

State of Colorado
Oil and Gas Conservation Commission



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

FOR OGCC USE ONLY

REM 9640
Document 2526157
Date 04/27/2016

SITE INVESTIGATION AND REMEDIATION WORKPLAN

This form shall be submitted to the Director for approval prior to the initiation of site investigation and remediation activities. Form 27 is intended to be used whenever possible. Additional documentation will be required when large volumes of soil and groundwater have been impacted or involve large facilities with multiple source areas. See Rule 910. Attach as many pages as needed to fully describe the proposed work.

OGCC Employee

☐ Spill ☐ Complaint
☐ Inspection ☐ NOAV

Tracking No:

CAUSE OF CONDITION BEING INVESTIGATED AND REMEDIATED

☐ Spill or Release ☐ Plug & Abandon ☐ Central Facility Closure ☐ Site/Facility Closure ☒ Other (describe): DRILL CUTTINGS REMEDIATION

OGCC Operator Number: 10150

Name of Operator: BLACK HILLS PLATEAU PRODUCTION LLC

Address: 1515 WYNKOOP ST STE 500

City: DENVER State: CO Zip: 80202

Contact Name and Telephone:

JESSICA DONAHUE

No: 720-210-1333

Fax: (303) 566-3344

API Number: N/A

County: MESA

Facility Name: WHF D17 998

Facility Number: 429734

Well Name: N/A

Well Number: D-17 998

Location: (QtrQtr, Sec, Twp, Rng, Meridian): NWNW, SEC 17, T9S, R98W, 6th PM Latitude: 39.277469 Longitude: -108.358933

TECHNICAL CONDITIONS

Type of Waste Causing Impact (crude oil, condensate, produced water, etc): WATER BASED DRILL CUTTINGS

Site Conditions: Is location within a sensitive area (according to Rule 901e)? ☐ Y ☒ N If yes, attach evaluation.

Adjacent land use (cultivated, irrigated, dry land farming, industrial, residential, etc.): OPEN RAGELAND W/ OIL AND GAS OPERATIONS

Soil type, if not previously identified on Form 2A or Federal Surface Use Plan: BARX LOAM

Potential receptors (water wells within 1/4 mi, surface waters, etc.): NO POTENTIAL RECEPTORS WITHIN 1/4 MILE.

Description of Impact (if previously provided, refer to that form or document):

Impacted Media (check):

- ☒ Soils
☐ Vegetation
☐ Groundwater
☐ Surface Water

Extent of Impact:

11,000 CUBIC YARDS

How Determined:

FIELD MEASUREMENTS, GIS DATA

REMEDIALATION WORKPLAN

Describe initial action taken (if previously provided, refer to that form or document):

SEE ATTACHED REPORT FOR DETAILS

Describe how source is to be removed:

SEE ATTACHED REPORT FOR DETAILS

Describe how remediation of existing impacts is to be accomplished, including removal and disposal at an injection well or licensed facility, land treatment on site, removal of impacted groundwater, insitu bioremediation, burning of oily vegetation, etc.:

SEE ATTACHED REPORT FOR DETAILS



Tracking Number: _____
Name of Operator: _____
OGCC Operator No: _____
Received Date: _____
Well Name & No: _____
Facility Name & No: _____

Page 2

REMEDIATION WORKPLAN (Cont.)

OGCC Employee: _____

If groundwater has been impacted, describe proposed monitoring plan (# of wells or sample points, sampling schedule, analytical methods, etc.):

SEE ATTACHED REPORT FOR DETAILS

Describe reclamation plan. Discuss existing and new grade recontouring; method and testing of compaction alleviation; and reseeding program, including location of new seed, seed mix and noxious weed prevention. Attach diagram or drawing. Use additional sheet for description if required.

SEE ATTACHED REPORT FOR DETAILS

Attach samples and analytical results taken to verify remediation of impacts. Show locations of samples on an onsite schematic or drawing.

Is further site investigation required? ☐ Y ☒ N If yes, describe:

Final disposition of E&P waste (landtreated and disposed onsite, name of licensed disposal facility, recycling, reuse, etc.):

SEE ATTACHED REPORT FOR DETAILS

IMPLEMENTATION SCHEDULE

Date Site Investigation Began: N/A Date Site Investigation Completed: N/A Date Remediation Plan Submitted: _____
Remediation Start Date: 4/8/16 Anticipated Completion Date: SPRING 2018 Actual Completion Date: TBD

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

Print Name: JESSICA DONAHUE

Signed: J Donahue

Title: REGULATORY TECHNICIAN

Date: 4/24/16

OGCC Approved: _____ Title: _____ Date: _____

COA: Please provide brief progress reports including either Petroflag readings and/or lab results and any additional information you might consider appropriate



*Black Hills Plateau Production, LLC
1515 Wynkoop St. Suite 500
Denver, CO 80202*

Whittaker Flats D-17 Drill Cuttings Remediation

Site Investigation & Remediation Form 27

Black Hills Plateau Production, LLC

Mesa County, CO

April 2016



HRL COMPLIANCE SOLUTIONS, INC.
Environmental Consultants

**Prepared by:
HRL Compliance Solutions, Inc.
2385 F ½ Road
Grand Junction, CO 81505**

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Introduction

The purpose of this Colorado Oil and Gas Conservation Commission (COGCC) Site Investigation and Remediation Plan (Form 27) is to outline remediation efforts to be implemented by Black Hills Plateau Production, LLC (Black Hills) for the remediation of water based drill cuttings, as the result of drilling activities on the Whittaker Flats D-17 (WHF D17) location.

