The logo for SWCA (Soil Water Conservation Agency) is positioned vertically on the left side of the page. It consists of the letters 'S', 'W', 'C', and 'A' in a large, stylized, light blue font, stacked one above the other.

# Hale Reclamation Plan, Weld County, Colorado

AUGUST 2022

PREPARED FOR

**Taproot Rockies Midstream, LLC**

PREPARED BY

**SWCA Environmental Consultants**



# **HALE RECLAMATION PLAN, WELD COUNTY, COLORADO**

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August 2022



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# 1 INTRODUCTION

SWCA Environmental Consultants (SWCA), on behalf of Taproot Rockies Midstream, LLC (Taproot Midstream), has prepared and is submitting this Reclamation Plan (Plan) to the Colorado Oil and Gas Conservation Commission (COGCC) in accordance with COGCC Rule 915b. This Plan describes the site-specific conditions and reclamation practices that will be employed at Taproot Midstream's Hale Produced Water Lateral Installation (Project) site in Weld County, Colorado. Two unplanned releases occurred in 2021 at the Project site that resulted in elevated soil sodicity, as well as increased soil pH. Salts, particularly sodium, and elevated soil pH are considered limiting to successful reclamation processes following oil and gas operations because they may deteriorate soil structure and interrupt normal soil-plant-water relationships. This may subsequently increase the risk of erosion by weakening the soil resource which further limits the establishment of vegetation. In such cases, under COGCC Rule 915b, operators are required to "provide a detailed reclamation plan that includes, but is not limited to, soil analysis from adjacent undisturbed lands, revegetation techniques, site stabilization, and details of seeded species."

The purpose of this Plan is to detail the remediation and reclamation activities for the Project in accordance with COGCC Rule 915b. Ecological conditions at the Project site and within the surrounding area were assessed on June 10, June 24, August 20, September 24, and December 2, 2021, and again on May 18, 2022 (see Section 3) to inform development of this Plan. Specifications regarding ecological conditions at the Project site and surrounding area, reclamation and remediation procedures and best management practices (BMPs), monitoring, and reporting are discussed in the sections below. This document may be revised based on site conditions documented during remediation activities or as new information becomes available through similar remediation efforts (see Section 5.1.1).

# 2 PROJECT OVERVIEW

The Project site is located approximately 13 miles northwest of Raymer, Colorado, in Weld County (SW¼ of the NW¼ of Section 22, Township 8 North, Range 60 West) and consists of a produced water transfer system (PWTS) with other ancillary facilities/infrastructure. A PWTS moves water produced from oil and gas activities between different oil and gas locations and is a network of interconnected off-location water flowlines proceeding from multiple well sites or production facilities (COGCC 2018). On June 8, and then again on August 18, 2021, produced water releases were discovered and reported at the Project site due to a failure of the PWTS. Following discovery of each release, contaminated soil was visually delineated within the PWTS, excavated to various depths based on the observed depth of seepage, removed from the site, and disposed of at an approved facility. Initial Spill/Release Reports (Form 19) were submitted by Taproot Midstream to COGCC on June 9 and August 19, 2021 (Appendix A). Approximately 0.40 acre within the Project footprint will be reclaimed as a result of the two releases (Table 1).

**Table 1. Acres of Disturbance as Constructed**

<b>Disturbance Type</b>	<b>Area of Disturbance (acres)</b>	<b>Area to be Reclaimed (acres)</b>
PWTS	0.40	0.40
Access Roads	0.00	0.00
Ancillary Facilities	0.00	0.00
<b>Total</b>	<b>0.40</b>	<b>0.40</b>

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## 3 ECOLOGICAL CONDITIONS

Identification of ecological characterizations of the land is important for reclamation planning as developing ecological site-specific reclamation techniques will increase the likelihood that revegetation is successful (see Section 4.2) and that reclamation success standards are met (see Section 5.1). Major Land Resource Areas (MLRAs) are geographically associated land resource units developed by the Natural Resources Conservation Service (NRCS) to provide regionally specific information on geology, climate, water, soils, and biological resources (NRCS 2006; Stringham et al. 2016). MLRAs are effective planning tools on a regional scale while ecological site descriptions (ESDs), which are refined geographical units within MLRAs, can be used to describe the physiographic setting, soils, vegetation, hydrology, and ecology at a site-specific scale. The Project falls within the Central High Plains, Southern Part MLRA and the Loamy Plains ecological site (R067BY002CO) which is largely associated with mixed-grass prairie (short- and midgrass species) and a minor component of forbs and shrubs (NRCS 2021a). The Loamy Plains ecological site occurs on gently rolling plains and average annual precipitation ranges from 13 inches to over 18 inches depending on location. Livestock grazing is common across the ecological site (NRCS 2021a).

### 3.1 Plant Communities

Pre-disturbance vegetative conditions at the Project site were assessed using publicly available datasets to better understand baseline conditions that inform reclamation actions and success standards for reclamation. These datasets include the NRCS's ESDs discussed above and the Rangeland Analysis Platform (RAP). The RAP integrates data from NRCS's National Resources Inventory and the Bureau of Land Management's (BLM's) Assessment, Inventory, and Monitoring and Landscape Monitoring Framework datasets. These quantitative vegetative assessments are modeled with the historical Landsat satellite record, gridded meteorology, and abiotic land surface data to provide estimates of the percent vegetation cover of annual grasses and forbs, perennial grasses and forbs, woody stems (e.g., shrubs and trees), litter, and bare ground (NRCS and BLM 2021). RAP data were used to inform vegetation and abiotic characteristics for the reclamation planning effort and were referenced to further assess the distribution and estimated cover of vegetation and cover types across the Project site.

The Project site falls within the Loamy Plains ecological site, as described above. This ecological site is correlated with mixed-grass prairie and plant community composition and is generally about 70% to 85% grasses and grass-like plants, 5% to 15% forbs, and 10% to 15% woody plants (NRCS 2021a). Common plant species in Loamy Plains ecological sites include western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), Indian ricegrass (*Achnatherum hymenoides*), squirreltail (*Elymus elymoides*), needle and thread (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), buffalograss (*Bouteloua dactyloides*), fourwing saltbush (*Atriplex canescens*), winterfat (*Krascheninnikovia lanata*), rubber rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa*), plains pricklypear (*Opuntia polyacantha*), soapweed yucca (*Yucca glauca*), scarlet globemallow (*Sphaeralcea coccinea*), and various other forbs along with invasive species such as cheatgrass (*Bromus tectorum*).

Surrounding the Project site, RAP estimates a 10-year average of foliar and surface cover consisting of approximately 11.4% annual grasses and forbs (i.e., cheatgrass and other invasive species), 52.2% perennial grasses and forbs (i.e., native mixed-grass species and forbs), 4.7% woody stems, 15.2% litter, and 15.8% bare ground.<sup>1</sup> RAP further estimates that the 10-year average biomass for the Project site is approximately 156.8 pounds per acre of annual grasses and forbs and approximately 780.1 pounds per

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<sup>1</sup> Cover estimates for percent foliar and surface cover do not sum to 100% based on annual variability across the 10-year averages.



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acre of perennial grasses and forbs for a total of approximately 936.9 pounds per acre of herbaceous vegetation. Understanding the average cover, density, and biomass of existing vegetation in the surrounding landscape informs revegetation efforts (see Section 4.2).

A qualified SWCA biologist conducted a site assessment on December 2, 2021, to ground-truth ecological conditions and to conduct a quantitative vegetation assessment at the Project site and within immediately adjacent reference sites (Appendix C, Table C1). The quantitative vegetation assessment used the Daubenmire method which consists of systematically placing a quadrat frame on the ground and recording canopy cover as well as composition by canopy cover (Coulloudon et al. 1999). Three locations were selected within the Project site (IMPACT-01, IMPACT-02, and IMPACT-03) and three locations were selected immediately adjacent to the Project site as reference sites (ADJACENT-01, ADJACENT-02, and ADJACENT-03) based on representative characteristics of the surrounding area for Daubenmire frame assessments.

Livestock grazing is present in adjacent pastures with existing oil and gas infrastructure. Because of the two releases, vegetation is not present at the Project site and ground cover consists mostly of bare ground and hay mulch. At the reference sites immediately adjacent to the Project site, smooth brome (*Bromus inermis*) is dominant with low frequency of native vegetation including purple threeawn (*Aristida purpurea*) and blue grama, with the non-native invasive Russian thistle (*Salsola tragus*) dispersed throughout the range. The adjacent is heavily used by livestock and is not representative of native shortgrass prairie vegetation. Results of the quantitative vegetation assessment are provided in Appendix C.

## 3.2 Soils

Soils in the Project site are typical of the Loamy Plains ecological site and are well-drained, shallow to moderately deep ustic loams derived from loess, alluvium, and/or eolian deposits with textures ranging from sandy to clayey (NRCS 2021a). The soils typically have a moderate to moderately slow permeability class and water capacity is high. As the fineness of soil texture increases, there is generally more available moisture storage from sands to loams to clays. Soil structure defines the process in which soil particles are aggregated and support vegetation and healthy aeration (NRCS 2021a). Surface soil structure for the Loamy Plains ecological site is granular to subangular blocky, and structure below the surface is prismatic or subangular blocky. These soils are typically high in fertility but may be susceptible to erosion by wind and water when unvegetated. The potential for water erosion accelerates with increasing slope.

The Olney fine sandy loam component makes up 85% of the map unit within the Project site (NRCS 2021b). Slopes are 0 to 6 percent. This component is found on dissected plains. The parent material consists of calcareous loamy alluvium. Depth to a restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded, and it is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 4c. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5%. There are no saline horizons within 30 inches of the soil surface.

A typical pedon for the Olney soil series is described in Table 2 (NRCS 2012). These well-drained soils typically have low runoff potential and moderate susceptibility to wind and water erosion, especially if unprotected (i.e., no vegetation cover) and/or on steeper slopes (NRCS 2021b). Olney soils are generally a fair source of reclamation material and topsoil may be limited by the low amount of organic matter and exchange capacity. The soil susceptibility to compaction is moderate which indicates that the potential for compaction is significant. The growth rate of seedlings may be reduced following compaction. After the

initial compaction (i.e., the first pass of equipment), soils with a moderate rating can support standard equipment with only minimal increases in soil density.

**Table 2. Typical Pedon and Horizon Descriptions of the Olney Soil Series**

Horizon	Depth (inches)	Description*
A	0–5	Pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; neutral (pH 7.2); clear smooth boundary; 4 to 6 inches thick.
Bt1	5–8	Brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; few faint clay films on faces of peds; neutral (pH 7.2); clear smooth boundary; 2 to 6 inches thick.
Bt2	8–16	Brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, common faint clay films on faces of peds; slightly alkaline (pH 7.4); clear smooth boundary; 8 to 24 inches thick.
Btk	16–22	Pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist, weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; few faint clay films on faces of peds; 3% gravel; common fine distinct threads of carbonate masses and carbonate coatings on the sand and pebble fragments in matrix; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary; 2 to 10 inches thick.
Bk1	22–24	Very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; common fine distinct threads of carbonate masses in matrix; strongly effervescent; moderately alkaline (pH 8.2); gradual irregular boundary; 10 to 16 inches thick.
Bk2	24–80	Pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few fine distinct carbonate masses in matrix; strongly effervescent; moderately alkaline (pH 8.2); several feet thick.

