

REMEDIATION AND RECLAMATION PLAN

REINERS B-3 LOGAN COUNTY, COLORADO

NOVEMBER 2017

Prepared for:

**WESTERN OPERATION COMPANY
Denver, Colorado**



Advancing Opportunity



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Prepared for:

**WESTERN OPERATING COMPANY
518 17th Street, Suite 200
Denver, Colorado 80202**

Prepared by:

**LT ENVIRONMENTAL, INC.
4600 West 60th Avenue
Arvada, Colorado 80003
(303) 433-9788**





**REMEDIATION AND RECLAMATION PLAN
REINERS B-3
LTE Project Number: 028417003**

**Prepared
by:**

A handwritten signature in blue ink, appearing to read "Hank Raizen".

Hank Raizen
LTE Staff Biologist

November 8, 2017

Date

**Reviewed
by:**

A handwritten signature in black ink, appearing to read "Ryan Dial".

Ryan Dial
LTE Project Scientist

November 9, 2017

Date





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1.0 REMEDIATION AND RECLAMATION OBJECTIVES

The objective of remediation and reclamation is to return the affected area to a condition approximating that which existed prior to disturbance. This includes restoring the natural vegetative community, hydrologic systems, ecological functions, and other natural resource values to maintain healthy, biologically active topsoil; to control erosion and sediment transport; and to minimize loss of habitat, forage, and visual resources. Remediation and reclamation will be judged successful when impacted areas have been stabilized and re-vegetated with a self-sustaining, vigorous, diverse, native (or otherwise approved) plant community sufficient to minimize visual impacts, provide forage, stabilize soil, impede the invasion of noxious weeds, and inorganic compound levels are in compliance with Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 (Table 1).

Reclamation objectives are provided to ensure understanding of performance standards and Best Management Practices (BMPs), so Western Operating Company (Western) can implement the BMPs in an effective and cost efficient manner.



2.0 REMEDIATION AND RECLAMATION PLAN

The Remediation and Reclamation Plan is an oil and gas operator's opportunity to provide plans or analyses that support overall achievement of reclamation objectives. The Remediation and Reclamation Plan includes the following to ensure reclamation objectives and standards are met. Changes and additions to the Remediation and Reclamation Plan may be necessary over the lifetime of a site to achieve the reclamation objectives and standards.

2.1 PRE-EXISTING SITE CONDITIONS

The Reiners B-3 injection well (Site) is located 0.9 miles south of the intersection of County Road (CR) 68 and CR 31 in Logan County, Colorado. The legal site description is the southwest quarter of the southwest quarter of Section 22, Township 11 North, Range 53 West, 6th Principal Meridian. The Site Location Map is provided as Figure 1.

The pre-existing land use is rangeland. The terrain is sloped to the southwest with sparse native grasses dominating the plant community.

2.2 CURRENT SITE CONDITIONS

The Site's current land use is rangeland. The dominant plant species present are kochia and Russian thistle, both of which are commonly known to be invasive and generally undesirable. Two mostly bare areas of salt-killed vegetation (Figure 2) exist along the flowline path 90 and 160 feet northeast of the injection well. Soil in the bare areas is susceptible to erosion.

2.3 RECOMMENDATIONS

2.3.1 Stormwater BMPs

Due to the minimal slope on the bare areas, adding a bulking agent (described in the section below) should be sufficient to prevent erosion and sediment transport on the Site.

2.3.2 Soil Treatment

To reduce salt levels in the soil, till gypsum and a bulking agent into the soil. Ground gypsum will be applied to the soil to promote a chemical reaction to reduce salt buildup. An application rate of 1,500 to 2,000 pounds (lbs) gypsum per acre is recommended.

Use bulking agents to prop open soil to allow for improved salt drainage. Straw or hay can be used as a bulking agent. An application rate of 2000 lbs per acre is recommended.

Cross-rip impacted soil to a minimum depth of 18 inches below ground surface (bgs), unless bedrock is encountered at a shallower depth. Double ripping, to help force the contact between the gypsum and impacted soil, and water trucks using different more soluble amendments could be employed for more aggressive treatment.