Black Hills intends to bio-remediate the water based drill cuttings (cuttings) stockpiled on location in order to meet thresholds outlined in the COGCC Table 910-1 with the intent to beneficially re-use the material on Black Hills location(s).

Describe initial action taken

A Form 4 submitted on March 8, 2016 and approved on March 11, 2016 by the COGCC (Doc. # 401001343) was utilized to notify the COGCC of anticipated activities associated with bio-remediating approximately 11,000 cubic yards (yds³) of cuttings. The bio-remediation process is anticipated to take eighteen (18) to twenty-four (24) months to complete.

A third party contractor was utilized to construct the Land Treatment Unit (LTU) for the remediation process. Approximately 1.5 feet of pad surface was removed from the LTU area and the remaining surface was compacted to provide a low permeability layer and to prevent downward migration of contaminants. Compacted berms were constructed around the LTU area in which the cuttings were spread to a thickness conducive for bio-remediation.

Three (3) remediation water tanks were staged on location and will be utilized throughout the remediation process to apply bio-remediation products, nutrients and water to the LTU. Watering and aeration will occur on a weekly basis to ensure active remediation.

Describe how source is to be removed

Exceedances to COGCC Table 910-1 within the cuttings were identified during the initial baseline sampling conducted on October 27, 2015. Based on the analytical results, a remediation plan was developed by HRL Compliance Solutions, Inc. (HRL) with the intent of bio-remediating the cuttings to meet COGCC Table 910-1 standards and utilized by Black Hills for beneficial re-use. This will be achieved by applying a microbial blend formulated to break-down and digest hydrocarbons, as well as other undesirable constituents exceeding COGCC Table 910-1.

Describe how remediation of existing impacts is to be accomplished

The degradation of hydrocarbons utilizing microbes is a natural process that is enhanced and accelerated by techniques developed by HRL. Maintaining proper soil conditions and nutrient levels is essential to microbial growth and productivity, and will be achieved by implementing several techniques listed above.

Bio-remediation products and nutrients will be applied to the LTU to promote microbial growth and proliferation. Water will be applied on a regular basis to maintain a moisture content essential to microbial mobility. The LTU will also be aeriated on a regular basis to provide oxygen and ensure even treatment distribution and a consistent media for treatment. Nutrient and water applications, in combination with aeration, will continue until analytical data confirms COGCC Table 910-1 standards are met.

Soil sampling and analytical data submission

Initial sampling was conducted in October, 2015 comprising of composite sampling at varying depths throughout the stockpile. Analytical collected during these sample events were utilized in formulating a bio-remediation schedule, and a timeline, which can be found in Appendix A.

Prior to cuttings being placed within the LTU, pad surface samples were collected to be used in comparison with pad surface samples to be collected at the completion of remediation activities. This will be used to verify the soils below the LTU were not impacted by remediation activities, and remaining soils satisfy COGCC Table 910-1.

To ensure representative sampling coverage, the LTU was divided into eleven (11) fifty (50) foot sections throughout the LTU. Sections were identified utilizing marking paint and GPS coordinates. Sample locations in each section will also be marked using GPS coordinates. Grab samples from each section were collected using EPA sampling techniques and combined into a composite sample for submittal to a NELAP certified laboratory for analysis.

HRL will monitor the remediation process by either; collecting monitoring samples and submitting them to an accredited laboratory for analysis, or utilizing Photoionization Detector (PID) meter and a Petroflag® meter to collect field screening data. This data collection will occur approximately every six (6) to eight (8) weeks and will be provided to the COGCC via Form 4 as requested by Carlos Lujan of the COGCC on April 4, 2016. When monitoring samples are collected and submitted to an accredited laboratory, only the constituents that were identified as exceeding COGCC Table 910-1 in previous baseline samples will be analyzed. Once all of the constituents in COGCC Table 910-1 are shown to be below acceptable concentration levels, analytical will be provided via Form 4 for project closure.

If groundwater has been impacted, describe proposed monitoring plan

It is not anticipated that groundwater has been impacted, as this is a surface treatment.

Describe reclamation plan

The remediated cuttings will be stored on location until a desired beneficial re-use is identified by Black Hills, and a Form 4 will be submitted once the beneficial re-use is determined. Once approved by the COGCC, an additional Form 4 will be submitted to the COGCC requesting project closure.

APPENDIX A

HRL Compliance Solutions- CO

Sample Delivery Group: L797041
Samples Received: 10/28/2015
Project Number:
Description: Black Hills-Whittaker Flats D-17 Remediation
Site: WF D-17
Report To: Jordan Cario
2385 F ½ Road
Grand Junction, CO 81505

Entire Report Reviewed By:



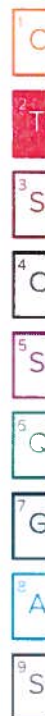
Jarred Willis
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.





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SAMPLE SUMMARY

ONE LAB. NATIONWIDE.



