

**CM Production, LLC**  
**Oliver Warren #1 Skim Pits Assessment**  

---

**COGCC Remediation Project #8209**  
**Hyde Field, Washington County, Colorado**

Prepared for:

**CM Production, LLC**  
**600 17<sup>th</sup> Street, Suite 2800 South**  
**Denver, Colorado 80202**

Prepared by:

**Olsson Associates**  
**4690 Table Mountain Drive, Suite 200**  
**Golden, Colorado 80403**

**May 27, 2014**

**Olsson Project #013-1681**  
**Phase 102/Task 102001**

# Table of Contents

Table of Contents.....	i
Tables .....	ii
Figures .....	ii
Appendices .....	ii
1.0 Introduction .....	1
1.1 Oliver Warren #1 Skim Pits Background.....	1
1.2 Complaint.....	1
1.3 Approved Workplan .....	2
1.4 Assessment Preparations .....	2
2.0 Oliver Warren Skim Pits Assessment.....	3
2.1 Field Screening.....	3
2.2 Soil Sampling.....	3
2.3 Soil Sample Analyses .....	4
3.0 Laboratory Analytical Results.....	6
4.0 Summary.....	10

## **TABLES**

Table 1- Photoionization Detector Field Readings

Table 2 - Oliver Warren #1 Skim Pit Organic Compounds Analytical Results

Table 3 - Oliver Warren #1 Skim Pit Inorganic Compound Analytical Results

## **FIGURES**

Figure 1 – Oliver Warren #1 Site Location Map

Figure 2 – Oliver Warren #1 Skim Pits GRO and BTEX Results Map

Figure 3 – Oliver Warren #1 Skim Pits DRO and PAH Results Map

Figure 4 – Oliver Warren #1 Skim Pits Inorganics Results Map

## **APPENDICES**

Appendix A – Site Photographs

Appendix B – Laboratory Analytical Results

## 1.0 Introduction

CM Production, LLC (CM Production), operator # 10352, retained Olsson Associates, Inc. (Olsson) to perform a limited subsurface investigation of two former skim pits located at the Oliver Warren #1 tank battery located in the southwest  $\frac{1}{4}$  of the northwest  $\frac{1}{4}$  of Section 11, Township 2 North, Range 49 West of the 6<sup>th</sup> Principal Meridian. The site is located approximately  $\frac{3}{4}$  of a mile north of Highway 34, on Washington County Road YY, and is approximately two miles west of the town of Yuma, Colorado. A site location map is provided as Figure 1.

### 1.1 Oliver Warren #1 Skim Pits Background

According to the Colorado Oil and Gas Conservation Commission (COGCC) online documents, the Oliver Warren #1 oil well was drilled and completed in January 1955. The COGCC records indicate that there are three pits associated with the Oliver Warren #1 site that were permitted by EMV Company, a former operator of the site. The facility ID numbers associated with these pits are listed as 102613, 102616, 102617. The status date is listed as 09/23/1999, and the coordinates listed for all three pits are given as 40.156786 N Latitude and -102.829809 W Longitude. These coordinates plot out in the farmed field to the southeast of the tank battery and to the northeast of the Oliver Warren #1 wellhead.

CM Production purchased the Oliver Warren #1 site from Delta Petroleum Corporation in 2010. According to the Change of Operator form the transaction was effective on May 1, 2010, and filed a Form 10 change of operator form that was signed by John Teff, with CM Production on October 7, 2010, James Berger with Hyndrex Resources, a contract pumper on February 21, 2011, and COGCC Director, David Neslin on April 13, 2011. CM Production did not construct the skim pits and never operated them.

### 1.2 Complaint

A complaint was filed by Mr. Ted Parks, a former CM Production employee, on December 2, 2013. The complaint alleged that CM Production directed Mr. Parks to bury two skim pits at the production facility. The former employee indicated that no samples were collected, and that exploration and production (E&P) waste (oily) was in the pit. CM Production had not filed Form 27 Remediation Workplans prior to closure of these pits.

Mr. Parks stated a spill that occurred at the Oliver Warren #1 tank battery on or about April 12, 2013 had not been properly reported. According to Mr. Parks, in a telephone conversation on 11/25/2013, the spill was 18 barrels and was the result of a release from the onsite treater in the spring of 2013. The spill was actually about 2 barrels and stayed within the berm. The oil was vacuumed up and the impacted soil was placed in a bermed area. The spill was not reportable at the time that it occurred.

At the time of the event the spill was estimated at two barrels which was not reportable under the COGCC rules that were in effect at that time. CM Production called Mr. Kym Schure and Mr. John Axelson at the time to inform them of the spill, and stated that it was not reportable. CM Production had a roustabout crew cleanup the impacted soils and place them within a plastic lined and bermed surface impoundment. The impacted soil was loaded into Waste Management rolloffs on March 27, 2013, and was subsequently hauled offsite to Waste Management's Buffalo Ridge landfill. The Form 19 was submitted to the COGCC on April 16, 2014 and the waste manifests will be provided once they are received. Photographs are included in Appendix A.

### **1.3 Approved Workplan**

On January 29, 2014 Olsson submitted a Form 27 workplan for the assessment and remediation of the skim pits at the Oliver Warren #1 site. The workplan was subsequently conditionally approved by Mr. John Noto, COGCC Northeast Region Environmental Protection Specialist, and assigned document #2147680. Prior to initiating the assessment of the former pits, and prior to collection of final/clean confirmation soil samples from the excavation, Olsson/CM Production was to provide the COGCC 48 hour notice via email.

The conditions included signing the form 27 and re-submitting to the COGCC, notifying Mr. John Noto at least 24 hours prior to conducting the excavation work, soil sample results were to be submitted to the COGCC prior to backfilling the excavation, items submitted to document the remediation were to include an analytical summary sheet/table comparing the soil analytical results with the COGCC Table 910-1 concentration levels, a sample location diagram with the final excavation dimensions, the full laboratory analytical report, the volume of soil excavated for disposal or treatment, and waste transportation documentation per Rule 907 (if applicable). If land treatment was the planned remedy for treating the soils to meet the Table 910-1 concentration levels, a Form 27 workplan was requested for prior approval per Rule 907 e. (2) (if applicable). This report is submitted to satisfy some of these requirements in part, or in whole.

### **1.4 Assessment Preparations**

CM Production authorized Olsson to perform the work. Prior to conducting the assessment of the skim pits at the Oliver Warren #1, Olsson called for buried utility locates by contacting the Utility Notification Center of Colorado. The utility locates were requested under locate ticket # A407800359 and were completed on Friday, March 21, 2014. Olsson sent an email to John Noto and to Kym Schure on March 22, to inform the COGCC that the assessment work at the Oliver Warren skim pits would be conducted on March 27, 2014.