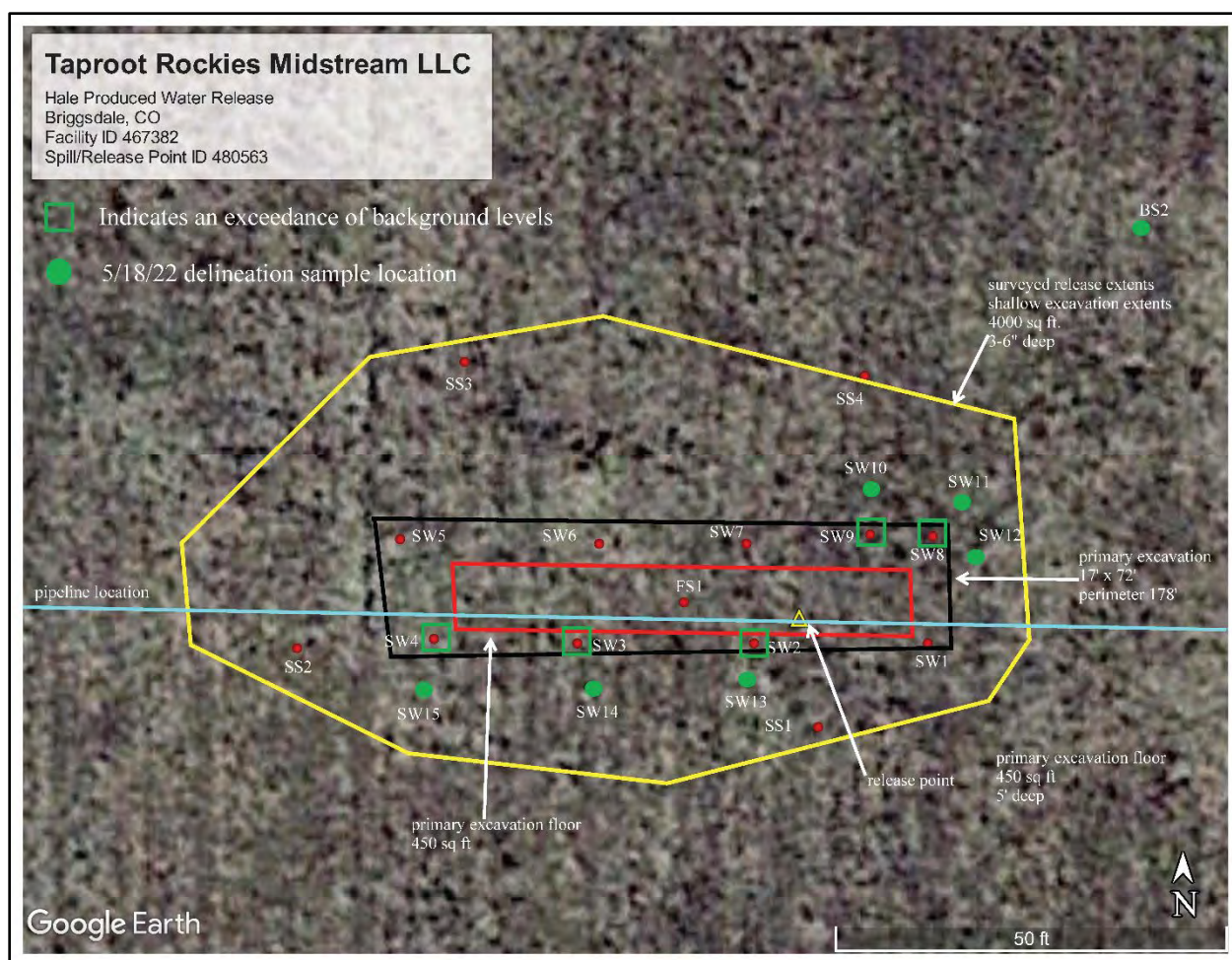
Source: NRCS (2012).

### **3.2.1 Affected Soils Analysis**

A qualified geologist from Environmental Works, Inc. (EWI), collected soil samples across the Project site and within immediately adjacent, non-impacted areas to assess the overall impact of the two unplanned releases on June 10, June 24, August 20, September 24, 2021, and again on May 18, 2022 (Figure 1). Soil samples were collected to assess the overall impact of the unplanned release on the Project area and adjacent soils to assist in development of this Plan.

For the initial release (6/8/2021), EWI collected 15 discrete soil samples at depths ranging from 0 to 6 inches (surface samples [SS]) up to 6 feet (floor samples [FS]) across the impacted area at the unintended release location to evaluate the nature and extent of soil contamination. Following the second release (8/18/2021), 14 discrete soil samples were collected at depths ranging from 0 to 6 inches (SS) up to 5.5 feet (FS). Additionally, one background sample (BS1) was collected outside of the area of impact for comparison of site conditions prior to the unintended release. Some excavation had already been conducted across the area of impact prior to sample collection. Sample analytical results were used to confirm potential impacts to the facility and adjacent soils as well as to establish further potential remediation requirements (i.e., excavation and replacement, soil amendments) for the location.

Preliminary analytics for the initial release indicated elevated soil pH in unexcavated materials at sample SW8 – 3 (2.5 to 3.5 feet). Soil analytics for the second release indicated elevated soil pH and SAR levels in unexcavated materials for samples SW – 09 (2.5 to 3 feet), SW – 02 (2 to 2.5 feet), SW – 04 (2 to 2.5 feet), and SW – 08 (2 to 2.5 feet). Elevated soil analytes warranted additional excavation and confirmation sampling. On May 18, 2022, EWI collected an additional six discrete soil samples at depths ranging from 2 to 2.5 feet at the unintended release location across the impacted area to further evaluate the nature and extent of impact and to verify that additional excavation efforts were successful. Follow-up confirmation sampling included an additional baseline sample (BS2) outside of the area of impact for background comparison of site conditions prior to the unintended release.



**Figure 1. Soil sample locations for the two Hale PWTs releases**

Ultimately confirmation samples were collected at 35 locations following excavations along the observed area of impact and submitted to Pace Analytical Laboratories (Mount Juliet, Tennessee) for analysis (Figure 1). Ten discrete surface samples (SS) were collected from areas of shallow excavations within the impacted area at depths ranging from 0 to 6 inches below ground surface (bgs). Twelve discrete sidewall samples (SW) were collected from the sidewall of the deeper excavations at depths ranging from 2 to 4 feet bgs. Two discrete floor samples (FS) were collected from the floor of deeper excavations ranging in depth from 5 to 6 feet at each release location. Finally, two baseline samples (BS) were collected outside of the area of impact at depths ranging from 1 to 2.5 feet.

All samples were analyzed for metals, volatile organic compounds (VOCs), semi-VOCs, total petroleum hydrocarbons (TPH), and soil suitability for reclamation (saturated paste pH, electrical conductivity [EC], and sodium adsorption ratio [SAR]). All samples were collected using standard regulatory protocol for hydrocarbons and equipment de-contamination procedures. Sampling equipment was properly decontaminated between individual samples. Discrete samples were collected in sterilized glass jars acquired from the laboratory and maintained on ice until submitted for analysis. Analytical results for all collected samples are provided in Appendix D.

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### **3.2.2 Analytical Results**

For the initial release (6/8/2021), soil laboratory analytical results indicate that soil pH, EC, and SAR are all within Table 915-1 Soil Suitability for Reclamation maximum levels. Only soil arsenic is elevated above Table 915-1 Residential Soil Screening Levels (RSSLS) but is elevated in background samples as well. For the second release (8/18/2021), soil laboratory analytical results indicate soil pH and SAR greater than Table 915-1 Soil Suitability for Reclamation maximum levels in some samples. Again, soil arsenic is elevated above Table 915-1 RSSLS but is elevated in background samples too. Elevated sodium in the soil may impact soil structure through soil dispersion making the soil surface hard. Soil dispersion and poor soil structure may impair seed germination and seedling development. Final laboratory analytical results (May 18, 2022) collected following additional excavation and import remediation efforts across the release location indicate that contaminated materials have been removed as soil pH, EC, and SAR are all within Table 915-1 Soil Suitability for Reclamation maximum levels.

#### **3.2.2.1 SOIL PH**

Soil pH is a measure of the acidity or alkaline condition, determined by measuring the hydrogen ion activity in the soil (Thorup 1984). Soil pH is considered one of the most important measurements in the soil and is often called the “master variable” (McBride 1994). Soil pH affects nutrient availability, ion exchange, dissolution/precipitation of minerals, reduction and oxidation (redox) reactions, adsorption, and other important factors in the soil system, which can greatly influence plant growth and development (McBride 1994; Thorup 1984). Soil pH between 6.4 and 8.2 is generally optimal for plant growth of agronomic crops and native grass species (Thorup 1984; Tisdale et al. 1993). As the pH increases or decreases from this ideal range, the availability of plant nutrients may limit plant growth. Additionally, COGCC Table 915-1 Soil Suitability for Reclamation parameters establishes soil pH suitability levels from 6.0 to 8.3.

Soil pH in samples collected from the impacted area range from 7.6 to 8.7 (average of 8.0), which is comparable to the background samples collected outside of the impacted area (7.7 and 8.0). Only soil sample SW – 09 (2.5 to 3 feet) was above the Soil Suitability for Reclamation maximum level of 8.3 (Appendix D). Elevated soil pH may be indicative of potential sodium hydrolysis and sodic soil conditions; however, pH in the unimpacted soils appears to be naturally elevated. Elevated soil pH will not cause harm to the environment and/or human health.

#### **3.2.2.2 SOIL SALINITY**

Soil EC is an estimate of soil salinity (Hanson et al. 1999) and is measured by the specific conductance of the saturated paste extract. EC is measured to determine the total estimated salinity of a soil. A saline soil is any soil that has an EC greater than 4.0 mmhos/cm (Ayers and Westcot 1985; Brady 1990). At elevated levels, soil salinity can negatively impact vegetative growth due to osmotic stress (Hanson et al. 1999). This osmotic stress makes it difficult for plants to extract water from the soil (Bohn et al. 1985).

Average EC in soil samples collected from the impacted area range from 0.05 to 3.5 mmhos/cm (average of 0.92 mmhos/cm). Out of 37 soil samples collected, none indicate elevated soil salinity above the Soil Suitability for Reclamation maximum level defined reporting limit of saline soil (4.0 mmhos/cm). Twenty of the 35 samples collected within the impacted area are higher than the background samples (0.25 to 0.36 mmhos/cm). All collected soil samples have EC below 4.0 mmhos/cm confirming that elevated soil salinity has been remediated across the location (Appendix D). Soil EC will not cause harm to the environment and/or human health nor impair vegetation establishment.