DRILL CUTTINGS BASELINE L797041-01 Solid

Collected by
Brackett MaysCollected date/time
10/27/15 10:15Received date/time
10/28/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Calculated Results	WG825130	1	10/28/15 13:23	11/03/15 08:26	ST
Calculated Results	WG825155	1	10/28/15 22:40	10/29/15 15:19	LTB
Mercury by Method 7471A	WG825134	1	10/28/15 12:39	10/28/15 15:51	TRB
Metals (ICP) by Method 6010B	WG825130	5	10/28/15 13:23	10/29/15 01:50	ST
Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM	WG825240	5	10/28/15 16:03	10/30/15 11:33	KMP
Wet Chemistry by Method 2580 B-2011	WG825165	1	10/29/15 07:59	10/29/15 08:46	KBC
Wet Chemistry by Method 3060A/7196A	WG824584	1	10/28/15 10:59	10/29/15 15:50	SJM
Wet Chemistry by Method 9045D	WG825141	1	10/29/15 12:00	10/29/15 12:00	AMC
Wet Chemistry by Method 9050AMod	WG825059	1	10/29/15 16:00	10/29/15 16:00	SAM

DRILL CUTTINGS BASELINE L797041-02 Solid

Collected by
Brackett MaysCollected date/time
10/27/15 10:15Received date/time
10/28/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi-Volatile Organic Compounds (GC) by Method 3546/DRO	WG825230	10	10/28/15 19:15	10/28/15 23:50	DMG
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG825203	5	10/28/15 19:17	10/29/15 06:15	LRL
Volatile Organic Compounds (GC/MS) by Method 8260B	WG824406	5	10/29/15 02:40	10/29/15 06:22	JHH



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jarred Willis
Technical Service Representative





Calculated Results

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
Sodium Adsorption Ratio	29.4		1	10/29/2015 15:19	WG825155

Calculated Results

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Chromium, Trivalent	13.9		5.00	1	11/03/2015 08:26	WG825130

Wet Chemistry by Method 2580 B-2011

Analyte	Result mV	Qualifier	Dilution	Analysis date / time	Batch
ORP	105		1	10/29/2015 08:46	WG825165

Wet Chemistry by Method 3060A/7196A

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Chromium, Hexavalent	3.96		2.00	1	10/29/2015 15:50	WG824584

Wet Chemistry by Method 9045D

Analyte	Result su	Qualifier	Dilution	Analysis date / time	Batch
pH	7.55		1	10/29/2015 12:00	WG825141

Sample Narrative:

9045D L797041-01 WG825141: 7.55 at 24.8c

Wet Chemistry by Method 9050AMod

Analyte	Result umhos/cm	Qualifier	Dilution	Analysis date / time	Batch
Specific Conductance	5120		1	10/29/2015 16:00	WG825059

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.0847		0.0200	1	10/28/2015 15:51	WG825134

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Arsenic	ND		10.0	5	10/29/2015 01:50	WG825130
Barium	9060		2.50	5	10/29/2015 01:50	WG825130
Cadmium	ND		2.50	5	10/29/2015 01:50	WG825130
Chromium	17.8		5.00	5	10/29/2015 01:50	WG825130
Copper	82.4		10.0	5	10/29/2015 01:50	WG825130
Lead	11.0		2.50	5	10/29/2015 01:50	WG825130
Nickel	20.2		10.0	5	10/29/2015 01:50	WG825130
Selenium	ND		10.0	5	10/29/2015 01:50	WG825130
Silver	ND		5.00	5	10/29/2015 01:50	WG825130
Zinc	58.1		25.0	5	10/29/2015 01:50	WG825130

DRILL CUTTINGS BASELINE

SAMPLE RESULTS - 01

ONE LAB. NATIONWIDE.



Collected date/time: 10/27/15 10:15

L797041

Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.132		0.0300	5	10/30/2015 11:33	WG825240
Acenaphthene	0.307		0.0300	5	10/30/2015 11:33	WG825240
Acenaphthylene	0.0326		0.0300	5	10/30/2015 11:33	WG825240
Benzo(a)anthracene	0.336		0.0300	5	10/30/2015 11:33	WG825240
Benzo(a)pyrene	0.0990		0.0300	5	10/30/2015 11:33	WG825240
Benzo(b)fluoranthene	0.475		0.0300	5	10/30/2015 11:33	WG825240
Benzo(g,h,i)perylene	0.111		0.0300	5	10/30/2015 11:33	WG825240
Benzo(k)fluoranthene	0.0557		0.0300	5	10/30/2015 11:33	WG825240
Chrysene	0.708		0.0300	5	10/30/2015 11:33	WG825240
Dibenz(a,h)anthracene	0.0739		0.0300	5	10/30/2015 11:33	WG825240
Fluoranthene	0.531		0.0300	5	10/30/2015 11:33	WG825240
Fluorene	0.416		0.0300	5	10/30/2015 11:33	WG825240
Indeno(1,2,3-cd)pyrene	0.0688		0.0300	5	10/30/2015 11:33	WG825240
Naphthalene	0.839		0.100	5	10/30/2015 11:33	WG825240
Phenanthrene	1.24		0.0300	5	10/30/2015 11:33	WG825240
Pyrene	0.541		0.0300	5	10/30/2015 11:33	WG825240
1-Methylnaphthalene	0.777		0.100	5	10/30/2015 11:33	WG825240
2-Methylnaphthalene	0.372		0.100	5	10/30/2015 11:33	WG825240
2-Chloronaphthalene	ND		0.100	5	10/30/2015 11:33	WG825240
(S) p-Terphenyl-d14	73.7		32.2-131		10/30/2015 11:33	WG825240
(S) Nitrobenzene-d5	53.3		22.1-146		10/30/2015 11:33	WG825240
(S) 2-Fluorobiphenyl	69.8		40.6-122		10/30/2015 11:33	WG825240