Olsson prepared a site health and safety plan for the assessment work to be conducted in the reported skim pit areas at the Oliver Warren #1 and the S.J. Warren. A tailgate safety meeting was held onsite prior to initiating the excavation work.

## 2.0 Oliver Warren Skim Pits Assessment

Olsson personnel met with CM Production's excavation contractor, Mr. Justin Crow, onsite on Thursday, March 27, 2014 to conduct the subsurface investigation of the former pits. Mr. Sam Spears, CM Production's contract pumper, stopped by the Oliver Warren site on March 27, 2014 to inform Olsson and Justin Crow, of the location of produced water lines from the vertical separator to the skim tank and produced water pit.

John Noto was onsite to observe the assessment activities and to document the collection and locations of the soil samples and the presence of E&P wastes buried in the pits. According to Mr. Noto the complainant, Ted Parks, alleged that he buried E&P waste consisting of oily mud in a deep trench between the buried skim pits at the direction of CM Production. The approximate location of the deep trench was identified by COGCC provided coordinates 40.158825 north latitude and -102.831849 west longitude.

### 2.1 Field Screening

Olsson personnel headspace screened soils in the field using a Thermo Environmental Instruments photoionization detector (PID). Prior to screening the PID was zeroed to ambient air, and calibrated to a 100 part per million (ppm) concentration span gas in air. The PID calibrated to 100 ppm and recorded in the bound field logbook. The PID was used to assess for the presence of elevated volatile organic compounds in the breathing zone; however, these readings were consistent with background levels which were also recorded in the field logbook.

The PID was used to headspace screen soils in sealable plastic bags to assess for desorbed volatile organic compounds. The PID readings are shown in Table 1.

### 2.2 Soil Sampling

Soil samples were selected for laboratory analysis on the basis of the highest PID reading, evidence of staining and hydrocarbon odor, or the sample from the bottom of the trench excavation. These soil samples were placed into laboratory provided jars, labeled with the location, depth, requested parameters, and stored in a cooler on ice pending delivery to the laboratory. A chain-of-custody was filled out for the soil samples and identified the parameters requested for analysis as defined by the COGCC Table 910-1 soil parameters. Maps showing the locations of the trenches and soil analytical results for samples collected in each of the pits are included as Figure 2, Figure 3, and Figure 4.

Mr. Justin Crow used a John Deere 310 SJ extendable backhoe to conduct the assessment of the former pits. Olsson directed Mr. Crow to excavate trenches to define the vertical and lateral extent of the impacted soils in order to assess future remediation of the E&P wastes and impacted soils. This included excavating trenches in the areas of the four side walls where the 2009 COGCC aerial photograph indicated that the pits

were located, excavation to a depth below materials that exhibited elevated PID readings or evidence of E&P wastes or soil impacts. The west pit was estimated to measure approximately 25 feet by 25 feet, and the east pit was estimated to measure approximately 28 feet from the earthen berm south to the vertical separator earthen berm, and approximately 20 feet to the west, as based on review of the COGCC 2009 aerial photograph showing the pits.

Trenches were excavated to assess the areas of the former pits:

- On the northwest corner of the west pit in a low area exhibiting desiccation cracks;
- On the southwest side of the west pit within a remnant earthen berm and north of the vertical separator berm;
- On the east side of the west pit parallel to the produced water line from the separator to the produced water tank;
- On the north side of the west pit near the produced water tank stairs; and
- On the west side of the west pit.
- On the north side of the east pit by the earthen berm for the produced water tank;
- On the east side of the east pit in line with the produced water tank and vertical separator earthen berms; and
- On the southeast side of the east pit.

Soil samples were also collected from these locations and submitted for laboratory analysis of the COGCC Table 910-1 soil parameters.

Groundwater was not encountered in any of the trenches. Olsson reviewed available water well records and the reported depth to groundwater in the vicinity of the site is more than 200 feet below ground surface (bgs).

### **2.3 Soil Sample Analyses**

Olsson hand delivered the soil samples to Accutest Mountain States Laboratories in Wheat Ridge, Colorado on March 28, 2014 and requested the samples be analyzed for the soil parameters listed in COGCC Table 910-1. These included the following analytes and laboratory analytical methods:

- Total Petroleum Hydrocarbons (TPH) as gasoline range organics (GRO) by EPA Method 8260, and diesel range organics by EPA modified Method 8015;
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) by EPA Method 8260;
- Polycyclic Aromatic Hydrocarbons (PAHs) including acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3,c,d) pyrene, naphthalene, and pyrene by EPA SIM Method 8270C;
- Electrical Conductivity (EC) (also referred to as specific conductivity) by Method SM 2510B-2011 modified;

- Total metals concentrations for arsenic (Method SW 846 6020A), barium, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc (Method SW 846 6010C), and mercury by Method 7471B;
- Sodium adsorption ratio (SAR) by USDA Handbook 60 Method; and
- pH by SW 846 9045D.

The soil samples were submitted for these analyses on a standard turn-around time from the laboratory. The laboratory results are summarized in Table 2 and Table 3, and are discussed in the next section. A copy of the Accutest laboratory report is provided in Appendix B.

Soil samples CMOW-WP@10NW and CMOW-WP@11N were held for PAH analysis pending the DRO results. Since the DRO concentration was greater than 500 mg/kg, these samples were later analyzed for PAH and Accutest issued a supplemental report on April 29, 2014 which is also included in Appendix B.

### 3.0 Laboratory Analytical Results

The results show that organic compounds were present in some of the soil samples at concentrations above the COGCC Table 910-1. A discussion of the laboratory results for the soil samples collected from each pit is presented below.

#### Oliver Warren #1 West Pit

The first trench was excavated on the northwest side of the west skim pit, and impacted soils were first encountered at a depth of approximately 6 feet bgs. The laboratory reported soil sample CMOW-WP @ 6NW had GRO at 535 mg/kg, and DRO was at 27,300 mg/kg, both of which are above the Table 910-1 concentration level of 500 mg/kg. The laboratory reported that the benzene concentration was 0.208 mg/kg, which is above the Table 910-1 concentration level of 0.17 mg/kg in the CMOW-WP @ 6NW soil sample.

