordance with the Construction Quality Assurance Plan.
4. **CONTRACTOR** shall assure that the geomembrane is delivered to the site at least 10 calendar days prior to installation. **CONTRACTOR** will provide required Quality Control information 10 calendar days prior to geosynthetics being delivered to the Squaw Gulch VLF project and on delivery of geosynthetics to the Squaw Gulch VLF project.
5. Geomembrane rolls that do not meet the requirements of this SPECIFICATION will be rejected. **CONTRACTOR** shall replace the rejected material with new material that conforms to the SPECIFICATION requirements, at no additional cost to **CC&V**.

6. **CONTRACTOR** shall ensure that all personnel performing geomembrane-seaming operations are qualified by experience or by successfully passing seaming tests (see Article 3.08(D) of this section). **MANAGER** reserves the right to reject any welding technician whose performance is unsatisfactory.

D. **INSTALLER'S** Superintendent and QC Inspector shall attend the pre-construction meeting.

E. Field Samples

1. Geomembrane sampling and testing shall be conducted in accordance with the project SPECIFICATIONS for the following:
   a. trial seam testing (Article 3.07 of this Section)
   b. destructive seam testing (Article 3.09 of this Section)
2. **CONTRACTOR** shall maintain on-site a minimum of one spare operable tensiometer and provide documentation indicating that all tensiometers used at the project were calibrated within 60 days prior to the tensiometer arriving on-site for testing field samples.

F. In order to prevent wind-damaged geomembranes from being placed, the following Quality Assurance procedures shall be followed:

1. **CONTRACTOR** shall perform its Work and utilize sufficient ballast as necessary to prevent wind uplift of the geomembrane panels.
2. If wind damage should occur, **CERTIFYING ENGINEER** shall determine if the geomembrane shall be repaired or replaced. Wind damage to the geomembrane will include wrinkles, creases, and tears, as determined by **CERTIFYING ENGINEER**.
3. Repair or replacement of the wind-damaged geomembrane shall be completed by **CONTRACTOR** at no additional cost to **CC&V**.
4. As determined by **MANAGER** and **CERTIFYING ENGINEER**, the geomembrane panel may be rejected at no cost to **CC&V**.

1.4. Delivery, Storage, and Handling

A. Packing and Shipping

1. Labels on each roll delivered to Site shall identify the following.
   a. MANUFACTURER's name
   b. Product Identification
   c. Thickness
   d. Roll number
   e. Batch or lot number
   f. Panel number (when applicable)
   g. Roll dimensions

2. **CONTRACTOR** shall ensure that geomembrane rolls are properly loaded and secured to prevent damage during transit.
3. **CONTRACTOR** shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
4. **CONTRACTOR** shall ensure personnel responsible for loading, transport and unloading of geomembrane are fully aware of the consequences of damage to geomembrane, and are familiar with handling and transport constraints imposed by MANUFACTURER

B. Acceptance at Site

1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geomembrane rolls upon delivery.
2. **CONTRACTOR** shall unroll and inspect any geomembrane roll that may be damaged below surface.
3. **CONTRACTOR** shall repair damage resulting from handling and transport of geomembranes at no additional cost to **CC&V**. If irreparable, in the opinion of **CERTIFYING ENGINEER**, damaged materials shall be replaced at no additional cost to **CC&V**.

C. Storage and Protection

1. **MANAGER** will provide area for on-site storage of the geomembrane rolls from time of delivery until installation.
2. The storage and handling of the materials is the responsibility of **CONTRACTOR** from the time the materials are manufactured until the time the completed installation is accepted. **CONTRACTOR** is responsible for preparing the storage location and for the protection of the materials from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After **CONTRACTOR** has removed material from storage, **CONTRACTOR** shall protect geomembrane from puncture, dirt, grease, water, moisture, mud, mechanical abrasion, excessive heat, and other sources of damage.
4. **CONTRACTOR** shall preserve integrity and readability of the geomembrane roll labels, and store the rolls such that **MANAGER** and **CERTIFYING ENGINEER** have access to the package slips or roll labels for each roll to verify roll acceptance.
5. The rolls shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than three rolls high. If the rolls are stacked higher than two rolls high, safety measures shall be put into place to prevent the rolls from shifting and personnel from climbing on the rolls to access the lifting straps.

1.5. Site Conditions

A. Geomembrane Deployment

1. Do not proceed with deployment at an ambient temperature below 14° F or above 100° F unless otherwise authorized, in writing, by **MANAGER**, **DESIGN ENGINEER,** and

CERTIFYING ENGINEER. Temperature monitoring shall be performed by the CQA Monitor.

2. Do not deploy during precipitation, in the presence of excessive moisture (e.g. fog, dew), in an area of ponded water, or in the presence of excessive winds. Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment, unless approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**. .

B. Seaming

1. Normal Weather Conditions

Normal seaming procedures may take place if the following weather conditions exist:

a. Ambient temperature between 35° F and 100° F.

b. Dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.

c. No excessive winds.

2. Adverse Weather Conditions

a. Do not seam if ambient temperature is below 14° F or above 100° F.

b. Do not seam during precipitation, in the presence of excessive moisture (e.g. fog, dew), in an area of ponded water, in the presence of excessive winds.

c. If the ambient air temperature is between 35° F and 14° F for the entire shift, Cold Weather Seaming provisions will govern.

1. The **INSTALLER** will be required to perform a minimum of four trial seams during the planned work shift, at approximately the same time interval throughout the scheduled workday.

2. If the Soil Liner Fill is considered frozen as outlined in Item 3.06 of Section 2200, the **INSTALLER** must place seaming boards or slip sheets when seaming. Seaming boards or slip-sheets shall be removed by **INSTALLER**.

2. PART 2: PRODUCTS

2.1. Materials

A. The geomembrane shall be a polyethylene. The geomembrane shall be manufactured of new, first- quality resin produced in the United States or Canada and shall be manufactured specifically for this type of application.

B. The geomembrane sheet shall be comprised of a minimum ninety-six (96) percent pure polyethylene. The remaining portion shall be made up of materials necessary for the performance of the liner (such as carbon black, anti-oxidants, etc.) The geomembrane rolls shall meet the following SPECIFICATIONS:

1. The surface of the geomembrane shall not have striations, roughness (except texture as specified), pinholes, or bubbles and shall be free of holes, blisters, undispersed raw materials, or any contamination by foreign matter. **MANAGER** and **CERTIFYING ENGINEER** may request additional testing in order to support such acceptance. All such testing shall be done at the sole expense of the **CONTRACTOR**.
2. The geomembrane rolls shall have the following properties:

TYPICAL PROPERTIES-TABLE 2.01

Property	Test Method Smooth/ Textured	Smooth 40 mil LLDPE	Textured 80 mil LLDPE	Smooth 100 mil LLDPE	Textured 100 mil LLDPE
Thickness (mils) 2 Compound Density (g/cc) Carbon Black Dispersion Carbon Black Content (%)	ASTM D 5199/ASTM D5994 ASTM D 792, method B for both ASTM D 5596 for both ASTM D 4218(2)(3) for both	36/40/40 0.939 (max) See Note 7 2-3	68/76/80 0.939 (max) See Note 7 2-3	90/100/100 (min) 0.939 (max) See Note 7 2-3	85/95/100 (min) 0.939 (max) See Note 7 2-3
Tensile Properties 1. Ultimate Tensile Strength (ppi) 2. Ultimate Elongation (%)(2.5" gauge)	 ASTM D 6693 for both ASTM D 6693 for both	 152 (min) 800 (min)	 120 (min) 250 (min)	 380 (min) 800 (min)	 150 (min) 250 (min)
Puncture Resistance (lbs.)	ASTM D 4833 for both	56 (min-ave)	88 (min-ave)	140 (min-ave)	110 (min-ave)
Field Seam Properties3,9 1. Shear Strength (ppi) 2. Peel Strength5 (Inside and outside tracks for fusion welds)	 ASTM D6392 for both ASTM D6392 for both	 60 (min) 44 (min), FTB4,5,6	 120 (min) 88 (min), FTB[4,5,6]	 150 (min) 114 (min), FTB4,5,6	 150 (min) 114 (min), FTB4,5,6

Notes:

1. LLDPE refers to Linear Low Density Polyethylene and VLDPE refers to Very Low Density Polyethylene.
2. First value represents lowest individual value out of 10 measured. Second value represents minimum average roll value. Third value represents nominal roll value.
3. Seam strength refers to both fusion and extruded seams for LLDPE to LLDPE welds.
4. If peel strength exceeds ultimate tensile strength of the sheet but the sample fails FTB, the test will be considered a pass.
5. Federal Test Method Standards.
6. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at the weld interface area (sheet fails before weld).

7 9 in Categories 1 or 2 and 1 in Category 3

8 Test methods and tolerances specified above for conformance testing are defined in GRI Test Method GM17, revision 12, dated November 4, 2015.

9 Test methods and tolerances specified above for field seam properties are defined in GRI Test Method GM19, revision 8, dated February 12, 2015.

2.2. Seaming and Testing Equipment

A. Seaming

1. Approved field seaming processes are hot shoe double fusion welding and extrusion welding, when approved by **CERTIFYING ENGINEER**. Use double fusion welding as primary method of seaming adjacent field panels.
2. **CONTRACTOR** shall maintain on-site a minimum of two spare operable seaming apparatuses.
3. Seaming equipment shall not damage the geomembrane.
4. **CONTRACTOR** may use a hot air device ("Leister") to temporarily bond geomembrane panels that are to be extrusion welded.
5. **CONTRACTOR** shall use extrusion welding apparatus equipped with gauges giving temperature of preheat and extrudate at nozzle of apparatus.
6. Welding rods or beads used for extrusion welding shall have the same physical properties as that used for the resin used in the manufacture of the type of geomembrane that is being installed at the Squaw Gulch VLF Project.
7. **CONTRACTOR** shall use fusion welding apparatus which are self-propelled devices equipped with a gauge indicating temperature of heating element, and a gauge indicating the speed of the welding apparatus.