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### **3.2.2.3 SOIL SODICITY**

Sodic soils are non-saline soils containing sufficient exchangeable sodium to adversely affect crop production and soil structure (Soil Science Society of America 2010). Elevated exchangeable sodium concentrations in the soil can negatively impact soil structure causing the soil to disperse, resulting in hard surface crusts, reduced infiltration rates, and reduced oxygen diffusion rates. The definition and standard for describing sodic soils based on soil chemistry are those soils that have a SAR greater than 13, an EC less than 4.0 mmhos/cm, and pH between 8.5 and 10.0. However, the COGCC Table 915-1 Soil Suitability for Reclamation maximum level for SAR is 6.0.

SAR in all samples collected from the impacted area range from 0.15 to 10.5 (average SAR of 2.4). Out of 37 soil samples collected, three indicate elevated soil sodicity above the Soil Suitability for Reclamation maximum level defined reporting limit for SAR (6.0). Samples SW – 02 (2 to 2.5 feet), SW – 04 (2 to 2.5 feet), and SW – 08 (2 to 2.5 feet) had SAR values that were above the Table 915-1 Soil Suitability for Reclamation maximum level of 6.0 (Appendix D). SAR in new soil samples collected from the impacted area on May 18, 2022, following additional excavation range from 1.1 to 1.4 (average SAR of 1.3). All newly collected samples (May 2022) have SAR below 6.0 confirming that elevated soil sodicity has been remediated across the location. Soil SAR will not cause harm to the environment and/or human health nor impair vegetation establishment and soil structure.

### **3.2.2.4 ADDITIONAL ANALYTES (METALS, VOCs, AND TPH)**

Soil laboratory analytical results indicate that arsenic levels are elevated above the Table 915-1 RSSL cleanup concentrations for most samples within the impact area (COGCC 2021:900-38–900-41). Soil arsenic is elevated above the RSSL of 0.68 mg/kg in all samples measured, but comparable to background levels indicating that arsenic is naturally elevated in soils at the location. Soil sample analytical results indicate that VOCs and semi-VOCs are all below RSSL cleanup concentrations. TPH levels are non-detectable (ND) or within Table 915-1 cleanup concentrations (COGCC 2021:900-38–900-41) for all samples within the impacted area.

### **3.2.3 Justifications**

Produced water releases from oil and gas infrastructure may have potential impacts on existing plant communities as produced water can penetrate the soil profile resulting in degraded soil quality due to various pollutants (Pichtel 2016). The depth of contamination varies depending on the amount of produced water released, the chemical makeup of the produced water, and the soil properties (Pichtel 2016). Native vegetation and the wildlife/livestock that browse and graze these plant species may experience the harmful impacts of soil contamination from produced water releases (Bamberger and Oswald 2012; Pichtel 2016).

Soil analytics indicate EC and SAR levels are below COGCC Table 915-1 Soil Suitability for Reclamation maximum levels in all confirmation samples collected. The average groundwater depth across the Project site is greater than 100 feet bgs. All hazardous analytes were within Table 915-1 cleanup concentrations and/or below RSSLs. Furthermore, all contaminated soils have been excavated and removed from the Project site and confirmation sampling conducted; therefore, these analytes are not a concern at the time of analysis and will not cause harm to the environment and/or human health. Furthermore, these analytes should not limit plant establishment at the time of reclamation (see Appendix D).

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## 4 RECLAMATION AND REMEDIATION PROCEDURES AND BEST MANAGEMENT PRACTICES

Based on the results of the environmental site investigation of the Project site, the following site-specific soil reclamation and remediation options have been established for the impacted areas.

### 4.1 Soil Excavation and Import

Excavation of impacted materials and import of suitable topsoil resources has been implemented. Impacted soil resources have been excavated to the depth of impact (based on visual observation and confirmation sampling) and replaced with suitable topsoil resources of similar physicochemical properties (i.e., soil pH, soil EC/SAR, SOM, soil texture). Confirmation sampling was conducted following all excavation efforts to verify that impacted soil resources were properly removed (Appendix D).

### 4.2 Revegetation

Revegetation measures and BMPs include the following measures.

#### 4.2.1 *Seedbed Preparation*

Seedbed preparation maximizes seeding efficiency and improves reclamation success. Seedbed preparation includes topsoil replacement and surface roughening techniques such as scarifying and/or disking. As needed, soil conditioning (i.e., soil amendments), decompaction, and topsoil protection measures must be implemented to successfully reestablish vegetation and to protect the seedbed and soil resources until revegetation and stabilization are effective. A good seedbed is uniformly firm with various micro-habitats and/or light mulch on the surface to prevent erosion and protect seed.

##### Topsoil Placement

1. Evaluate the compaction of subsoil prior to the respread of topsoil and deep-rip accordingly, depending on ecological site and type of equipment used for topsoil replacement. Ripping should occur to a minimum depth of 18 inches using a parabolic ripper or equivalent equipment to reduce soil compaction and improve drainage. The shanks on the back of a grader or dozer should NOT be used to reduce soil compaction.
2. Apply topsoil evenly across prepared subsoil surface.
3. Disk applied topsoil to a depth of 4.0 to 6.0 inches. Disking should be conducted using a disk and harrow, field cultivator, vibra-shank, or other alternative suitable to site conditions. Identify with the appropriate signage when leaving topsoil in place for more than one month prior to seeding.

Additional erosion-control BMPs will be added to minimize erosion and control sediment transport, as needed (see Section 4.3).

##### Prior to Seeding (i.e., no more than 2.0 to 4.0 weeks prior to seeding)

1. Perform primary disking/tillage of topsoil to break up clods.
2. Continue to till and aerate until clods are reduced to less than 4.0 inches and the overall density of cloddiness is reduced to less than 50% of the disturbance extent. Tillage must be no deeper than the depth of the replaced topsoil.

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3. As applicable, till across slopes or perpendicular to the aspect of the slope to reduce erosive forces and avoid channelization from sheet flow and/or wind whenever possible.
  4. Once topsoil is applied and prepared for seeding, adequately identify with signage to prevent equipment from unnecessarily driving on and/or compacting applied topsoil.
  5. Prior to or during seeding, perform a final tillage to break up any remaining clods and produce a firm seed bed.
  6. Suspend site preparation when soils are too wet to support equipment without significant rutting or soil mixing.

#### **4.2.2 Seeding**

Appropriate revegetation practices provide the species composition, diversity, structure, and total ground cover to promote the reestablishment of the desired plant community. The reclamation contractor is encouraged to provide suggestions for deviations from this Plan to Taproot Midstream based on their experience in implementing these techniques in similar areas. A site-specific seed mix will be used to reclaim and stabilize disturbed soils across the Project site (Table 3).

Seeding is more successful when implemented during fall prior to late fall/early winter freeze and precipitation events. When possible, seeding will occur prior to anticipated precipitation events to increase the likelihood of germination and vegetation establishment.

##### Seeding Schedule

1. Seeding should occur within ideal seeding windows for greatest success. In Colorado, this is after October 1 for late fall, dormant seeding (preferred) and from spring thaw to June 1, for spring seeding.
2. If reclamation is completed outside of the ideal seeding season, a sterile cover crop should be seeded to provide quick vegetation establishment and more immediate ground cover and protection (e.g., sterile triticale [*Triticum aestivum* x *Secale cereal*] at 30 lbs per acre). Cover crops should only include species that are non-invasive, non-persistent and non-competitive.
3. The actual end date will be based on the current weather patterns and ground conditions. No seeding is allowed outside of the recommended window without prior approval from Taproot Midstream.
4. Seeding within the recommended window should be conducted in consideration of the current and anticipated weather conditions. Soil temperatures of around 40 degrees Fahrenheit are ideal.

The appropriate seeding technique and equipment must be used in consideration of site conditions and terrain. Drill seeding is the primary seeding method for the Project site and will be implemented across the site. Drill seeding is preferred as it improves seed-to-soil contact. Drill seeding should not be used on steep slopes (steeper than 3:1 slopes) and may be limited in shallow ecological sites with restrictive layers near the surface (i.e., bedrock/ unconsolidated rock) and certain textures. Weather and site conditions must be suitable for the selected seeding method to ensure an adequate seeding rate and to minimize soil clodding or mixing. The reclamation contractor is expected to use its expertise in recommending modifications to the proposed seed applications and methods.

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### Drill Seeding

1. Inspect and calibrate drill seeders regularly. Generally, inspections should be conducted before each site visit and calibrations should be conducted for each seed mix once per season, following significant maintenance, and/or when the application rate is significantly adjusted.
  - a. Drill seeding should occur using a drill equipped with an agitator and depth bands to mix seed and ensure proper seeding depths.
  - b. Seed tubes, packer wheels, and depth bands must be in proper, functioning condition.
  - c. Proper seeding depths must be established and calibrated prior to seeding; 0.25 to 0.50 inch for grasses and large-seeded forbs and less than 0.125 inch for small-seeded shrubs and forbs, when practicable.
2. Adequately mix seed hopper each time seed is added.
3. Prior to seeding, disc topsoil surface with scarifier and/or disc, or cultipacker, or harrow as needed to loosen seedbed and aerate surface (see Section 4.2.1).
4. Maintain an appropriate speed during drill seeding to ensure appropriate seed spacing and seed depth. The speed must be appropriate to site conditions, typically less than 5.0 miles per hour for flat conditions.
5. Apply certified noxious “weed-free” mulch and/or other erosion-control devices/BMPs as specified following seeding (see Section 4.3).

#### **4.2.2.1 SEED MIX**

The reclamation seed mix was designed to achieve species composition and diversity for the desired plant community, ecological setting, and current soil properties based on pre-disturbance vegetation characteristics described in Section 3.1, Plant Communities. Species for the reclamation seed mix were selected for their likelihood of occurring in the Project area, wildlife and forage value, erosion control capabilities, and commercial availability. Table 3 provides a list of selected species by pure live seed (PLS) per square foot and pounds per acre. Final selection of seed mixes will be dependent on seed availability.

### Seed Mix

1. The reclamation contractor must purchase “Certified Seed” (blue tagged) or “Source Identified” (yellow tagged) seeds from a reputable seller. Certified Seed is certified by the State Department of Agriculture to contain 0% weed seed and no more than six seeds per pound of “restricted” weed seeds.
2. The reclamation contractor must follow proper seed handling guidelines, including storage temperature and humidity.
3. To increase the likelihood of successful reclamation, locally adapted native plant materials should be selected when possible.
4. Seeding rates are specified in Table 5 and are specific to drill seeding applications (*i.e., seed rates would double for broadcast or hydroseeding applications*). The seed mix should provide approximately 60 PLS per square foot and should contain a mycorrhizal inoculum at the rate of 5.0 pounds per acre. The reclamation contractor must procure and apply seed at the specified rate for the seeding method selected.
5. Contractor must retain all seed tags (labels) and provide the original seed tags along with documentation of the application location in a timely manner to Taproot Midstream.