The results of the PAH analysis show that benzo(b)fluoranthene was detected at 1.22 mg/kg, which is above the Table 910-1 concentration of 0.22 mg/kg, and naphthalene at 41.9 mg/kg which is above the Table 910-1 concentration of 23 mg/kg for naphthalene. The other PAH compounds were either not detected or were below the Table 910-1 concentration levels; however, the laboratory reporting limit of 0.13 mg/kg for benzo(a)pyrene was above the Table 910-1 0.022 mg/kg concentration level for benzo(a)pyrene. Benzo(a)pyrene was not detected in the CMOW-WP @ 6NW sample.

The inorganic parameters for the CMOW-WP @ 6NW soil sample showed that the pH was 9.56 standard units which is above the Table 910-1 range of 6 to 9 standard units, and the sodium adsorption ratio (SAR) was reported at 15, which is above the Table 910-1 concentration level of 12. The only metal that was reported above the Table 910-1 concentrations was arsenic, which was reported at 2.6 mg/kg, and is above the 0.39 mg/kg concentration level. However the results for site specific background soil samples collected from non-impacted areas away from the former skim pits and production facilities show that this arsenic concentration likely represents background conditions.

Olsson directed Mr. Crow to excavate the northwest trench down to a total depth of 10 feet bgs to define the vertical extent of these impacts. The laboratory results for the soil sample CMOW-WP @ 10NW show that the GRO, DRO, BTEX, and PAH were not detected or were below the Table 910-1 concentration levels. The DRO concentration in the CMOW-WP @ 10NW sample was reported at 73.5 mg/kg, which is below the 500 mg/kg Table 910-1 concentration level.

Impacted soils were not encountered in the southwest trench from the surface down to a depth of 8 feet bgs. A soil sample, CMOW-WP @ 8SW, was collected and submitted for laboratory analysis. The results show that GRO, DRO, BTEX, and PAH were not detected, with the exception of naphthalene which was estimated at a concentration of 0.0044 mg/kg. This result is qualified with a 'J' to indicate that it was reported below the laboratory reporting limit, but was above the laboratory method detection limit.

Impacted soils were not encountered in the east trench from the surface down to a depth of 9 feet bgs. The soil analytical results for soil sample CMOW-WP @ 9E show that GRO, DRO, and BTEX were not detected. Naphthalene was the only PAH compound that was detected at a concentration of 0.0074 mg/kg in the CMOW-WP @ 9E soil sample. This naphthalene concentration is below the COGCC Table 910-1 concentration level of 23 mg/kg.

Impacted soils were encountered in an excavation on the north side of the west pit. According to John Noto, the complaint alleged that a deep trench had been excavated on the north side of the pit and was used to bury E&P wastes.

Impacted soils were encountered at a depth of approximately 4 feet bgs in the north trench of the west pit which was located to the southwest of the stairs to the 300-barrel capacity produced water skim tank. The PID headspace reading was 130 ppm for soils collected at 4 feet bgs, the PID reading at 9 feet bgs was 225 ppm, the PID reading at 10 feet bgs was 234 ppm.

The results for the CMOW-WP @ 11N soil sample show that GRO was reported at 31 mg/kg and that DRO was reported at 371 mg/kg, both of which are below the Table 910-1 concentration level of 500 mg/kg for TPH. The laboratory reported that ethylbenzene was detected at 0.34 mg/kg, which is below the Table 910-1 concentration level of 100 mg/kg in soil.

The results for the soil sample from the west trench on the west side of the west pit show that there were some impacted materials encountered on the north end of the trench. The results for soil sample CMOW-WP @ 7W show that BTEX and GRO were not detected. Concentrations of DRO were reported at 8.43 mg/kg, which is below the Table 910-1 500 mg/kg concentration level for TPH-DRO. The PAH results for CMOW-WP @ 7W show that chrysene was detected at 0.0094 mg/kg, naphthalene at 0.0106 mg/kg, and pyrene at 0.0051 mg/kg; however, none of these exceed the Table 910-1 concentration levels for these compounds.

### **Oliver Warren #1 East Pit**

Impacted soils were not encountered in the trench excavated to a depth of 8 feet bgs on the north side of the east pit, near the produced water tank earthen berm. The laboratory did not report GRO, DRO, BTEX, or PAH for soil sample CMOW-EP @ 8N.

Impacted soils were encountered at a depth of approximately 4 feet bgs in the east trench of the east pit. A headspace reading of 288 ppm was recorded for soils from 4 feet bgs and 5 feet bgs from the east trench. The soil analytical results for sample CMOW-EP @ 4.5E showed that benzene, ethylbenzene, and xylenes were detected, but were at concentrations below the Table 910-1 concentration levels. Toluene was not detected. The GRO result was reported at 237 mg/kg, which was below the Table 910-1 concentration level of 500 mg/kg. The DRO was 4,610 mg/kg which is above the 500 mg/kg TPH concentration level. The PAH results show that benzo(b)fluoranthene was reported at 2.66 mg/kg, benzo(a)pyrene was reported at 1.37 mg/kg, and naphthalene

was reported at 95.8 mg/kg. The other PAH compounds were not detected, or were below the Table 910-1 concentration levels.

The inorganic compounds were analyzed for the soil sample CMOW-EP @ 4.5E to assess the impacts near the expected base of the former pit to assess what may be expected to leach, or inorganic parameters that could affect crop growth. Arsenic was reported at 2.4 mg/kg, which is above the Table 910-1 concentration level of 0.39 mg/kg, but is consistent with the site specific background soil arsenic concentrations.

The SAR result was 12.4, which is above the Table 910-1 SAR level of 12, and is elevated above the site specific background sample results for SAR. Two of the background soil samples, CMOW-BG1 @ 0.2 and CMOW-BG2 @ 0.2, were collected to the northeast of the Oliver Warren #1 produced water pit and to the southeast of the Oliver Warren #1 tank battery in areas between these facilities and the farmed fields. The third background soil sample, CMSJW-BG3, was collected to the north of the S.J. Warren produced water pit to the south. The arsenic results for these three background soil samples were 3.6 mg/kg, 2.6 mg/kg, and 2.7 mg/kg, respectively. Therefore, arsenic appears to be consistent with natural background, and does not appear to be related to the E&P wastes.

Olsson had Mr. Crow excavate down to see if it was possible to get to non-impacted soils. The highest PID reading was 339 ppm at 7 feet bgs, so a soil sample was collected and submitted for analysis of BTEX, GRO, and DRO. Benzene was reported at 0.124 mg/kg, ethylbenzene at 7.55 mg/kg, neither of which are above their respective Table 910-1 concentration levels. The GRO result was reported at 374 mg/kg, which was below the 500 mg/kg concentration level. The DRO result was 18,900 mg/kg. The PAH results were requested if the DRO was greater than 500 mg/kg but not run by Accutest. Olsson requested that PAHs be analyzed.