B. Vacuum Testing (for extrusion seam only) The equipment shall consist of the following:

1. Vacuum box assembly consisting of: rigid housing, transparent viewing window, soft neoprene gasket attached to bottom of housing or porthole and valve assembly, and vacuum gauge.
2. Pump assembly equipped with pressure controller and pipe connections.
3. Rubber pressure/vacuum hose with fittings and connections.
4. Bucket of soapy solution.
5. Wide paint brush, or other means of applying soapy solution.

C. Air Pressure Testing (for double fusion seam only) The equipment shall consist of the following:

1. Air pump (manual or motor driven), equipped with a pressure gauge, capable of generating, sustaining, and measuring pressure between 25 and 30 psi and mounted on a cushion to protect geomembrane.
2. Rubber hose with fittings and connections. Sharp hollow needle, or other approved pressure feed device.
3. An air pressure-monitoring device.

3. PART 3: EXECUTION

3.1. Subgrade

CONTRACTOR, on a daily basis, shall certify in writing that the surface on which the geomembrane will be installed is acceptable. It will be the **CONTRACTOR**'s responsibility to maintain, protect, and if required return, the subgrade in the condition that was originally accepted, prior to geosynthetic deployment until accepted by **CC&V**, under criteria identified in Section 02200 as per the Bedding Fill and Soil Liner Fill SPECIFICATIONS.

3.2. Acceptance

CONTRACTOR shall retain all ownership and responsibility for the geomembrane until final acceptance. The geomembrane shall be accepted by **CC&V** when all of the following conditions are met:

1. Installation is finished.
2. Verification of the adequacy of all seams and repairs, including associated testing, is complete.
3. Certification, including QC documentation is provided by CONTRACTOR to MANAGER.
4. Recommended acceptance by **MANAGER** and **CERTIFYING ENGINEER**.
5. The entire PROJECT, including Drain Cover Fill placement and Diversion Channel construction is completed.

3.3. Anchor Trench

A. The anchor trenches shall be excavated to the lines, grade, and width shown on the DRAWINGS, prior to geosynthetic placement. **CERTIFYING ENGINEER** shall verify that the anchor trench has been constructed according to the DRAWINGS.

Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane.

B. The anchor trench shall be backfilled and compacted as approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**. Trench backfill material shall be placed in eight

(8) to twelve (12) inch thick loose lifts and compacted by wheel rolling with light, rubber-tired, or other light compaction equipment, as approved by **CERTIFYING ENGINEER**.

Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. At no time shall construction equipment come into direct contact with the geomembrane. If damage occurs, it shall be repaired by **CONTRACTOR** prior to the completion of backfilling, at no cost to **CC&V**. Extend geomembrane into the anchor

trench as shown in the DRAWINGS. The geomembrane shall be seamed along the entire distance of the anchor trench to the termination of the geomembrane sheet.

3.4. Protection

CONTRACTOR shall be responsible for the following:

A. Do not use equipment or tools, which damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons, or other means.

B. Ensure prepared surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable until acceptance by **CC&V**, as detailed in Section 3.02.

C. Keep geotextile elements immediately underlying the geomembrane clean and free of debris.

D. Do not permit personnel to smoke or wear damaging shoes while working on geomembrane.

E. Unroll panels in a manner, which prevents scratches or crimps in geomembrane and does not damage supporting Soil Liner Fill.

F. Place panels in a manner that prevents wrinkles (especially differential wrinkles between adjacent panels).

G. Prevent wind uplift and damage to geomembrane subgrade by providing temporary and permanent loading and/or anchoring that will not damage geomembrane.

H. Minimize direct contact of equipment and personnel with geomembrane.

I. Protect geomembrane in areas where excessive traffic is expected with geotextiles, extra geomembrane, or other materials acceptable to **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**.

3.5. Field Panel Deployment

A. **CONTRACTOR** shall install field panels at locations indicated on **CONTRACTOR**'s layout plan, as approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**.

B. **CONTRACTOR** shall replace damaged (i.e., torn, twisted, or crimped) field panels, or portions thereof, at no cost to **CC&V**. **CONTRACTOR** shall repair less serious damage according to Article 3.10 of this Section, at no cost to **CC&V**. **CERTIFYING ENGINEER** shall determine if material is to be repaired or replaced.

C. **CONTRACTOR** shall remove damaged panels, portions of damaged panels, and other geomembrane scrap.

D. **CONTRACTOR** shall not deploy more geomembrane field panels in one day than can be seamed during the day of deployment.

E. Geomembrane deployment shall proceed between ambient temperatures of fourteen degrees (14° F) Fahrenheit to one-hundred degrees (100o) Fahrenheit. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the CQA Monitor.

F. Following the installation of the geomembrane, an examination of the entire surface shall be conducted to detect potentially harmful rocks or other objects. Any such objects will be removed and the geomembrane repaired by the **CONTRACTOR**, at no cost to **CC&V**.

3.6. Factory Seams

MANAGER and **CERTIFYING ENGINEER** may require **CONTRACTOR** to test up to as much as twenty percent (20%) of factory fusion welds (non-destructive air pressure test) in the field to verify factory test results. Additional testing at **CONTRACTOR**'s expense will be required if failed tests are obtained in the field.

3.7. Field Seams

A. Seam Layout

1. Seams shall be oriented parallel to the line of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.
2. No horizontal or base T-seam or tie-in seams shall be closer than five (5) feet from the toe of the slope. Seams shall be aligned to prevent wrinkles and "fish mouths." If a fish mouth or wrinkle is found, it shall be relieved and capped.
3. Panels of geomembrane will have sufficient overlap provided to allow peel tests to be performed on the seam.

B. Seaming Method

1. The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.
2. **CONTRACTOR** shall use double fusion welding as primary method of seaming adjacent field panels.
    a. For cross seam tees associated with fusion welding, **CONTRACTOR** shall patch panel intersections consisting of three or more panels and extrusion weld to a minimum distance of 4

inches on each side of patch. The edge of the sheet shall be ground to a 45° angle prior to welding.

b. Place a protective layer, e.g., insulting plate or fabric, beneath hot welding apparatus after usage.

c. When subgrade conditions dictate, use a moveable protective layer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers.

3. Remove seaming sheets and excess geomembrane trimmed to provide required overlap. Use conventional extrusion welding as a secondary method for seaming between adjacent panels and as a primary method of welding for detail and repair work.

a. Purge heat-degraded extrudate from barrel of extruder under the following conditions:

1. Prior to beginning a seam.

2. Whenever extruder has been inactive.

b. Place a smooth insulating plate or fabric beneath hot welding apparatus after usage.

c. Use clean and dry welding rods or extrudate pellets.

d. Complete grinding process without damaging geomembrane according to MANUFACTURER's instructions no more than one (1) hour prior to seaming operations.

e. Prevent exposed grinding marks adjacent to an extrusion weld. Do not extend exposed grinding marks more than one-quarter (1/4) inch from seam area. **CERTIFYING ENGINEER** may request that any and all abraded areas be covered with extrudate.

f. Extrusion weld all cross seam tees to a minimum distance of four (4) inches on each side of the tee.

g. For extrusion welds, the edge of the top sheet shall be beveled by grinding the edge of the sheet to approximately a 45-degree angle. Extrusion welds cannot be placed on previous extrusion welds.

C. Seaming Procedures

1. General Seaming Procedures

a. Areas to be seamed shall be cleaned and free of moisture, debris, or any marking on the geomembrane.

b. Use a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support if required.

c. Cut fish mouths or wrinkles at the seam overlap along the ridge of the wrinkle in order to achieve a flat overlap. The cut fish mouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.

d. Extend seaming to the outside edge of panels placed in the anchor trench.

D. Do not field seam without the Seaming Supervisor present.

E. Field Trial Seams

1. Trial seams shall be conducted at the beginning of each seaming period and within 30 minutes of commencement of seaming, at the **CERTIFYING ENGINEER**'s discretion, and immediately following any work stoppage (i.e., lunch, weather conditions, etc.) of 30 minutes or more for each seaming apparatus used that day. Each Seamer shall make at least one trial seam each day.

2. Testing shall include visual observation of a trial seam on the geomembrane material. The **INSTALLER** will mark the trial seam with date, ambient air temperature, welding machine number, welding technician identification, and machine temperature and speed. For extrusion welding, the **INSTALLER** will include the nozzle and extrusion settings and welding technician identification.

3. All trial seams shall be made at a location selected by the **CERTIFYING ENGINEER** in the area of the seaming and in contact with the subgrade. The trial seam samples shall be ten (10) feet long for fusion seaming and five (5) feet long for extrusion seaming, with the seam centered lengthwise. Specimens one (1) inch wide shall be cut from opposite ends of the test seam by **CONTRACTOR**. **CONTRACTOR** shall use a tensiometer to test these specimens for shear and peel. Both inside and outside tracks of fusion welds will be tested for peel. For both fusion and extrusion welds, two (2) coupons will be tested for peel and one (1) coupon for shear. The tensiometer shall have a grip separation of four (4) inches plus the width of the seam. The seam is to be centered between the clamps. The grip separation rates for LLDPE are twenty (20) inches per minute for shear and twenty (20) inches per minute for peel. These tests shall not fail according to the criteria in Section 2.01. A break through the weld or at the weld/sheet interface shall be considered a

failure in both shear and peel strength tests unless the weld strength exceeds the sheet strength, as discussed in Section 2.01. If a trial seam fails to meet field seam SPECIFICATIONS, the seaming apparatus and/or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full trial seams are achieved.