**Table 3. Recommended seed mix for revegetation activities at the Hale Project site, Weld County, Colorado**

Common Name	Scientific Name	PLS (pounds/acre)*	PLS per square foot	Composition (%)
Blue Grama	<i>Bouteloua gracilis</i>	0.48	9	15
Thickspike wheatgrass	<i>Elymus lanceolatus</i>	2.5	9	15
Western wheatgrass	<i>Pascopyrum smithii</i>	2.4	6	10
Sand dropseed	<i>Sporobolus cryptandrus</i>	0.10	12	20
Little bluestem	<i>Schizachyrium scoparium</i>	1.5	9	15
Bottlebrush squirreltail	<i>Elymus elymoides</i>	2.0	9	15
Scarlett globemallow	<i>Sphaeralcea coccinea</i>	0.26	3	5
Purple prairie clover	<i>Dalea purpureum</i>	0.62	3	5
<b>Total*</b>		<b>9.9</b>	<b>60</b>	<b>100</b>

+PLS = pure live seed

\*Totals may not be exact due to rounding

## 4.3 Site Stabilization

Site stabilization applications and erosion-control devices (ECDs) will be installed, as needed, following reclamation activities and in accordance with the Project's stormwater management plan (SWMP). The SWMP will provide available actions, ECDs, and installation measures to meet the standards and requirements of the Project's stormwater discharge permit. The remediation and reclamation actions identified in this Plan were designed to promote further site stabilization through amelioration of potential saline-sodic soil conditions and to facilitate the establishment of desirable vegetation that provides additional protections against site erosion.

Following reclamation efforts, apply and crimp straw mulch into surface soils to reduce potential water and wind erosion. Recommended straw mulch application rates are between 1.5 to 2.0 tons per acre. This will provide ground coverage of approximately 80% to 90% of the ground surface prior to crimping. Once applied the straw mulch should be crimped into the soil. Upon successful crimping, the straw mulch should be standing vertically with approximately 40% to 60% of the ground surface covered. Straw mulch should be at least 6.0 inches in length. Straw mulch should be crimped sufficiently to cause vertical cover that will not be dislodged by light breezes. Straw mulch should be certified "weed-free".

## 4.4 Noxious Weed Management

The primary goal of noxious weed management is to prevent and manage the establishment and spread of state- and/or county-listed noxious weeds because of Project disturbance and/or activities. The invasion and establishment of these plant species are a threat to the overall health of ecosystems. Detrimental effects may include diminished habitat and quality of forage for wildlife and livestock, diminished native plant communities, and increased fuel load for wildfires. Noxious weed management of state-listed and county-listed species will occur within the Project area and focus on areas where reclamation and remediation activities occur. Any state- and/or county-listed noxious weeds that occur outside of the Project site as the result of Project activities will be monitored and/or controlled by Taproot Midstream in coordination with the surface owner.

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Areas most susceptible to noxious and invasive weed infestations or occurrences include recently disturbed soils, roadsides, pipeline rights-of-way, drainages, and agricultural improvements. Noxious weed management will be a cooperative effort between the surface owners.

#### Herbicide Application

1. All herbicide applications will be completed or supervised by a state-licensed pesticide applicator.
2. All herbicide label requirements must be followed. Deviations are not allowed.
3. All herbicide application on the Project site will be made with the appropriate spraying equipment (as determined by weed species, selected herbicide, terrain, infestation level, etc.).
4. Do not conduct treatments during precipitation events or when precipitation is expected within 24 hours.
5. Apply herbicides in favorable weather conditions to minimize drift. Herbicide applications will only be conducted when average wind speeds are below 10 miles per hour.
6. Complete herbicide treatment records during herbicide application for each treated area and submit to Taproot Midstream within 24 hours of application.

No state- and/or county-listed noxious weed species were observed during site inspections in 2021.

## **4.5 Fencing Installation**

Fencing options will be determined in coordination with the surface owner and current land use management. If no grazing activities are planned during site reclamation, fencing will not be installed. If, during the first two growing seasons, grazing is planned, fencing will be installed per the preference and/or recommendation of the surface owner and may include wildlife-friendly three-wire fencing or temporary hotwire fencing to discourage grazing impacts to reclamation and revegetation efforts.

## **4.6 Reclamation Timing**

Planned reclamation efforts will be determined prior to site reclamation. Final reclamation for the Project site (i.e., the PWTS) is not planned by Taproot Midstream at this time and the site is currently stabilized according to their SWMP. Final reclamation for the acres impacted will occur during 2022/2023 in accordance with appropriate reclamation timing. A schedule template for planned reclamation activities is included in Appendix E and will be completed prior to reclamation and additional remediation actions at the Project site.

# **5 MONITORING AND REPORTING**

## **5.1 Monitoring**

The purpose of monitoring is to obtain information for use in evaluating responses to reclamation and remediation activities. Establishing a strong monitoring program that can be easily followed and repeated will greatly assist in future efforts to make appropriate management decisions. As described in COGCC's Reclamation Regulations 1000 Series, Rule 1004.d "final reclamation of all disturbed areas shall be considered complete when all activities disturbing the ground have been completed, and all disturbed areas have been either built upon, compacted, covered, paved, or otherwise stabilized in such a way as to

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minimize erosion, or a uniform vegetative cover has been established that reflects pre-disturbance or reference area forbs, shrubs, and grasses with total percent plant cover of at least eighty percent (80%) of pre-disturbance or reference area levels, excluding noxious weeds, or equivalent permanent, physical erosion reduction methods have been employed” (COGCC 2021:1000-8). As such, annual monitoring will occur for a minimum of two growing seasons and until vegetative cover of at least 80% of reference area levels has been met or exceeded. Annual monitoring will document vegetation establishment as well as composition and percent foliar and surface cover within reclaimed areas to evaluate the overall success of reclamation and remediation activities and inform further prevention and management efforts.

### **5.1.1 Adaptive Management**

In an adaptive management strategy, the outcome of management efforts may vary; these outcomes may require that changes in methods for reclamation be made. Adaptive management greatly increases the potential for reclamation success by providing early detection of problems and the opportunity to implement remedial actions to address these problems. No single management technique is applicable or effective for all situations, and multiple management actions may be required for effective management. Effective monitoring is an essential element of adaptive management because it provides reliable feedback on the effects of reclamation actions. If it has been determined that adaptive measures are necessary, monitoring data will provide information on target areas and species, such as poor seedling establishment or noxious weeds, that may require varied or more intensive treatments.

## **5.2 Reporting**

Reclamation results will be described in annual reports for a minimum of two growing seasons and until vegetative cover of at least 80% of reference area levels has been met or exceeded. Annual reports will include documentation of overall areas reclaimed, conditions associated with the Project site and reclaimed areas, and additional strategies to meet success criteria described above if necessary. The results of annual monitoring and reporting will determine if these areas require additional remedial action and treatment (see Section 5.1.1).

## **6 CONCLUSION**

SWCA was retained by Taproot Midstream to investigate site conditions following a produced water release during the winter of 2021 at the Hale PWTS, approximately 13 miles northwest of Raymer, Colorado. Soils at the Project site were sampled on June 10 and 24, 2021, (immediately following discovery of the initial release) and again on August 20, 2021 (immediately following discovery of the second release). Additional confirmation sampling occurred on September 24, 2021, and May 18, 2022, following contaminated soil excavation. Preliminary discrete soil samples collected from various impact areas and soil depths across the location following the second release indicated that the location soils had SAR levels greater than the Table 915-1 Soil Suitability for Reclamation maximum level of 6.0. Following further soil excavation, discrete soil samples collected post-excavation of contaminated soils indicate that excavation and topsoil import have been successful and materials containing elevated SAR have been successfully removed from the facility and replaced with suitable resources.

Using field observations and collected analytical data, SWCA developed this Plan to propose various options for revegetation (e.g., seedbed preparation, seeding, noxious weed control, monitoring, adaptive management) following appropriate remediation actions. Site preparation and seeding should occur in late fall/early winter (2022–2023) with a suitable seed mix that will achieve species composition and diversity for the desired plant community, ecological setting, and current soil properties based on pre-disturbance

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vegetation characteristics. Fall seeding ensures suitable soil conditions for drill-seeding efforts and takes advantage of spring snowmelt and increased soil moisture for germination. A seed mix recommendation is available in Table 3. SWCA further recommends that follow-up monitoring occur for a minimum of two growing seasons to verify remediation effectiveness and desirable revegetation.

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## 7 LITERATURE CITED

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## **APPENDIX A**

### **Initial Spill/Release Reports (Form 19)**





# State of Colorado Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203  
Phone: (303) 894-2100 Fax: (303) 894-2109



Document Number:

402711705

Date Received:

06/09/2021

Spill report taken by:

Spill/Release Point ID:

## SPILL/RELEASE REPORT (INITIAL)

This form is to be submitted by the party responsible for the oil and gas spill or release. Refer to COGCC Rule 906.b. for reporting requirements of spills or releases of E&P Waste or produced fluids. Submit a Site Investigation and Remediation Workplan (Form 27) when requested by the Director.

### OPERATOR INFORMATION

Name of Operator: TAPROOT ROCKIES MIDSTREAM LLC	Operator No: 10718	<b>Phone Numbers</b>
Address: 555 17TH STREET SUITE 800		Phone: (701) 509-2063
City: DENVER State: CO Zip: 80202		Mobile: (701) 509-2063
Contact Person: Dave Brazeal		Email: dbrazeal@taprootep.com

### INITIAL SPILL/RELEASE REPORT

Initial Spill/Release Report Doc# 402711705

Initial Report Date: 06/08/2021 Date of Discovery: 06/08/2021 Spill Type: Recent Spill

#### Spill/Release Point Location:

QTRQTR NWNW SEC 22 TWP 8N RNG 60W MERIDIAN 6

Latitude: 40.651673 Longitude: -104.085584

Municipality (if within municipal boundaries): County: WELD

Enter Lat./long measurement of the actual Spill/Release Point. Lat./Long. Data shall meet standards of Rule 216.

#### Reference Location:

Facility Type: PRODUCED WATER TRANSFER SYSTEM

☒ Facility/Location ID No 467382

Spill/Release Point Name: Hale Produced Water Lateral

☐ Well API No. (Only if the reference facility is well) 05- -

☐ No Existing Facility or Location ID No.