The excavation advanced to a total depth of 10 feet bgs. The PID headspace at 10 feet was 87 ppm, and a confirmation soil sample, CMOW-EP @ 10 E was collected for laboratory analysis of BTEX, GRO, and PAH.

The laboratory analytical results for CMOW-EP @ 10E showed that ethylbenzene was reported at 1.52 mg/kg. Benzene, toluene and total xylenes were not detected. The GRO concentration was reported at 32.4 mg/kg. The DRO result was 1,170 mg/kg, which is above the 500 mg/kg concentration level, but does show a significant decrease from the sample at 7 feet bgs.

The PAH results for CMOW-EP @ 10E show that benzo(a) pyrene was reported at 0.0693 mg/kg which was above the 0.022 mg/kg Table 910-1 concentration level. The other PAH compounds were either not detected or were reported below the Table 910-1 concentration levels.

A trench was excavated on the south side of the east pit to define the lateral nature and extent. The results for the soil sample CMOW-EP @7SE showed that benzene was estimated at 0.028 mg/kg and qualified with a "J" value, indicating that it was a

concentration that was below the reporting limit, but above the method detection limit. The benzene result is less than the Table 910-1 concentration level of 0.17 mg/kg for benzene in soils. Ethylbenzene was reported at 1.52 mg/kg, which is less than the 100 mg/kg concentration level. The GRO results were reported at 46.4 mg/kg, less than the 500 mg/kg concentration level. The DRO results were reported at 7,800 mg/kg, which is above the Table 910-1 concentration level of 500 mg/kg.

The PAH results for the CMOW-EP @ 7SE soil sample show that benzo(b)fluoranthene was detected at 0.252 mg/kg, which is above the Table 910-1 concentration level of 0.22 mg/kg, and benzo(a)pyrene was reported at 0.459 mg/kg, which is above the Table 910-1 concentration level of 0.022 mg/kg. The other PAH compounds were either not detected or were reported at concentrations below the Table 910-1 concentration levels.

Soil samples CMOW-WP @10 NW and CMOW-WP @11N were held for PAH analysis pending the DRO results. Since the DRO results for each of these samples was greater than 500 mg/kg, Olsson requested that Accutest analyze these samples for PAH. The results for sample CMOW-WP @10NW show that PAH compounds were reportedly not detected above the laboratory reporting limit (RL) of 0.084 mg/kg, or the method detection limit (MDL) of 0.021 mg/kg.

The analytical results for soil sample CMOW-WP @11N show that benzo(g,h,i)perylene was reported at 0.0754 mg/kg "J", chrysene was reported at 0.374 mg/kg, fluoranthene at 0.074 mg/kg "J", fluorene at 0.595 mg/kg, naphthalene at 0.856 mg/kg, and pyrene at 0.133 mg/kg. The "J" values indicate that the compound was estimated at a concentration above the MDL, but below the RL. These PAH compounds were not reported at concentrations above the Table 910-1 concentration levels.

## 4.0 Summary

The field observations and laboratory results show that concentrations of organic compounds in soil are above the COGCC Table 910-1 concentration levels in samples from both the skim pits at the Oliver Warren #1 facility. The results for the west pit show that Olsson was able to define the vertical and lateral extent of the impacts and collected soil samples that are below the Table 910-1. The impacted soils and E&P wastes in the west pit range from approximately 4 feet bgs to approximately 11 feet bgs, and appear to be limited to the north part of the west pit near the stairs for the 300-barrel produced water tank.

The E&P wastes and impacted soils in the east pit appear to be located closer to the south and east side of the former skim pit. Olsson did not excavate a trench on the west side of the east pit due to the presence of produced water flow line from the vertical separator to the 300-barrel produced water skim tank. Since the exact location of the produced water flow line is not known, care will need to be exercised during the removal of the E&P wastes and impacted soils from the skim pits.

According to Mr. Sam Spears, the 300-barrel skim tank was installed by Delta Petroleum, and there are other buried lines in the area that are abandoned. A greater thickness of the impacted soils and E&P wastes was noted near the line separating the former pits, but it did not appear that a deep trench had been excavated in this area as mentioned in the complaint. There was a low area with desiccation cracks in the mud on the north end of the west skim pit, and this area did have impacted materials starting at about 4 feet bgs. A weathered earthen berm was observed along the west side of the west pit.

The east skim pit materials appear to be located toward the center and east-southeast side of the pit. The constituents of concern are primarily DRO and PAHs in both pits; however, the DRO impacted soils were more prevalent in the eastern pit.

The reported GRO concentrations were below the 500 mg/kg concentration level. The PID readings were relatively low, which may be indicative of the crude oil wastes. With the exception of the CMOW-WP @ 6NW soil sample, benzene was not detected in the soil samples, or was below the Table 910-1 soil concentration level of 0.17 mg/kg benzene. Toluene was not detected in any of the soil samples collected from the Oliver Warren #1 site.

Benzene and toluene are the two most mobile constituents and have the potential to impact groundwater; however, considering the depth to groundwater in this area and the silty clay soils present in the area, it does not appear likely that these compounds pose a threat to groundwater resources. There are no surface waters in the immediate vicinity of the site, other than the produced water pit. There are no residential properties in close proximity to the site.

Olsson recommends that the soils in the two skim pits be excavated and either disposed offsite at a commercial landfill facility, or that CM Production obtain permission from the surface landowner and the COGCC to landfarm the impacted soils onsite to meet the Table 910-1 concentration levels.

A Form 27, Remediation Workplan will need to be prepared explaining how the soils are to be landfarmed. Once the COGCC approves the landfarm request, CM Production would be able to excavate the impacted soils, construct the necessary land treatment facility onsite, and would be allowed to treat the soils for a maximum of three years.

If CM Production decides to dispose of the impacted soils at a commercial landfill facility, copies of the waste manifests will need to be provided to the COGCC to demonstrate that the wastes were disposed.

In order to meet the COGCC conditions of approval, CM Production will need to provide the COGCC confirmation soil sample results from the base and side walls of the excavation meet the Table 910-1 concentration levels and documenting that the impacted soil has been removed. CM Production will need to inform Mr. Noto – Northeast Region Environmental Protection Specialist of its intent to backfill the excavations with clean, non-impacted soils prior to closing the excavations.

It is expected that the assessment soil samples can be used to satisfy the requirements of the Table 910-1 concentration levels, and that the side wall samples would only need to be analyzed for GRO and DRO, and that BTEX and PAH compounds would only need to be analyzed in the event that either the GRO or DRO concentrations were reported above 500 mg/kg. Two soil samples, one from each pit, will be collected from the base of each excavation and submitted for the Table 910-1 soil parameter concentration levels have been met.