Collected date/time: 10/27/15 10:15

L797041

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	ND		0.500	5	10/29/2015 06:15	WG825203
(S) <i>a,a,a</i> -Trifluorotoluene(FID)	96.6		59.0-128		10/29/2015 06:15	WG825203

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.00500	5	10/29/2015 06:22	WG824406
Toluene	ND		0.0250	5	10/29/2015 06:22	WG824406
Ethylbenzene	ND		0.00500	5	10/29/2015 06:22	WG824406
Total Xylenes	ND		0.0150	5	10/29/2015 06:22	WG824406
(S) <i>Toluene-d8</i>	99.7		88.7-115		10/29/2015 06:22	WG824406
(S) <i>Dibromofluoromethane</i>	107		76.3-123		10/29/2015 06:22	WG824406
(S) <i>a,a,a</i> -Trifluorotoluene	94.3		87.2-117		10/29/2015 06:22	WG824406
(S) <i>4</i> -Bromofluorobenzene	89.5		69.7-129		10/29/2015 06:22	WG824406

Semi-Volatile Organic Compounds (GC) by Method 3546/DRO

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	3680		40.0	10	10/28/2015 23:50	WG825230
(S) <i>o</i> -Terphenyl	75.6		50.0-150		10/28/2015 23:50	WG825230



L796726-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 08:46 • (DUP) 10/29/15 08:46

Analyte	Original Result mV	DUP Result mV	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
ORP	98.0	96	1	2.06		20

L797041-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 08:46 • (DUP) 10/29/15 08:46

Analyte	Original Result mV	DUP Result mV	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
ORP	105	105	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 08:46 • (LCSD) 10/29/15 08:46

Analyte	Spike Amount mV	LCS Result mV	LCSD Result mV	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
ORP	100	96	95	96.0	95.0	90.0-110			1.05	20

1	Cf
2	Tc
3	Ss
4	Cr
5	Sr
6	Qc
7	Gl
8	Al
9	Sc



Method Blank (MB)

(MB) 10/29/15 15:36			
Analyte	MB Result mg/kg	MB Qualifier	MB RDL mg/kg
Chromium,Hexavalent	ND		2.00

L796733-10 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 15:49 • (DUP) 10/29/15 15:49			
Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution
Chromium,Hexavalent	ND	ND	1
		DUP RPD %	DUP RPD Limits %
		0.000	20

L796726-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 15:40 • (DUP) 10/29/15 15:40			
Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution
Chromium,Hexavalent	6.10	21.1	1
		DUP RPD %	DUP RPD Limits %
		1.63	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 15:37 • (LCSD) 10/29/15 15:37									
Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCSD Qualifier	RPD %	RPD Limits %
Chromium,Hexavalent	59.8	49.0	48.8	81.9	81.6	80.0-120		0.409	20

L796733-10 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/29/15 15:49 • (MS) 10/29/15 15:49 • (MSD) 10/29/15 15:50									
Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chromium,Hexavalent	20.0	ND	9.48	9.44	47.4	47.2	1	75.0-125	J6
									J6
									0.423
									20



L797041-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 12:00 • (DUP) 10/29/15 12:00

Analyte	Original Result SU	DUP Result SU	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
pH	7.55	7.56	1	0.132		1

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 12 00 • (LCSD) 10/29/15 12 00

Analyte	Spike Amount SU	LCS Result SU	LCSD Result SU	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
pH	6.72	6.72	6.73	100	100	98.2-102			0.149	1

1	Cf
2	Tc
3	Ss
4	Cr
5	Sr
6	Qc
7	Gl
8	Al
9	Sc



Method Blank (MB)

(MB) 10/29/15 16:00			
Analyte	MB Result	MB Qualifier	MB RDL
	umhos/cm		umhos/cm
Specific Conductance	0.760		

L796741-112 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 16:00 • (DUP) 10/29/15 16:00					
Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP RPD Limits
	umhos/cm	umhos/cm		%	%
Specific Conductance	7490	7870	1	4.95	20

L797041-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/29/15 16:00 • (DUP) 10/29/15 16:00					
Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP RPD Limits
	umhos/cm	umhos/cm		%	%
Specific Conductance	5120	4510	1	12.7	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 16:00 • (LCSD) 10/29/15 16:00									
Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD Limits
	umhos/cm	umhos/cm	umhos/cm	%	%	%			%
Specific Conductance	873	921	921	105	105	90.0-110		0.000	20

1	Cf
2	Tc
3	Ss
4	Cr
5	Sr
6	Qc
7	Gl
8	Al
9	Sc



Method Blank (MB)

(MB) 10/28/15 15:21

Analyte	MB Result mg/kg	<u>MB Qualifier</u>	MB RDL mg/kg
Mercury	ND		0.0200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCS-D)

(LCS) 10/28/15 15.23 • (LCS) 10/28/15 15.26

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD %
Mercury	0.300	0.285	0.269	95	90	80-120			5	20

L796929-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/28/15 15:28 - (MS) 10/28/15 15:31 • (MSD) 10/28/15 15:33

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPT %
Mercury	0.300	0.0327	0.328	0.309	99	92	1	75-125			6	20

1 Cp 2 Tc 3 Ss 4 Cr 5 Sr 6 Qd 7 Gl 8 Al 9 Sc



Method Blank (MB)

(MB) 10/28/15 22:52

Analyte	MB Result mg/kg	MB Qualifier	MB RDL mg/kg
Arsenic	ND		2.00
Barium	ND		0.500
Cadmium	ND		0.500
Chromium	ND		1.00
Copper	ND		2.00
Lead	ND		0.500
Nickel	ND		2.00
Selenium	ND		2.00
Silver	ND		1.00
Zinc	ND		5.00

