VENTURE RESOURCES, INC.
P.O. Box 1974 2208 County Road 281
Idaho Springs, Colorado 80452

February 1, 2017

Mr. Michael A. Cunningham, Environmental Protection Specialist
Colorado Division of Reclamation, Mining & Safety
Department of Natural Resources
1313 Sherman Street – Room 215
Denver, Colorado 80203

RE: Response to Adequacy Review No. 1
Technical Revision No. 4 – Hukill Gulch Millsite
Task 1: Logistical Assessment and Removal Action Plan and Specifications

Dear Mr. Cunningham:

Venture Resources, Inc. ("VRI") herein provides the supplemental information requested by the Division in its Adequacy Review No. 1 (letter dated December 28, 2016) in response to VRI's December 6, 2016 Technical Revision No. 4 submittal.

We provide summarized responses below, in the same sequence as that put forth in your letter of December 28, 2016, and direct you to the corresponding revisions within the modified text of the accompanying Technical Revision 4 (Supplemental Modification #1), enclosed herein.

Item 1: Please provide a map which depicts the locations of the following: (a) the staging and stockpile area for the non-authorized waste rock; (b) the stockpile area for the man-made materials and debris; and, (c) the temporary storage area for the residual liquids.

Please refer to the new **Attachment I – Site Mapping**, which contains three figures, as follows, all of which are now incorporated into the Technical Revision No. 4 (as modified this date):

- Figure 1: Site Location Map
- Figure 2: Aerial Base Map
- Figure 3: Site Detail

It is **Figure 3: Site Detail** that identifies each of the respective areas (or provides for a specific point of reference) as requested by the Division. The intended stockpile area for the man-made materials and debris is not specifically identified in Figure 3; however, it will be located within the overall stockpile area at a location to be determined, dependent on volume (anticipated to be minimal) and in consideration of potential salvage/disposal opportunities. [*Note: All other Attachments remain in their original sequence, but Attachment numbers have been advanced to reflect the insertion of the new Attachment I*]

Section 1.0 of the Technical Revision (and as appropriate thereafter) has been revised to reflect the foregoing.

Item 2: Please specify where the material to construct the berm around the staging and stockpile area will come from. In addition, describe how the berm will be compacted to ensure a stable configuration for the management of stormwater.

VRI plans to excavate both the upgradient run-on diversion berm and the downgradient material containment berm by cutting a v-ditch in the existing ground surface on the upslope (north) side of each, and spoiling the material along and adjacent to the south (downslope) side of the resultant v-ditch. Inasmuch as these features are to be excavated: (1) interior to the existing perimeter diversion feature; (3) upgradient of the existing tailing storage facility capture system; and (3) within the historic waste rock materials that form the basal interior of the EPF, engineered compaction specifications are not envisioned to provide significant benefit for the intended purpose, and as such are not proposed.

VRI will, however, consolidate the embankment material utilizing rubber-tired or tracked equipment to the extent practicable, and in addition (not previously proposed), install silt fencing and/or erosion wattles along the upgradient side (at the toe of the berm) of each feature to enhance berm stability and stormwater control/diversion. The upgradient berm feature (upslope of the proposed stockpile area) is envisioned to function as a redundant (secondary) stormwater run-on control feature routing stormwater flow around the stockpile; whereas, the downgradient berm feature is purposed toward containment of the stockpiled material, which would be subject only to "footprint" precipitation over its limited areal extent, in order to mitigate the potential for sediment excursions to occur.

Section 2.0 of the Technical Revision has been revised to reflect the foregoing.

Item 3: Please specify where the onsite materials used to construct the lower-level working platform will come from and provide approximate volumes of the required material. If the material used to construct the lower-level working platform will be imported to the site, then the Operator will need to provide the Division with an affidavit certifying the material is clean and inert as required by Rule 3.1.5(9). Finally, please specify how this material will be used once the lower-level working platform is removed.

VRI estimates that the volume of material necessary to establish a working surface will be, at most, on the order of 100 to 125 cubic yards of material (assuming 125-ft. length x 12-ft width x 2-ft depth). It is VRI's intent to identify and excavate suitable material from either natural bank deposits or waste rock situated within the Permit Area and more specifically within (i.e., inside of) the area circumscribed by the existing facility perimeter stormwater diversion feature.

Once introduced atop the non-authorized material within the EPF, VRI will consider the material to be the same as the previously placed non-authorized material, and on removal, it too will be transported to the non-authorized material stockpile for purposes of interim relocation, after which it will be considered (consistent with its current status) feedstock material (e.g., "ore") for future milling operations.

In the event importation of offsite-sourced material is determined to be necessary, VRI will obtain an affidavit certifying that the material is "clean and inert" as required by Rule 3.1.5(9) and such documentation will be provided to the Division in the removal action "final report".

Section 2.0 of the Technical Revision has been revised to specifically reflect the foregoing.

Item 4: RE: The Operator has committed to sampling the residual liquids which will be pumped from the tailings storage facility. Please commit to providing the analytical results to the Division prior to final disposition of the residual liquids.

VRI commits to providing analytical results (for "residual liquids") to the Division for purposes of obtaining Division approval/authorization relative to final disposition. While not specifically so-stated, the provision of such results to the Division was implicit in the statement on Page 4 of the Technical Revision: *"The ultimate water management method selected by VRI shall be subject to approval/authorization by DRMS prior to initiation of removal (pumping) activities".*

In addition, analytical results (and disposition method) will be fully documented in the "final report" to be submitted to the Division at the conclusion of the removal action.

Sections 1.2 and 3.4 of the Technical Revision, respectively, have been modified to reflect this commitment.

Item 5: RE: The Operator has specified the removal of potential toxic or acid-forming materials from within the tailings storage facility will occur within 90 days from the approval of Technical Revision No. 4. Please clarify if the proposed timeline has taken into account potential delays due to unfavorable weather conditions.

VRI acknowledges the previously expressed commitment to accomplish removal of the non-authorized materials within 90 days after Division approval of TR4, and duly notes that adherence with that time frame will be difficult given the seasonal access limitations as well as the potential for unfavorable weather conditions to inhibit operations during the performance of the removal action.

The performance commitment was provided as a good-faith estimate and in the interest of effectuating the removal action in a timely manner; however, VRI (and its contractors) have had limited site access to the relatively remote location during the winter months (due to snow cover) for purposes of meaningfully completing necessary evaluations, etc., thus inhibiting both preliminary contractor input and overall planning efforts.

Given the foregoing, VRI respectfully requests that the Division approve a start date for the Task 2 component of the removal action of "not later than June 1, 2017" and a completion date for the field component of the removal action of "not later than September 15, 2017. All other (Tasks 3 through 5) completion dates remain as stated.

The Technical Revision "Background" Task 2 (bullet item) as presented on Page 1 has been modified to reflect this change.

We trust that the foregoing (and the accompanying re-submittal of Technical Revision No. 4) incorporating the supplemental information addresses the Division's concerns in full. If you have any questions, please do not hesitate to contact the undersigned at (239) 537-1420.

Sincerely
VENTURE RESOURCES, INC.

Patrick Maher
President

cc: James M. Beck, P.E.

TECHNICAL REVISION 4
(As Modified 02/01/2017 to Address Adequacy Response No. 1)

TASK 1: LOGISTICAL ASSESSMENT AND REMOVAL ACTION PLAN AND SPECIFICATIONS

To Address Liner System Integrity and Recertification of the Hukill Mill Site Environmental Protection Facility

Background

On August 18, 2016, the Colorado Division of Reclamation, Mining and Safety (DRMS) approved Venture Resources, Inc.'s (VRI) Technical Revision 3, as pertaining to VRI's proposed *"Composite Liner System Corrective Action and Recertification Plan for the Hukill Mill Site"* (hereafter, "the CAP").

The DRMS approval requires VRI to prepare and submit to DRMS within 120 days of the approval date (i.e., by December 16, 2016), as a separate Technical Revision, a detailed scope of work defining the CAP's Task 1: Logistical Assessment and Removal Action Plan and Specifications. Task 1 was initially outlined in VRI's August 8, 2016 Response to the DRMS Adequacy Review No. 1 (to Technical Revision 3); accordingly, this Technical Revision 4 submittal provides the incremental level of detail for Task 1.

To reiterate, the CAP (as approved) is on an overall basis subject to the following sequentially staged performance criteria and general timelines:

- Task 1: Logistical Assessment and Removal Action Plan and Specifications
  (To be completed within 120 days of DRMS approval of the CAP)

- Task 2: Removal of Potential Toxic or Acid-Forming Materials
  (To commence not later than June 1, 2017 and complete not later than September 15, 2017)

- Task 3: Inspection of Composite Liner System
  (To be completed concurrent with or not later than 15 days following Task 2)

- Task 4: Alternatives Evaluation
  (To be completed concurrent with or not later than 30 days following Task 3)

- Task 5: Repair/Recertification or Closure Determination
  (To be completed concurrent with or not later than 30 days following Task 4)

The following sections provide detailed discussion of the proposed Task 1 through Task 5 activities, respectively, giving due consideration to the requirements of the Colorado Hard Rock/Metal Mining Rules, as applicable.

1.0 PHASE 1 - SITE PREPARATION

Phase I of Task 1 will address the various site preparation requirements necessary to effectuate the CAP, to include establishment of interim material relocation area(s), interim management of the various materials to be removed from the composite liner system, and other measures that ensure protection of the environment, all of which are to be carried out in general accordance with the requirements of the Hard Rock/Metal Mining Rules, and more specifically, Sections 3.1.5, 6.4.21, 7.3, and 6.4.21 thereof, respectively.

The Hukill Millsite is located at an elevation of approximately 8,300 feet above mean sea level (amsl), and in a somewhat difficult to access location, northwest of Idaho Springs, in Clear Creek County, Colorado (**Attachment I: Site Mapping** – refer to therein provided **Figure 1: Site Location Map** and **Figure 2: Aerial Base Map**, respectively).

At present, there are three types of material(s) present within the designated environmental protection facility (EPF), otherwise referred to as the tailing storage facility: (1) meteoric precipitation accumulation – an authorized content component; (2) an estimated +/-140-tons of tailing materials and entrained water as derived from gravity-only processes – also an authorized content component; and, (3) waste rock and bank run (natural) weathered rock materials which were introduced atop the composite liner system, and which are a non-authorized content component. The latter, placement of non-authorized waste rock (and bank run) materials atop the composite liner system (see **Attachment II: Site Photographs**) has been determined by DRMS to have potentially compromised liner system integrity, thereby rendering previously-issued DRMS certification of the subject environmental protection facility (EPF) void, and resulting in the requirement that VRI develop and implement the subject CAP in order to effectuate EPF recertification (see also **Attachment I** – **Figure 3: Site Detail**).

In essence, the CAP will incorporate the removal, disposition and/or interim relocation of materials currently residing within the EPF; inspection and repair of the composite liner system (as determined necessary and to the extent determined technically and/or economically practicable); and, recertification of the (repaired) composite liner system component of the EPF. On completion of the recertification process, it is anticipated that those materials that were subject to interim relocation would be designated feedstock(s) for future processing (milling) activities once milling operations are restored. In the event VRI determines that it is non-practicable to restore the EPF to certifiable status (from either a technical or economic based decision process), those materials subject to interim relocation would at that time be dealt with in a to-be-determined manner. Absent current knowledge as to the extent of damage (if any) to the composite liner system, and therefore the current inability to define the extent and cost associated with any necessary remedial measures, VRI cannot at this juncture commit to a specific final disposition method (due to business reasons); however, VRI does acknowledge the responsibility and reasserts the commitment to carrying out the CAP in accordance with the requirements of the Colorado Hard Rock/Metal Mining Rules. To that end, the respective components of the CAP will be carried out as sequentially discussed below.