---

# TABLES

TABLE 1

### Photoionization Detector Headspace Readings

CM Production, LLC  
 Oliver Warren #1 Skim Pits Assessment - COGCC REM# 8209  
 Washington County, Colorado

Sample ID and Depth (feet)/Location	Date	PID Reading (ppm)	Comments
Oliver Warren #1 - West Skim Pit			
CMOW-WP @ 4NW	3/27/2014	0.0	West Pit - Northwest trench - low area, desiccation cracks. No odor; no staining.
CMOW-WP @ 6NW	3/27/2014	81	West Pit - Northwest trench - some oily soil and staining; odor detected. Sample collected at 6 feet bgs for laboratory analysis.
CMOW-WP @ 7NW	3/27/2014	232	West Pit - Northwest trench - gray staining, oily soil, and odor detected.
CMOW-WP @ 8 NW	3/27/2014	97	West Pit - Northwest trench - gray staining and odor detected.
CMOW-WP @ 10NW	3/27/2014	11	West Pit - Northwest trench - gray soils. Soil sample collected at 10 feet bgs for laboratory analysis.
CMOW-WP @ 8SW	3/27/2014	0.0	West Pit - Southwest trench. No staining and no odor were detected from the surface to the bottom of the trench. Soil sample collected at 8 feet bgs for laboratory analysis.
CMOW-WP @ 9E	3/27/2014	0.0	West Pit - East trench. No soil impacts were encountered from surface down to 9 feet bgs. Collect soil sample at 9 feet bgs for laboratory analysis.
CMOW-WP @ 9N	3/27/2014	225	West Pit - North trench (southwest of produced water AST stairs). Stained soils and odor detected.
CMOW-WP @ 10N	3/27/2014	234	West Pit - North trench (southwest of produced water AST stairs). Stained soils and odor detected.
CMOW-WP @ 11N	3/27/2014	82	West Pit - North trench (southwest of produced water AST stairs). Soil sample collected at 11 feet bgs for laboratory analysis.
CMOW-WP @ 3W	3/27/2014	120	West Pit - West trench. No staining; no odor.
CMOW-WP @ 5W	3/27/2014	168	West Pit - West trench. Gray staining and odor detected.
CMOW-WP @ 7W	3/27/2014	3.0	West Pit - Gray brown soils edge of impacts/pit. Collected soil sample at 7 feet bgs for laboratory analysis.
Oliver Warren #1 - East Skim Pit			
CMOW-EP @ 8N	3/27/2014	1.0	East Pit - North trench. No staining; no odor from surface to bottom of excavation. Parallel to berm for Produced Water AST. Collect soil sample at 8 feet bgs for laboratory analysis.
CMOW-EP @ 4.5E	3/27/2014	288	East Pit - east trench at 4 feet to 5 feet bgs. Staining and oil impacted soils encountered. Soil sample collected at 4.5 feet for laboratory analysis.
CMOW-EP @ 7E	3/27/2014	339	East Pit - east trench at 7 feet bgs. Staining and oil impacted soil. Collect soil sample at 7 ft for laboratory analysis.
CMOW-EP @ 10E	3/27/2014	87	East Pit - east trench at 10 feet bgs. Staining and oil impacted soil. Collect soil sample at 10 feet for laboratory analysis.
CMOW-EP @ 7SE	3/27/2014	88	East Pit - southeast trench at 7 feet. Staining and odor detected. Collect soil sample at 7 feet bgs for laboratory analysis.

PID - Photoionization Detector

ppm - parts per million

Note: The PID was zeroed to ambient air, and then calibrated to 100 parts per million using a 100 ppm isobutylene in air span gas.

TABLE 2

Organic Compound Analytical Results

CM Production, LLC  
 Oliver Warren #1 Skim Pits Assessment - COGCC REM# 8209  
 Washington County, Colorado

Sample ID and Depth (feet)/Location	Date	Volatile Organic Compounds in Soil				TPH in Soil		PAH Compounds in Soil												
		Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzo(a)pyrene (mg/kg)	Chrysene (mg/kg)	Dibenzo(a,h)anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3,c,d)pyrene (mg/kg)	Napthalene (mg/kg)	Pyrene (mg/kg)
<b>COGCC Table 910-1</b>		0.17	85	100	175	500	500	1000	1000	0.22	0.22	2.2	0.022	22	0.022	1,000	1,000	0.22	23	1,000
<b>Oliver Warren #1 - West Skim Pit</b>																				
CMOW-WP @ 6NW	3/27/2014	<b>0.208</b>	< 0.14	21.6	< 0.28	<b>535</b>	<b>27,300</b>	< 0.130	< 0.130	< 0.130	<b>1.22</b>	< 0.130	< 0.130	7.4	< 0.130	< 0.130	15.5	< 0.130	<b>41.9</b>	4.39
CMOW-WP @ 10NW	3/27/2014	< 0.076	< 0.15	< 0.15	< 0.30	< 15	73.5	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084	< 0.084
CMOW-WP @ 8SW	3/27/2014	< 0.066	< 0.13	< 0.13	< 0.27	< 13	< 7.8	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0044	< 0.0051
CMOW-WP @ 9E	3/27/2014	< 0.068	< 0.14	< 0.14	< 0.27	< 14	< 7.8	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0074	< 0.0051
CMOW-WP @ 11N	3/27/2014	< 0.077	< 0.15	0.34	< 0.31	31	371	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085	0.374	< 0.085	0.074 J	0.595	< 0.085	0.856	0.133
CMOW-WP @ 7W	3/27/2014	< 0.069	< 0.14	< 0.14	< 0.27	< 14	8.43	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	9.4	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0106	0.0051
<b>Oliver Warren #1 - East Skim Pit</b>																				
CMOW-EP @ 8N	3/27/2014	< 0.074	< 0.15	< 0.15	< 0.30	< 15	< 8.3	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054
CMOW-EP @ 4.5E	3/27/2014	0.116	0.18	< 0.18	11.2	237	<b>4,610</b>	< 0.31	< 0.31	< 0.31	<b>2.66</b>	< 0.31	<b>1.37</b>	16.7	< 0.31	3.78	35.7	< 0.31	<b>95.8</b>	10
CMOW-EP @ 7E	3/27/2014	0.124	< 0.16	7.55	< 0.32	374	<b>18,900</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CMOW-EP @ 10E	3/27/2014	< 0.075	< 0.15	0.854	< 0.30	32.4	<b>1,170</b>	0.0706	< 0.0055	0.0326	0.0317	< 0.0055	<b>0.0693</b>	0.155	< 0.0055	< 0.0055	0.406	< 0.0055	0.522	0.1
CMOW-EP @ 7SE	3/27/2014	0.028 J	< 0.14	1.52	< 0.270	46.4	<b>7,800</b>	0.371	< 0.021	< 0.021	<b>0.252</b>	< 0.021	<b>0.459</b>	1.16	< 0.021	< 0.021	2.1	< 0.021	1.91	0.504

mg/kg - milligrams per kilogram  
 TPH - Total Petroleum Hydrocarbons  
 GRO - Gasoline Range Organics  
 DRO - Diesel Range Organics  
 PAH - Polycyclic Aromatic Hydrocarbons

Note: Values in bold orange type exceed the COGCC Table 910-1 concentration levels.