2.3.3 Seeding

After allowing the gypsum and bulking agent to reduce salt levels in the soil for approximately one year, vegetation will need to be established to provide long-term soil stabilization. Seed the Site using the seed mix recommendations provided by the National Resource Conservation Service (NRCS) (Appendix A).

2.3.4 Weed Control

Conduct weed mitigation by mowing the Site prior to when the undesirable plant species set seed. Seed set for the undesirable plant species observed in this region is typically mid-July through August. More than one mowing event per growing season may be necessary.

2.3.5 Monitoring

Monitor the Site during the growing season following remediation and reclamation activities to identify whether remediation and reclamation objectives are likely to be achieved in the near future without additional actions and/or identify actions that are needed to meet the objectives and standards. Monitoring should be done by a qualified vegetation expert using quantitative methods, such as line-point intercept, during the growing season to determine if the Site has achieved 80 percent (%) of pre-disturbance or reference area vegetation coverage levels, excluding undesirable plant species. Additionally, a second method for qualitative analysis could include quadrant evaluation to determine the success of germination of recently planted vegetation. Documentation of the vegetation monitoring data conducted by the qualified vegetation expert demonstrating that the vegetation meets the 80% standard is required per the COGCC Field Inspection Form (Appendix B).

Special attention should be given to the monitoring of undesirable species or noxious weeds for prompt control if necessary. Additional actions to achieve successful remediation and reclamation is contingent upon monitoring results.

2.3.6 Submit Field Inspection Report Resolution (FIRR)

Submit a Field Inspection Report Resolution (FIRR) to the COGCC once the Site has achieved remediation and reclamation objectives. Include invoices and/or documentation demonstrating the work completed and the data collected on site that directly relates to the remediation and reclamation corrective actions required on the COGCC Field Inspection Form.