1.1 Establish Staging and Stockpile Area

VRI will first establish an internal staging and stockpile area at the higher elevation bench immediately upgradient of the EPF's concrete barrier wall and the associated (potentially compromised) Phase 1 composite liner system. This staging/stockpile area, will be graded and leveled to accommodate the interim relocation of the solid materials (non-authorized waste rock and commingled bank run materials to be removed from atop the composite liner system).

In a similar manner, a leveled area will be established in a to-be-determined area immediately downgradient of and proximal to the concrete barrier wall to accommodate interim storage of free liquids (i.e., meteoric precipitation accumulation) to be pumped from the EPF. More specifically, this interim water storage area will be within or adjacent to the existing two-track road that parallels and traverses the toe of the earthen embankment portion of the barrier wall feature.

The upgradient staging/stockpile area will be established within the same area from which the non-authorized waste rock and bank run materials were derived; an area that continues to be occupied by like materials. This proposed staging and stockpile area location is also within the defined environmental protection facility (EPF) footprint, and as such, any/all materials placed therein will be fully protected from run-on (and subject to run-off containment) by the existing perimeter stormwater diversion features and concrete barrier wall, respectively; and, in addition, the stockpile area itself will be circumscribed by upslope and downslope run-on and containment barriers, respectively, both of which will be further enhanced by the installation of silt fencing to ensure stability of the feature(s).

In conjunction with preparing the staging/stockpile area, VRI will ensure that the "as approved" design criteria of the existing stormwater channel features are maintained, and that the carrying capacity is sufficient to preclude run-on from contacting and/or otherwise adversely affecting the also-protected staging and stockpiled material storage area.

Surface preparation of the staging/stockpile area will include blading and leveling of an area sufficient to accommodate on an interim basis those materials subject to removal from the EPF. In addition, a nominal 2-ft. high perimeter berm (or equivalent; as described above) will be established around the limits of the staging/stockpile area, to include a ramped access road across the berm to facilitate entry to the area.

Berm construction will be accomplished by excavating or cutting a shallow (nominal 12-inch depth) "v-ditch" and windrowing or stacking the material adjacent to the cut to establish the berm. Berm stability will be enhanced by consolidation (utilizing rubber-tired or tracked equipment) and deployment of silt fencing and/or erosion wattles on the uphill side of each feature. The perimeter berm shall serve the dual purposes of (a) secondary run-on prevention; and, (b) stabilization/containment of both the subject material stockpile and any "footprint" precipitation thereon.

1.2 Interim Management of Residual Liquids

At this juncture (early February 2017), VRI estimates that a pool of approximately 7,500 to 10,000 gallons of free liquid resides in the EPF, and it is anticipated that this volume will be further reduced through natural evaporative effects prior to the startup of the removal action. If the final volume is such that it can be practicably managed through interim storage, VRI will pump all residual water (which can be largely characterized as meteoric precipitation accumulation) to an interim portable storage tank (or tanks) to be situated on or adjacent to the two-track roadway located parallel to and downslope of the toe of the embankment associated with the concrete barrier wall. The proposed interim storage tank(s), or other suitable volume containment vessel(s) will be of sufficient capacity to receive the estimated volume of water contained within the EPF. All pumping efforts will be carried out in a manner that ensures maximum water recovery but avoids recovery of sediments and/or sludge. Recovered water will be retained within the interim storage tank through conclusion of the removal effort.

In the event the EPF contained water volume exceeds readily available storage capacity at the time removal action efforts are undertaken, other disposition options may be considered, to include: onsite evaporation (e.g., high-pressure atomization or via land application within the designated EPF footprint); onsite relocation; and/or potential disposition at a publically operated treatment works (POTW). The ultimate water management method selected by VRI shall be subject to approval/authorization by DRMS prior to initiation of removal (pumping) activities.

On completion of the removal effort VRI will sample the contained water volume (assuming water management is maintained onsite), with the objective of obtaining a single (i.e., one sample) representative full-depth profile sample of the water.

The sampling effort will be subject to standard US EPA SW-846 protocols relative to sampling instrument, method, preservation, holding time, and chain-of-custody. The sample(s) will be submitted to ESC Lab Sciences, Inc. of Mt. Juliet, Tennessee (the same laboratory utilized by VRI for groundwater monitoring sample analyses) and analyzed for both pH and the following suite of metals (total concentration): Aluminum, Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Selenium, Silver, and Zinc (ICP per EPA Method 6010B) and Mercury (per EPA Method 7470A). [Note: These analytical parameters are consistent with those required for the groundwater monitoring wells associated with the EPF]. Analytical results (standard turn-around basis), will be provided to the DRMS and utilized by VRI (in consultation with DRMS) to determine the appropriate ultimate disposition of the water at the conclusion of the CAP program, subject to DRMS approval/authorization.

Documentation of water quality analytical results and the selected (i.e., DRMS approved) disposition method will be provided to the Division in a final report addressing all aspects of the removal action.

1.3 Pre-Sorting and Disposition of Deleterious Materials

Prior to initiation of mechanized removal actions, VRI will employ manual labor procedures to "hand cull" observable and accessible timbers, dimension lumber, scrap steel, spikes/nails, large and/or jagged rocks, or other potentially deleterious materials from the non-authorized material zone within the EPF. VRI anticipates that such efforts may extend through the duration of the removal action if/when such materials are encountered, in order to minimize any further potential for compromise of the composite liner system. All such materials will be transported to the staging/stockpile area for interim storage (see Attachment I – Figure 3: Site Detail) during the performance of the removal action; man-made materials or similar debris (which are anticipated to comprise only a minor quantity (or volume) of material), will be separately stored proximal to the waste materials within the designated material storage area per Section 1.4, below.

On completion of the removal action (or during the course thereof), VRI will either selectively sell/dispose of such materials for scrap value, if any; or, for the greater portion (if not all), dispose of such materials at an authorized and licensed solid waste management facility (to be determined). Any waste rock materials will be managed in accordance with procedures defined in Section 1.4, below.

1.4 Management of Non-Authorized Waste Rock Materials

The "non-authorized" waste rock materials are those materials (inclusive of natural or bank run weathered rock materials) that were excavated and placed atop the composite liner system, thereby introducing the DRMS concerns relative to the potential compromise of the liner system integrity, and resulting in the subject corrective action requirement. These waste rock materials were derived from direct excavation (carried out using a rubber-tired wheel loader) from the very same historic waste rock stockpile (and surrounding area) that occupies upper Hukill Gulch (confined within the designated footprint of the EPF), and which represents a designated "ore" source for the early stages of the planned VRI processing operations. As a point of reference, Exhibit T – Environmental Protection Plan (within DRMS Permit No. M2009-076), in addressing Rule 6.4.20(6)(c), establishes that there are an estimated "8,000 tons of pre-existing abandoned mine waste rock currently contained within the proposed tailing impoundment area".

Prior analysis of a representative composite sample of these waste rock materials (comprising a total of 1,079 lbs, or approximately ½-ton) [refer also to Exhibit C (Appendix Item #1) of DRMS Permit No. M2009-076] demonstrates that the waste rock materials, particularly if isolated and maintained within the designated EPF area, do not pose an environmental concern.

This prior analysis included Synthetic Precipitation Leach Procedure (SPLP) testing on the waste rock materials (carried out in August 2009), in the following manner (see DRMS Permit No. M2009-076 - Exhibit C: "Waste Stream Characterization" – Pilot Plant Sampling Test Description):

> *"This particular* (waste rock) *sample was collected by filling 20 five-gallon buckets with waste rock from the surface and subsurface of the abandoned mine waste rock dump*

located within the Tailings Impoundment area (see Exhibit E). Each bucket is (was) *filled on a grid pattern of approximately 20 yards, representing an average of the contents of the dump.*

The material was then run through a two-stage dry crushing process consisting of: 10" x 20" jaw crusher that dresses the material down to -3/4 inches and a 24" x 14" roll crusher that further dresses the material to -1/8". The crushed material is (was) *then weighed. This sample yielded 1,079 pounds of dry crushed material, with a density of approximately 1.5 tons/cubic yard.*

Each bucket is (was) *then fed into the hopper of a variable speed screw conveyer that feeds into a 2' diameter x 4' ball mill. Municipal water is* (was) *then added at a rate of approximately 0.5 gpm to achieve 60% to 70% solids by weight. The output of the ball mill averages 35 mesh, but some coarser material is present. A 1-liter sample of this slurry, referred to as "Raw-Before Treatment", was collected in a clean plastic bottle at the ball mill discharge. Some coarser material is* (was) *captured in a screen box at the ball mill discharge, and is* (was) *manually collected and fed back into the ball mill for regrinding".*

The "raw solids" sample (i.e., the crushed and milled waste rock) obtained in the foregoing manner was then submitted to Evergreen Analytical, Inc. of Wheat Ridge, Colorado for SPLP analyses for arsenic, barium, cadmium, chromium, copper, lead, manganese, selenium, silver and zinc (Method SW1312/6010B) and mercury (Method SW1312/7470A), respectively. All analytes, with the exception of barium, manganese, and zinc returned results of "U" (i.e., compound analyzed for but not detected).

VRI subsequently completed a pilot-scale gravity separation process which produced both a solid tailing matrix and a tailing water component. With respect to the solid matrix portion of the tailing, all analytes, with the exception of barium, copper, manganese, and zinc returned results of "U" (i.e., compound analyzed for but not detected). With respect to the tailing water, all analytes, with the exception of barium, copper, lead, manganese, and zinc returned results of "U" (i.e., compound analyzed for but not detected).

The US EPA (www.epa.gov/dwstandardsregulations) has established National Primary Drinking Water Regulations that are legally enforceable primary standards and treatment techniques that apply to public water systems. In addition, EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants; however, EPA does not enforce "secondary maximum contaminant levels" (MCLs).

Comparison of the SPLP results for the three sample media (e.g., crushed/milled waste rock, tailing, and tailing water, respectively), against primary and secondary drinking water standards (MCLs) provides one method for examining the constituent concentrations in context. (albeit conservative, as VRI has not confirmed the presence of any potable water supply wells within a

radius of approximately ¾-mile of the Hukill Mill Site (refer to DRMS Permit No. M2009-076 – List of Wells).

Thus, the analytical results (see **Appendix III: Analytical Reports – Waste Rock and Tailing**) for the three sample media (e.g., crushed/milled waste rock; solid tailing matrix; and, tailing water, respectively) are depicted below in **Table 1-1: SPLP Leach Results on Waste Rock and Processed Tailing** alongside the respective primary and secondary MCLs for each respective analyte.

TABLE 1-1: SPLP LEACH RESULTS ON WASTE ROCK AND PROCESSED TAILING

Metal	MCL (mg/L)	Waste Rock	Tailing Solid	Tailing Liquid
Arsenic	0.010	-	-	-
Barium	2.0	0.20	0.71	0.008
Cadmium	0.005	-	-	-
Chromium	0.1	-	-	-
Copper	1.3	-	0.15	0.0053
Lead	0.015	-	-	**0.076**
Manganese	0.05*	**0.23**	0.03	**0.40**
Mercury	0.002	-	-	-
Selenium	0.05	-	-	-
Silver	0.1*	-	-	-
Zinc	5.0*	0.39	0.073	-

*Secondary Drinking Water MCL; All others are Primary Drinking Water MCL

As depicted (via bolded font and shading) in the foregoing Table 1-1, there are three instances where the respective MCL is exceeded per SPLP testing, as follows:

- Lead (Pb) – in the Tailing Liquid
- Manganese (Mn) – in the Crushed/Milled Waste Rock
- Manganese (Mn) – in the Tailing Liquid

The analytical results for Pb in the residual tailing liquid would represent a potential human health risk from “long term exposure” in drinking water. However, the tailing liquid is contained within the EPF (and likely significantly diluted via meteoric precipitation accumulation) and is proposed to be contained/managed throughout the course of the removal action.