< - analyte was not detected above the laboratory reporting limit

Gray shaded cells indicate that the laboratory reporting limit is above the COGCC Table 910-1 concentration level for the analyte. Analyses were run by Accutest: BTEX and GRO (Method 8260), DRO (Method m. 8015), PAH (8270 Sim)

TABLE 3

Inorganic Compound Analytical Results

CM Production, LLC  
 Oliver Warren #1 Skim Pits Assessment - COGCC REM #8209  
 Washington County, Colorado

Sample ID and Depth (feet)/Location	Date	Total Metals in Soil													Inorganic Parameters in Soil			
		Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Magnesium (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Sodium (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	pH (s.u.)	EC (mmhos/cm)	SAR
COGCC T910-1		0.39	15,000	70	N/A	23*	3,100	400	N/A	23	1,600	390	N/A	390	23,000	6 to 9	< 4 or 2x BG	< 12
Oliver Warren #1 - West Skim Pit																		
CMOW-WP @ 6NW	3/27/2014	<b>2.6</b>	248	< 1.1	10.7	10.3	115	12.9	2.03	< 0.11	10.1	< 5.4	204	< 3.2	222	<b>9.56</b>	0.9	<b>15</b>
Oliver Warren #1 - East Skim Pit																		
CMOW-EP @ 4.5E	3/27/2014	<b>2.4</b>	166	< 1.4	9.4	11.4	27.9	88.9	2.62	< 0.11	17.2	< 6.9	167	< 4.1	1790	8.31	0.792	<b>12.4</b>
Background Samples																		
CMOW-BG1 @ 0.2	3/27/2014	3.6	157	< 1.1	90.6	7.9	11.8	10.5	23.5	< 0.091	8.1	< 5.7	33.5	< 3.4	53.2	7.83	1.17	0.811
CMOW-BG2 @ 0.2	3/27/2014	2.6	142	< 1.1	33.9	6.1	8.4	8.8	5.35	< 0.088	6.9	< 5.3	22.1	< 3.2	37.3	8.38	0.534	0.93
CMSJW-BG3	3/27/2014	2.7	142	< 1.1	53.8	7.2	7.7	10.9	5.80	< 0.092	7.7	< 5.7	93.6	< 3.4	53.4	8.41	0.753	3.23

mg/kg - milligrams per kilogram

BG - Background Samples: CMOW-BG1 @ 0.2 feet was collected northeast of the produced water pit near the farm field and access road, CMOW-BG2 @ 0.2 feet was collected southeast of the Oliver Warren #1 tank battery near the farmed field, CMSJW-BG3 was collected on the north side of the S.J. Warren Produced Water pit.