FIGURES

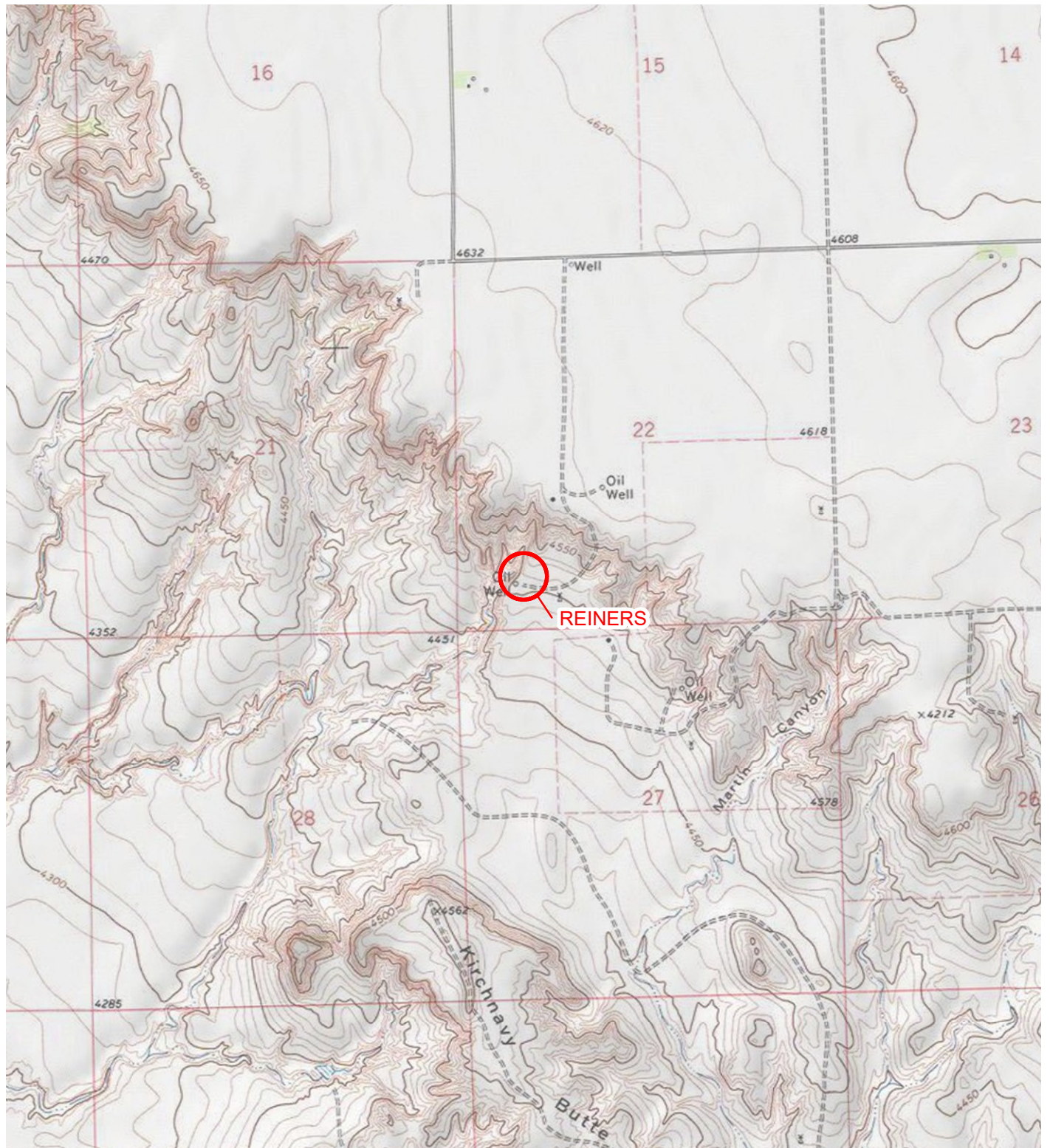


IMAGE COURTESY OF ESRI/USGS

LEGEND

○ SITE LOCATION

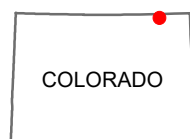
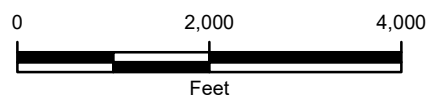


FIGURE 1
SITE LOCATION MAP
REINERS
SWSW SEC 22 T11N R53W
LOGAN COUNTY, COLORADO
WESTERN OPERATING COMPANY





LEGEND

- INJECTION WELL
- FLOWLINE PATH
- ⬭ SALT KILL RECLAMATION AREA

IMAGE COURTESY OF GOOGLE EARTH 2015

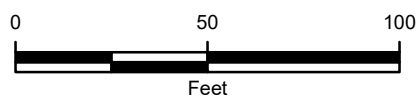


FIGURE 2
RECLAMATION DRAWING
REINERS B #3 INJECTION WELL
SWSW SEC 22 T11N R53W
LOGAN COUNTY, COLORADO
WESTERN OPERATING COMPANY