Estimated Total Spill Volume: use same ranges as others for values

Estimated Oil Spill Volume(bbl): 0

Estimated Condensate Spill Volume(bbl): 0

Estimated Flow Back Fluid Spill Volume(bbl): 0

Estimated Produced Water Spill Volume(bbl): >=5 and <100

Estimated Other E&P Waste Spill Volume(bbl): 0

Estimated Drilling Fluid Spill Volume(bbl): 0

Specify:

Has the subject Spill/Release been controlled at the time of reporting? Yes

#### Land Use:

Current Land Use: NON-CROP LAND

Other(Specify):

Weather Condition: Sunny, 85F, winds from SE 20-30mph

Surface Owner: OTHER (SPECIFY)

Other(Specify): Taproot Rockies Midstream LLC

Describe what is known about the spill/release event (what happened -- including how it was stopped, contained, and recovered):

On 06/08/2021 at approximately 02:12:30 PM a 4" Thermofelx reinforced poly pipeline failed releasing produced water in the immediate area. The leak lasted for about 20 minutes with a system flow of about 1 bbl/min before the system was shut down and isolated. Just before the failure the pressure had gradually increased to about 624 psig, caused by a closed valve due to a power failure at the delivery site. This line section was rated for 710 psig and has been in service for about that 6 months. Hydrovac and excavation cleanup began within a couple of hours. The failed section of pipe will be recovered and analyzed for the cause of premature failure.

**List of Agencies and Other Parties Notified Pursuant to Rule 912.b.(7)-(11):**

**OTHER NOTIFICATIONS**

Date	Agency/Party	Contact	Phone	Response
6/9/2021	Weld County OEM/LEPC	OEM Spill Report Form	-	online submittal
6/8/2021	Landowner-Taproot Rockies Mids	Dave Brazeal	701-509-2063	the leak stayed on our own property
6/8/2021	Tenant	Chad Hale	303-877-3897	left a voicemail

**REPORT CRITERIA**

**Rule 912.b.(1) Report to the Director (select all criteria that apply):**

- No Rule 912.b.(1).A: A Spill or Release of any size that impacts or threatens to impact any Waters of the State, Public Water System, residence or occupied structure, livestock, wildlife, or publicly-maintained road.
- Waters of the State: \_\_\_\_\_ Public Water System: \_\_\_\_\_
- Residence or Occupied Structure: \_\_\_\_\_ Livestock: \_\_\_\_\_
- Wildlife: \_\_\_\_\_ Publicly-Maintained Road: \_\_\_\_\_
- Yes Rule 912.b.(1).B: A Spill or Release in which 1 barrel or more of E&P Waste or produced fluids is spilled or released outside of berms or other secondary containment.
- Yes Rule 912.b.(1).C: A Spill or Release of 5 barrels or more of E&P Waste or produced Fluids regardless of whether the Spill or Release is completely contained within berms or other secondary containment.
- No Rule 912.b.(1).D: Within 6 hours of discovery, a Grade 1 Gas Leak. For a Grade 1 Gas Leak from a Flowline, the Operator also must submit the Form 19 – Initial, document number on a Form 44, Flowline Report, for the Grade 1 Gas Leak
- Enter the approximate time of discovery \_\_\_\_\_ (HH:MM)
- Enter the Document Number of the Grade 1 Gas Leak Report, Form 44 \_\_\_\_\_
- Was there a reportable accident associated with either a Grade 1 Gas Leak or an E&P waste spill or release? \_\_\_\_\_
- Enter the Document Number of the Initial Accident Report, Form 22 \_\_\_\_\_
- Was there damage during excavation? \_\_\_\_\_
- Was CO 811 notified prior to excavation? \_\_\_\_\_
- Yes Rule 912.b.(1).E: The discovery of 10 cubic yards or more of impacted material resulting from a current or historic Spill or Release. Discovery and reporting will not be contingent upon confirmation samples demonstrating exceedance of Table 915-1 standards.
- Estimated Volume of Impacted Solids (cu. yd.): \_\_\_\_\_ 185
- No Rule 912.b.(1).F: The discovery of impacted Waters of the State, including Groundwater. Discovery and reporting will not be contingent upon confirmation samples demonstrating exceedance of Table 915-1 standards. The presence of free product or hydrocarbon sheen on Groundwater or surface water is reportable. The presence of contaminated soil in contact with Groundwater or surface water is reportable. Check all that apply:
- ☐ The presence of free product or hydrocarbon sheen Surface Water
- ☐ The presence of free product or hydrocarbon sheen on Groundwater
- ☐ The presence of contaminated soil in contact with Groundwater
- ☐ The presence of contaminated soil in contact with Surface water

No	Rule 912.b.(1).G: A suspected or actual Spill or Release of any volume where the volume cannot be immediately determined, including a spill or release of any volume that daylights from the subsurface.
No	Rule 912.b.(1).H: Spill or Release resulting in vaporized hydrocarbon mists that leave the Oil and Gas Location or Off-Location Flowline right of way from an Oil and Gas Location and impacts or threatens to impact off-location property.  <input type="checkbox"/> Areas offsite of Oil & Gas Location <input type="checkbox"/> Off-Location Flowline right of way
No	Rule 912.b.(1).I: A Release of natural gas that results in an accumulation of soil gas or gas seeps.
No	Rule 912.b.(1).J: A Release that results in natural gas in Groundwater.

**OPERATOR COMMENTS:**

--

I hereby certify all statements made in this form are to the best of my knowledge true, correct, and complete.

Signed: \_\_\_\_\_ Print Name: Dale Hunt  
 Title: VP of Engineering Date: 06/09/2021 Email: dhunt@taprootep.com

<u>COA Type</u>	<u>Description</u>
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**Attachment List**

<u>Att Doc Num</u>	<u>Name</u>
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Total Attach: 0 Files

**General Comments**

<u>User Group</u>	<u>Comment</u>	<u>Comment Date</u>
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		Stamp Upon Approval
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Total: 0 comment(s)



# State of Colorado Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203  
Phone: (303) 894-2100 Fax: (303) 894-2109



Document Number:

402785810

Date Received:

08/19/2021

Spill report taken by:

Spill/Release Point ID:

## SPILL/RELEASE REPORT (INITIAL)

This form is to be submitted by the party responsible for the oil and gas spill or release. Refer to COGCC Rule 912.b. for reporting requirements of spills or releases of E&P Waste, produced Fluids, or unauthorized Releases of natural gas. Submit a Site Investigation and Remediation Workplan (Form 27) if Rule 913.c. applies.

### OPERATOR INFORMATION

Name of Operator: <u>TAPROOT ROCKIES MIDSTREAM LLC</u>	Operator No: <u>10718</u>	<b>Phone Numbers</b>
Address: <u>555 17TH STREET SUITE 800</u>		Phone: <u>( )</u>
City: <u>DENVER</u>	State: <u>CO</u>	Zip: <u>80202</u>
Contact Person: <u>Dave Brazeal</u>		Mobile: <u>(701) 509-2063</u>
		Email: <u>dbrazeal@taprootep.com</u>

### INITIAL SPILL/RELEASE REPORT

Initial Spill/Release Report Doc# 402785810

Initial Report Date: 08/19/2021 Date of Discovery: 08/18/2021 Spill Type: Recent Spill

#### Spill/Release Point Location:

QTRQTR NWNW SEC 22 TWP 8N RNG 60W MERIDIAN 6

Latitude: 40.651669 Longitude: -104.085683

Municipality (if within municipal boundaries): N/A County: WELD

Enter Lat./long measurement of the actual Spill/Release Point. Lat./Long. Data shall meet standards of Rule 216.

#### Reference Location:

Facility Type: PRODUCED WATER TRANSFER SYSTEM

☒ Facility/Location ID No 467382

Spill/Release Point Name: Hale East PW Leak

☐ Well API No. (Only if the reference facility is well) 05- -

☐ No Existing Facility or Location ID No.

Estimated Total Spill Volume: use same ranges as others for values

Estimated Oil Spill Volume(bbl): 0

Estimated Condensate Spill Volume(bbl): 0

Estimated Flow Back Fluid Spill Volume(bbl): 0

Estimated Produced Water Spill Volume(bbl): >=100

Estimated Other E&P Waste Spill Volume(bbl): 0

Estimated Drilling Fluid Spill Volume(bbl): 0

Specify: \_\_\_\_\_

Has the subject Spill/Release been controlled at the time of reporting? Yes

#### Land Use:

Current Land Use: NON-CROP LAND

Other(Specify): \_\_\_\_\_

Weather Condition: Normal August evening

Surface Owner: OTHER (SPECIFY)

Other(Specify): Private Owner (Taproot)

Describe what is known about the spill/release event (what happened -- including how it was stopped, contained, and recovered):

The leak was discovered NE of the Bison Haul well pad on 08/18/2021. It was determined to be from the Taproot Produced Water Transfer system, just east of a previous leak. The system was shut down, isolated, and cleanup began. The spill occurred on land owned by Taproot. Initial indications are that the 4" Thermoflex 750 psi pipeline had buckled, and the thin spot created by the buckling failed at about 416 psig (well below the 750 psig rating). The piping has been in service since January of 2021. Taproot is currently evaluating repair/replacement options including hydrotesting to locate additional weak spots.

**List of Agencies and Other Parties Notified Pursuant to Rule 912.b.(7)-(11):**

**OTHER NOTIFICATIONS**

Date	Agency/Party	Contact	Phone	Response
8/19/2021	Weld County OEM/LEPC	OEM Spill Report Form	-	Online Submittal

**REPORT CRITERIA**

**Rule 912.b.(1) Report to the Director (select all criteria that apply):**

- No Rule 912.b.(1).A: A Spill or Release of any size that impacts or threatens to impact any Waters of the State, Public Water System, residence or occupied structure, livestock, wildlife, or publicly-maintained road.
- Waters of the State: \_\_\_\_\_ Public Water System: \_\_\_\_\_
- Residence or Occupied Structure: \_\_\_\_\_ Livestock: \_\_\_\_\_
- Wildlife: \_\_\_\_\_ Publicly-Maintained Road: \_\_\_\_\_
- Yes Rule 912.b.(1).B: A Spill or Release in which 1 barrel or more of E&P Waste or produced fluids is spilled or released outside of berms or other secondary containment.
- Yes Rule 912.b.(1).C: A Spill or Release of 5 barrels or more of E&P Waste or produced Fluids regardless of whether the Spill or Release is completely contained within berms or other secondary containment.
- No Rule 912.b.(1).D: Within 6 hours of discovery, a Grade 1 Gas Leak. For a Grade 1 Gas Leak from a Flowline, the Operator also must submit the Form 19 – Initial, document number on a Form 44, Flowline Report, for the Grade 1 Gas Leak
- Enter the approximate time of discovery \_\_\_\_\_ (HH:MM)
- Enter the Document Number of the Grade 1 Gas Leak Report, Form 44 \_\_\_\_\_
- Was there a reportable accident associated with either a Grade 1 Gas Leak or an E&P waste spill or release? \_\_\_\_\_
- Enter the Document Number of the Initial Accident Report, Form 22 \_\_\_\_\_
- Was there damage during excavation? \_\_\_\_\_
- Was CO 811 notified prior to excavation? \_\_\_\_\_
- Yes Rule 912.b.(1).E: The discovery of 10 cubic yards or more of impacted material resulting from a current or historic Spill or Release. Discovery and reporting will not be contingent upon confirmation samples demonstrating exceedance of Table 915-1 standards.
- Estimated Volume of Impacted Solids (cu. yd.): \_\_\_\_\_ 300
- No Rule 912.b.(1).F: The discovery of impacted Waters of the State, including Groundwater. Discovery and reporting will not be contingent upon confirmation samples demonstrating exceedance of Table 915-1 standards. The presence of free product or hydrocarbon sheen on Groundwater or surface water is reportable. The presence of contaminated soil in contact with Groundwater or surface water is reportable. Check all that apply:
- ☐ The presence of free product or hydrocarbon sheen Surface Water
- ☐ The presence of free product or hydrocarbon sheen on Groundwater
- ☐ The presence of contaminated soil in contact with Groundwater
- ☐ The presence of contaminated soil in contact with Surface water
- No Rule 912.b.(1).G: A suspected or actual Spill or Release of any volume where the volume cannot be immediately determined, including a spill or release of any volume that daylight from the subsurface.