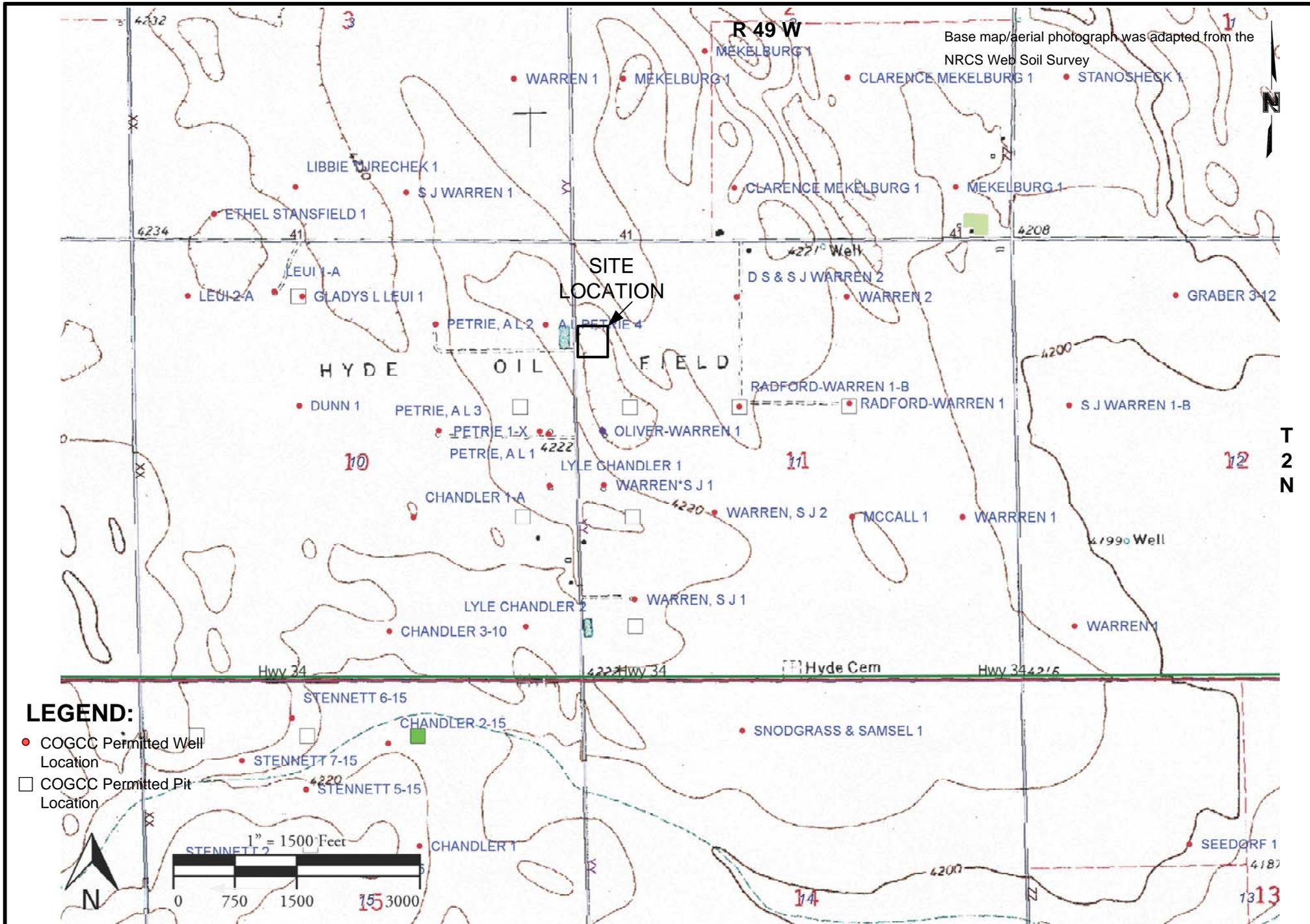
s.u. - standard units for soil pH

SAR - sodium adsorption ratio

Values shown in bold orange type are above the COGCC Table 910-1 Concentration Levels. Arsenic was above the Table 910-1 concentration level of 0.39 mg/kg, however, the arsenic concentrations are consistent with background concentrations. The pH of the soils at 6 feet in the west pit were above the pH range of 6 to 9 s.u., and the SAR was above 12.

---

# FIGURES



PROJECT NO: 013-1681  
 DRAWN BY: JWH  
 DATE: 04/14/14

CM Production, LLC  
 Oliver Warren #1 – Skim Pits Subsurface Investigation  
 Site Location Map

**OLSSON**  
 ASSOCIATES

4690 Table Mountain Drive #200  
 Golden, Colorado 80403  
 TEL 303.237.2072  
 FAX 303.237.2659

FIGURE  
**1**

CMOW-WP@6NW CMOW-WP@10NW

GRO 535  
 B **0.208**  
 T < 0.14  
 E 21.6  
 X < 0.28

GRO < 1.5  
 B < 0.076  
 T < 0.15  
 E < 0.15  
 X < 0.30

R 49 W

Base map/aerial photograph was adapted from the  
 NRCS Web Soil Survey



Produced Water Pit

Farm Field

CMOW-WP@7W

GRO < 14  
 B < 0.069  
 T < 0.14  
 E < 0.14  
 X < 0.27

CMOW-WP@11N

GRO 31  
 B < 0.077  
 T < 0.15  
 E 0.34  
 X < 0.31

CMOW-EP@8N

GRO < 15  
 B < 0.074  
 T < 0.15  
 E < 0.15  
 X < 0.30

T  
2  
N

CMOW-WP@9E

GRO < 14  
 B < 0.068  
 T < 0.14  
 E < 0.14  
 X < 0.27

Skim Tank

CMOW-EP@4.5E

GRO 237  
 B 0.116  
 T < 0.18  
 E 11.2  
 X < 0.37

CMOW-EP@7E

GRO 374  
 B 0.124  
 T < 0.16  
 E 75.5  
 X < 0.32

CMOW-EP@10E

GRO 32.4  
 B < 0.075  
 T < 0.15  
 E 0.854  
 X < 0.30

CMOW-WP@8SW

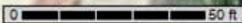
GRO < 13  
 B < 0.066  
 T < 0.13  
 E < 0.13  
 X < 0.27

CMOW-EP@7SE

GRO < 15  
 B < 0.074  
 T < 0.15  
 E < 0.15  
 X < 0.30

Vertical Separator

Scale



**LEGEND:**

Former Skim Pit Location

Buried Water Line

GRO – Diesel Range Organics (500 mg/kg)

B – Benzene (0.17mg/kg)

T – Toluene (85 mg/kg)

E – Ethylbenzene (100 mg/kg)

X – Xylenes (175 mg/kg)

Note: All results are reported in milligrams per kilogram (mg/kg) Concentrations above the COGCC Table 910-1 are shown in bold font. Table 910-1 concentration levels are Shown in parentheses after parameter name in the legend.

PROJECT NO: 013-1681

DRAWN BY: JWH

DATE: 04/14/14

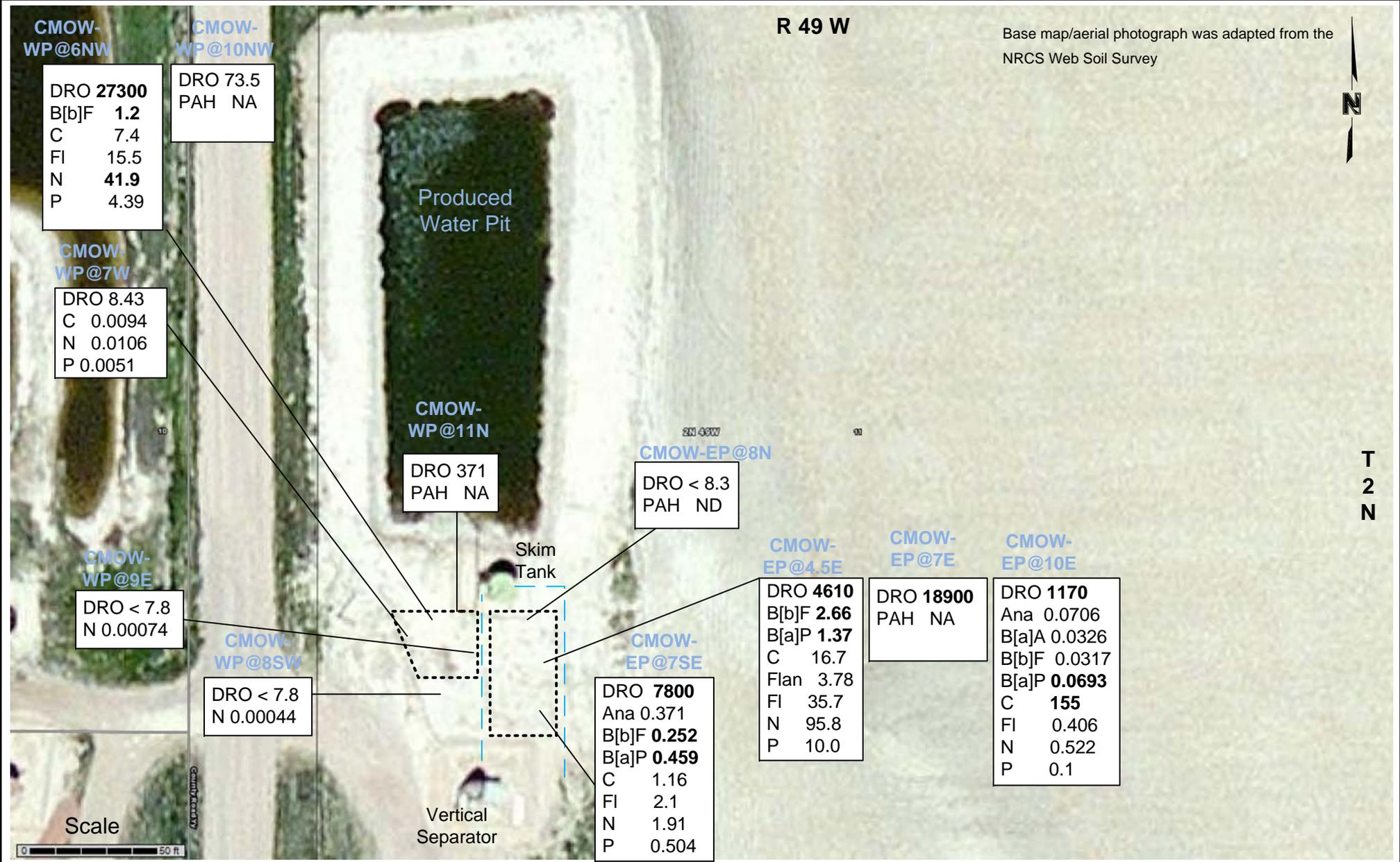
CM Production, LLC  
 Oliver Warren #1 Skim Pits – GRO and BTEX  
 Hyde Field, Washington County, Colorado