4. **CONTRACTOR** shall mark the test weld with date, ambient temperature, welding machine number, welding technician identification, machine temperature, and speed. For extrusion welding, **CONTRACTOR** shall record the nozzle and extrusion settings.

3.8. Nondestructive Testing

A. **CONTRACTOR** shall non-destructively test all field seams over their full length. All test equipment shall be furnished by **CONTRACTOR**.

B. The following vacuum box procedures are applicable to extrusion seaming and shall be followed by **CONTRACTOR**:

1. Excess sheet overlap shall be trimmed away.
2. Clean the vacuum box window, gasket surfaces and check for leaks.
3. Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
4. Wet a strip of geomembrane the approximate dimensions of the vacuum box with the soapy solution.
5. Place the box over the wetted area and compress.
6. Close the bleed valve and open the vacuum valve.
7. Ensure that a leak-tight seal is created.
8. For a period of not less than ten (10) seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
9. If no bubbles appear after ten (10) seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum three (3) inches overlap and repeat the process.
10. All areas where soap bubbles appear shall be marked and repaired and then retested.
11. Test locations, documentation number, date and tester will be indicated with an indelible marker on the geomembrane for each repair or seam section. The color code for indelible markers is to be determined at the pre-construction meetings, and strictly adhered to.

C. The following nondestructive test procedures are applicable to fusion seaming and shall be followed by **CONTRACTOR**.

1. Seal one end of the seam to be tested.
2. Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.
3. Energize the air pump to verify the unobstructed passage of air through the channel.
4. Seal the other end of the channel.
5. Energize the air pump to the pressure of approximately 30 psi, close valve, and sustain pressure for approximately 5 minutes.
6. If loss of pressure exceeds 3 psi, or pressure does not stabilize, locate faulty area, repair, and retest.
7. Remove needle or other approved pressure feed device.
8. Repair pressure test locations as described in Section 3.11.
9. Beginning and ending pressures and times, test locations, documentation number, date, and tester will be indicated with an indelible marker on the liner at each test interval location.

D. The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by **CERTIFYING ENGINEER**:

1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by CQA Monitor for uniformity and completeness.

E. In the event that seam continuity cannot be demonstrated for a non-destructive test of a fusion seam as outlined above, the **CONTRACTOR** shall perform the non-destructive testing over smaller areas as a means of defining the questionable area. The identified questionable area shall be capped.

3.9. Destructive Testing

A. **CONTRACTOR** shall test a minimum of one destructive test sample per five hundred (500) feet of seam length from a location specified by **CERTIFYING ENGINEER**. **CONTRACTOR** shall not be informed in advance of the sample location. The samples shall be taken centered over the seam and prioritized as follows:

1. A minimum of one sample per day;

2. All areas identified as suspect during seaming, non-destructive testing/monitoring, and in unusual working conditions.
3. A minimum of one sample for each geomembrane seamer.
4. A minimum of one sample every five hundred (500) feet of seaming.

B. Samples shall be cut by **CONTRACTOR** as the seaming progresses. Sampling locations shall be determined by **CERTIFYING ENGINEER**. CQA Monitor must witness the obtainment of all destructive test samples by **CONTRACTOR**. **CONTRACTOR** shall mark all samples with their seam number, date, welding machine number, welding technician identification, extruder and nozzle/wedge temperature, and ambient air temperature. **CONTRACTOR** shall document the date, time, roll and seam number, ambient temperature, and pass or fail description. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired. All patches shall be vacuum tested.

C. The samples shall be a minimum twelve (12) inches wide by twenty-four (24) inches long with the seam centered lengthwise. The sample shall be cut into two equal length pieces, half to be given to **CC&V** and the other half kept by **CONTRACTOR**.

D. **CONTRACTOR** shall cut and test ten (10) one (1) inch wide specimens from his sample. All testing shall be conducted at room temperature (60° F - 80° F) **CONTRACTOR** shall test five

(5) specimens for seam shear strength and five (5) for peel strength. Both inside and outside tracks of fusion seams will be tested for peel strength. To be acceptable, four (4) out of the five

(5) specimens must pass according to criteria established in Article 2.01. Any specimen that fails through the weld or at the weld/sheet interface shall be considered a failure, unless the weld strength exceeds the sheet strength, as discussed in Section 2776, Item 2.01. The tensiometer shall have a grip separation of four (4) inches plus the width of the seam. The seam is to be centered between the clamps. The grip separation rates for LLDPE are twenty (20) inches per minute for shear and twenty (20) inches per minute for peel. These tests shall not fail according to the criteria in Article 2.01.

E. CQA Monitor must witness the testing of all destructive samples. Destructive tests will be performed within two (2) days of the samples being obtained. Failing tests shall be subjected to additional testing until a passing area is found. A passing area is defined as a seam(s) bounded at each end by a passing destructive test. Seams will be tracked in each direction until a passing destructive test is found or until a previous passing destructive test is reached. Seams will be tracked according to the welding apparatus and the machine

operator. The following procedures shall apply whenever a sample fails the field destructive test:

1. **CONTRACTOR** can retrace the welding path to an intermediate location (at a minimum of ten (10) feet from the location of the failed test in both directions), at **CERTIFYING ENGINEER** discretion, and take a small sample for an additional field test. If this test passes, then the seam shall be capped between the two passing locations. If the test fails, in either direction, the tracking process shall continue until a passing area is found.
2. Over the length of seam failure, **CONTRACTOR** shall either cut out the old seam, reposition the panel and reseam, or cap the failing area, as required by **CERTIFYING ENGINEER**.
3. If the area is reseamed, additional destructive field test(s) shall be taken within the reseamed area. The reseamed sample shall be found acceptable if test results are approved by **CERTIFYING ENGINEER**. If test results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory by **MANAGER** and **CERTIFYING ENGINEER**.
4. Samples taken as the result of failed tests do not count toward the total number of destructive tests required.

F. **CONTRACTOR** shall document all actions taken in conjunction with destructive test failures, with **CERTIFYING ENGINEER** providing Quality Assurance documentation.

G. Failing seam lengths which were capped shall be non-destructively tested as described in Section 3.08.

3.10. Defects and Repairs

A. All seams and non-seam areas of the geomembrane shall be observed by CQA Monitor for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of observation. The geomembrane surface shall be brushed, blown, or washed by **CONTRACTOR** if the amount of dust or mud inhibits inspection. **MANAGER** and **CERTIFYING ENGINEER** shall determine if cleaning of the geomembrane is needed to facilitate observation at no additional cost to **CC&V**.

B. Each suspect location in seam and non-seam areas shall be non-destructively tested as determined appropriate by CQA Monitor, in the presence of CQA Monitor. Each location that fails the non- destructive testing shall be marked by **CONTRACTOR**, and repaired accordingly.

C. Repair Procedures

1. Defective seams shall be reconstructed as described in these SPECIFICATIONS.
2. Small holes shall be repaired by abrading the sheet surface and welding an extrusion bead. If the hole is larger than one-quarter (1/4) inch in diameter it shall be patched. Tears shall be repaired by patching. Where the tear is on a slope or an area of stress and has a sharp end it must be rounded prior to patching.
3. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
4. Surface of geomembrane that are to be patched shall be abraded and cleaned no more than fifteen (15) minutes prior to the repair. No more than 10% of the thickness shall be removed.

D. Patches shall be round or oval in shape, and extend a minimum of six (6) inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled to an approximately 45-degree angle with an angle grinder prior to placement of the patch. Patches shall be applied using approved methods only.

E. The extrusion welding process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least two (2) inches. Reseaming over an existing seam without regrinding shall not be permitted.

F. Each repair shall be non-destructively tested, except when **CERTIFYING ENGINEER** requires a destructive seam sample obtained from a repaired seam. Repairs that pass the destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

Recording the Results: Daily documentation of all non-destructive and destructive testing shall be provided to **MANAGER** by CQA Monitor. This documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested.

3.11. Conformance Testing

A. During manufacturing of the geomembrane, CQA Monitor will be present to obtain and forward samples to the Quality Assurance Testing Laboratory for testing to ensure conformance with the SPECIFICATIONS.

B. Samples will be taken across the entire width of the roll and shall not include the first three (3) feet. Unless otherwise stated, samples will be three (3) feet long by the width of the roll. CQA Monitor will mark the machine direction on the samples

with an arrow. Unless otherwise stated, samples shall be taken at a frequency of no less than one per one hundred fifty thousand (150,000) square feet. As a minimum, the following tests will be performed to verify conformance to the design SPECIFICATIONS with minimum values specified in Section 2776, Article 2.01.:

PROPERTY	TEST METHOD
Thickness (mils) Smooth/Textured	ASTM D5199/D5994
Compound Density (g/cc)	ASTM D792 (B)
Tensile Strength (both yield and ultimate strength and elongation, as specified)	ASTM D6693
Carbon Black Content (%)	ASTM D4218(2)(3)

3.12. Placement of Soil or Granular Materials

All soil materials located on top of a geomembrane shall be placed in such a manner as to ensure:

A. The geomembrane and any underlying geotextile are not damaged.

B. Minimal slippage of the geomembrane on underlying layer occurs.

C. Minimal movement and wrinkling or folding of the underlying geosynthetics layer(s) occurs.

D. No excess tensile stresses shall occur in the geomembrane, such as by earth moving equipment making sudden starts, stops, turns. The allowable ground pressure for equipment shall be prescribed by **DESIGN ENGINEER** for the material type and layer thickness as identified in Item 3.06 of Section 2200.

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SECTION 02776.1 GEOGRID

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes requirements for the manufacture, fabrication (if needed), supply, and installation of geogrid over potential mine workings, as shown on the DRAWINGS; and construction quality control monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the SPECIFICATIONS, Construction Quality Assurance Plan, and the DRAWINGS.