No	Rule 912.b.(1).H: Spill or Release resulting in vaporized hydrocarbon mists that leave the Oil and Gas Location or Off-Location Flowline right of way from an Oil and Gas Location and impacts or threatens to impact off-location property.
	<input type="checkbox"/> Areas offsite of Oil & Gas Location <input type="checkbox"/> Off-Location Flowline right of way
No	Rule 912.b.(1).I: A Release of natural gas that results in an accumulation of soil gas or gas seeps.
No	Rule 912.b.(1).J: A Release that results in natural gas in Groundwater.

**OPERATOR COMMENTS:**

--

I hereby certify all statements made in this form are to the best of my knowledge true, correct, and complete.

Signed: \_\_\_\_\_ Print Name: Dale L. Hunt

Title: VP of Engineering Date: 08/19/2021 Email: dhunt@taprootep.com

COA Type	Description
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**Attachment List**

Att Doc Num	Name
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Total Attach: 0 Files

**General Comments**

User Group	Comment	Comment Date
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		Stamp Upon Approval
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Total: 0 comment(s)





## **APPENDIX B**

### **Assessment Photos**



## Briggsdale, CO Taproot – Hale site – Produced Water Release

**Photo: B-1**

Initial site conditions



**Photo: B-2**

Initial site conditions



## Briggsdale, CO Taproot – Hale site – Produced Water Release

**Photo: B-3**

Hydro Excavation;  
Daylighting pipeline



**Photo: B-4**

Hydro Excavation





## Briggsdale, CO Taproot – Hale site – Produced Water Release

**Photo: B-5**

Loading impacted soil





## **APPENDIX C**

### **Vegetation Assessment Results**





Table C1. Results of the December 2, 2021, Vegetation Site Assessment for the Hale Project, Weld County, Colorado

Site*	Latitude (degrees)	Longitude (degrees)	Surface Cover														Total	
			Smooth Brome ( <i>Bromus inermis</i> )		Russian Thistle ( <i>Salsola tragus</i> )		Purple Threeawn ( <i>Aristida purpurea</i> )		Blue Grama ( <i>Bouteloua gracilis</i> )		Litter (Native Vegetation)		Litter (Hay Mulch)		Bare Ground			
			Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)	Cover (%)	Density (Count)
IMPACT-01	40.39271	-104.5671	-	-	-	-	-	-	-	-	NA	100.0	NA	-	NA	100.0	-	
IMPACT-02	40.39264	-104.5651	-	-	-	-	-	-	-	-	NA	10.0	NA	90.0	NA	100.0	-	
IMPACT-03	40.39265	-103.5682	-	-	-	-	-	-	-	-	NA	50.0	NA	50.0	NA	100.0	-	
Average			-	-	-	-	-	-	-	-	NA	53.3	NA	46.7	NA	100.0	-	
ADJACENT-01	40.39321	-104.5538	10.0	3	20.0	1	5.0	1	-	-	15.0	NA	-	NA	50.0	NA	100.0	5
ADJACENT-02	40.39325	-104.5521	70.0	30	-	-	-	-	-	-	10.0	NA	-	NA	20.0	NA	100.0	30
ADJACENT-03	40.39362	-104.5562	25.0	6	1.0	1	-	-	5.0	1	15.0	NA	-	NA	54.0	NA	100.0	8
Average			35.0	13	7.0		1.7	0.3	1.7	0.3	13.3	NA	-	NA	41.3	NA	100.0	14.3

Note: Density for each species represents the count of individuals of said species rooted inside the Daubenmire frame. Cover percent is a general estimate of the surface cover each species is occupying within the Daubenmire frame.  
\*The IMPACT-01, IMPACT-02, and IMPACT-03 sites are representative of ecological conditions within the Project site and the ADJACENT-01, ADJACENT-02, and ADJACENT-03 sites are the reference sites and are representative of ecological conditions immediately adjacent to the Project site.  
NA = Not Available; plant density was not recorded for litter or bare ground surface cover categories.

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## **APPENDIX D**

### **Soil Sampling Analytical Results**



Table D1. Summary of Soil Sample Analytical Results for Release #1 (part 1)

Sample Name	Units	RSSL*	BS1	FS1†	SS1†	SS2	SS3	SS4	SS5	SS6	SW1†
Sample Date			6/24/21	6/10/21	6/10/21	6/24/21	6/24/21	6/24/21	6/24/21	6/24/21	6/10/21
Sample Depth			1 - 2 ft	6 - 6 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	2 - 3 ft
Metals											
ARSENIC	mg/kg	0.68	2.04	NS	NS	2.26	2.45	2.13	2.2	2.35	NS
BARIUM	mg/kg	15,000	183	NS	NS	198	216	197	220	190	NS
CADMIUM	mg/kg	71	<0.5	NS	NS	<0.5	<0.5	<0.5	<0.5	<0.5	NS
CHROMIUM (VI)	mg/kg	0.3	NS	NS	NS	<1	<1	<1	<1	<1	NS
COPPER	mg/kg	3,100	11.1	NS	NS	13	11.5	12.4	11	11.7	NS
LEAD	mg/kg	400	12.8	NS	NS	10.2	11.1	10.7	10.5	10.4	NS
NICKEL	mg/kg	1,500	9.75	NS	NS	12	10.4	11.5	9.1	10.6	NS
SELENIUM	mg/kg	390	2.11	NS	NS	2.54	2.26	2.66	<2	<2	NS
SILVER	mg/kg	390	<1	NS	NS	<1	<1	<1	<1	<1	NS
ZINC	mg/kg	23,000	42.7	NS	NS	48.5	42	47.1	37	43.9	NS
VOCs											
BENZENE	mg/kg	1.2	NS	NS	NS	<0.001	<0.001	<0.001	<0.001	<0.001	NS
ETHYLBENZENE	mg/kg	5.8	NS	NS	NS	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NS
TOLUENE	mg/kg	490	NS	NS	NS	<0.005	<0.005	<0.005	<0.005	<0.005	NS
XYLENES, TOTAL	mg/kg	58	NS	NS	NS	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	NS
1,2,4-TRIMETHYLBENZENE	mg/kg	30	NS	NS	NS	<0.005	<0.005	<0.005	<0.005	<0.005	NS
1,3,5-TRIMETHYLBENZENE	mg/kg	27	NS	NS	NS	<0.005	<0.005	<0.005	<0.005	<0.005	NS
Semi-VOCs											
1-METHYLNAPHTHALENE	mg/kg	18	NS	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	NS
2-CHLORONAPHTHALENE	mg/kg	--	NS	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	NS
2-METHYLNAPHTHALENE	mg/kg	24	NS	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	NS
ACENAPHTHENE	mg/kg	360	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
ACENAPHTHYLENE	mg/kg	--	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
ANTHRACENE	mg/kg	1,800	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
BENZO(A)ANTHRACENE	mg/kg	1.1	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
BENZO(A)PYRENE	mg/kg	0.11	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
BENZO(B)FLUORANTHENE	mg/kg	1.1	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
BENZO(G,H,I)PERYLENE	mg/kg	--	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
BENZO(K)FLUORANTHENE	mg/kg	11	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
CHRYSENE	mg/kg	110	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
DIBENZ(A,H)ANTHRACENE	mg/kg	0.11	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
FLUORANTHENE	mg/kg	240	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
FLUORENE	mg/kg	240	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS

Sample Name	Units	RSSL*	BS1	FS1†	SS1†	SS2	SS3	SS4	SS5	SS6	SW1†
Sample Date			6/24/21	6/10/21	6/10/21	6/24/21	6/24/21	6/24/21	6/24/21	6/24/21	6/10/21
Sample Depth			1 - 2 ft	6 - 6 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	2 - 3 ft
INDENO(1,2,3-CD)PYRENE	mg/kg	1.1	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
NAPHTHALENE	mg/kg	2	NS	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	NS
PHENANTHRENE	mg/kg	--	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
PYRENE	mg/kg	180	NS	NS	NS	<0.006	<0.006	<0.006	<0.006	<0.006	NS
TPH											
C6-C10 TPH	mg/kg	500	NS	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5
C10-C28 DIESEL RANGE	mg/kg	500	NS	<50	<50	5.98	<4	<4	<4	<4	<50
C28-C36 MOTOR OIL RANGE	mg/kg	500	NS	<50	<50	8.02	5.11	6.95	7.17	<4	<50
Soil Suitability for Reclamation											
PH	s.u.	6.0 - 8.3	7.7	7.8	8.2	8.0	8.2	8.1	8.1	8.1	8.0
ELECTRICAL CONDUCTIVITY	mmhos/cm	<4	0.358	0.114	0.120	0.487	0.197	0.259	0.242	0.216	0.052
SODIUM ADSORPTION RATIO	--	<6	0.078	0.213	1.45	1.12	0.226	0.147	0.253	0.186	0.589
BORON (hot water soluble)	mg/l	2	0.470	0.042	0.060	0.494	0.335	0.343	0.483	0.416	0.065

**NOTES:**  
RSSL = Residential soil screening levels; NA = Not applicable; NS = Not sampled; '–' = No standard established  
'BS' indicates a background sample; 'FS' indicates a sample collected from the floor of an excavation; 'SW' indicates a sample collected from the sidewall of an excavation; 'SS' indicates a surface sample collected from the area of shallow excavation with limited impact from produced water.  
Shaded cells indicate an exceedance of residential soil screening levels (RSSLs).  
\* Where RSSL is not present, Table 915-1 Cleanup Concentrations are used.  
† Indicates samples collected during the initial release response.