The analytical results for Mn in the crushed/milled waste rock and the tailing liquid, respectively, would also represent a potential human health risk from “long term exposure” in drinking water. Manganese, however, is subject to a Secondary Drinking Water Standard, and while contaminant

levels exceeding the secondary MCLs may pose a potential risk to human health, manganese is primarily recognized as a contributor to potentially adverse aesthetic effects (e.g., odor, taste, and color) and to potentially adverse technical effects (e.g., corrosion and staining).

Given the non-presence of an immediately proximal groundwater aquifer system and the lack of potable water supply wells within or proximal to Hukill Gulch (an ephemeral drainage), as well as the significant distance (e.g. in excess of ½-mile) to the nearest receiving stream (Clear Creek), the net effect of either (or both) of these attributes (i.e., "aesthetic" or "technical"), particularly at the concentrations noted, can be considered negligible.

DRMS Permit No. M2009-076 – Exhibit T provides a detailed discussion of the geologic setting of the Hukill Mill Site. In essence, the immediate locale exhibits a groundwater depression due to the drainage of the area facilitated by the Big Five Tunnel. The Hukill Mill Site has a nominal elevation (at the barrier wall) of approximately 8,320 ft. above mean sea level (amsl); whereas, the Big Five Tunnel invert elevation at this location is at approximately 7,600 ft. amsl, (m/l), indicative of an approximately 720-ft. (m/l) elevation differential.

The Big Five Tunnel discharge is subject to treatment (at the Argo treatment plant) prior to release to Clear Creek, at a location approximately ¾--mile south-southeast of the Hukill Mill Site. Thus, the potential for adverse impact to either surface water or localized groundwater (if present) from any *de minimis* release at the site can be considered to be negligible to non-existent.

Based on the foregoing, and given the site specific conditions at the Hukill Mill Site (e.g., with the proximal area being drained by the Big Five Tunnel, present at approximately 720 ft. (m/l) vertically below the Hukill Mill Site EPF nominal surface elevation of 8,320 ft. amsl), the non-authorized waste rock materials do not warrant special consideration *per se*. Nevertheless, VRI will ensure that all such materials are at all times contained within the designated footprint area of the upgradient portion of the EPF throughout the conduct of the removal action.

Accordingly, the non-authorized waste rock materials will be excavated/removed from atop the liner system using excavation techniques selected specifically to minimize or preclude damage to the underlying composite liner system; and the excavated materials will be transported upslope to the designated staging/stockpile area for interim storage and stabilization.

VRI anticipates that placement of the material will be carried out in a manner that minimizes the areal extent (e.g., overall footprint) of the stockpile; that is, efforts will be focused on stacking the material or placing it in lifts to minimize the stockpile footprint area and to consolidate/stabilize same.

Post-CAP management of the stockpiled material will be dependent on findings relative to the extent of damage, if any, to the composite liner system. VRI will, at that time, make a determination as to whether the materials constitute stockpiled "ore" feedstock for future milling operations (the presumptive basis); or, alternatively, if it will be subject to "abandonment in place" (i.e., not a component of future operations). In the event of the latter, VRI will address the

stockpile in a manner not inconsistent with reclamation obligations specified within DRMS Permit No. M2009-076.

1.5 Management of Solid Matrix Tailing Materials

The surface of the solid matrix tailing material, at this juncture, remains largely exposed, excepting minor portions which may underlie the toe run-out zone of the emplaced non-approved waste rock materials. Inasmuch as there is no evidence of the emplaced waste rock materials having had direct contact with the composite liner system in the area underlying the tailing material, VRI will endeavor to avoid disturbance of the tailing matrix material, with the intent that the material will be left in place. This can be readily accomplished, as the interface between the two materials is visually discernible and observation of the interface can be utilized to guide field (excavation) activities. To the extent minor quantities of tailing may be encountered/excavated, the material will be managed in the same manner as that employed for the non-approved waste rock materials

1.6 Groundwater Monitoring

As a component of the previously approved Technical Revision 3, VRI voluntarily committed to an enhanced groundwater quality monitoring program. The enhanced program increased the groundwater monitoring frequency from a previously approved quarterly (i.e., once every three months) interval to what is currently a monthly frequency. This enhanced groundwater monitoring program was undertaken by VRI to provide more timely detection of potential seepage, if any, attributable to the potential compromise of the composite liner system.

To date (i.e., since approval of Technical Revision 3), three (3) groundwater monitoring events have been carried out, on the following dates, with the results as indicated below in **Table 1-2: Enhanced Groundwater Monitoring Program Results** (copies of monitor well sampling reports have been previously provided to DRMS under separate cover; however, duplicate documentation is herein provided as **Attachment III: Groundwater Monitoring Reports**).

TABLE 1-2: ENHANCED GROUNDWATER MONITORING PROGRAM RESULTS

Sampling Date	Sampling Point	Result
September 24, 2016	Upper and Lower Wells	Both Dry (No Sample Obtained)
October 28, 2016	Upper and Lower Wells	Both Dry on Resample*
November 21, 2016	Upper and Lower Wells	Both Dry (No Sample Obtained)
January 27, 2017	Upper and Lower Wells	Both Dry (No Sample Obtained

*Initial sampling of Upper Well encountered 1.5" water; subsequent resampling confirmed dry conditions.

Virtually all sampling episodes to date have encountered “dry” monitoring wells, with the sole exception being the October 28, 2016 sampling of the upper monitoring well (situated upgradient of the EPF and the potentially impacted liner area). Subsequent sampling of that well two days later suggests that an anomalous condition may have been encountered, as the October 30 sampling effort again determined “dry hole” conditions.

With respect to the lower (or down gradient) monitoring well, all sampling events have consistently encountered “dry hole” conditions. Thus, the monitoring data (or general lack thereof) suggests that it is unlikely that the composite liner system has been compromised; or, if so, that it is functioning as per the original multi-component design objectives, thereby precluding significant downward migration (if any) through and beneath the liner system.

The full extent of adverse impact (if any) on liner system integrity can best be determined through the execution of the proposed removal action and subsequent liner system inspection and/or testing.

VRI anticipates continuation of the enhanced groundwater monitoring program (i.e., the monthly sampling frequency) until such time that the removal action is completed and the EPF obtains the requisite recertification. At that time, by separate Technical Revision, VRI anticipates requesting DRMS approval to modify the groundwater sampling program, reverting back to the original frequency of once per quarter.

2.0 REMOVAL OF NON-AUTHORIZED MATERIALS

VRI has addressed preliminary actions to include establishment of a staging/stockpile area, removal/management of deleterious materials, and removal/management of free liquid (primarily meteoric precipitation accumulation) in Sections 1.1 through 1.5, above.

This section specifically addresses (and is limited to) the excavation, transport, interim storage, and disposition of the non-authorized materials that presently reside within the EPF and atop the EPF's composite liner system.

The removal action will likely incorporate the establishment of a lower level working platform of width sufficient to accommodate planned equipment size requirements. This will be accomplished through placement of a "fines" cushion at and along the waste rock toe area and immediately behind the concrete barrier wall (and potentially atop the existing solid matrix tailing material if determined necessary to provide sufficient bearing capacity for excavating equipment). This will be accomplished using onsite materials (with screening, as may be warranted) excavated from the existing waste rock inventory within the EPF boundaries (i.e., within the area protected by the existing perimeter diversion feature) and/or importation of offsite-sourced (commercially procured) "clean" fill material. To the extent offsite-sourced materials are procured (if any), VRI will obtain certification that such materials are "clean and inert" as per the requirements of Rule 3.1.5(9), and provide evidence of same in the final report documenting all aspects of the removal action.

The material will be placed into the working area and be advanced or extended (via dozer push) along the full length of (and interior to) the barrier wall utilizing low ground pressure equipment. In this manner, entrance and exit points will be established at either end. A haulage ramp will also be established at the point of egress, extending upslope and leading to the aforementioned upgradient staging/stockpile area, entering same via the previously discussed access ramp.

Once the working platform earthworks have been completed, solid surface panels will be laid out to serve the dual purposes of being a mucking platform and travel surface. Final material specifications have not yet been determined, and may be largely dependent on final equipment selection (giving due consideration to machine operating weight and bearing capacity, etc.); however, it is anticipated that the panels may be steel sheeting or mats, wood panels, or of similar configuration.

Once the working platform panels are in place, excavation work will proceed utilizing one, or a combination of, the following methods: (1) downslope push of material onto the mucking platform using a small, low ground pressure loader or dozer (i.e., either a tracked Bobcat skid steer unit or flotation tire equipped unit, or equivalent); (2) downslope push or downslope pull of material utilizing a backhoe excavator unit with a smooth-edge (toothless) bucket; and/or (3) overhand removal via backhoe excavator unit with a smooth-edge (toothless) bucket as performed from a crest area position. [Note: It is anticipated that full material removal will require an iterative series of excavating actions, each followed by a mucking cycle of material pickup, load, and transport].

Once a sufficient volume of material has been moved onto the mucking platform, the platform area will be cleared of the excavating equipment (as necessary), and a rubber-tired front end loader unit (or equivalent) will be utilized to re-excavate (muck) the material and tram the material upgradient via the haulage route to the staging/stockpile area. At that location, the material will stockpiled in a manner that minimizes the areal extent of the stockpile. The front end loader will then return to the mucking platform for successive loads until all muck-ready material has been removed from the working platform; after which, the slope excavation process will be repeated.

When the entirety of the composite liner system has been fully exposed (i.e., all significant quantities of loose material removed), manual “sweeping” and/or hand-held blower units may be employed (if necessary) to fine clean the topmost geotextile (drainage) layer component of the liner system. As warranted (and if determined feasible), a low ground pressure Bobcat mounted (or equivalent) rotary brush unit may also be utilized in order to expose areas for visual inspection. Residual materials derived from this action will be similarly pushed downslope to the mucking platform for retrieval and transport to the stockpile.

The working platform area would then be removed from within the EPF via a retreating method, first removing the individual platform panels, followed by backhoe excavation (smooth-edge bucket) of the previously emplaced earthen materials, with direct loading to the rubber-tired front end loader bucket (or dump truck unit) for direct tram to the stockpile location. Inasmuch as the materials would be either waste rock (e.g., “like” materials) or “inert” materials commingled with waste rock, all such materials would be stockpiled and considered by VRI to constitute “ore” and as such, subject to future operational and processing plans.

3.0 LINER SYSTEM INSPECTION AND TESTING

Liner system inspection will consist of a two-staged effort to: (1) initially and qualitatively identify the location(s) and type(s) of potential liner damage, if any, followed by (2) a quantitative assessment of the lateral and vertical extent of such damage locations to develop sufficient information, upon which repair, replace, or (potentially) closure options can be evaluated.

As detailed in Exhibit C of the approved DRMS Permit M2009-076 (and as per the certified "as-built" configuration), the composite liner system provided and installed by Colorado Lining International for the Hukill Mill Site EPF consists of the following individual components (listed from lowermost to uppermost):

- **Bentomat DN Geosynthetic Clay Liner**
  - a self-healing layer of sodium bentonite sandwiched between two nonwoven geotextiles needle-punched together, with a hydraulic conductivity of 5×10^{-9} cm/sec

- **HDPE Geomembrane (Textured)**
  - a chemically resistant, UV stable 60 mil high density polyethylene (HDPE) geomembrane with a textured surface on both sides

- **Geotextile Drainage Layer**
  - a geocomposite drainage layer incorporating an HDPE grid (to facilitate lateral drainage) sandwiched between two 6 oz/yd^2 nonwoven geotextile layers.