1.2. References

A. ASTM D1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.

B. ASTM D4218 - Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle- Furnace Technique.

C. ASTM D4355 - Test Method for Deterioration of Geotextile by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.

D. ASTM D5262 - Test Method for Evaluating Creep and Creep Rupture Behavior of Geosynthetics.

E. ASTM D5732 - Test Method for Stiffness of Non-Woven Fabrics Using the Cantilever Test.

F. ASTM D6637- Test Method for Determining Tensile Properties of Geogrids by the Single or Multi- Rib Tensile Method.

G. ASTM D7737- Standard Test Method of Individual Geogrid Junction Strength

H. ASTM D7748- Standard Test Method for Flexural Rigidity of Geogrids, Geotextiles, and Related Products

I. GRI - Test Method GG2 - Geogrid Junction Strength.

J. GRI - Test Method GG4- Determination of the Long-Term Design Strengths of Geogrids.

K. EPA 9090 - Test Method for Determining the Chemical Waste Compatibility of Synthetic Liners.

1.3. Submittals

CONTRACTOR shall provide the following information relating to the geogrid MANUFACTURER and **INSTALLER** prior to commencement of the **WORK**:

A. Information from the MANUFACTURER including company name, address, telephone number, and the names of the company president and quality control manager.

B. Quality Control Manuals from the MANUFACTURER for the installation and testing of the geogrid.

C. Quality Control Certificates from the MANUFACTURER.

1.4. Quality Assurance

A. All work shall be constructed, monitored, and tested in compliance with the requirements of the Construction Quality Assurance Plan (Section01400.2). **CONTRACTOR** and MANUFACTURER shall participate in and comply with all items in these SPECIFICATIONS and requirements of the CQA plan.

B. **CONTRACTOR** shall ensure that each geogrid MANUFACTURER that supplies materials to this project has an internal product quality control program that meets SPECIFICATIONS.

C. Geogrid rolls that do not meet the requirements of this SPECIFICATION will be rejected. **CONTRACTOR** shall replace the rejected material with new material that conforms to the SPECIFICATION requirements, at no additional cost to **CC&V**.

1.5. Delivery, Storage, and Handling

A. Packing and Shipping

1. Labels on each roll delivered to Site shall identify the following.
    a. MANUFACTURER's name
    b. Product Identification
    c. Thickness
    d. Roll number
    e. Batch or lot number
    f. Roll dimensions
2. **CONTRACTOR** shall ensure that geogrid rolls are properly loaded and secured to prevent damage during transit.
3. **CONTRACTOR** shall protect geogrid from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
4. **CONTRACTOR** shall ensure personnel responsible for loading, transport, and unloading of geogrid are fully aware of the consequences of damage to geogrid, and are familiar with handling and transport constraints imposed by MANUFACTURER.
5. Geogrid delivered to the project shall be protected by a relatively impermeable and opaque protective cover, with individual straps for unloading.

B. Acceptance at Site

1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geogrid rolls upon delivery.
2. **CONTRACTOR** shall unroll and inspect any geogrid roll that may be damaged below surface.
3. **CONTRACTOR** shall repair damage resulting from handling and transport of geogrid at no additional cost to **CC&V**. If irreparable, in the opinion of **CERTIFYING ENGINEER**, damaged materials shall be replaced at no additional cost to **CC&V**.

C. Storage and Protection

1. **MANAGER** will provide area for on-site storage of the geogrid rolls from time of delivery until installation.
2. The storage and handling of the materials is the responsibility of **CONTRACTOR** from the time the materials are manufactured until the time the completed installation is accepted. **CONTRACTOR** is responsible for preparing the storage location and for the protection of the materials from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After **CONTRACTOR** has removed material from storage, **CONTRACTOR** shall protect geogrid from puncture, dirt, grease, water, moisture, mud, mechanical abrasion, excessive heat, and other sources of damage.
4. **CONTRACTOR** shall preserve integrity and readability of the geogrid roll labels, and store the rolls such that **MANAGER** and **CERTIFYING ENGINEER** have access to the package slips or roll labels for each roll to verify roll acceptance.
5. The rolls shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than two rolls high.

2. PART 2: PRODUCTS

2.1. Materials

A. Geogrid shall be Tensar UX1800 HS or equivalent and shall have the following properties:

TABLE 2.01 - TYPICAL GEOGRID PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
Reinforcement			
- tensile strength	ASTM D6637		
at 5% strain			6,500 (min)
at ultimate			14,300 (min)
- junctions strength	ASTM D7737/GRI GG2	lb/ft	12,340 (min)
Material			
Mass Unit Area	ASTM D5261	Oz/sq yd	28

Notes:

1. **True resistance to elongation when initially subjected to a load via ASTM D6637 without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties.**
2. **Geogrid junction strength and junction efficiency measured by ASTM D7737.**

B. Geogrid shall be capable of retaining its structure during handling, placement, and long-term service.

2.2. Manufacturer Quality Control

CONTRACTOR shall ensure that geogrid MANUFACTURER meets the conditions in this section.

A. Geogrid Tests and Inspection

1. Geogrid MANUFACTURER shall perform quality control testing of the geogrid. Samples not satisfying specifications shall result in the rejection of applicable rolls. At a minimum, the following tests shall be performed for quality control in accordance with test methods specified in Table 2.01.
   a. Density
   b. Mass per unit area
   c. Carbon black content
2. At geogrid MANUFACTURER'S discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.
3. Geogrid manufacturer shall perform quality control tests at a frequency of at least every 50,000 ft2 of geogrid produced.

3. PART 3: EXECUTION

3.1. Examinations

A. Conformance Testing

1. Geogrid manufacturer shall supply samples of geogrid to CQA ENGINEER for conformance testing. Unless otherwise specified, samples shall be taken at a rate of one per lot, not to exceed one conformance test per 100,000 square feet of geogrid.
2. For geogrid, the following tests shall be performed using the procedures listed in Table 2.01:
   a. Mass per unit area
   b. Aperture size
   c. Wide strip tensile strength
   d. Junction strength
3. Geogrid shall be rejected if conformance test results do not meet or exceed the values presented in Table 2.01.

3.2. Installation

A. Geogrid Deployment
   1. No equipment or tools shall damage the geogrid by handling, trafficking, or other means.
   2. No personnel working on the geogrid shall smoke, wear damaging shoes, or engage in other activities that could damage the geogrid.
   3. On slopes, the geogrid shall be securely anchored and then rolled down the slope in such a manner as to continually keep the sheet in tension.
   4. Geogrid panels shall be deployed in such a manner as to preclude wrinkles and folds.
   5. Geogrid within the lined area shall be cut with a cutter approved by **CC&V**, such as scissors. Unshielded razor knives are not acceptable.
   6. Two layers of geogrid shall be installed as indicated on the Drawings. The layers will be placed at right angles to each other as directed by the **CERTIFYING ENGINEER.**
   7. The subgrade shall be prepared for geogrid placement by uniform grading. No steep grade changes or edges shall be allowed. The **CERTIFYING ENGINEER** shall approve the subgrade prior to geogrid installation. The subgrade ***must not*** be smooth rolled.

B. Joining
   1. The geogrid shall be placed in continuous pieces downslope.
   2. If the geogrid is to be joined end to end, a pinned connection splice shall be used. The pinned connection must be manufactured from HDPE materials and shall be manufacturer approved.

C. Defects and Repairs
   1. All damaged geogrid rolls shall be rejected. No repairs shall be made.

3.3. Placement of Soil or Granular Materials

All soil materials located on top of a geogrid shall be placed in such a manner as to ensure:

1. The geogrid is not damaged.
2. Minimal movement and wrinkling or folding of the underlying geogrid layer(s) occurs.
3. No excess tensile stresses shall occur in the geogrid such as when earth-moving equipment makes sudden starts, stops, or turns.
4. Soil placement over the geogrid shall be performed with construction equipment approved by the **CERTIFYING ENGINEER**. Such construction equipment includes low to moderate ground pressure dozers (e.g., D-6 or D-8 CAT dozer). Dozers will push soil materials over the geogrid from the bottom of the slope in an uphill direction.
5. A minimum of 6” of soil cover shall be placed over the geogrid layers. No construction equipment shall operate directly on the geogrid layer or on less than 6” of soil cover.
6. Soil cover over the geogrid shall consist of Select Structural Fill and shall be compacted and placed according to Select Structural Fill SPECIFICATIONS in Section 2200.
7. Extent of geogrid-reinforced areas shall be surveyed and staked in the field by the CONTRACTOR. Subsequent construction activities over the reinforced areas shall not damage geogrid or reduce soil cover thickness to less than 6 inches.

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SECTION 02711.0 GEOTEXTILE

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes requirements for the manufacture, supply, and installation of the geotextile in the Underdrains, and Leak Detection System, as shown on the DRAWINGS; and construction quality control monitoring. All procedures, operations, and methods shall be in strict compliance with the SPECIFICATIONS, the Construction Quality Assurance Plan, and the DRAWINGS.

1.2. Submittals

A. Submittals with Bid Documents

CONTRACTOR shall provide the following information relating to the geotextile MANUFACTURER with its proposal.

1. Information from MANUFACTURER including company name, address, telephone number, the names of the company president and quality control manager, and narrative of the company history.
2. Description of MANUFACTURER's manufacturing capabilities:
   a. Information on plant size, equipment, personnel, number of shifts per day, and capacity per shift.
   b. A list of standard material properties and test methods employed to arrive at the values for each. As a minimum, the list shall include properties given in Part 2 of this Section.
3. The Quality Control Manual followed during the manufacturing process including those for the polymer material and for detecting foreign objects in the finished goods, and a description of the quality control laboratory facilities, including the name and telephone number of the quality control manager. Upon review of the Quality Control Manual, the **MANAGER** and **CERTIFYING ENGINEER** may request additional testing during the manufacturing process at no additional cost to **CC&V**.