TABLES

**COGCC Table 910-1
CONCENTRATION LEVELS**

Contaminant of Concern	Concentrations
Organic Compounds in Soil	
TPH (total volatile and extractable petroleum hydrocarbons)	500 mg/kg
Benzene	0.17 mg/kg
Toluene	85 mg/kg
Ethylbenzene	100 mg/kg
Xylenes (total)	175 mg/kg
Acenaphthene	1,000 mg/kg
Anthracene	1,000 mg/kg
Benz(a)anthracene	0.22 mg/kg
Benzo(b)fluoranthene	0.22 mg/kg
Benzo(k)fluoranthene	2.2 mg/kg
Benzo(a)pyrene	0.022 mg/kg
Chrysene	22 mg/kg
Dibenzo(a,h)anthracene	0.022 mg/kg
Fluoranthene	1,000 mg/kg
Fluorene	1,000 mg/kg
Indeno(1,2,3,c,d)pyrene	0.22 mg/kg
Naphthalene	23 mg/kg
Pyrene	1,000 mg/kg
Organic Compounds in Ground Water	
Benzene	5 µg/l
Toluene	560 to 1,000 µg/l
Ethylbenzene	700 µg/l
Xylenes (Total)	1,400 to 10,000 µg/l
Inorganics in Soils	
Electrical Conductivity (EC)	<4 mmhos/cm or 2x background
Sodium Adsorption Ratio (SAR)	<12
pH	6-9
Inorganics in Ground Water	
Total Dissolved Solids (TDS)	<1.25 x background
Chlorides	<1.25 x background
Sulfates	<1.25 x background
Metals in Soils	
Arsenic	0.39 mg/kg
Barium (LDNR True Total Barium)	15,000 mg/kg
Boron (Hot Water Soluble)	2 mg/l
Cadmium	70 mg/kg
Chromium (III)	120,000 mg/kg
Chromium (VI)	23 mg/kg
Copper	3,100 mg/kg
Lead (inorganic)	400 mg/kg
Mercury	23 mg/kg
Nickel (soluble salts)	1,600 mg/kg
Selenium	390 mg/kg
Silver	390 mg/kg
Zinc	23,000 mg/kg
Liquid Hydrocarbons in Soils and Ground Water	
Liquid hydrocarbons including condensate and oil	Below detection level

APPENDIX A
NRCS SEED MIX RECOMMENDATIONS





Date _____

APPENDIX B
COGCC FIELD INSPECTION FORM



**FORM
INSP**Rev
X/15**State of Colorado
Oil and Gas Conservation Commission**1120 Lincoln Street, Suite 801, Denver, Colorado 80203
Phone: (303) 894-2100 Fax: (303) 894-2109

Inspection Date:

02/09/2017

Submitted Date:

03/27/2017

Document Number:

678200657**FIELD INSPECTION FORM**Loc ID 312232 Inspector Name: YOUNG, ROB On-Site Inspection ☐ 2A Doc Num: _____**Operator Information:**OGCC Operator Number: 95620Name of Operator: WESTERN OPERATING COMPANYAddress: 518 17TH ST STE 200City: DENVER State: CO Zip: 80202**Status Summary:**

- ☐ THIS IS A FOLLOW UP INSPECTION
- ☐ FOLLOW UP INSPECTION REQUIRED
- ☐ NO FOLLOW UP INSPECTION REQUIRED

Findings:3 Number of Comments1 Number of Corrective Actions☒ Corrective Action Response Requested**Contact Information:**

Contact Name	Phone	Email	Comment
Hart, Dale	719-688-1638 cell/10284	dalehartwoc@fairpoint.net	
James, Steve	(303) 893-2438	steve@westernoperating.com	All Inspections
Hart, Dale	719-688-1638	dale@westernoperating.com	
Axelson, John		john.axelson@state.co.us	

General Comment:

Environmental inspection related to historic salt kills along the flowline path. Submit a Form 27 describing the remediation/reclamation of the impacted areas.

Environmental**Spills/Releases:**

Type of Spill: PRODUCED WATER

Estimated Spill Volume: _____

Comment: Historic flowline releases of produced water have caused localized salt kills.Corrective Action: Submit a Form 27 describing the remediation and reclamation of the affected areas.

Date: 04/07/2017

Reportable: NO

GPS: Lat _____ Long _____

Proximity to Surface Water: _____

Depth to Ground Water: _____

Water Well Complaint:

Lat _____ Long _____

DWR Receipt Num: _____ Owner Name: _____ GPS : _____

Field Parameters:

Sample Location: _____ Comment: _____

Attached DocumentsYou can go to COGCC Images (<https://cogcc.state.co.us/weblink/>) and search by document number:

Document Num	Description	URL
678200658	Location photographs	http://ogccweblink.state.co.us/DownloadDocumentPDF.aspx?DocumentId=4110284
678200659	Google Earth aerial photograph showing salt kills	http://ogccweblink.state.co.us/DownloadDocumentPDF.aspx?DocumentId=4110285