VRI anticipates that there may be significant to extensive ultra-violet (UV) degradation and/or wind-induced damage to the topmost non-woven geotextile encapsulating portion of the upper geocomposite drainage layer. This damage potential, in fact, was the determinative reason for VRI's Fall 2015 placement of the non-authorized waste rock and weathered rock material, an action undertaken to minimize the exposed surface area and to prevent further ultra-violet and/or wind-induced damage to the exposed liner surface. VRI anticipates the likelihood of further or incremental damage to this liner component (to be introduced via equipment contact); although, all removal action efforts will be undertaken in a manner that minimizes such potential.

3.1 Visual Inspection and Assessment

With the exposed liner system having been made readily observable as a result of the removal of overlying waste rock materials, etc. followed by the fine cleaning (refer to Section 2.0, above), VRI will complete a visual assessment of the full areal extent of the liner system, specifically observing for indications of ruptured or severed grid components and/or significant indentations indicative of concentrated impact loading or sharp/angular rock penetration, etc.

3.1.1 Damage Report

Any visibly ruptured or torn area, and any area exhibiting significant indentation (i.e., exhibiting non-rebounded vertical depth distortion greater than 2-inches) will be demarcated by orange

spray paint depicting the full perimeter. A "Damage Report" will be prepared, and each discrete area will be assigned an identifying number with the location noted on a sketch map, referencing distance and direction from a common control point (VRI anticipates utilizing the centroid of the leachate sump as the control point). Field documentation of these locations (i.e., inspection notes) will include information as to the type of damage, lateral or areal extent, probable depth influence or deformation, and other discernible characteristics associated with the damaged grid area/feature (and/or underlying liner component(s), as may be applicable).

3.2 Damage and/or Defect Repair

VRI will place greatest emphasis on ensuring integrity of the primary "impermeable" liner components (i.e., the 60 mil HDPE Geomembrane and the underlying Bentomat DN Geosynthetic Clay Liner, respectively) as these two components are the essence of the liner system. Inasmuch as the designated function of the (uppermost) geotextile drainage layer was/is to facilitate drain down of entrained tailing pore water, damage to the geotextile drainage layer component will be addressed through visual observation and determination of damage (e.g., HDPE grid rupture or tear, degraded or missing geotextile material, etc.) and it is anticipated that damaged portions will be either replaced and/or augmented with overlapping placement of an equivalent geotextile drainage layer component. Damaged/removed portions of this liner component will be disposed at an offsite non-hazardous waste facility.

Damage repair relative to the primary liner components will be dependent upon the type, frequency, and extent of damage noted during the inspection and assessment phase. VRI anticipates that damage repair methods will include, and be carried out in general accordance with, the specifications provided in the Colorado Lining International, Inc. geomembrane installation guideline document (see **Attachment IV: Polyethylene Geomembrane Product Specifications**), as per the following:

- Patching – which may be used to repair large holes, tears, and contamination by foreign matter;
- Grinding and re-welding – which may be used to repair small sections of extruded seams;
- Spot welding or seaming – which may be used to repair pinholes or other minor, localized defects; and/or
- Capping – which may be used to repair large lengths of damaged or failed seams.

Methods for patching lining system defects shall consist of welding patches or caps over such areas using the same membrane lining material as previously used on the project. Patches or caps shall extend at least 6-inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3-inches.

All seaming, preparation, and welding equipment deployment procedures will be consistent with established procedures employed during initial liner system installation.

Each repair shall be non-destructively tested using methods identified in *Part VI: Non-Destructive Seam Continuity Testing* of the aforementioned manual **"Polyethylene Geomembrane Product Specifications"**, as appropriate. The appropriate test procedure shall be selected by qualified field personnel in consultation with (and subject to agreement thereto) an independent Colorado Registered Professional Engineer (see also Section 3.3: Verification of Repairs, below). Dependent on the characteristics of the damage/defect area and the subsequent repair, non-destructive testing of all repair seams shall be carried out over their full length (to ensure continuity of seams) using a vacuum test unit, air pressure testing, or other approved method, as per the following:

- Vacuum Box Testing – utilized almost exclusively for evaluating extrusion weld bead quality;

- Air Channel Pressure Testing (ASTM D5820) – applicable only to seam continuity testing of air channels produced using dual track hot wedge welding equipment;

Repairs that pass the non-destructive test shall be accepted as indicative of proper and adequate repair. Failed tests shall be indicative that the repair is defective and that said repair shall be redone and re-tested until a passing result is obtained.

3.3 Verification of Repairs and Recertification

All repair actions will be carried out by qualified personnel and under the observation of an independent Colorado Registered Professional Engineer (PE). In addition to daily logs that are to be prepared by the installation/repair crew, the designated PE shall also maintain a field log documenting each discrete repair action, referenced by number, and such additional information as may be deemed appropriate. The PE documentation (and other field data, as appropriate) will be entered into a final report to be provided to DRMS on completion of the repair effort.

This PE documentation of satisfactory repair of all identified damage areas or defects shall serve as the basis for recertification of the composite liner system, and the PE shall provide in the final report a statement to that effect, along with signature and seal, thereby attesting to the completion of satisfactory repair and recertification of the EPF composite liner system.

3.4 Post Repair/Recertification Actions

At the conclusion of the removal action, liner system repair, and recertification, VRI will undertake the following:

(a) Liquids – Either return to the recertified EPF impoundment; or, dispose through other methods to be determined in consultation with DRMS after submittal and evaluation of sampling and analytical results. In the event "other methods" are employed, VRI will ensure that disposition subject to having received DRMS approval/authorization and that such is carried out in a manner consistent with applicable laws, regulations, and ordinances.

(b) Non-approved Waste Rock Materials – Will remain in-place at the interim stockpile location. These materials are considered by VRI to constitute “ore” and as such are subject to future operational and processing plans.

VRI will ensure that such materials remain adequately stabilized and/or contained in accordance with both this Plan and the facility/operation Stormwater Permit and Stormwater Management Plan requirements, to include retention of the peripheral run-on and containment features and incremental erosion controls (as may be required), in a manner consistent with Best Management Practice (BMP) guidelines.

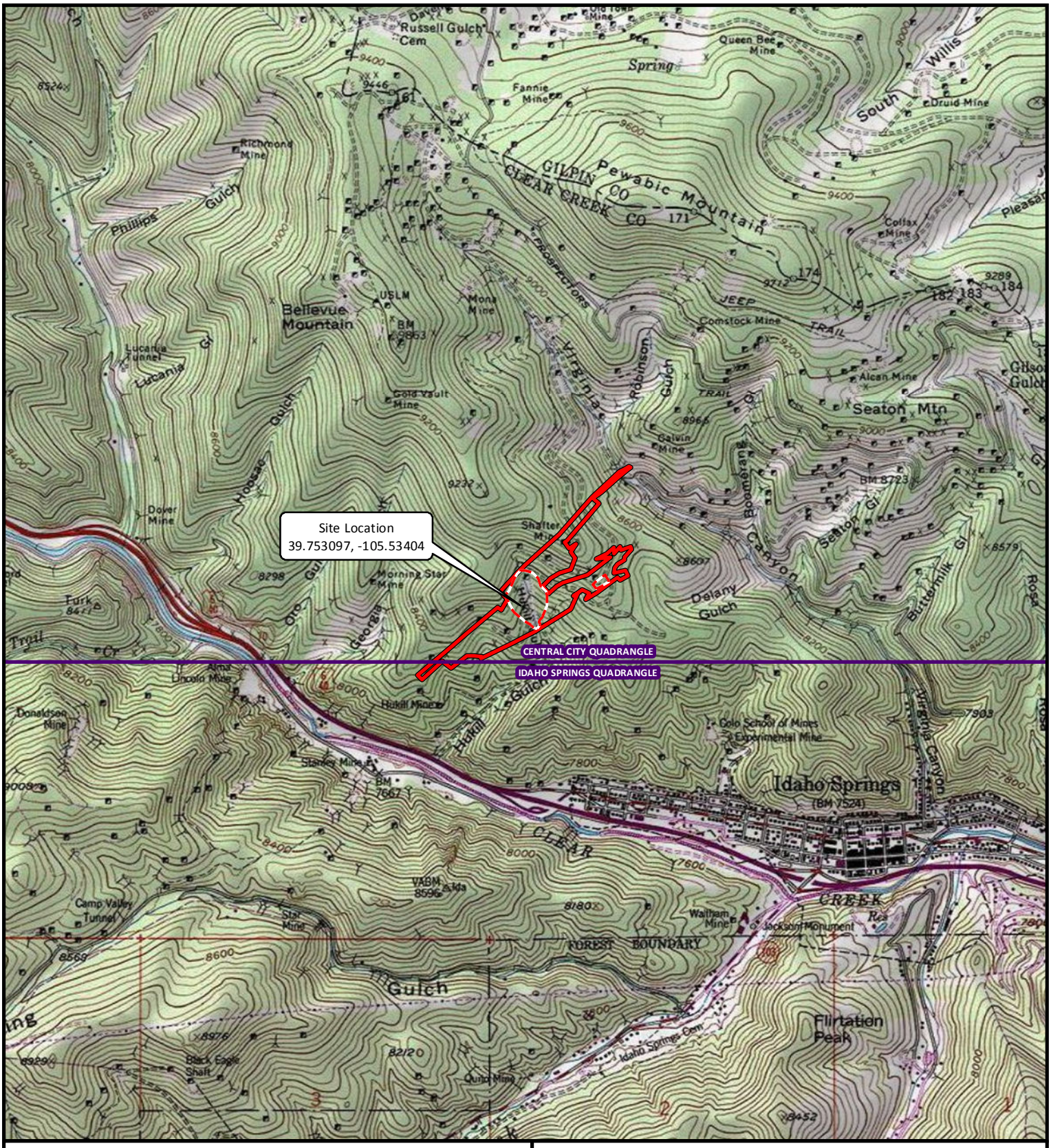
4.0 NON-REPAIR OPTION(S)

While it is VRI’s intent to remove all non-authorized materials from the EPF and gain recertification of same, VRI shall retain the right to make any determination as to the technical and/or economic viability of undertaking liner system repair and re-certification.

In the event VRI determines that, for technical and/or economic reasons, liner system repair and recertification is non-viable, VRI shall in a timely manner develop a closure (or other alternative) plan and submit same to DRMS in the form of a separate Technical Revision or Permit Amendment, as may be warranted.

ATTACHMENT I

Site Mapping



Permit Area

Property Boundary

Venture Resources, Inc.

Hukill Gulch Millsite

Figure 1 - Site Location Map

Project No. 107732000

Clear Creek County, CO
Central City, CO USGS 7.5' Topographic Quadrangle

1/27/2017

N W E S

0 2,000 Feet

1 inch = 2,000 feet

RETTEW

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Venture Resources, Inc.

Hukill Gulch Millsite

Figure 2 - Aerial Basemap

Clear Creek County, CO

Project No. 107732000

1/27/2017

Highway

Permit Area

Property Boundary

N W E S

0 500 Feet

1 inch = 500 feet

Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

RETTEW SM

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Up-Gradient Monitoring Well

Permit Area

Upslope Diversion (Proposed)

Interim Storage Area (Proposed)

Containment Berm (Proposed)

Permit Area

Perimeter Diversion

Non-Authorized Waste Rock

Impounded Tailing/Water

Water Storage Area (Proposed)

Down-Gradient Monitoring Well

Concrete Barrier Wall

SW/Sediment Basin

All Locations/features as indicated are approximate and have not been field validated or surveyed

Venture Resources, Inc.