B. **CONTRACTOR** shall provide the following information after contract award but within ten (10) days prior to material arrival on-site and prior to commencement of the work:

1. The geotextile MANUFACTURER shall provide written certification that the geotextile to be used meets the requirements of the Squaw Gulch VLF Project and has been continuously inspected for the presence of needles and geotextile was found to be needle free.

2. A copy of the MANUFACTURER's geotextile QC test results of properties outlined in Part 2 of this Section. The **MANAGER** reserves the right to refuse use of any geotextile supplied without the proper QC documentation.
3. A detailed list of performance criteria for the geosynthetic material being produced for this project. (Note: Performance criteria are sometimes referred to as "minimum property values." Refer to Part 2 of this Section for geotextile properties and test methods.)

1.3. Quality Assurance

A. All Work shall be constructed, monitored, and tested in compliance with requirements in the Construction Quality Assurance Plan (Section 01400.2). **CONTRACTOR** and MANUFACTURER shall participate and comply with all items in these SPECIFICATIONS and requirements of the CQA plan.

B. **CONTRACTOR** shall ensure that geotextile MANUFACTURER has an internal product quality control program that meets Contract requirements.

C. **CONTRACTOR** shall be aware of all activities outlined in the Construction Quality Assurance Plan, and the **CONTRACTOR** shall account for these activities in the construction schedule.

D. **CONTRACTOR** shall assure that the geotextile is delivered to the site at least 14 calendar days prior to installation to allow sufficient time for conformance testing, if necessary.

E. Geotextile rolls that do not meet the requirements of this SPECIFICATION will be rejected. **CONTRACTOR** will be required to replace the rejected material with new material that complies with the SPECIFICATIONS, at no additional cost to **CC&V**.

F. In order to prevent weather-damaged geotextile from being placed, the following Quality Assurance procedures shall be followed:

1. **CONTRACTOR** shall perform its Work and utilize sufficient ballast as necessary to prevent wind uplift of the geotextile panels.
2. If weather damage should occur, **CERTIFYING ENGINEER** shall determine if the geotextile shall be repaired or replaced. Weather damage to the geotextile will include tears and dirty fabric, as determined by the **CERTIFYING ENGINEER**.
3. Repair or replacement of the weather-damaged geotextile shall be completed by **CONTRACTOR** at no additional cost to **CC&V**.
4. As determined by **MANAGER** and **CERTIFYING ENGINEER**, the geotextile panel may be rejected at no cost to **CC&V**.

1.4. Delivery, Storage, And Handling

A. Packing and Shipping

1. Geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.
2. Geotextile rolls shall be marked or tagged with the following information.
    a. MANUFACTURER's name
    b. Product information
    c. Roll number
    d. Batch of lot number
    e. Roll dimensions
3. **CONTRACTOR** shall ensure that geotextile rolls are properly loaded and secured to prevent damage during transit.
4. **CONTRACTOR** shall protect geotextile from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
5. **CONTRACTOR** shall ensure personnel responsible for loading, transport, and unloading of are familiar with handling and transport constraints imposed by MANUFACTURER.

B. Acceptance at Site

1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geotextile rolls upon delivery.
2. **CONTRACTOR** shall unroll and inspect any geotextile roll that may be damaged below surface.
3. **CONTRACTOR** shall repair damage resulting from handling and transport of geotextile at no cost to **CC&V**. If irreparable, in the opinion of **CERTIFYING ENGINEER**, damaged materials shall be replaced at no cost to **CC&V**.

C. Storage and Protection

1. **MANAGER** will provide on-site storage area for geotextile rolls from time of delivery until installation.
2. The storage of the materials is the responsibility of **CONTRACTOR** from the time the materials are manufactured until the time the completed installation is accepted. **CONTRACTOR** is responsible for preparing the storage location and for the protection of the material from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After **CONTRACTOR** has removed material from storage area, protect geotextile from puncture, dirt, groundwater, moisture, mud, mechanical abrasion, excessive heat, ultraviolet light exposure, and other sources of damage.
4. Geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers, with straps for unloading.

5. **CONTRACTOR** shall preserve integrity and readability of the geotextile roll labels, and store such that **MANAGER** and **CERTIFYING ENGINEER** have access to the package slips or roll labels for each roll to verify roll acceptance.

2. PART 2: PRODUCTS

2.1. Materials

A. Twelve-ounce Non-Woven Needle Punched Geotextile:

1. Geotextile shall be comprised of polyester or polypropylene fibers. Rolls shall be free of holes, contamination, and foreign matter.
2. The geotextile supplied for the project shall meet or exceed the minimum (unless noted otherwise) roll values shown in the table below:

MINIMUM AVERAGE ROLL VALUES FOR GEOTEXTILE MATERIAL		
Property	**ASTM Test Method**	**Value**
Weight (oz./sq. yd.)	D 5261	11.9
Puncture (lbs.)	D4833	130
Apparent Opening Size	D4751	No. 80 to 140 Sieve

3. PART 3: EXECUTION

3.1. Installation

A. Geotextile Deployment

CONTRACTOR shall handle geotextile in a manner to ensure that geotextile is not damaged, and shall comply with the following:

1. No equipment or tools shall damage the geotextile by handling, trafficking, or other means.
2. No personnel working on the geotextile shall smoke, wear damaging shoes, or engage in other activities that could damage the geotextile.
3. Cross seams between two (2) panels of geotextile shall be staggered by a minimum distance of five (5) feet on slopes greater than ten percent (10%).
4. In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during deployment and shall remain until replaced with cover material.

5. Geotextile panels shall be deployed in such a manner as to preclude wrinkles and folds. Any wrinkle or fold that may manifest itself into other geosynthetic layers shall be removed.
6. Geotextile within the lined area shall be cut with a cutter approved by **CERTIFYING ENGINEER**, such as scissors.
7. Take necessary precautions to prevent damage to the underlying subgrade during placement of the geotextile.
8. During placement of geotextiles, care shall be taken not to entrap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the underlying or overlying geomembrane, cause clogging of drains or filters, or hamper subsequent seaming.
9. Following the installation of all geotextile, an examination of the entire surface shall be conducted to detect potentially harmful foreign objects. Any such foreign objects found shall be removed or the panel shall be replaced by the **CONTRACTOR**, at no cost to CC&V**.**
10. Geotextile panels shall not be deployed over frozen ground, unless approved by CERTIFYING ENGINEER.

B. Seaming Procedures

1. On slopes steeper than ten (10) percent, and in all cases in which soil or granular materials are to be placed over the geotextile, all seams shall be continuously sewn. In all other applications, sewing is the preferred seaming method.
2. Seams to be sewn shall be overlapped a minimum of six (6) inches and shall be sewn with a locking stitch. Seams to be thermally bonded shall be overlapped a minimum of twelve

(12) inches.

3. The thread used in sewing shall be of polymeric material having chemical resistance, and if the geotextile is to be exposed for more than thirty (30) days, ultraviolet resistance equal to or exceeding that of the geotextile.
4. **CONTRACTOR** shall take measures to prevent soil, granular materials, or foreign materials from entering or becoming trapped beneath the geotextile both during and following installation.

C. Defects and Repairs

Repair holes or tears in geotextile as follows:

1. Remove any soil or other material that may have penetrated the torn geotextile.
2. Should any tear exceed 10 percent of the width of the roll, that section of the roll shall be removed from the slope and replaced.

3. On slopes steeper than 10:1 (horizontal:vertical), sew into place, in accordance with Article 3.01(B) of this Section, a patch made from same geotextile. Use continuous sewing.
4. On slopes shallower than 10:1 (horizontal:vertical), sew geotextile patch into place using continuous (preferred) or spot seam in place a patch made from same geotextile, with a minimum 24-inch overlap in all directions.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –GEOCELL		**SPECIFICATION NO.** **02778**

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SECTION 02778.0 GEOCELL

1. PART 1: GENERAL

1.1. Summary

This SPECIFICATION describes requirements for the manufacture, fabrication (if needed), supply, and installation of geocell for erosion control, as shown on the DRAWINGS; and construction quality control monitoring and testing. All procedures, operations, and methods shall be in strict compliance with the SPECIFICATIONS, Construction Quality Assurance Plan, and the DRAWINGS.

1.2. References

A. ASTM D1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique.

B. ASTM D4218 – Standard Test Method for Carbon Black Content in Olefin Plastics.

C. ASTM D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

D. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

E. US Army Corps of Engineers (USACE) Technical Report GL-86-19, Appendix A.

1.3. Submittals

CONTRACTOR shall provide the following information relating to the geocell MANUFACTURER and **INSTALLER** prior to commencement of the **WORK**:

A. Information from the MANUFACTURER including company name, address, telephone number, and the names of the company president and quality control manager.

B. Quality Control Manuals from the MANUFACTURER for the installation and testing of the geocell.

C. Quality Control Certificates from the MANUFACTURER.

1.4. Quality Assurance

A. All work shall be constructed, monitored, and tested in compliance with the requirements of the Geosynthetic Construction Quality Assurance Plan (Section 01400.2). **CONTRACTOR** and MANUFACTURER shall participate in and comply with all items in these SPECIFICATIONS and requirements of the CQA plan.

1.5. Delivery, Storage, and Handling

A. Packing and Shipping:

1. Labels on each panel delivered to site shall identify the following:
    a. MANUFACTURER's name.
    b. Product Identification.
2. **CONTRACTOR** shall ensure that geocell panels are properly loaded and secured to prevent damage during transit.
3. **CONTRACTOR** shall protect geocell from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.
4. **CONTRACTOR** shall ensure personnel responsible for loading, transport, and unloading of geocell are fully aware of the consequences of damage to geocell, and are familiar with handling and transport constraints imposed by MANUFACTURER.
5. **CONTRACTOR** shall protect geocell delivered to the project by a relatively impermeable and opaque protective cover.