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/28/15 22:55 • (LCSD) 10/28/15 22:58

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCSD Qualifier	LCSD Qualifier %	RPD	RPD Limits %
Arsenic	100	102	98.2	102	98	80-120			4	20
Barium	100	104	101	104	101	80-120			3	20
Cadmium	100	100	96.7	100	97	80-120			3	20
Chromium	100	103	100	103	100	80-120			3	20
Copper	100	104	102	104	102	80-120			2	20
Lead	100	105	101	105	101	80-120			4	20
Nickel	100	106	102	106	102	80-120			4	20
Selenium	100	103	99.4	103	99	80-120			3	20
Silver	100	96.3	92.9	96	93	80-120			4	20
Zinc	100	104	100	104	100	80-120			3	20

L796586-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/28/15 23:01 • (MS) 10/28/15 23:19 • (MSD) 10/28/15 23:21

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD	RPD Limits %
Arsenic	100	2.02	97.3	93.8	95	92	1	75-125			4	20
Barium	100	111	214	200	103	90	1	75-125			7	20
Cadmium	100	ND	97.4	93.7	97	94	1	75-125			4	20



L797041-01

L796586-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/28/15 23:01 • (MS) 10/28/15 23:19 • (MSD) 10/28/15 23:21

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium	100	7.38	101	97.7	93	90	1	75-125			3	20
Copper	100	2.64	102	96.6	99	94	1	75-125			6	20
Lead	100	8.01	112	108	104	100	1	75-125			3	20
Nickel	100	7.38	108	106	101	99	1	75-125			2	20
Selenium	100	ND	83.1	80.0	83	80	1	75-125			4	20
Silver	100	ND	94.8	91.4	95	91	1	75-125			4	20
Zinc	100	13.2	105	103	92	90	1	75-125			2	20

1	Cd
2	Tc
3	Ss
4	Cr
5	Sr
6	Cu
7	Gl
8	Al
9	Sc



Method Blank (MB)

(MB) 10/29/15 05:33

Analyte	MB Result		MB Qualifier		MB RDL	
	mg/kg	ND	mg/kg	0.100	mg/kg	59.0-128
TPH (GC/FID) Low Fraction						
(S) o,a,a'-Trifluorotoluene(FID)	98.9					

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 04:31 • (LCSD) 10/29/15 04:51

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier		LCSD Qualifier		RPD	RPD Limits %
TPH (GC/FID) Low Fraction	5.50	5.23	5.05	95.2	91.8	63.5-137					3.63	20
(S) o,a,a'-Trifluorotoluene(FID)				100	99.6	59.0-128						

L796666-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/29/15 07:17 • (MS) 10/29/15 07:38 • (MSD) 10/29/15 07:59

Analyte	Spike Amount		Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
TPH (GC/FID) Low Fraction	5.50	ND	ND	22.3	22.2	81.0	80.7	5	28.5-138			0.420	23.6
(S) o,a,a'-Trifluorotoluene(FID)						97.6	98.8		59.0-128				

Method Blank (MB)

(MB) 10/29/15 03:56

Analyte	MB Result mg/kg	MB Qualifier	MB RDL mg/kg
Benzene	ND		0.00100
Ethylbenzene	ND		0.00100
Toluene	ND		0.00500
Xylenes, Total	ND		0.00300
(S) Toluene-d8	101		88.7-115
(S) Dibromofluoromethane	110		76.3-123
(S) o,o,a-Trifluorotoluene	97.1		87.2-117
(S) 4-Bromofluorobenzene	88.8		69.7-129

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 02:34 • (LCSD) 10/29/15 03:15

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.0250	0.0300	0.0292	120	117	72.6-120		2.82	20
Ethylbenzene	0.0250	0.0256	0.0250	102	99.8	78.6-124		2.61	20
Toluene	0.0250	0.0268	0.0261	107	104	76.7-116		2.93	20
Xylenes, Total	0.0750	0.0750	0.0727	100	97.0	78.1-123		3.10	20
(S) Toluene-d8				101	100	88.7-115			
(S) Dibromofluoromethane				107	109	76.3-123			
(S) o,o,a-Trifluorotoluene				98.0	96.2	87.2-117			
(S) 4-Bromofluorobenzene				91.2	90.6	69.7-129			

L796452-09 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/29/15 09:06 • (MS) 10/29/15 04:17 • (MSD) 10/29/15 04:37

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MSD Rec. %	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	0.0250	ND	0.134	0.114	107	91.4	5	47.8-131			16.1	22.8
Ethylbenzene	0.0250	ND	0.112	0.0954	89.3	76.3	5	44.8-135			15.6	26.9
Toluene	0.0250	ND	0.120	0.100	95.8	80.0	5	47.8-127			17.9	24.3
Xylenes, Total	0.0750	ND	0.327	0.277	87.3	73.9	5	42.7-135			16.6	26.6
(S) Toluene-d8					100	100		88.7-115				
(S) Dibromofluoromethane					105	110		76.3-123				
(S) o,o,a-Trifluorotoluene					95.1	95.0		87.2-117				
(S) 4-Bromofluorobenzene					96.3	94.2		69.7-129				



Method Blank (MB)

(MB) 10/28/15 21:58

Analyte	MB Result mg/kg	MB Qualifier	MB RDL mg/kg
TPH (GC/FID) High Fraction	ND		4.00
(S) o-Terphenyl	95.6		50.0-150