Hukill Gulch Millsite

Figure 3 - Site Detail

Clear Creek County, CO

Project No. 107732000

1/31/2017

- Concrete Barrier Wall
- Perimeter Diversion
- Impounded Tailing/Water
- Non-Authorized Waste Rock
- Containment Berm (Proposed)
- Upslope Diversion (Proposed)
- Interim Storage Area (Proposed)
- Water Storage Area (Proposed)
- Monitoring Well
- Permit Area
- SW/Sediment Basin
- Property Boundary

N W E S

0 120 Feet

1 inch = 120 feet

Service Layer Credits: Google Earth Imagery

RETTEW SM

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ATTACHMENT II

Site Photographs

Photo of tailings impoundment and liner in 2013

Photo of tailings impoundment and liner in 2015.

Photo of the tailings impoundment and liner in 2015.

ATTACHMENT III

Analytical Reports
Waste Rock and Tailing

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862

(303) 425-6021

Client Sample ID: RAW SOLIDS
Client Project ID: HUKILL GULCH
Date Collected: 8/23/09
Date Received: 8/26/09

Lab Work Order: 09-6826
Lab Sample ID: 09-6826-01
Sample Matrix: Sludge

MERCURY, SPLP LEACHED

Method: SW1312/7470A **Prep Method: SW1311/7470A**

Date Prepared: 9/3/09
Date Analyzed: 9/5/09
Lab File ID: 090509w
Method Blank: MB-20638/20635
Dilution Factor: 1
Lab Fraction ID: 09-6826-01A

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	U	0.0010	mg/L

METALS, SPLP LEACHED

Method: SW1312/6010B **Prep Method: SW1311,2/3010A**

Date Prepared: 9/3/09
Date Analyzed: 9/3/09
Lab File ID: 090309OPT
Method Blank: MB-20635/20637
Dilution Factor: 1
Lab Fraction ID: 09-6826-01A

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	U	0.15	mg/L
Barium	7440-39-3	0.20	0.0050	mg/L
Cadmium	7440-43-9	U	0.0050	mg/L
Chromium	7440-47-3	U	0.050	mg/L
Copper	7440-50-8	U	0.015	mg/L
Lead	7439-92-1	U	0.37	mg/L
Manganese	7439-96-5	0.23	0.0050	mg/L
Selenium	7782-49-2	U	0.50	mg/L
Silver	7440-22-4	U	0.023	mg/L
Zinc	7440-66-6	0.39	0.056	mg/L

Analyst

Approved

Qualifiers:
B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value. Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions:
NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date: 9/23/2009

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862

(303) 425-6021

Client Sample ID: TAILS SOLIDS
Client Project ID: HUKILL GULCH
Date Collected: 8/23/09
Date Received: 8/26/09

Lab Work Order: 09-6826
Lab Sample ID: 09-6826-03
Sample Matrix: Sludge

MERCURY, SPLP LEACHED

Method: SW1312/7470A **Prep Method: SW1311/7470A**

Date Prepared: 9/3/09
Date Analyzed: 9/5/09
Lab File ID: 090509w
Method Blank: MB-20638/20635
Dilution Factor: 1
Lab Fraction ID: 09-6826-03A

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	U	0.0010	mg/L

METALS, SPLP LEACHED

Method: SW1312/6010B **Prep Method: SW1311,2/3010A**

Date Prepared: 9/3/09
Date Analyzed: 9/3/09
Lab File ID: 090309OPT
Method Blank: MB-20635/20637
Dilution Factor: 1
Lab Fraction ID: 09-6826-03A

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	U	0.15	mg/L
Barium	7440-39-3	0.71	0.0050	mg/L
Cadmium	7440-43-9	U	0.0050	mg/L
Chromium	7440-47-3	U	0.050	mg/L
Copper	7440-50-8	0.15	0.015	mg/L
Lead	7439-92-1	U	0.37	mg/L
Manganese	7439-96-5	0.030	0.0050	mg/L
Selenium	7782-49-2	U	0.50	mg/L
Silver	7440-22-4	U	0.023	mg/L
Zinc	7440-66-6	0.073	0.056	mg/L

NMB
Analyst

Approved

Qualifiers: B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value. Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date: 9/23/2009

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862

(303) 425-6021

Client Sample ID: TAILS WATER
Client Project ID: HUKILL GULCH
Date Collected: 8/23/09
Date Received: 8/26/09

Lab Work Order: 09-6826
Lab Sample ID: 09-6826-04
Sample Matrix: Water

TOTAL METALS

Method: SW6010B — **Prep Method: E200.7/SW3010A**

Date Prepared: 9/1/09
Date Analyzed: 9/2/09
Lab File ID: 090109AM
Method Blank: MB-20602
Dilution Factor: 1
Lab Fraction ID: 09-6826-04A

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	U	0.050	mg/L
Barium	7440-39-3	0.0080	0.0015	mg/L
Cadmium	7440-43-9	U	0.0080	mg/L
Chromium	7440-47-3	U	0.010	mg/L
Copper	7440-50-8	0.0053	0.0050	mg/L
Lead	7439-92-1	0.076	0.070	mg/L
Manganese	7439-96-5	0.40	0.0050	mg/L
Selenium	7782-49-2	U	0.10	mg/L
Silver	7440-22-4	U	0.026	mg/L
Zinc	7440-66-6	U	0.030	mg/L

TOTAL MERCURY

Method: SW7470A — **Prep Method: E245.1**

Date Prepared: 8/27/09
Date Analyzed: 8/28/09
Lab File ID: 082809W
Method Blank: MB-20518
Dilution Factor: 1
Lab Fraction ID: 09-6826-04A

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	U	0.00010	mg/L

Analyst

Approved

Qualifiers:
B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value. Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions:
NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date: 9/23/2009

ATTACHMENT IV

Groundwater Monitoring Reports

RETTEW

We answer to you.

110 N. Rubey Dr., Ste. 201, Golden, CO 80403-2453 • Phone: (800) 738-8395
E-mail: rettew@rettew.com • Website: rettew.com

October 13, 2016

Mr. Patrick D. Maher
Venture Resources, Inc.
P.O. Box 1974, 2208 County Road 281
Idaho Springs, Colorado 80452

RE: Hukill Gulch Millsite, Permit #M-2009-076
Groundwater Monitoring Plan
September 2016 Groundwater Monitoring Report

Dear Mr. Maher,

RETTEW Associates, Inc. is pleased to provide Venture Resources, Inc. with this Groundwater Sampling Report documenting groundwater monitoring activities conducted at the Hukill Gulch Mill Site located near Idaho Springs, Colorado (Site).

Groundwater Monitoring Summary

RETTEW conducted groundwater monitoring of the upgradient and downgradient monitoring wells on September 24, 2016. Both monitoring wells were dry, therefore, no samples were collected. The groundwater monitoring field form and field notes are provided as **Attachment 1**.

Tailings Pond Observation

The water level in the tailings pond has decreased by approximately three inches due to evaporation based on information provided by Mr. Patrick Maher of Venture Resources, Inc.

We trust this letter report provides Venture Resource, Inc. with the information required. Please feel free to contact Dustin Krajewski by telephone at (303) 800-4901 or by email at dkrajewski@rettew.com if you have questions or comments regarding this cost estimate. We truly appreciate the opportunity to support Venture Resources, Inc. with this project.

Sincerely,

Devin Black
Geoscientist

Dustin E. Krajewski, PE
Group Manager/Senior Engineer

Enclosures: Attachment 1 – Field Sampling Forms

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ATTACHMENT 1
FIELD SAMPLING FORMS

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Upgradient & Downgradient wells

Well No.:
Dup: N/A
MS/MSD: N/A

Well Type: X Monitor ☐ Extraction ☐ Other

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☐ Other
Job Number: 107732000 Phase
Date: 9/24/16 Time: 10:30 AM

Recorded By: (Signature)
Sampled By: (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2 3/8"
Total Depth of Casing (TD in feet BTOC): 20'
Water Level Depth (WL in feet BTOC): N/A, DRY
Number of Well Volumes to be Purged: N/A
Screened/Open Interval in Feet (BTOC) from 3 to 20

PURGE METHOD

☒ Bailer - Type: Checked w/ bailer, no purge
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.:
Other - Type:

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:

Depth in feet (BTOC)

PURGE VOLUME CALCULATIONS

(TD (feet) - WL (feet)) X D (inches)^2 X No. Volumes X 0.0408 = Calculated Purge Volume Gallons

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9										
	12	N/A - DRY									
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: Color:
Turbidity (Qualitative): Odor: Other:
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type Size Other:

SAMPLE COLLECTION RECORD

Analysis	

Notes:
Both wells DRY

1) Unlocked and opened security cap
2) Inserted a geotech 0.84x12 inch bailer into casing and lowered to bottom
3) Let sampler remain on bottom for 4 minutes
4) Confirmed dry wells / no water collected

RETTEW

We answer to you.

110 N. Rubey Dr., Ste. 201, Golden, CO 80403-2453 • Phone: (800) 738-8395
E-mail: rettew@rettew.com • Website: rettew.com

November 2, 2016

Mr. Patrick D. Maher
Venture Resources, Inc.
P.O. Box 1974, 2208 County Road 281
Idaho Springs, Colorado 80452

RE: Hukill Gulch Millsite, Permit #M-2009-076
Groundwater Monitoring Plan
October 2016 Groundwater Monitoring Report

Dear Mr. Maher,

RETTEW Associates, Inc. is pleased to provide Venture Resources, Inc. with this Groundwater Sampling Report documenting groundwater monitoring activities conducted at the Hukill Gulch Mill Site located near Idaho Springs, Colorado (Site).

Groundwater Monitoring Summary

RETTEW conducted groundwater monitoring of the upgradient and downgradient monitoring wells on October 28 and 31, 2016. The downgradient well was dry and approximately 1.5 inches of water was present in the upgradient well on October 28, 2016. Approximately 120 millilitres of water was purged and submitted to ESC Lab Sciences for analysis of Al, As, Ba, Cd, Cr, Cu, Pb, Mn, Hg, Se, Ag, and Zn metals - total concentration. Results were not available within the timeframe of this report, and will be provided upon their receipt. RETTEW gauged the upgradient well again on October 31, 2016 and found it to be dry. The groundwater monitoring field forms are provided as **Attachment 1**.

Tailings Pond Observation

The water level in the tailings pond has decreased by approximately four inches due to evaporation based on a comparison of the water level during the September event.

We trust this letter report provides Venture Resource, Inc. with the information required. Please feel free to contact Dustin Krajewski by telephone at (303) 800-4901 or by email at dkrajewski@rettew.com if you have questions or comments regarding this cost estimate. We truly appreciate the opportunity to support Venture Resources, Inc. with this project.