B. Acceptance at Site:

1. CQA Monitor shall perform inventory and surface inspection for defects and damage of all geocell panels upon delivery.
2. **CONTRACTOR** shall expand and inspect any geocell panel that may be damaged below surface.
3. **CONTRACTOR** shall repair damage resulting from handling and transport of geocell at no additional cost to **CC&V**. If irreparable, in the opinion of **CERTIFYING ENGINEER**, damaged materials shall be replaced at no additional cost to **CC&V**.

C. Storage and Protection:

1. **MANAGER** will provide area for on-site storage of the geocell panels from time of delivery until installation.
2. The storage and handling of the materials is the responsibility of **CONTRACTOR** from the time the materials are manufactured until the time the completed installation is accepted. **CONTRACTOR** is responsible for preparing the storage location and for the protection of the materials from the elements (e.g. ultraviolet light, moisture, temperature, etc.).
3. After **CONTRACTOR** has removed material from storage, **CONTRACTOR** shall protect geocell from puncture, dirt, grease, water, moisture, mud, mechanical abrasion, excessive heat, and other sources of damage.

4. **CONTRACTOR** shall preserve integrity and readability of the geocell labels and store the panels such that **MANAGER** and **CERTIFYING ENGINEER** have access to the package slips or labels for each panel to verify panel acceptance.

2. PART 2: PRODUCTS

2.1. Materials

A. Geocell shall be TerraCell 140 or equivalent and shall have the following properties:

PROPERTY	TEST METHOD	VALUE
Density (g/cc)	ASTM D1505	0.94 (max)
Carbon Black Content (%)	ASTM D4218	1.5%
Environmental Stress Crack Resistance (hours)	ASTM D1693	4,000 hours
Sheet Thickness (mils)	ASTM D5199	50 mils, ±5%
Cell Depth (inches)	-	6
Cell Wall	-	Solid
Color	-	Black

B. Geocell shall have a Seam Peel Strength (USACE Technical Report GL-86-19, Appendix A) of 480 lbs.

2.2. Accessories

A. J-Hooks:
   1. Material with sufficient strength to support and anchor geocells.
   2. Galvanized Steel Reinforcing Bars:
      a. Diameter: As indicated on the drawings.
      b. Length: As indicated on the drawings.
      c. Hook: As indicated on the drawings.
   3. Fiberglass Reinforced Polymer (FRP) Reinforcing Bars:
      a. Diameter: As indicated on the drawings.
      b. Length: As indicated on the drawings.
      c. Hook: As indicated on the drawings.

B. Straight Stakes:
   1. Material with sufficient strength to support and anchor geocells.
   2. Galvanized Steel Reinforcing Bars:
      a. Diameter: As indicated on the drawings.

b. Length: As indicated on the drawings.

C. Tendons:

1. Material: High-tenacity, polyester fibers woven into webbing.

2.3. Infill

A. **CONTRACTOR** shall place select structural fill as infill material.

1. Select Structural Fill - well graded granular soil or sound, hard, durable, rockfill excavated on-site or supplied from off-site mine waste rock with a maximum particle size of 3 inches as approved by **MANAGER** and **CERTIFYING ENGINEER**.

3. PART 3: EXECUTION

3.1. Examinations

A. Examine area to receive geocell placement. Area must be free of debris, grade stakes, roots, branches, vegetation and unacceptable soils.

3.2. Preparation

A. **CONTRACTOR** shall prepare geocell subgrade following criteria identified in Section 02200 as per the Bedding Fill and Soil Liner Fill SPECIFICATIONS.

3.3. Installation

A. Geocell Deployment

1. **CONTRACTOR** shall install geocells in accordance with manufacturer's instructions.
2. **CONTRACTOR** shall install geocell panels at locations indicated on the drawings, as approved by **MANAGER**, **DESIGN ENGINEER,** and **CERTIFYING ENGINEER**.
3. **CONTRACTOR** shall remove and replace damaged (i.e., torn, twisted, or crimped) field panels at no cost to **CC&V**. **CERTIFYING ENGINEER** shall determine if material is to be replaced.
4. **CONTRACTOR** shall deploy geocell between ambient temperatures of sixteen degrees (16° F) Fahrenheit to one-hundred ten degrees (110o) Fahrenheit.
5. No equipment or tools shall damage the geocell by handling, trafficking, or other means.
6. No personnel working on the geocell shall smoke, wear damaging shoes, or engage in other activities that could damage the geocell.
7. **CONTRACTOR** shall deploy geocell so that adjoining cell walls are flush and in proper alignment.

8. **CONTRACTOR** shall place infill material in the geocells from the top of slope or channel in accordance with manufacturer's instructions. In order to prevent damage to geocells, drop height of infill material not to exceed 3 feet.
9. **CONTRACTOR** shall overfill expanded geocell sections 1 to 2 inches to account for settlement and compaction of infill material
10. **CONTRACTOR** shall compact infill material to top of geocell in order to obtain a minimum of 95 percent of maximum dry density as determined by the standard Proctor test (ASTM D698).
11. Extent of geocell areas shall be surveyed and staked in the field by the **CONTRACTOR**.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –GALVANIZED STEEL WIRE FORMED, STONE FILLED MECHANICALLY STABILIZED EARTH RETAINING WALL		**SPECIFICATION NO.** 02830

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SECTION 02830.0 GALVANIZED STEEL WIRE FORMED, STONE FILLED MECHANICALLY STABILIZED EARTH RETAINING WALL

1. PART 1: GENERAL

1.1. Summary

Section includes – Mechanically Stabilized Earth (MSE) retaining wall system having high density polyethylene or polypropylene geogrids positively connected to steel welded wire mesh facing.

1.2. Related Sections

Refer to the following Sections for related work:

- Section 00508.0 – Timber Facing

1.3. Submittals

A. Product Data - Manufacturer's materials specifications, installation instructions, and general recommendations for all components of the MSE wall system.

B. Design Data – Design calculations for the retaining wall system sealed by a Registered Professional Engineer.

C. Detailed Shop Drawings – Detailed shop drawings showing all components of the retaining wall system sealed by a Registered Professional Engineer.

D. Samples

1. Geogrid - 4-in. by 16-in. piece
2. Geotextile Materials - 4-in by 8-in pieces

E. Quality Control Submittals

1. Certificates - Manufacturer's certification that the components of the retaining wall system are adequate for the intended site location and that the components are compatible with each other.

2. PART 2: PRODUCTS

2.1. Materials

A. The DRAWINGS show a general concept for an MSE embankment with a welded wire facing. The general dimensions are shown on the plans. The Contractor may select any MSE wall components provided that the wall is durable for the intended location and exposure, has a ¼ to 1 front face slope and can accommodate attachment of the salvaged timber facade.

B. Structural Geogrid: Provide the following or approved equal.

1. Tensar UX1100MSE: Polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth; functions primarily as reinforcement.
    a. Ultimate Tensile Strength: 3970 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D 6637.
    b. Junction Strength: 3,690 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D7737.
2. Tensar UX1400MSE: Polymeric grid formed by regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock or earth and function primarily as reinforcement.
    a. Ultimate Tensile Strength: 4800 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D 6637.
    b. Junction Strength: 4520 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D7737.
3. Tensar UX1500MSE: Polymeric grid formed by regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock or earth and function primarily as reinforcement.
    a. Ultimate Tensile Strength: 7810 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D 6637.
    b. Junction Strength: 7200 pounds per linear foot, minimum average roll value, when tested in accordance with ASTM D7737.

C. Welded Wire Facing:
1. Provide a galvanized welded wire facing material for the MSE embankment. The facing material shall be commonly used for public roadway projects in harsh environments.

2.2. Accessories

A. Geotextile - 4 oz. per sq. yd. polypropylene non-woven geotextile, AASHTO M288-96, Class 3.

2.3. Backfill Materials

A. Facing Fill - Free draining, uniformly graded.
1. 100 percent passing a 4-in. sieve
2. 0 to 10 percent passing a 2-in. sieve
3. Non-plastic fines
4. Resistivity greater than 5,000 ohm-cm

B. Reinforced Backfill - Granular fills graded as follows:
   1. 100 to 75 percent passing a 2-in. sieve
   2. 100 to 75 percent passing a 3/4-in. sieve
   3. 100 to 20 percent passing a No. 4 sieve
   4. 0 to 60 percent passing a No. 40 sieve
   5. 0 to 15 percent passing a No. 200 sieve

3. PART 3: EXECUTION

3.1. Pre-Construction Conference

A. Pre-Construction Conference - Prior to erection of retaining walls, hold a meeting at the site with the retaining wall materials supplier, the retaining wall installer, and the Designer to review the retaining wall requirements. Notify the OWNER and the ENGINEER at one week in advance of the time of the meeting.

3.2. Qualification

A. Contractor and site supervisor shall provide **ENGINEER** the following proof of experience prior to the start of construction of the retaining wall system.
   1. Successfully installed ten or more MSE structures of similar size and magnitude.
   2. Wall superintendent have at least five years of experience constructing similar type walls.
   3. At least two letters of reference from other owners on the successful completion of similar type wall system.

3.3. Excavation

A. The subgrade shall be excavated vertically to the plan elevation and horizontally to the designed geogrid lengths.

B. Overexcavated or filled areas shall be well compacted and inspected by the **ENGINEER**.

C. Excavated materials that are used for backfilling the reinforcement zone shall be protected from the weather.

3.4. Foundation Preparation

A. Foundation trench shall be excavated to the dimensions indicated on the DRAWINGS.

B. The foundation area shall be examined by the **ENGINEER** to ensure proper bearing strength.

C. Soils not meeting required strength shall be removed and replaced with the proper materials as approved by the **ENGINEER**.