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/28/15 22:09 • (LCSD) 10/28/15 22:20

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) High Fraction	60.0	44.1	46.2	73.6	77.0	50.0-150			4.53	20
(S) o-Terphenyl				90.0	88.8	50.0-150				

1	Cf
2	Tc
3	Ss
4	Cr
5	Sr
6	Qc
7	Gl
8	Al
9	Sc

Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM

L797041-01

Method Blank (MB)

(MB) 10/29/15 09:05

Analyte	MB Result mg/kg	MB Qualifier	MB RDL mg/kg
Anthracene	ND		0.00600
Acenaphthene	ND		0.00600
Acenaphthylene	ND		0.00600
Benzo(a)anthracene	ND		0.00600
Benzo(a)pyrene	ND		0.00600
Benzo(b)fluoranthene	ND		0.00600
Benzo(g,h,i)perylene	ND		0.00600
Benzo(k)fluoranthene	ND		0.00600
Chrysene	ND		0.00600
Dibenz(a,h)anthracene	ND		0.00600
Fluoranthene	ND		0.00600
Fluorene	ND		0.00600
Indeno(1,2,3-cd)pyrene	ND		0.00600
Naphthalene	ND		0.0200
Phenanthrene	ND		0.00600
Pyrene	ND		0.00600
1-Methylnaphthalene	ND		0.0200
2-Methylnaphthalene	ND		0.0200
2-Chloronaphthalene	ND		0.0200
(S) p-Terphenyl-d14	92.4		32.2-131
(S) Nitrobenzene-d5	81.7		22.1-146
(S) 2-Fluorobiphenyl	89.5		40.6-122

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 08:19 • (LCSD) 10/29/15 08:42

Analyte	Spike mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	0.0800	0.0776	0.0739	97.0	92.4	50.3-130			4.87	20
Acenaphthene	0.0800	0.0752	0.0708	94.0	88.5	52.4-120			6.06	20
Acenaphthylene	0.0800	0.0760	0.0721	95.0	90.1	49.6-120			5.33	20
Benzo(a)anthracene	0.0800	0.0759	0.0710	94.9	88.7	46.7-125			6.75	20
Benzo(a)pyrene	0.0800	0.0740	0.0703	92.5	87.9	42.3-119			5.03	20
Benzo(b)fluoranthene	0.0800	0.0706	0.0722	88.3	90.2	43.6-124			2.16	20
Benzo(g,h,i)perylene	0.0800	0.0832	0.0788	104	98.5	45.1-132			5.34	20
Benzo(k)fluoranthene	0.0800	0.0754	0.0696	94.2	87.0	46.1-131			7.95	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/29/15 08:19 • (LCSD) 10/29/15 08:42

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chrysene	0.0800	0.0761	0.0703	95.1	87.8	49.5-131			8.00	20
Dibenz(a,h)anthracene	0.0800	0.0849	0.0811	106	101	44.8-133			4.65	20
Fluoranthene	0.0800	0.0782	0.0747	97.7	93.4	49.3-128			4.55	20
Fluorene	0.0800	0.0783	0.0740	97.8	92.5	50.6-121			5.60	20
Indeno(1,2,3-cd)pyrene	0.0800	0.0824	0.0784	103	98.0	46.1-135			5.02	20
Naphthalene	0.0800	0.0747	0.0702	93.4	87.7	49.6-115			6.29	20
Phenanthrene	0.0800	0.0751	0.0704	93.9	88.0	48.8-121			6.47	20
Pyrene	0.0800	0.0779	0.0722	97.3	90.3	44.7-130			7.50	20
1-Methylnaphthalene	0.0800	0.0797	0.0753	99.6	94.1	50.6-122			5.68	20
2-Methylnaphthalene	0.0800	0.0802	0.0758	100	94.8	50.4-120			5.58	20
2-Chloronaphthalene	0.0800	0.0763	0.0726	95.4	90.8	53.9-121			5.01	20
(S) p-Terphenyl-d14				102	101	32.2-131				
(S) Nitrobenzene-d5				90.0	87.0	22.1-146				
(S) 2-Fluorobiphenyl				98.9	96.0	40.6-122				

L796656-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/29/15 16:01 • (MS) 10/29/15 16:24 • (MSD) 10/29/15 16:48

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Anthracene	0.0800	ND	0.0758	0.0743	94.7	92.9	1	26.5-141			1.98	21.2
Acenaphthene	0.0800	ND	0.0731	0.0707	91.4	88.3	1	31.9-130			3.40	20
Acenaphthylene	0.0800	ND	0.0746	0.0727	93.3	90.9	1	33.7-129			2.62	20
Benzo(a)anthracene	0.0800	ND	0.0745	0.0711	93.2	88.8	1	18.3-136			4.77	24.6
Benzo(a)pyrene	0.0800	ND	0.0756	0.0734	94.5	91.8	1	16.9-135			2.89	25.2
Benzo(b)fluoranthene	0.0800	ND	0.0752	0.0686	94.0	85.7	1	10.0-134			9.21	30.9
Benzo(g,h,i)perylene	0.0800	ND	0.104	0.0832	130	104	1	14.1-140			22.2	25.5
Benzo(k)fluoranthene	0.0800	ND	0.0839	0.0765	105	95.6	1	18.2-138			9.32	25.6
Chrysene	0.0800	ND	0.0733	0.0714	91.6	89.2	1	17.1-145			2.64	24.2
Dibenz(a,h)anthracene	0.0800	ND	0.104	0.0840	129	105	1	18.5-138			20.9	24.3
Fluoranthene	0.0800	ND	0.0758	0.0746	94.7	93.3	1	15.4-144			1.53	27.1
Fluorene	0.0800	ND	0.0753	0.0735	94.2	91.8	1	23.5-136			2.48	20
Indeno(1,2,3-cd)pyrene	0.0800	ND	0.0994	0.0815	124	102	1	14.5-142			19.7	25.8
Naphthalene	0.0800	ND	0.0732	0.0707	91.5	88.4	1	29.2-128			3.49	20
Phenanthrene	0.0800	ND	0.0737	0.0721	92.1	90.1	1	20.1-134			2.14	23.6
Pyrene	0.0800	ND	0.0764	0.0714	95.5	89.3	1	11.0-148			6.75	26.1

Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM

L797041-01

L796656-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/29/15 16:01 • (MS) 10/29/15 16:24 • (MSD) 10/29/15 16:48

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier		MSD Qualifier		RPD	RPD Limits	
														%	%
1-Methylnaphthalene	0.0800	ND	0.0777	0.0742	97.1	92.8	1	28.4-137					4.55	20	
2-Methylnaphthalene	0.0800	ND	0.0780	0.0750	97.5	93.7	1	26.6-137					4.01	20	
2-Chloronaphthalene	0.0800	ND	0.0762	0.0738	95.3	92.2	1	38.6-126					3.26	20	
(S) p-Terphenyl-d14					100	92.9		32.2-131							
(S) Nitrobenzene-d5					84.7	82.8		22.1-146							
(S) 2-Fluorobiphenyl					95.8	92.5		40.6-122							

1 Cf

2 Tc

3 Ss

4 Cr

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

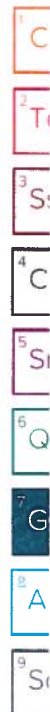


Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
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J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
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Florida	E87487	North Carolina ²	41
Georgia	NELAP	North Dakota	R-140
Georgia ¹	923	Ohio-VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky ¹	90010	South Dakota	n/a
Kentucky ²	16	Tennessee ¹⁴	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

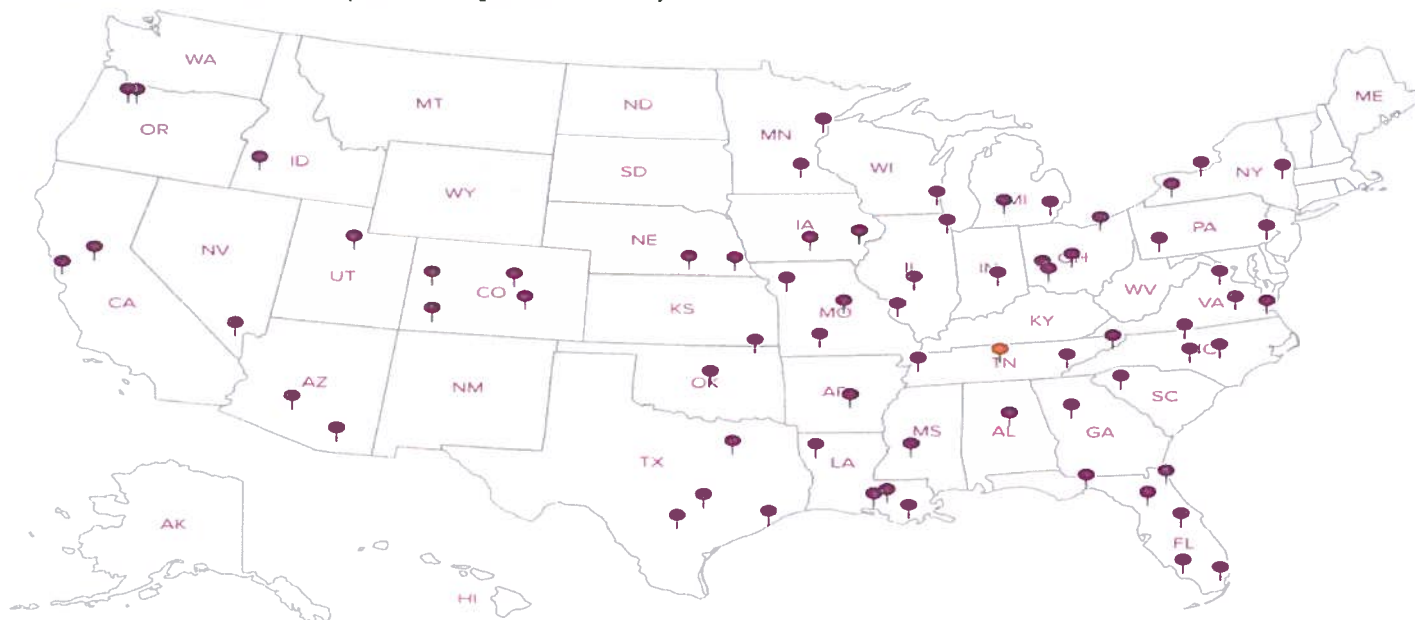
¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ¹⁴ Accreditation not applicable

Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
Canada	1461.01	DOD	1461.01
EPA-Crypto	TN00003	USDA	S-67674