Sincerely,

Devin Black
Geoscientist

Dustin E. Krajewski, PE
Group Manager/Senior Engineer

Enclosures: Attachment 1 – Field Sampling Forms

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ATTACHMENT 1
FIELD SAMPLING FORMS

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

downgradient

Well No.: [illegible]
Dup:_____
MS/MSD:_____

Well Type: ☑ Monitor ☐ Extraction ☐ Other _____

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☐ Other HDPE
Job Number: 107732000 Phase _____ Date: 10/28/16 Time: 1134

Recorded By: _____ Sampled By: DB
(Signature) (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 13.5'
Water Level Depth (WL in feet BTOC): dry
Number of Well Volumes to be Purged: _____
Screened/Open Interval in Feet (BTOC) from _____ to _____
5.75 to ground surface

PURGE METHOD

☐ Bailer - Type: _____
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.: _____
Other - Type: _____

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:
Depth in feet (BTOC) _____

PURGE VOLUME CALCULATIONS

(_____ - _____) X _____ ^{2} X _____ X 0.0408 = _____ Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6			DRY							
	9										
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING: Well Condition: _____ Color: _____

Turbidity (Qualitative): _____ Odor: _____ Other: _____
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type _____ Size ____ Other: _____

SAMPLE COLLECTION RECORD

Analysis	

Notes:
DRY no moisture on probe

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Upgradient
Well No.:
Dup:
MS/MSD:

Well Type: ☑ Monitor ☐ Extraction ☐ Other

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☐ Other HDPE
Job Number: 107732000 Phase
Date: 10/28/16 Time: 1150
Recorded By: (Signature) Sampled By: DD (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 25.3
Water Level Depth (WL in feet BTOC): 25.1
Number of Well Volumes to be Purged:
Screened/Open Interval in Feet (BTOC) from to
6.6' to ground surface

PURGE METHOD

☑ Bailer - Type: 1.6" x 12"
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.:
Other - Type:

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:
Depth in feet (BTOC)

PURGE VOLUME CALCULATIONS

(-) X ² X X 0.0408 = Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/min)	~~Gallons Purged~~ mL	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0		~120mL	4.59							
	3										
	6										
	9										
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: Color:
Turbidity (Qualitative): Odor: Other:
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type Size Other:

SAMPLE COLLECTION RECORD

Analysis	Al, As, Ba, Cd, Cr, Cu, Pb, Mn, Hg, Se, Ag, Zn by 6010
Notes:	purged ~120 mL before well went dry Sampled upgradient well @ 1220

RETTEW.
We answer to you.

GROUNDWATER SAMPLING FORM

upgradient
Well No.:_____
Dup:_____
MS/MSD:_____

Well Type: ☐ Monitor ☐ Extraction ☐ Other _____

Job Name: Hukill Gulch Millsite #M-2009-076 **Well Material:** ☐PVC ☐ St. Steel ☑ Other HDPE
Job Number: 107732000 Phase _____ **Date:** 10/31/16 **Time:** 1045

Recorded By: _____ Sampled By: Mitch
(Signature) *(Sampling Team Members)*

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 25.7
Water Level Depth (WL in feet BTOC): _____
Number of Well Volumes to be Purged: _____
Screened/Open Interval in Feet (BTOC) from _____ to _____

PURGE METHOD

☐ Bailer - Type: _____
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.: _____
Other - Type: _____

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:

Depth in feet (BTOC) _____

PURGE VOLUME CALCULATIONS

(_____ - _____) X _____ ^{2} X _____ X 0.0408 = _____ Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9										
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: _____ Color: _____
Turbidity (Qualitative): _____ Odor: _____ Other: _____
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type _____ Size ____ Other: _____

SAMPLE COLLECTION RECORD

Analysis	

Notes:

Dry, mud on end of probe

RETTEW

We answer to you.

110 N. Rubey Dr., Ste. 201, Golden, CO 80403-2453 • Phone: (800) 738-8395
E-mail: rettew@rettew.com • Website: rettew.com

November 23, 2016

Mr. Patrick D. Maher
Venture Resources, Inc.
P.O. Box 1974, 2208 County Road 281
Idaho Springs, Colorado 80452

RE: Hukill Gulch Millsite, Permit #M-2009-076
Groundwater Monitoring Plan
November 2016 Groundwater Monitoring Report

Dear Mr. Maher,

RETTEW Associates, Inc. is pleased to provide Venture Resources, Inc. with this Groundwater Sampling Report documenting groundwater monitoring activities conducted at the Hukill Gulch Mill Site located near Idaho Springs, Colorado (Site).

Groundwater Monitoring Summary
RETTEW conducted groundwater monitoring of the upgradient and downgradient monitoring wells on November 21, 2016. Both monitoring wells were dry, therefore, no samples were collected. The groundwater monitoring field forms are provided as **Attachment 1**.

Tailings Pond Observation
The water level in the tailings pond has decreased by approximately two inches due to evaporation based on the October sampling event.

We trust this letter report provides Venture Resource, Inc. with the information required. Please feel free to contact Dustin Krajewski by telephone at (303) 800-4901 or by email at dkrajewski@rettew.com if you have questions or comments regarding this cost estimate. We truly appreciate the opportunity to support Venture Resources, Inc. with this project.

Sincerely,

Devin Black
Geoscientist

Dustin E. Krajewski, PE
Group Manager/Senior Engineer

Enclosures: Attachment 1 – Field Sampling Forms

ATTACHMENT 1
FIELD SAMPLING FORMS

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Downgradient

Well No.:
Dup:
MS/MSD:

Well Type: ☑ Monitor ☐ Extraction ☐ Other

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☑ Other HDPE
Job Number: 107732000 Phase
Date: 11/21/16 Time: 1215
Recorded By: (Signature) Sampled By: DB (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 23.8'
Water Level Depth (WL in feet BTOC): dry
Number of Well Volumes to be Purged:
Screened/Open Interval in Feet (BTOC) from ____ to ____
5.75' to ground surface

PURGE METHOD

☑ Bailer - Type:
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.:
Other - Type:

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:

Depth in feet (BTOC)

PURGE VOLUME CALCULATIONS

(____ - ____) X ____ ² X ____ X 0.0408 = ____ Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9			DRY							
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: good Color:
Turbidity (Qualitative): Odor: Other:
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type Size Other:

SAMPLE COLLECTION RECORD

Analysis	

Notes:

DRY - no moisture on probe

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Upgradient

Well No.:_____
Dup:_____
MS/MSD:_____

Well Type: ☑ Monitor ☐ Extraction ☐ Other _____

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☑ Other HDPE
Job Number: 107732000 Phase _____ Date: 11/21/16 Time: 1230
Recorded By: _____ Sampled By: DB
(Signature) (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 25.3'
Water Level Depth (WL in feet BTOC): Dry
Number of Well Volumes to be Purged: _____
Screened/Open Interval in Feet (BTOC) from _____ to _____
6.6' to ground surface

PURGE METHOD

☑ Bailer - Type: _____
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.: _____
Other - Type: _____

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:
Depth in feet (BTOC) _____

PURGE VOLUME CALCULATIONS

(_____ - _____) X _____ ² X _____ X 0.0408 = _____ Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9		DRY								
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: _____ Color: _____
Turbidity (Qualitative): _____ Odor: _____ Other: _____
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type _____ Size ____ Other: _____

SAMPLE COLLECTION RECORD

Analysis	

Notes:

DRY - Some mud on tip of DB WL meter

RETTEW

We answer to you.

110 N. Rubey Dr., Ste. 201, Golden, CO 80403-2453 • Phone: (800) 738-8395
E-mail: rettew@rettew.com • Website: rettew.com

January 30, 2017

Mr. Patrick D. Maher
Venture Resources, Inc.
P.O. Box 1974, 2208 County Road 281
Idaho Springs, Colorado 80452

RE: Hukill Gulch Millsite, Permit #M-2009-076
Groundwater Monitoring Plan
January 2017 Groundwater Monitoring Report

Dear Mr. Maher,

RETTEW Associates, Inc. is pleased to provide Venture Resources, Inc. with this Groundwater Sampling Report documenting groundwater monitoring activities conducted at the Hukill Gulch Mill Site located near Idaho Springs, Colorado (Site).

Groundwater Monitoring Summary

RETTEW conducted groundwater monitoring of the upgradient and downgradient monitoring wells on January 27, 2016. Both monitoring wells were dry, therefore, no samples were collected. The groundwater monitoring field forms are provided as **Attachment 1**.

Tailings Pond Observation

The water level in the tailings pond could not be observed. Snow has drifted against the retaining wall and completely obscured the pond surface.

We trust this letter report provides Venture Resources, Inc. with the information required. Please feel free to contact Dustin Krajewski by telephone at (303) 800-4901 or by email at dkrajewski@rettew.com if you have questions or comments regarding this cost estimate. We truly appreciate the opportunity to support Venture Resources, Inc. with this project.

Sincerely,

Devin Black
Geoscientist

Dustin E. Krajewski, PE
Group Manager/Senior Engineer

Enclosures: Attachment 1 – Field Sampling Forms

ATTACHMENT 1
FIELD SAMPLING FORMS

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Upgradient
Well No.:
Dup:
MS/MSD:

Well Type: ☑ Monitor ☐ Extraction ☐ Other

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☑ Other HDPE
Job Number: 107732000 Phase
Date: 01/27/17 Time: 1400
Recorded By: (Signature) Sampled By: DBlack (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 25.3'
Water Level Depth (WL in feet BTOC): DRY
Number of Well Volumes to be Purged:
Screened/Open Interval in Feet (BTOC) from to

PURGE METHOD

☑ Bailer - Type:
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.:
Other - Type:

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:

Depth in feet (BTOC)

PURGE VOLUME CALCULATIONS

(-) X ² X X 0.0408 = Gallons

TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9										
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING

Well Condition: Good Color:
Turbidity (Qualitative): Odor: Other:
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type Size Other:

SAMPLE COLLECTION RECORD

Analysis	

Notes:

DRY - no moisture on probe

RETTEW
We answer to you.

GROUNDWATER SAMPLING FORM

Downgradient

Well No.:_____
Dup:_____
MS/MSD:_____

Well Type: ☑ Monitor ☐ Extraction ☐ Other _____

Job Name: Hukill Gulch Millsite #M-2009-076 Well Material: ☐PVC ☐ St. Steel ☑ Other _____
Job Number: 107732000 Phase _____ Date: 01/27/17 Time: 1430
Recorded By: _____ Sampled By: DBlack
(Signature) (Sampling Team Members)

PURGE VOLUME

Casing Diameter (D in inches): 2"
Total Depth of Casing (TD in feet BTOC): 23.8'
Water Level Depth (WL in feet BTOC): Dry
Number of Well Volumes to be Purged: _____
Screened/Open Interval in Feet (BTOC) from _____ to _____

PURGE METHOD

☑ Bailer - Type: _____
☐ Submersible ☐ Peristaltic ☐ Bladder; Pump No.: _____
Other - Type: _____

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Middle of water column ☐ Other:

Depth in feet (BTOC) _____

PURGE VOLUME CALCULATIONS

(_____ - _____) X _____ ² X _____ X 0.0408 = _____ Gallons
TD (feet) WL (feet) D (inches) No. Volumes Calculated Purge Volume

FIELD PARAMETER MEASUREMENT

Time	Minutes Elapsed	Rate (mL/ min)	Gallons Purged	pH	Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	Temp. (°C)	ORP (mV)	Depth to Water (ft t.o.c.)	Comments
	0										
	3										
	6										
	9										
	12										
	15										
	18										
	21										
	24										
	27										
	30										

Note: GT = Greater Than. LT = Less Than.
NM = Not Measured. NC = Not Collected.

OBSERVATIONS DURING WELL PURGING: Well Condition: good Color: _____

Turbidity (Qualitative): _____ Odor: _____ Other: _____
Purge Water Disposal: ☐ San. Sewer ☐ Storm Sewer ☐Bucket: Type _____ Size ____ Other: _____

SAMPLE COLLECTION RECORD

Analysis	

Notes:

DRY - no moisture on probe

ATTACHMENT V

Polyethylene Geomembrane Product Specifications

(Colorado Lining International)

Polyethylene Geomembrane Product Specifications

Colorado Lining International, Inc.
Parker, CO 80138
(800) 524-8672/(303) 841-2022
Fax: (303) 841-5780
www.coloradolining.com

TABLE OF CONTENTS

PART I
PURPOSE

This manual addresses the quality assurance and quality control of the installation of High Density Polyethylene (HDPE) geomembrane liners used by Colorado Lining Construction (CLC) in hazardous waste disposal landfills, surface impoundments or other installations as specified by the owner and/or engineer. This manual delineates the quality procedures and standards for installation.