D. Foundation materials shall be compacted to a minimum of 95 percent Standard Proctor Maximum Dry Density in accordance with ASTM D698.

3.5. Backfill

A. The Reinforced Backfill material shall be placed in maximum compacted lifts of 9 inches and shall be compacted to a minimum of 95 percent Standard Proctor Maximum Dry Density in accordance with ASTM D698.

B. Only hand-operated compaction equipment shall be used within 3 feet of the front face.

C. Soil density testing shall not be performed within 3 feet of the front face.

D. The backfill shall be smooth and level so that the geogrid lays flat.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –Reinforcing Steel		**SPECIFICATION NO.** **03220**

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SECTION 03220.0 REINFORCING STEEL

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 03300.0 - Cast-in-Place Concrete

1.2. Submittals

CONTRACTOR shall provide product data including Mill certification sheets and specifications sufficient to allow evaluation by **CERTIFYING ENGINEER**.

1.3. Tolerances

Reinforcing steel shall be placed as shown on the DRAWINGS.

1.4. Quality Assurance

A. All work shall be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.

B. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**, at no additional cost to **CC&V.**

2. PART 2: PRODUCTS

2.1. Materials

A. Reinforcing steel shall be Grade 60. Reinforcing bars shall be shop fabricated and tabbed with suitable identifications to facilitate sorting and placement.

B. Tie wire shall be No. 16 AWG or heavier.

3. PART 3: EXECUTION

3.1. Installation

A. **CONTRACTOR** shall be responsible for the locations and placement of all reinforcing bars.

B. All reinforcing steel shall be of the size and shape shown on the DRAWINGS.

C. The use of a torch or heat source for cutting or bending steel shall not be allowed.

D. Bars shall be free of scale, dirt, grease, or other foreign matter, which are detrimental to bond.

E. Reinforcing bars shall be accurately placed with respect to spacing and clearance, securely tied at intersections, and supported in such a manner as to prevent displacement during placement of concrete.

F. Where pipe sleeves, inserts, and anchors prevent placement of reinforcing bars in the locations shown, additional reinforcing shall be required, in locations as approved by **CERTIFYING ENGINEER.**

G. Reinforcing bar splices shall be used only in the locations shown on the DRAWINGS.

H. Welded splices shall not be permitted.

I. The length of lap for reinforcing bars shall be in accordance with ACI 318, unless otherwise shown.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –CAST-IN-PLACE CONCRETE		**SPECIFICATION NO.** **03300**

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SECTION 03300.0 CAST-IN-PLACE CONCRETE

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks
- Section 03220.0 - Reinforcing Steel

1.2. Submittals

A. CONTRACTOR shall provide product data to allow evaluation by MANAGER and CERTIFYING ENGINEER.

B. **CONTRACTOR**'s mix design for each tentative mix for concrete shall contain the following information:

1. Slump on which design is based.
2. Total gallons of water per cubic yard.
3. Brand, type, composition, and quantity of cement.
4. Specific gravity and gradation of each aggregate.
5. Ratio of fine to total aggregates.
6. Weight (surface dry) of each aggregate per cubic yard.
7. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.
8. Time of initial set.

1.3. Tolerances

Concrete shall be placed to the lines and dimensions shown on the DRAWINGS.

1.4. Quality Assurance

A. All concrete testing (both field and laboratory testing) will be the responsibility of **CONTRACTOR**. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities.

B. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**.

C. Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.

2. PART 2: PRODUCTS

2.1. Materials

A. Portland Cement, ASTM C 150, Type II.

B. Coarse Aggregate, ASTM C 33, except that clay and shale particles shall not exceed 1 percent of total aggregate.

C. Fine Aggregate, ASTM C 33, washed natural sand.

D. Flowable Fill containing, at a minimum, cementitious materials and water. The mixture may also contain fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the **CERTIFYING ENGINEER**.

1. Portland Cement: ASTM C150, Type II.
2. Mixing Water
3. Air-Entraining Admixture: ASTM C260.
4. Chemical Admixtures: ASTM C494.
5. Aggregate: ASTM C33.

2.2. Mixes

A. Mix Designs:

Concrete mix design shall be designed by an independent testing laboratory.

B. Cast-In-Place Concrete:

1. Cast-in-place concrete with reinforcing steel shall have a minimum 28-day compressivestrength of 4,000 psi.
2. Maximum Aggregate size of 1-inch.
3. Placement slump between 2-inches and 5-inches.
4. Air entrainment of 5% to 8%.

C. Flowable Fill:

1. Minimum compressive strength of 300 psi, ASTM C 39, at 28 days after placement.
2. Minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 1/8 inch per ft. of flowable fill depth (for mixes containing high fly ash content).
3. Unit weight of (115 – 145 lb/feet^3) measured at the point of placement. In the absence of strength data the cementitious content shall be a maximum 150 lbs/cy.

2.3. Curing Compounds

Concrete curing compound shall be a clear compound complying with ASTM C 309, Type 1-D, Class A andB, such as "RES-X" by Burke, or an equivalent approved by **CERTIFYING ENGINEER**.

3. PART 3: EXECUTION

3.1. Structural Concrete

Place structural concrete as shown on DRAWINGS.

3.2. Installation

A. Ready-Mix Concrete shall be batched, transported, and placed in accordance with ASTM C94. Each batch delivered to the Site shall be accompanied by a certified weight master's delivery ticket.

B. All mixed concrete delivered to the Site shall be placed within 90 minutes from the time of introduction of cement and water into the mix.

C. No water shall be added after leaving the batch plant without the approval of **CERTIFYING ENGINEER**.

D. Placement of concrete, once started, shall be performed as a continuous operation until the scheduled placement is completed.

E. Cold joints shall be approved by **CERTIFYING ENGINEER**.

F. Concrete shall be thoroughly compacted by vibrating with suitable tools during placement, aroundembedded fixtures, and into the corners of forms.

G. Vibrators shall be operated at each point of placement and a standby vibrator in good working condition shall be kept at the placement site until all concrete is placed. Vibrators shall be used that will maintain at least 9,000 cycles per minute when immersed in the concrete.

H. Vibrations shall be used only to minimize honeycomb and accomplish compaction of the concrete, and shall not be used to move concrete from one location to another. Concrete shall not be moved in the forms more than 5 feet.

I. The surface of hardened concrete on which fresh concrete is to be placed shall be rough, clean, sound, and damp. The hardened surface shall be cleaned of all laitance, foreign substances, curing compound, washed with clean water, and wetted thoroughly preceding placement of fresh concrete.

J. Secure tanks, pipes and other members to be encased in flowable fill. Insure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the

flowable fill. Replacement or protection of metallic objects is subject to the approval of the **CERTIFYING ENGINEER.**

3.3. Cleaning

All form materials and debris resulting from construction shall be disposed of as directed by **MANAGER**.

3.4. Curing

A. General:
   1. Concrete shall be protected from loss of moisture for at least seven (7) days after placement.
   2. Curing may be accomplished with water or a curing compound.
   3. Water or curing compound shall be applied to formed surfaces within one (1) hour of form stripping.

B. Water Curing:
   1. Water saturation of unformed surfaces shall begin as quickly as possible after initial set of the concrete.
   2. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff.
   3. Concrete surfaces shall not be permitted to become dry during the curing period.

C. Curing Compound:
   1. Curing compound shall be spray-applied at the MANUFACTURER's recommended coverage rate.
   2. Unformed surfaces shall be covered within 30 minutes after final finishing.
   3. Curing compound shall be protected against abrasion during the curing period.

3.5. Schedules

CONTRACTOR shall notify **MANAGER** at least forty-eight (48) hours before each concrete placement.

3.6. Field Quality Control

A. Concrete testing will be performed by **CONTRACTOR**.

B. Four standard 4-inch diameter by 8-inch long test cylinders shall be prepared for every 50 yards of concrete placed or for each placement, whichever is greater, at the discretion of the **MANAGER, DESIGN ENGINEER** and **CERTIFYING ENGINEER**.

C. Standard compression tests shall be performed to determine the compressive strength: one at seven (7) days, one at fourteen (14) days, and one at twenty-eight (28) days. The fourth cylinder shall be kept in reserve for additional testing, if necessary.

D. Slump testing shall be performed at the time the cylinders are prepared.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –CEMENTED ROCKFILL		**SPECIFICATION NO.** **03310**

REV	DATE	PAGES	APPROVALS			REMARKS
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1	04/07/2016	2	JNM	RMS		Issued for Client Review
2	06/15/2016	2	JNM	RMS		Issued for Construction

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SECTION 03310.0 CEMENTED ROCKFILL

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks

1.2. Submittals

A. CONTRACTOR shall provide product data to allow evaluation by MANAGER and CERTIFYING ENGINEER.

B. **CONTRACTOR**'s mix design for each tentative mix for cemented rockfill shall contain the following information:

1. Total gallons of water per cubic yard.
2. Brand, type, composition, and quantity of cement.
3. Time of initial set.
4. Placement and compaction technique, including chute arrangement to transfer material from truck to bottom of underground working without contaminating the Cemented Rockfill with loose surficial soils.
5. Method of mixing the aggregate and cement, and transporting the Cemented Rockfill.

1.3. Tolerances

Cemented rockfill shall be placed to the lines and dimensions shown on the DRAWINGS.

1.4. Quality Assurance

A. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**, at no additional cost to **CC&V**.