Table D2. Summary of Soil Sample Analytical Results for Release #1 (part 2)

Sample Name	Units	RSSL*	SW2-3	SW3-3	SW4-3	SW5-3	SW6-3	SW7-3	SW8-3
Sample Date			6/24/21	6/24/21	6/24/21	6/24/21	6/24/2021	6/24/21	6/24/21
Sample Depth			3 - 4 ft	3 - 4 ft	2.5 - 3.5 ft	2.5 - 3.5 ft	3 - 4 ft	2.5 - 3.5 ft	2.5 - 3.5 ft
Metals									
ARSENIC	mg/kg	0.68	3.27	3.44	2.95	3.64	3.24	2.88	3.84
BARIUM	mg/kg	15,000	250	491	368	367	367	213	595
CADMIUM	mg/kg	71	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
CHROMIUM (VI)	mg/kg	0.3	<1	<1	<1	<1	<1	<1	<1
COPPER	mg/kg	3,100	15.4	16.1	13.6	16	16.2	14.1	14.5
LEAD	mg/kg	400	10.7	11.7	9.49	12.2	10.3	9.78	11.5
NICKEL	mg/kg	1,500	14.1	15.1	12.2	16	14.9	13.1	13.2
SELENIUM	mg/kg	390	2.35	2.69	3.19	3.15	3.08	3	2.01
SILVER	mg/kg	390	<1	<1	<1	<1	<1	<1	<1
ZINC	mg/kg	23,000	54.8	58.0	49.1	59.6	67.6	50.0	50.1
VOCs									
BENZENE	mg/kg	1.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
ETHYLBENZENE	mg/kg	5.8	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
TOLUENE	mg/kg	490	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
XYLENES, TOTAL	mg/kg	58	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
1,2,4-TRIMETHYLBENZENE	mg/kg	30	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,3,5-TRIMETHYLBENZENE	mg/kg	27	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Semi-VOCs									
1-METHYLNAPHTHALENE	mg/kg	18	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-CHLORONAPHTHALENE	mg/kg	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-METHYLNAPHTHALENE	mg/kg	24	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ACENAPHTHENE	mg/kg	360	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
ACENAPHTHYLENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
ANTHRACENE	mg/kg	1,800	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)ANTHRACENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)PYRENE	mg/kg	0.11	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(B)FLUORANTHENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(G,H,I)PERYLENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(K)FLUORANTHENE	mg/kg	11	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHRYSENE	mg/kg	110	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
DIBENZ(A,H)ANTHRACENE	mg/kg	0.11	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
FLUORANTHENE	mg/kg	240	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
FLUORENE	mg/kg	240	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006

Sample Name	Units	RSSL*	SW2-3	SW3-3	SW4-3	SW5-3	SW6-3	SW7-3	SW8-3
Sample Date			6/24/21	6/24/21	6/24/21	6/24/21	6/24/2021	6/24/21	6/24/21
Sample Depth			3 - 4 ft	3 - 4 ft	2.5 - 3.5 ft	2.5 - 3.5 ft	3 - 4 ft	2.5 - 3.5 ft	2.5 - 3.5 ft
INDENO(1,2,3-CD)PYRENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
NAPHTHALENE	mg/kg	2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
PHENANTHRENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
PYRENE	mg/kg	180	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
TPH									
C6-C10 TPH	mg/kg	500	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C10-C28 DIESEL RANGE	mg/kg	500	<4	<4	<4	<4	<4	<4	<4
C28-C36 MOTOR OIL RANGE	mg/kg	500	4.61	<4	<4	<4	<4	<4	<4
Soil Suitability for Reclamation									
PH	s.u.	6.0 - 8.3	8.1	7.9	8.2	7.9	7.9	8.1	8.3
ELECTRICAL CONDUCTIVITY	mmhos/cm	<4	0.612	1.330	0.550	1.580	1.490	0.526	0.420
SODIUM ADSORPTION RATIO	--	<6	2.11	2.29	2.43	2.40	2.17	1.87	2.19
BORON (hot water soluble)	mg/l	2	0.714	1.11	0.968	1.2	0.923	0.654	1.0

**NOTES:**  
RSSL = Residential soil screening levels; NA = Not applicable; NS = Not sampled; '–' = No standard established  
'BS' indicates a background sample; 'FS' indicates a sample collected from the floor of an excavation; 'SW' indicates a sample collected from the sidewall of an excavation; 'SS' indicates a surface sample collected from the area of shallow excavation with limited impact from produced water.  
Shaded cells indicate an exceedance of residential soil screening levels (RSSLs).  
\* Where RSSL is not present, Table 915-1 Cleanup Concentrations are used.  
† Indicates samples collected during the initial release response.



Table D3. Summary of Soil Sample Analytical Results Release #2 (part 1)

Sample Name	Units	RSSL*	FS-01	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-08
Sample Date			8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021
Sample Depth			5 - 5.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft
Metals											
ARSENIC	mg/kg	0.68	2.42	2.82	2.45	3.05	2.66	3.24	2.72	2.84	2.46
BARIUM	mg/kg	15,000	230	180	200	192	424	446	200	245	196
CADMIUM	mg/kg	71	0.127	0.138	0.198	0.175	0.113	0.143	0.145	0.21	0.146
CHROMIUM (VI)	mg/kg	0.3	12.7	12.7	12	12.6	12.1	15.8	13.1	13.3	12.2
COPPER	mg/kg	3,100	<1	<1	<1	<1	<1	<1	<1	<1	<1
LEAD	mg/kg	400	8.96	9.4	9.87	10.2	8.81	10.5	8.92	9.78	9.79
NICKEL	mg/kg	1,500	10.8	10.6	10.2	11.4	10.4	13.1	11	11.4	10.3
SELENIUM	mg/kg	390	1.54	1.51	1.45	2.08	1.49	2.23	1.67	1.82	2.25
SILVER	mg/kg	390	<1	<1	<1	<1	<1	<1	<1	<1	<1
ZINC	mg/kg	23,000	45	47.1	43.8	43.2	44.8	56.1	47.1	47.3	44.4
VOCs											
BENZENE	mg/kg	1.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
ETHYLBENZENE	mg/kg	5.8	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0028	<0.0025	<0.0025
TOLUENE	mg/kg	490	<0.005	<0.005	0.00155	<0.005	<0.005	<0.005	0.0029	<0.005	<0.005
XYLENES, TOTAL	mg/kg	58	0.00103	0.00123	0.0137	<0.0065	0.00425	<0.0065	0.00926	<0.0065	<0.0065
1,2,4-TRIMETHYLBENZENE	mg/kg	30	0.00188	0.00178	<0.005	<0.005	<0.005	<0.005	0.0051	<0.005	<0.005
1,3,5-TRIMETHYLBENZENE	mg/kg	27	<0.005	<0.005	0.0093	<0.005	0.00298	<0.005	<0.005	<0.005	<0.005
Semi-VOCs											
1-METHYLNAPHTHALENE	mg/kg	18	0.0336	0.0755	0.133	<0.02	0.00627	0.0052	0.0388	0.0303	0.0788
2-CHLORONAPHTHALENE	mg/kg	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-METHYLNAPHTHALENE	mg/kg	24	0.0284	0.0535	0.0589	<0.02	<0.02	0.00445	0.0302	0.0215	0.058
ACENAPHTHENE	mg/kg	360	<0.006	0.00361	0.0101	<0.006	<0.006	<0.006	<0.006	<0.006	0.00513
ACENAPHTHYLENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
ANTHRACENE	mg/kg	1,800	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)ANTHRACENE	mg/kg	1.1	<0.006	0.00254	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)PYRENE	mg/kg	0.11	<0.006	0.003	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(B)FLUORANTHENE	mg/kg	1.1	<0.006	0.00637	0.0028	<0.006	<0.006	<0.006	<0.006	<0.006	0.00196
BENZO(G,H,I)PERYLENE	mg/kg	--	<0.006	0.00213	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(K)FLUORANTHENE	mg/kg	11	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHRYSENE	mg/kg	110	<0.006	0.00436	0.0107	<0.006	<0.006	<0.006	<0.006	<0.006	0.00677
DIBENZ(A,H)ANTHRACENE	mg/kg	0.11	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
FLUORANTHENE	mg/kg	240	<0.006	0.00389	0.0049	<0.006	<0.006	<0.006	<0.006	<0.006	0.00278
FLUORENE	mg/kg	240	0.00495	0.0138	0.0451	<0.006	<0.006	<0.006	0.00937	0.00899	0.0228

Sample Name	Units	RSSL*	FS-01	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-08
Sample Date			8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021	8/20/2021
Sample Depth			5 - 5.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft
INDENO(1,2,3-CD)PYRENE	mg/kg	1.1	<0.006	0.00226	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
NAPHTHALENE	mg/kg	2	<0.0125	0.00895	0.0104	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125
PHENANTHRENE	mg/kg	--	0.012	0.0311	0.112	<0.006	<0.006	<0.006	0.0248	0.0259	0.0684
PYRENE	mg/kg	180	<0.006	0.0062	0.00908	<0.006	<0.006	<0.006	0.0021	0.00203	0.00591
TPH											
C6-C10 TPH	mg/kg	500	0.0725	0.781	2.18	<0.1	3.23	0.0247	0.496	0.0382	0.867
C10-C28 DIESEL RANGE	mg/kg	500	6.42	43.1	166	<4	4.96	<4	2.57	4.38	49.5
C28-C36 MOTOR OIL RANGE	mg/kg	500	5.75	32	111	3.67	3.51	2.54	3.23	4.9	35.2
Soil Suitability for Reclamation											
PH	s.u.	6.0 - 8.3	8.1	7.8	7.6	8.3	8.0	8.0	8.0	7.9	7.8
ELECTRICAL CONDUCTIVITY	mmhos/cm	<4	1.75	0.983	3.06	0.304	3.53	1.44	1.16	1.58	3.49
SODIUM ADSORPTION RATIO	--	<6	5.21	2.65	7.2	1.52	10.5	2.73	3.68	3.51	9.8
BORON (hot water soluble)	mg/l	2	1.41	0.514	0.953	0.407	2.04	0.744	0.674	0.733	0.999
<b>NOTES:</b>											
RSSL = Residential soil screening levels; NA = Not applicable; NS = Not sampled; '–' = No standard established											
'BS' indicates a background sample; 'FS' indicates a sample collected from the floor of an excavation; 'SW' indicates a sample collected from the sidewall of an excavation; 'SS' indicates a surface sample collected from the area of shallow excavation with limited impact from produced water.											
Shaded cells indicate an exceedance of residential soil screening levels (RSSLs).											
* Where RSSL is not present, Table 915-1 Cleanup Concentrations are used.											
† Indicates samples collected during the initial release response.											