1.1.0 Scope of Quality Assurance

The scope of this manual includes the quality assurance applicable to shipment, handling, and installation of High Density Polyethylene (HDPE) geomembrane liners also referred to Flexible Membrane Liners (FML's).

1.2.0 Units

In this manual, all properties and dimensions are expressed in English units, with "equivalent" Système International (SI)/metric units in parentheses. It should be noted that the conversion is typically only accurate within ten percent. In cases of conflict or clarifications, the U.S. units shall be deemed to govern. Since most field geomembrane testing equipment manufactured in the United States are equipped to measure in English units, required test result data are tabulated herein with such units.

1.3.0 References

The manual includes references to test procedures of the American Society for Testing and Materials (ASTM), the Federal Test Method Standards (FTMS) and the "Standards for Flexible Membrane Liners" of the National Sanitation Foundation (NSF).

PART II
DELIVERY

2.1.0 Transportation and Handling

CLC through its own transportation or an independent trucking firm or other party as agreed upon by the Owner will perform transportation of the geomembrane. If the geomembrane arrives on site prior to CLC project personnel, the Owner is responsible for off-loading roll goods and any ancillary items shipped. The material received shall be matched against the freight bill of lading. Any discrepancies shall be immediately reported to CLC before the shipment is signed for. When off-loaded, geomembrane and any ancillary items should be placed on a smooth, well drained surface, free of rocks or any other protrusions which may damage the material. No special covering is necessary for geomembrane.

The following should be verified prior to and during off-loading geomembrane:

> Handling equipment used on the site is adequate and does not pose any risk or damage to the geomembrane and that personnel handle the geomembrane with care. If slings are provided, the material should be lifted with such. In any event, materials shall be offloaded in a safe manner whereby the rolls are properly balanced and no personnel or property are at risk of being injured/damaged should loss of control of any roll(s) of material occur.

Upon arrival at the site, CLC shall conduct a surface observation of all rolls for

defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. CLC shall indicate any damage to the Owner's Representative. The Owner shall immediately report to CLC any damage known to exist prior to delivery or that may have occurred during off-loading/handling.

2.2.0 Storage

The Owner shall provide storage in location (or several locations) such that on-site transportation and handling are minimized. Storage space should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined.

2.2.1 Special Consideration for Welding Rod or GCL Liner

Should any welding rod or geoclay (GCL) liner be delivered to the site prior to CLC arrival, such materials shall be immediately secured in a sheltered/dry condition and maintained in such condition until deployed by CLC personnel.

PART III
SITE PREPARATION & INSPECTION

3.1.0 Anchor Trench Systems

All Anchor Trench Systems shall be excavated by others (unless otherwise specified) to the lines and widths shown on the design drawings, prior to geomembrane placement.

3.2.0 Site Inspection

Immediately prior to installation, the subgrade shall be jointly inspection walked by the Owner's Representative and CLC personnel to determine it's worthiness to accept the specified lining system. The decision to repair cracks, if any, should be made only by the Owner's Representative. Once properly prepared, CLC will sign acceptance of the surface condition of the subgrade. The integrity of the underlying soil shall remain the responsibility of the owner/earthwork contractor.

Subgrade Preparation Recommendations:

No liner shall be placed on surfaces not previously found acceptable by the CLC supervisor or his agent.

Surfaces to be lined shall be compacted, smooth, and free of all rocks greater than 3/8" in diameter, sharp angular stones, sticks, vegetation, roots, sharp objects, gravel, or debris of any kind. The surface shall provide a firm, unyielding foundation for the lining system with no sudden, sharp or abrupt changes or breaks in grade or geometry.

Part IV
PANEL DEPOLYMENT AND TRACKING

4.1.0 Weather and Site Conditions

Panel placement shall not take place during precipitation, or in the presence of excessive winds (unless wind barriers are provided). In addition, deployment shall not take place in any areas of ponded water.

4.2.0 Panel Identification

Panels are portions of roll stock membrane that are field cut to size as required for

fitment and overlapped/welded in situ. In larger projects, a panel may consist of an entire uncut roll.

At the time of installation, the CLC Field Supervisor shall give each field panel an "identification code" (Number or letter-number). This field panel identification code shall be as simple and logical as possible.

4.3.0 Panel Placement

Panels are located by the CLC Field Supervisor in a manner consistent with the specification and best suited to existing site conditions. Field Panels shall be placed one at a time and each shall be seamed immediately after its placement for protection against wind action or rainwater infiltration.

CLC shall record the identification code, location, and date of installation of each geomembrane field panel.

4.4.0 Precautions During Panel Placement

CLC shall ensure that:

Any equipment used will not damage the geomembrane by handling, trafficking, excessive heat, leakage of fluids, or other means.

The prepared surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to liner placement.

Any geosynthetic elements immediately underlying the geomembrane are clean and free of debris.

All personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

Methods used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil.

Methods used to place the panels minimize wrinkles (especially differential wrinkles between adjacent panels).

Adequate temporary ballast is placed over deployed lining panel edges to prevent wind uplift and is not likely to damage the geomembrane. In the event of high winds, continuous loading such as sandbags shall be placed end to end along edges of panels to minimize risk of wind effects.

Direct contact with the geomembrane is minimized. Geotextiles, extra liner or other suitable materials shall be used as protective buffers in areas where excessive traffic may be expected.

4.5.0 Damaged Material

CLC shall inspect the geomembrane after placement and prior to seaming for damage. Any damaged membrane that cannot be reasonably repaired shall be removed and replaced. Repairs to geomembrane shall be made according to procedures described in section 8.2.0.

PART IV
SEAMING

5.1.0 Required Weather Conditions for Seaming

No seaming shall be conducted during periods of excessive moisture, blowing dust, or in the presence of excessive winds (unless wind barriers are provided). Seaming shall not take place in an areas of ponded water.

High temperature limits for welding are dependent upon crew safety and membrane material limits. Elevated temperatures can create conditions whereby seam strength may be compromised and an inferior installation may result. When elevated temperature conditions exist over 95° F/35° C, weld quality shall be closely monitored during seaming operations.

No seaming shall be conducted during rain or snow, unless the seam is covered with an enclosure permitting favorable seaming conditions.

No seaming shall be attempted at ambient temperatures below 5° F without proper pre-heating of material promoting favorable seaming conditions.

In all cases, geomembrane shall be dry and protected from wind.

CLC shall verify that favorable weather conditions exist and advise the Owner's Representative if they are not favorable.

5.2.0 Seaming and Related Equipment

Unless otherwise specified, all field seaming procedures shall be limited to two methods: extrusion welding and fusion (via hot wedge/"wedge welding"). The bulk of all panel to panel seaming shall be performed using the wedge weld technique. Extrusion welding shall limited to areas where wedge welders cannot practically be deployed such as patching and pipe penetration sealing. These machines typically require gas or diesel fueled generators as power sources.

Each extrusion welding apparatus shall be equipped with gauges giving the temperature of the apparatus at the nozzle and extruder barrel.

Each wedge welding apparatus shall be equipped with gauges giving the applicable temperatures.

Although welding over a frozen, wet or muddy subgrade is generally not encouraged, fusion welding may be possible under such conditions by deployment of a movable plastic slip-sheet placed directly below the overlapped membranes being seamed. Properly designed and deployed slip-sheets serve to prevent moisture buildup between the sheets being welded while providing conditions whereby wedge welding machines may be propelled at an uninterrupted rate of speed.

5.2.1 Equipment Preparation

Generator(s) shall be fueled outside the extents of the lining system and be inspected for fluid leakage and mechanical damage that may result in damage to the lining system. Should it be necessary to place the generator over the lining system a suitable buffer strip shall be placed between the tires and the membrane. Generators without inflated rubber tires shall not be introduced over the lining system. Tires shall be pre-inspected to be free of foreign matter that may damage the membrane. Generators shall be positioned within close proximity of the seaming region and have adequate extension cords to complete an entire seam without the necessity to move the machine.

Wedge welders shall be calibrated for ambient conditions and the material type/thickness to be welded. The front part of the seaming device should be inspected for sharp corners and irregular details, which may damage the liner. The major point for inspection is that no sharp edges should exist where FML sheet surfaces must pass over the heated wedge element. If a dual, or split, hot wedge seam is being made, the recessed space for the air track should be examined. Knurled pressure rollers shall be inspected for sharp surfaces. All wedge welder adjustments shall be checked daily. Cleaning of machine should be done at least daily.

Extrusion welders shall have an initial inspection before warm up to confirm that the insulation and covers are in good condition and that the welding nozzles (or Teflon shoes) are correct for the FML to be seamed. Teflon shoes should be checked for proper weld bead geometry and excessive wear and replaced if necessary. They shall then be heated to the correct welding temperature for thickness of the material to be welded and then purged of all heat-degraded resin from within the barrel. During the purge process temperature controllers shall be monitored for proper function and that the welding rod feed systems and rotating tips are operating properly.

5.2.2 Trial Seams

Before any welding is performed by either method on the actual membrane lining system, trial seam welds must first be performed yielding passing results.

CLC shall prepare trial seams made with test strips of the actual membrane being installed to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period (start of the day and midday) for each seaming apparatus used. Trial seams shall be made under the same conditions as actual seams.

The trial seam sample shall be approximately 3 feet/1.0 m long by 1 foot/0.3 m wide (after seaming) with the seam centered lengthwise. Seam overlap shall be nominally 4 inches/10.2 cm, 3 inches/7.6 cm minimum.

Unless otherwise specified, five (5) seam sample coupons each measuring 1"/25mm wide x 6"/150mm long shall be cut from the trial seam sample in increments to span its length. The specimens shall be tested in peel (3 ea.) and shear (2 ea.) modes using a field tensiometer. No seaming apparatus shall be used for seaming until deficiencies are corrected and two consecutive trial welds are successfully achieved.

5.3.0 Seam Layout

In general, seams should be oriented parallel to the line of maximum slope, in the direction of slope, not across the slope (horizontal to slopes). Horizontal to slope seams should be no less than 5 feet (1.5 m) from the toe of the slope or areas of potential

stress concentrations unless otherwise approved by The Owner's Representative. When full roll lengths do not extend past the toe of the slope, panel ends may be seamed provided the panel end is cut at an angle greater than 45° to minimize seam stress. In corners and areas of irregular geometry, the number of seams should be minimized.

A seam numbering system compatible with a panel numbering system shall be employed.

5.4.0 Panel Overlap for Seaming

Controlled overlapping of adjacent sheets shall produce approximately 3 inches of overlap for extrusion welds and 4 inches of overlap between sheets for wedge welded seams.

5.5.0 Seam Preparation

CLC shall verify that:

Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material, and seams are aligned with the fewest possible number of wrinkles or "fishmouths".

All areas to receive extrusion welds shall first be lightly/evenly ground with a hand held grinder with a 60 or 80 grit disc to roughen the surface while removing all surface shine. The grinding is performed parallel to the seam and controlled such that grinding marks do not extend more than 0.25 inches outside the area of the weld bead area. Sixty mil or thicker liners should have the edge of the top sheet beveled by grinding to approximately a 45° angle. This grinding preparation shall be completed no more than one (1) hour prior to extrusion welding. Grinding preparation does not apply to wedge welding.

5.6.0 Wedge Welder Seaming Procedure

A smooth insulating plate or fabric is shall be placed beneath the hot welding apparatus both before and after usage.

Unless otherwise specified, the general seaming procedure used by CLC shall be as follows:

The rolls of geomembrane shall be overlapped by approximately four inches (100 mm) for fusion welding and three inches for extrusion welding.