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



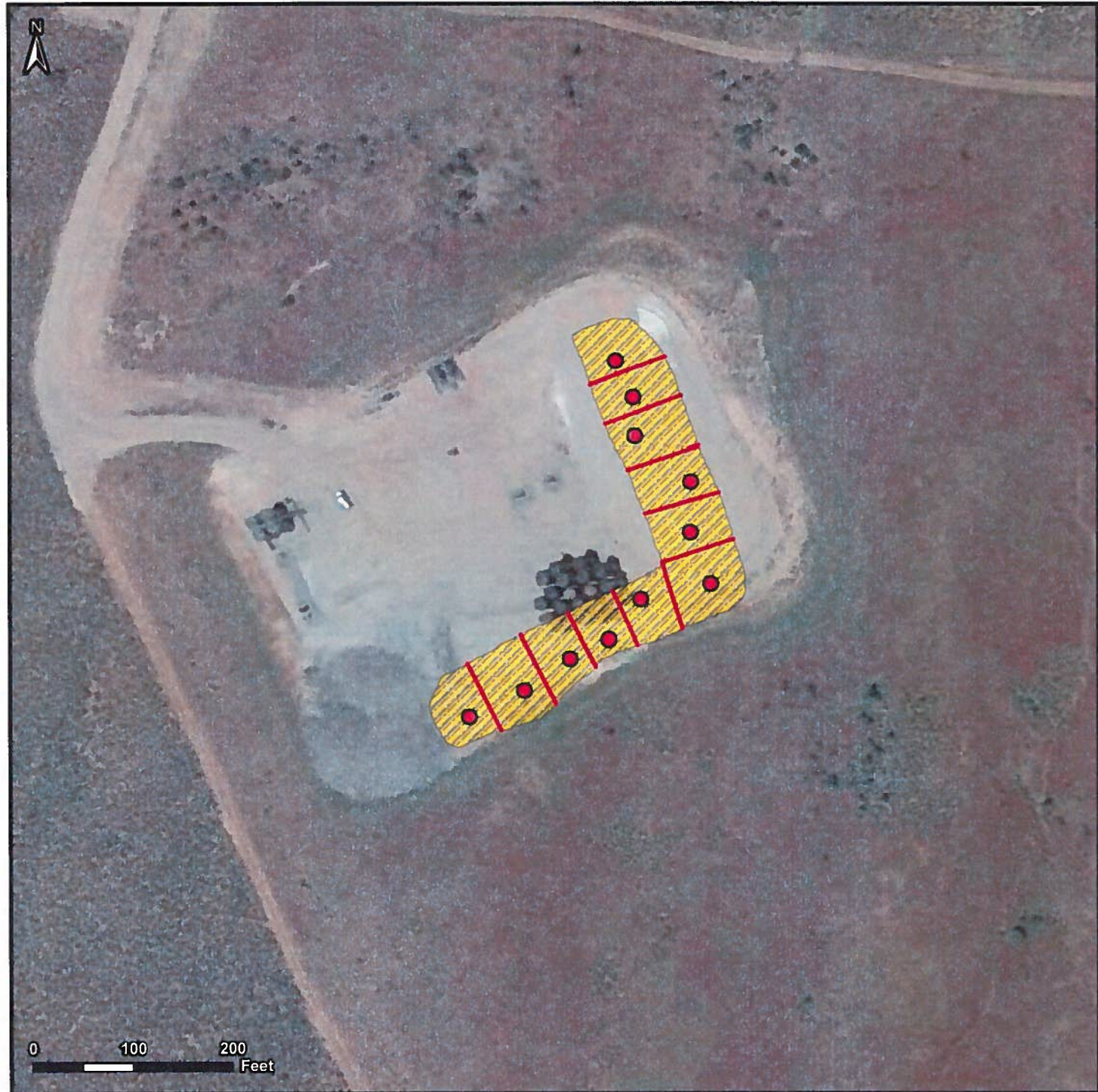
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Table 810-1
CONCENTRATION LEVELS

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
Benz(b)fluoranthene		0.22 mg/kg
Benz(k)fluoranthene		2.2 mg/kg
Benz(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 Groundwater		
Benzene		5 µg/l
Toluene		600 to 1,000 µg/l
Ethylbenzene		700 µg/l
Xylenes (total)		1,500 to 10,000 µg/l
Inorganics in Soil		
Electrical Conductivity (EC)		<4 mmhos/cm or 2x background
Sodium Adsorption Ratio (SAR)		<12
pH		6-9
Inorganics in Groundwater		
Total Dissolved Solids (TDS)		1,000 x background
Chloride		1.25 x background
Sulfate		1.25 x background
Metals in Soil		
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		380 mg/kg
Zinc		23,000 mg/kg
Liquid hydrocarbons in soils and ground water		
Liquid hydrocarbons including condensate		Below detection level
and oil		

APPENDIX B



NOTES / COMMENTS:

DISCLAIMER: This representation and the Geographic Information System (GIS) used to create it are designed as a source of reference and not intended to replace official records and/or legal surveys. HCS assumes no responsibility for any risks, dangers, or liabilities that may result from its use and makes no guarantee as to the quality or accuracy of the underlying data.



**Remediation Map
Whittaker Flats D17**

39 277469 -108 358933
Section 17, Township 9 South, Range 98 West

Mapped Features	Transportation	Hydrography
● Random Sample Location	CO Highways	Ditch
Section Lines	County Roads	Intermittent Stream
Potential Land Treatment Unit (LTU)	Local Streets	Perennial Stream
PLSS	Access Roads	Waterbody
Township		Watershed
Section		



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