Table D4. Summary of Soil Sample Analytical Results Release #2 (part 2)

Sample Name	Units	RSSL*	SW-09	SS1	SS2	SS3	SS4
Sample Date			9/24/2021	9/24/2021	9/24/2021	9/24/2021	9/24/2021
Sample Depth			2.5 - 3 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft
Metals							
ARSENIC	mg/kg	0.68	3.5	3.5	3.2	2.4	3.1
BARIUM	mg/kg	15,000	147	315	301	184	247
CADMIUM	mg/kg	71	0.309	0.257	0.301	0.33	0.282
CHROMIUM (VI)	mg/kg	0.3	12.3	11.3	12.5	12.5	12.5
COPPER	mg/kg	3,100	<1	<1	<1	<1	<1
LEAD	mg/kg	400	9.65	11.5	10.6	10.1	19.2
NICKEL	mg/kg	1,500	11.7	10.1	11.6	11.2	11.4
SELENIUM	mg/kg	390	<2	<2	<2	<2	<2
SILVER	mg/kg	390	<1	<1	<1	<1	<1
ZINC	mg/kg	23,000	41.3	38.7	43.3	44	43
VOCs							
BENZENE	mg/kg	1.2	<0.001	<0.001	<0.001	<0.001	<0.001
ETHYLBENZENE	mg/kg	5.8	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
TOLUENE	mg/kg	490	<0.005	<0.005	<0.005	<0.005	<0.005
XYLENES, TOTAL	mg/kg	58	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
1,2,4-TRIMETHYLBENZENE	mg/kg	30	<0.005	<0.005	<0.005	<0.005	<0.005
1,3,5-TRIMETHYLBENZENE	mg/kg	27	<0.005	<0.005	<0.005	<0.005	<0.005
Semi-VOCs							
1-METHYLNAPHTHALENE	mg/kg	18	<0.02	<0.02	<0.02	<0.02	<0.02
2-CHLORONAPHTHALENE	mg/kg	--	<0.02	<0.02	<0.02	<0.02	<0.02
2-METHYLNAPHTHALENE	mg/kg	24	<0.02	<0.02	<0.02	<0.02	<0.02
ACENAPHTHENE	mg/kg	360	<0.006	<0.006	<0.006	<0.006	<0.006
ACENAPHTHYLENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006
ANTHRACENE	mg/kg	1,800	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)ANTHRACENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(A)PYRENE	mg/kg	0.11	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(B)FLUORANTHENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(G,H,I)PERYLENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006
BENZO(K)FLUORANTHENE	mg/kg	11	<0.006	<0.006	<0.006	<0.006	<0.006
CHRYSENE	mg/kg	110	<0.006	<0.006	<0.006	<0.006	<0.006
DIBENZ(A,H)ANTHRACENE	mg/kg	0.11	<0.006	<0.006	<0.006	<0.006	<0.006
FLUORANTHENE	mg/kg	240	<0.006	<0.006	<0.006	<0.006	<0.006
FLUORENE	mg/kg	240	<0.006	<0.006	<0.006	<0.006	<0.006
INDENO(1,2,3-CD)PYRENE	mg/kg	1.1	<0.006	<0.006	<0.006	<0.006	<0.006

Sample Name	Units	RSSL*	SW-09	SS1	SS2	SS3	SS4
Sample Date			9/24/2021	9/24/2021	9/24/2021	9/24/2021	9/24/2021
Sample Depth			2.5 - 3 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft	0.5 - 0.5 ft
NAPHTHALENE	mg/kg	2	<0.02	<0.02	<0.02	<0.02	<0.02
PHENANTHRENE	mg/kg	--	<0.006	<0.006	<0.006	<0.006	<0.006
PYRENE	mg/kg	180	<0.006	<0.006	<0.006	<0.006	<0.006
TPH							
C6-C10 TPH	mg/kg	500	<0.1	<0.1	<0.1	<0.1	<0.1
C10-C28 DIESEL RANGE	mg/kg	500	2.53	8.62	4.01	4.24	4.22
C28-C36 MOTOR OIL RANGE	mg/kg	500	8.65	18	14.9	16.4	10.6
Soil Suitability for Reclamation							
PH	s.u.	6.0 - 8.3	8.7	8.1	8.0	8.0	7.8
ELECTRICAL CONDUCTIVITY	mmhos/cm	<4	0.291	0.575	1.1	0.250	1.6
SODIUM ADSORPTION RATIO	--	<6	1.6	3.2	3.3	0.517	1.1
BORON (hot water soluble)	mg/l	2	0.235	0.511	0.332	0.139	0.133

**NOTES:**  
RSSL = Residential soil screening levels; NA = Not applicable; NS = Not sampled; '—' = No standard established  
'BS' indicates a background sample; 'FS' indicates a sample collected from the floor of an excavation; 'SW' indicates a sample collected from the sidewall of an excavation; 'SS' indicates a surface sample collected from the area of shallow excavation with limited impact from produced water.  
Shaded cells indicate an exceedance of residential soil screening levels (RSSLs).  
\* Where RSSL is not present, Table 915-1 Cleanup Concentrations are used.  
† Indicates samples collected during the initial release response.

Table D5. Summary of Soil Sample Analytical Results Release #2 (part 3)

Sample Name	Units	RSSL*	SW-10	SW-11	SW-12	SW-13	SW-14	SW-15	BS2
Sample Date			5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022
Sample Depth			2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2-2.5 ft
Metals									
ARSENIC	mg/kg	0.68	NS	NS	NS	NS	NS	NS	NS
BARIUM	mg/kg	15,000	NS	NS	NS	NS	NS	NS	NS
CADMIUM	mg/kg	71	NS	NS	NS	NS	NS	NS	NS
CHROMIUM (VI)	mg/kg	0.3	NS	NS	NS	NS	NS	NS	NS
COPPER	mg/kg	3,100	NS	NS	NS	NS	NS	NS	NS
LEAD	mg/kg	400	NS	NS	NS	NS	NS	NS	NS
NICKEL	mg/kg	1,500	NS	NS	NS	NS	NS	NS	NS
SELENIUM	mg/kg	390	NS	NS	NS	NS	NS	NS	NS
SILVER	mg/kg	390	NS	NS	NS	NS	NS	NS	NS
ZINC	mg/kg	23,000	NS	NS	NS	NS	NS	NS	NS
VOCs									
BENZENE	mg/kg	1.2	NS	NS	NS	NS	NS	NS	NS
ETHYLBENZENE	mg/kg	5.8	NS	NS	NS	NS	NS	NS	NS
TOLUENE	mg/kg	490	NS	NS	NS	NS	NS	NS	NS
XYLENES, TOTAL	mg/kg	58	NS	NS	NS	NS	NS	NS	NS
1,2,4-TRIMETHYLBENZENE	mg/kg	30	NS	NS	NS	NS	NS	NS	NS
1,3,5-TRIMETHYLBENZENE	mg/kg	27	NS	NS	NS	NS	NS	NS	NS
Semi-VOCs									
1-METHYLNAPHTHALENE	mg/kg	18	NS	NS	NS	NS	NS	NS	NS
2-CHLORONAPHTHALENE	mg/kg	--	NS	NS	NS	NS	NS	NS	NS
2-METHYLNAPHTHALENE	mg/kg	24	NS	NS	NS	NS	NS	NS	NS
ACENAPHTHENE	mg/kg	360	NS	NS	NS	NS	NS	NS	NS
ACENAPHTHYLENE	mg/kg	--	NS	NS	NS	NS	NS	NS	NS
ANTHRACENE	mg/kg	1,800	NS	NS	NS	NS	NS	NS	NS
BENZO(A)ANTHRACENE	mg/kg	1.1	NS	NS	NS	NS	NS	NS	NS
BENZO(A)PYRENE	mg/kg	0.11	NS	NS	NS	NS	NS	NS	NS
BENZO(B)FLUORANTHENE	mg/kg	1.1	NS	NS	NS	NS	NS	NS	NS
BENZO(G,H,I)PERYLENE	mg/kg	--	NS	NS	NS	NS	NS	NS	NS
BENZO(K)FLUORANTHENE	mg/kg	11	NS	NS	NS	NS	NS	NS	NS
CHRYSENE	mg/kg	110	NS	NS	NS	NS	NS	NS	NS
DIBENZ(A,H)ANTHRACENE	mg/kg	0.11	NS	NS	NS	NS	NS	NS	NS
FLUORANTHENE	mg/kg	240	NS	NS	NS	NS	NS	NS	NS
FLUORENE	mg/kg	240	NS	NS	NS	NS	NS	NS	NS
INDENO(1,2,3-CD)PYRENE	mg/kg	1.1	NS	NS	NS	NS	NS	NS	NS

Sample Name	Units	RSSL*	SW-10	SW-11	SW-12	SW-13	SW-14	SW-15	BS2
Sample Date			5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022	5/18/2022
Sample Depth			2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2 - 2.5 ft	2-2.5 ft
NAPHTHALENE	mg/kg	2	NS	NS	NS	NS	NS	NS	NS
PHENANTHRENE	mg/kg	--	NS	NS	NS	NS	NS	NS	NS
PYRENE	mg/kg	180	NS	NS	NS	NS	NS	NS	NS
TPH									
C6-C10 TPH	mg/kg	500	NS	NS	NS	NS	NS	NS	NS
C10-C28 DIESEL RANGE	mg/kg	500	NS	NS	NS	NS	NS	NS	NS
C28-C36 MOTOR OIL RANGE	mg/kg	500	NS	NS	NS	NS	NS	NS	NS
Soil Suitability for Reclamation									
PH	s.u.	6.0 - 8.3	7.8	8.3	7.7	8.1	7.6	7.9	8.0
ELECTRICAL CONDUCTIVITY	mmhos/cm	<4	0.250	0.230	0.239	0.337	1.640	0.313	0.250
SODIUM ADSORPTION RATIO	--	<6	1.32	1.32	1.16	1.37	1.38	1.09	1.59
BORON (hot water soluble)	mg/l	2	0.332	0.285	0.211	0.308	0.261	0.236	0.239

**NOTES:**  
RSSL = Residential soil screening levels; NA = Not applicable; NS = Not sampled; '—' = No standard established  
'BS' indicates a background sample; 'FS' indicates a sample collected from the floor of an excavation; 'SW' indicates a sample collected from the sidewall of an excavation; 'SS' indicates a surface sample collected from the area of shallow excavation with limited impact from produced water.  
Shaded cells indicate an exceedance of residential soil screening levels (RSSLs).  
\* Where RSSL is not present, Table 915-1 Cleanup Concentrations are used.  
† Indicates samples collected during the initial release response.

## **APPENDIX E**

### **Reclamation Schedule Template**





**Table E1. Reclamation Schedule\***

Reclamation Action	Date
Soil sampling (include past dates)	
Initial soil sampling	June 10, June 24, August 20, 2021
Pre-reclamation soil sampling	September 24, 2021, and May 18, 2022
Contaminated soil removal/disposal	June 8 through August 20, 2021
Initial stabilization measures	June 15, 2021
Seed mixture consultation	TBD
Stormwater BMP installation	June 15, 2021
Soil movement and recontouring	TBD
Decompaction	TBD
Topsoil placement	TBD
Soil amendments	TBD
Seedbed preparation	TBD
Seeding	TBD
Seedbed stabilization	TBD
Monitoring	Two growing seasons post-reclamation
Reporting	Annually (until reclamation standards achieved)

\* To be completed prior to reclamation and additional remediation actions.

TBD = to be determined