Welding can occur once the panels to be joined have been brought into their exact plan position for final installation.

"Fishmouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut "fishmouths" 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 6 inches beyond the cut in all directions.

Power to the drive motor shall remain switched-off off when positioning the machine to make a seam.

When starting a new weld, the machine shall be manually placed into the overlapped sheet of material. The sheets shall then be guided between the idlers and the wedge element, and into the drive/nip rollers.

When starting a weld in the middle of two sheets, the material must be loaded from the sides. The machine is to be picked up a few inches, loading the bottom sheet first and top sheet second.

As soon as the wedge is in position and the nip rollers are engaged, the drive motor should be energized and the hot wedge moved into position and locked.

Welder alignment and temperature shall be monitored during the seaming process and any adjustments be made as necessary.

Should the machine tend to bulldoze the subgrade due to soil conditions, the operator shall take some of the weight off the front of the machine by lifting it slightly. Alternatively, a base for the machine to travel on could be provided consisting of strips of geotextile or geomembrane.

To avoid damaging membrane material, once the end of a seam is reached the drive and/or pressure rollers shall be immediately disengaged before the material runs completely out of the machine. The machine shall be withdrawn as quickly as possible to avoid damaging the membrane.

Seaming shall span the full panel length extend well into the anchor trench.

All cross seams or "T" intersections are to be extrusion welded where they intersect. The top flap of geomembrane shall be removed in the area to be extrusion welded and the weld area is ground prior to welding.

5.7.0 Extrusion Welder Seaming Procedure

A smooth insulating plate or fabric is shall be placed beneath the hot welding apparatus both before and after usage.

Using a hot air welders or hand held heat guns with seam rollers the overlapping materials to be welded must first be pre-bonded to hold the materials in place before actual extruding.
Welding operations should be observed to assure that the machines are properly aligned resulting in weld beads that are centered over the edges of the top FML sheets and that weld bead appearances are smooth and uniform.

PART VI
Non-Destructive Seam Continuity Testing

CLC shall non-destructively test all field seams over their full length using a vacuum test unit, air pressure testing, or other approved method. The purpose of non-destructive tests is to check the continuity of seams. It does not provide information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

6.1.0 Vacuum Box Testing

This test method is almost exclusively used for evaluating extrusion weld bead quality. In areas where vacuum boxes cannot practically be deployed, the welds shall be visually inspected and manually probed over their full length to check adhesion.

The equipment shall be comprised of the following:

A vacuum box assembly constructed from clear transparent plastic with a soft neoprene gasket attached to the bottom and a gauge to indicate vacuum chamber pressure.

A vacuum motor capable of creating a vacuum of 2.5 to 3 psi.

A bucket and wide brush, mop or spray assembly.

A soapy solution.

Procedure:

Wet a strip of geomembrane approximately 12 inches by 48 inches (0.3 m by 1.2 m) with the soapy solution;

Place the box over the wetted area.

Energize the vacuum apparatus; confirm 2.5 to 3psi.

Ensure that a leak tight seal is created.

For a period of approximately 5 to 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

All areas where soap bubbles appear shall be marked and repaired in accordance with Section 3.4.

If no bubbles appear, the vacuum shall be disengaged and the box indexed to the next test area with a minimum 6" overlap between indexes, and the process repeated.

Vacuum tested seams are recorded on Daily Progress Reports.

6.2.0 Air Channel Pressure Testing ASTM D 5820

This method is only applicable to seam continuity testing of air channels produced using dual track hot wedge welding equipment.

Testing equipment shall be comprised of the following:

An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa).

A air hose with fittings and connections.

A sharp hollow needle or other approved pressure feed device.

Procedure:

Seal both ends of the seam to be tested by tack welding and clamping with Vise Grips;

Insert needle into the air test channel created by the fusion weld.

Inflate the channel to pressure 30 psi (210 kPa),
close pressurized air source valve and monitor air pressure drop for five (5) minutes.

Remove needle or other approved pressure feed device and seal.

If pressure drop exceeds values tabulated herein or does not stabilize, locate faulty area and repair and re-test until defects are corrected and test values are passing.

Pressure tested seams are recorded on Daily Progress Reports.

TABLE 6.2
SEAM PRESSURE TEST ALLOWANCE

Material Thickness	Minimum psi Test Pressure	Maximum psi Test Pressure	Maximum psi Drop Allowed After 5 Minutes
30 mil	30	30	4 PSI
40 mil	30	30	4 PSI
60 mil	30	30	4 PSI
80 mil	30	30	4 PSI
100 mil & Thicker	30	30	4 PSI

6.2.1 Pressure Test Failure

Should excessive pressure drop occur, both ends of seam shall be checked to insure proper seal and be re-tested. Should failure reoccur, the top fusion seam shall be checked by applying a constant air pressure to the air channel and applying a soapy water solution over the weld length. Any failure or leak will be indicated by continuous bubbles appearing.

If no failure appears in the top fusion seam area the seam shall then be systematically isolated into in one hundred and fifty linear foot sections of seam which shall each be re-tested by pressure testing until the leak is located. Failed seam areas shall be repaired by extrusion welding the outside edge of the top fusion weld between areas of failure. The extruded edge shall be vacuum tested in accordance with this manual.

PART VII
Destructive Seam Testing

Destructive seam tests (if required by the project specification) shall be performed at random selected locations at a frequency of one sample per every 500 lineal feet of seam or as otherwise specified. Seam testing shall be conducted concurrent to the seaming work progress. The Owner's Representative if required, may select locations where seam samples are to be cut. If destructive seam tests are not required, representative seam samples may be substituted at a similar frequency using material samples of the actual material being installed so that no "damage" is done to the actual lining system requiring patching and testing, etc.

Procedure

Samples shall be cut by CLC as the seaming progresses. CLC shall:

Cut samples.

Assign a number to each sample, which is to be based upon seam and sample number and mark it accordingly.

Record sample location on daily report.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in Section 8.2.0.

7.1.0 Sample and Coupon Size and Extraction

Unless otherwise specified, the following sample preparation guidelines shall govern:

Trial, representative or destructive seam samples cut from the installed liner shall measure 12"/30cm in width x 3'/1m in length with the width of the seam centered in the long axis of the sample. Coupons shall measure 1"/25mm wide by 6"/150mm long with the seam centered perpendicular to the length.

Coupon extractions shall occur in three paired locations along the length of the seam sample:

2 coupons at the beginning, 2 coupons in the center and 2 coupons at the end of the sample for a total of six (6) extractions. Coupons may be extracted and evaluated incrementally.

Sample Distribution

Remnant 12"/30 cm square samples shall be cut into parts, labeled as specified and distributed as applicable:

One portion for independent geosynthetic laboratory testing if previously specified

and

One portion to the Owner for archive storage

7.2.0 Coupon Field Testing

Coupons shall be tested with a tensiometer and evaluated for bonded seam strength (shear) and peel using methods ASTM D4437. Tensiometer jaw separation rate for bonded seam strength/shear and peel test shall be 2"/minute (5cm/min.)

All peel and shear strength samples shall yield Film Tearing Bond (FTB) as defined in GRI-GM 19.

If the initial sample coupon test passes shear analysis yielding a FTB, the sample qualifies for further testing to obtain quantitative results until three (3) each peel samples and three (3) each shear samples are evaluated from the beginning middle and end of each sample.

If more than one (1) of six coupons per sample fails, the seam should be repaired in accordance with Section 7.3.0.

TABLE 7.2
REQUIRED FUSION AND EXTRUSION SEAM TEST RESULTS
GRI-GM 19

Minimum Values Required
(In Units of Pounds per inch of Width)

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams [1]							
shear strength[2], lb/in.	57	80	100	120	160	200	240
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength [2], lb/in.	45	60	76	91	121	151	181
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams [1]							
shear strength[2], lb/in.	57	80	100	120	160	200	240
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength [2], lb/in.	39	52	65	78	104	130	156
peel separation, %	25	25	25	25	25	25	25

Table 2(a) – Seam Strength and related Properties of Thermally Bonded Smooth and Textured Linear High Density Polyethylene (HDPE) Geomembrane (English Units)

7.3.0 Procedures for Test Failure

Should a sample fail a destructive test, the defect may be remedied by:

Capping the respective seam in its entirety as described in this section,

or

If a defect is suspected to be local to a certain area it may be further investigated to isolate the defective are by:

Taking small coupon test samples located 10' on either side of the defective sample seam void area. If these additional samples pass tensiometer testing, then full samples are to be taken. If these samples pass the tests, then the seam is capped between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed. All acceptable seam areas must be bounded by two locations from which samples passing destructive tests have been taken.

Cap stripping of defective seams or isolated areas shall be performed using either wedge or extrusion welding techniques or combination thereof and re-testing the repaired area with applicable methods as described herein. Cap strips shall cover the defective seam by no less than 6"/15cm On either side of the original weld. Wider patches will be required to cover seam sample void areas.

CLC shall document all actions taken in conjunction with destructive test failures; e.g., capping of failed seam area.

PART VIII
Defects and Repairs

8.1.0 Identification

All seams and non-seam areas of the geomembrane shall be examined by CLC for identification of defects, holes, blisters, un-dispersed raw materials and any sign of contamination by foreign matter.

Defective/damaged materials shall be identified via a deficiency report, either separately or on the Daily Report. Actions taken to resolve or correct the problem will also be recorded on the similar form.

Defects, holes, blisters, un-dispersed raw materials, signs of contamination by foreign matter, unacceptable welds in geomembranes and other unsatisfactory conditions will be identified on the Daily Report form. The repair/corrective action to "fix" the problem will also be recorded on a similar form.

8.2.0 Repair Procedures

Available methods include:

Patching - used to repair large holes, tears, and contamination by foreign matter.

Grinding and re-welding - used to repair small sections of extruded seams.

Spot welding or seaming - used to repair pinholes or other minor localized flaws;

Capping - used to repair large lengths of failed seams;

Methods for patching lining system defects shall consist of welding patches or caps over such areas using the same membrane lining material as used on the specific project. Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.

Seaming, preparation and welding equipment deployment procedures previously addressed in this manual shall be adhered to during patching operations.

8.2.1 Verification of Repairs

Each repair shall be non-destructively tested using the methods described in Section 6 as appropriate. Repairs which pass the non-destructive test, shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be redone and re-tested until a passing test result is obtained.

Part IX
Ancillary Items and Final Acceptance

9.1.0 Pipe Penetrations

Pipes penetrating through the lined area shall be sealed using pipe boot details that are welded to the lining system via extrusion weld method and sealed the pipe with double stainless steel banding clamps and butyl sealant tape. Pipe boots shall be fabricated from the membrane material being installed and shall fit snugly over the pipe and pipe to grade interface without undue slack or bridging. In instances where piping is

manufactured from HDPE, the pipe boot sleeve may be extrusion welded directly to the pipe foregoing the need for banding clamps.

9.2.0 Backfilling of Anchor Trenches

Anchor trenches, if any, shall be adequately drained by others to prevent ponding or otherwise softening the adjacent soils while the trench is open. The anchor trench shall be back-filled by others or as outlined in the specifications and bid documents.

Since back-filling the anchor trench can affect material bridging at toe of slope, consideration should be given to backfill the liner at its most contracted state; preferably during the cool of the morning or extended period of overcast skies. Care shall be taken when back-filling the trenches to prevent any damage to the lining system.

9.3.0 Lining System Acceptance

Once the lining system is installed and all quality assurance testing has been completed with satisfactory results, and the system is approved by Owner's Representative, the Representative shall sign an acceptance form provided by CLC prior to demobilization.