2. PART 2: PRODUCTS

2.1. Materials

A. Portland Cement, ASTM C 150, Type V

B. Fine Shaft Backfill

2.2. Mixes

A. Cemented Rockfill:

1. Maximum Aggregate size of 2-inch.
2. 6 percent (by dry weight) cement.
3. The Cemented Rockfill will be placed at a water content to be approved by **CERTIFYING ENGINEER**, corresponding to approximately at optimum water content to wet of optimum water content, as determined by ASTM D698.

3. PART 3: EXECUTION

3.1. Installation

A. CONTRACTOR shall prepare the underground working to minimize the amount of sloughing in of material from the sides.

B. No water shall be added after leaving the mixing area/batch plant without the approval of MANAGER and CERTIFYING ENGINEER.

C. The surface of hardened concrete on which fresh Cemented Rockfill is to be placed shall be rough, and cleaned of all laitance and foreign substances.

D. The rock surface within the competent bedrock of the underground working shall be scaled to remove any loose material prior to Cemented Rockfill placement.

E. Each 3 foot thick lift of the Cemented Rockfill shall be compacted according to a method specification, approved by the **MANAGER** and **CERTIFYING ENGINEER**.

3.2. Field Quality Control

A. All concrete testing (both field and laboratory testing) will be the responsibility of **CONTRACTOR**. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities.

B. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –CONCRETE PLUG		SPECIFICATION NO. 03320

REV	DATE	PAGES	APPROVALS			REMARKS
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SECTION 03320.0 CONCRETE PLUG

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks

1.2. Submittals

A. CONTRACTOR shall provide product data to allow evaluation by MANAGER and CERTIFYING ENGINEER.

B. **CONTRACTOR**'s mix design for each tentative mix for concrete shall contain the following information:

1. Slump on which design is based.
2. Total gallons of water per cubic yard.
3. Brand, type, composition, and quantity of cement.
4. Specific gravity and gradation of each aggregate.
5. Ratio of fine to total aggregates.
6. Weight (surface dry) of each aggregate per cubic yard.
7. Time of initial set.

1.3. Tolerances

Concrete shall be placed to the lines and dimensions shown on the DRAWINGS.

1.4. Quality Assurance

A. All concrete testing (both field and laboratory testing) will be the responsibility of **CONTRACTOR**. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities.

B. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**.

2. PART 2: PRODUCTS

2.1. Materials

A. Portland Cement, ASTM C 150, Type V.

B. Coarse Aggregate, ASTM C 33, except that clay and shale particles shall not exceed 1 percent of total aggregate.

C. Fine Aggregate, ASTM C 33, washed natural sand.

2.2. Mixes

A. Mix Designs:

Concrete mix design shall be designed by an independent testing laboratory.

B. Cast-In-Place Concrete:

1. Cast-in-place concrete shall have a minimum 28-day compressive strength of 4,000 psi.
2. Maximum Aggregate size of 1-inch.
3. Placement slump of between 2-inches and 5-inches.

3. PART 3: EXECUTION

3.1. Installation

A. Ready-Mix Concrete shall be batched, transported, and placed in accordance with ASTM C94. Each batch delivered to the Site shall be accompanied by a certified weight master's delivery ticket.

B. All mixed concrete delivered to the Site shall be placed within 90 minutes from the time of introduction of cement and water into the mix.

C. No water shall be added after leaving the batch plant without the approval of **CERTIFYING ENGINEER**.

D. Placement of concrete, once started, shall be performed as a continuous operation until the scheduled placement is completed.

E. Cold joints shall be approved by **CERTIFYING ENGINEER**.

F. Vibrators shall be used only to minimize honeycomb, and shall not be used to move concrete from one location to another. Concrete shall not be moved in the forms more than 5 feet.

G. The rock surface within the competent bedrock of the underground working shall be scaled to remove any loose material prior to Cement Plug placement.

3.2. Cleaning

All form materials and debris resulting from construction shall be disposed of as directed by **MANAGER**.

3.3. Schedules

CONTRACTOR shall notify **MANAGER** at least forty-eight (48) hours before each concrete placement.

3.4. Field Quality Control

A. Concrete testing will be performed by **CONTRACTOR**.

B. Four standard 4-inch diameter by 8-inch long test cylinders shall be prepared for every 50 yards of concrete placed or one per day, whichever is greater, at the discretion of the **MANAGER, DESIGN ENGINEER,** and **CERTIFYING ENGINEER**.

C. Standard compression tests shall be performed to determine the compressive strength: one at seven

(7) days, one at fourteen (14) days, and one at twenty-eight (28) days. The fourth cylinder shall be kept in reserve for additional testing, if necessary.

D. Slump testing shall be performed at the time the cylinders are prepared.

NewFields	CLIENT Newmont - Cripple Creek & Victor Gold Mine	PROJECT NO 475.0106.006
PROJECT: Squaw Gulch VLF		
TITLE: TECHNICAL SPECIFICATIONS –FLOWABLE FILL		**SPECIFICATION NO.** **03330**

REV	DATE	PAGES	APPROVALS			REMARKS
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1	04/07/2016	3	JNM	RMS		Issued for Client Review
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   - 3.3. Field Quality Control 2

SECTION 03330.0 FLOWABLE FILL

1. PART 1: GENERAL

1.1. Related Sections

Refer to the following Sections for related work:

- Section 02200.0 - Earthworks

1.2. Submittals

A. CONTRACTOR shall provide product data to allow evaluation by MANAGER and CERTIFYING ENGINEER.

B. **CONTRACTOR**'s mix design for each tentative mix for flowable fill shall contain the following information:

1. Total gallons of water per cubic yard.
2. Brand, type, composition, and quantity of cement.
3. Specific gravity and gradation of each aggregate.
4. Ratio of fine to total aggregates.
5. Weight (surface dry) of each aggregate per cubic yard.
6. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.
7. Time of initial set.
8. Method of mixing the aggregate and cement, and transporting the Flowable Fill.

1.3. Tolerances

Flowable fill shall be placed to the lines and dimensions shown on the DRAWINGS.

1.4. Quality Assurance

A. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**, at no additional cost to **CC&V**.

2. PART 2: PRODUCTS

2.1. Materials

A. Portland Cement: ASTM C150, Type II.

B. Mixing Water

C. Air-Entraining Admixture: ASTM C260.

D. Chemical Admixtures: ASTM C494.

E. Aggregate: ASTM C33.

2.2. Mixes

A. Flowable Fill:

1. Minimum strength of 300 psi, ASTM C 39, at 28 days after placement.
2. Placement slump of between 3-inches and 7-inches.

3. PART 3: EXECUTION

3.1. Installation

A. All flowable fill delivered to the Site shall be placed within ninety (90) minutes from the time of introduction of cement and water into the mix.

B. No water shall be added after leaving the batch plant without the approval of **CERTIFYING ENGINEER.**

C. Placement of flowable fill, once started, shall be performed as a continuous operation until the scheduled placement is completed.

3.2. Protection And Curing

A. Protect exposed surfaces of flowable fill from premature drying, was by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by **CERTIFYING ENGINEER**.

3.3. Field Quality Control

A. All testing (both field and laboratory testing) will be the responsibility of **CONTRACTOR**. **CONTRACTOR** shall be responsible for cooperating with CQA Monitor during all testing activities. **CONTRACTOR** shall provide equipment and labor to assist CQA Monitor in sampling, if requested, and shall also provide access to all areas requiring testing activities.

B. Any Work found unsatisfactory or any Work disturbed by subsequent operations before acceptance is granted shall be corrected by **CONTRACTOR**.

APPENDIX D – STRUCTURAL FILL METHOD SPECIFICATION

TECHNICAL MEMORANDUM

9400 Station Street
Suite 300
Lone Tree, CO 80124

T: 720.508.3300
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To: Jeff Gaul – CC&V

From: Eric Niebler – NewFields

Project: Squaw Gulch VLF2 Phase 2A

Project No: 475.0106.032

Subject: Structural Fill Compaction Method Specification

Date: April 15, 2019

Tezak Heavy Equipment (Tezak) used structural fill (SF) to perform site grading during the construction of the Squaw Gulch VLF 2 Phase 2A project. All fills constructed with SF were placed using a method specification that was developed during construction. The CQA Monitor observed and approved the method specification for the VLF2 project. The use of this method compaction technique was necessary as the fill materials used contained greater than 30 percent rock above the 3/4-inch sieve, classifying it as a rock fill. Based on site experience and anticipated fill materials, method specifications were developed for a 12-ton vibratory sheepsfoot drum compactor.

The method specification was developed by first preparing an area to receive material that was firm, unyielding, and representative of actual fill placement conditions. The desired lift thickness of two feet was then placed and moisture conditioned. A grid was surveyed and marked across the test pad by the surveyor from Foresight West Surveying (FWS) allowing for the same points to be checked repeatedly. One pass was made and the points were checked for any change in elevation. This was repeated until less than 3/4" elevation change was noted after at least four consecutive passes. Two lifts were tested for the method specification and this process was performed for each lift. It was found that, with a lift thickness of two feet, four passes of the respective equipment would be sufficient for compaction.

The CQA monitor evaluated the compacted test pad surface. Based on a visual inspection, rock fill uniformity, material durability, and firmness of the surface were found to be acceptable. A sample of rock fill material was collected and a particle size analysis test performed ensuring the material used for the test fill met project specifications. Photographs of the method specification are attached to this memo. The CQA Monitor accepted the method specification and all fills constructed with SF were performed in accordance with it and the project technical specifications.

If you have any questions or require additional information, please contact the undersigned.

Sincerely,

NewFields Mining Design & Technical Services

Eric Niebler

Eric Niebler, P.E.
Project Resident

Attachments: Photos 1 - 4

Photo 1: Construction of test pad

Photo 2: Survey grid on test pad

Photo 3: Compaction with 12-ton Vibratory Sheepsfoot Drum Compactor

Photo 4: Inspection of completed test pad