4690 Table Mountain Drive #200  
 Golden, Colorado 80403  
 TEL 303.237.2072  
 FAX 303.237.2659

FIGURE

2



**LEGEND:**

- Former Skim Pit Location
- Buried Water Line

DRO – Diesel Range Organics (500 mg/kg)  
 PAH – Polycyclic aromatic hydrocarbons  
 Ana – acenaphthene (1,000 mg/kg)  
 B[a]A - benzo[a]anthracene (0.22 mg/kg)  
 B[b]F - benzo[b]fluoranthene (0.22 mg/kg)  
 B[a]P - benzo[a]pyrene (0.022 mg/kg)  
 C – chysene (22 mg/kg)  
 Flan – fluoranthene (1,000 mg/kg)  
 FI – fluorene (1,000 mg/kg)  
 N – naphthalene (23 mg/kg)

Note: All results are reported in milligrams per kilogram (mg/kg) Concentrations above the COGCC Table 910-1 are shown in bold font. Table 910-1 concentration levels are Shown in parentheses after PAH name in the legend.

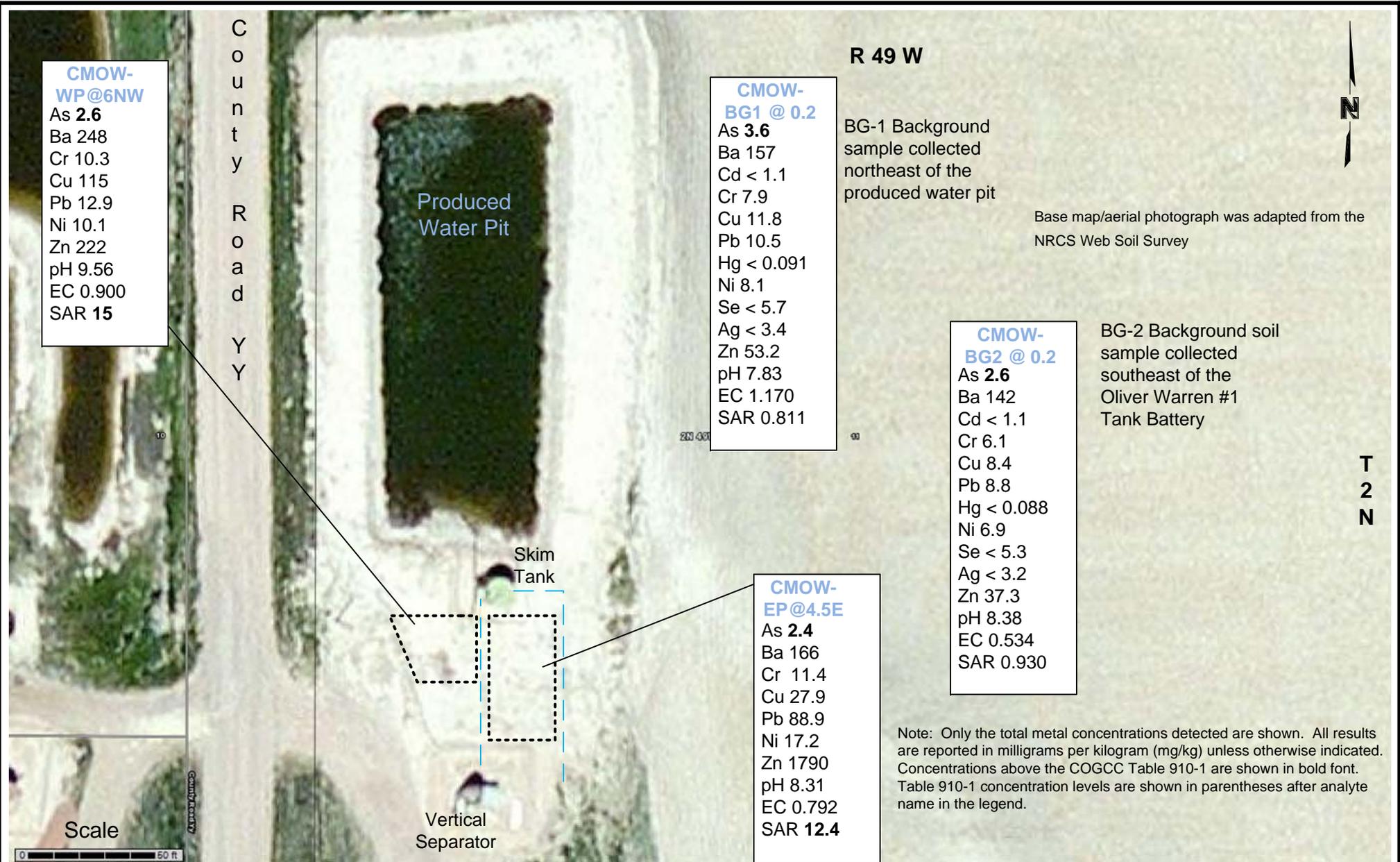
PROJECT NO:	013-1681
DRAWN BY:	JWH
DATE:	04/14/14

**CM Production, LLC**  
**Oliver Warren #1 Skim Pits – DRO and PAH**  
**Hyde Field, Washington County, Colorado**



4690 Table Mountain Drive #200  
 Golden, Colorado 80403  
 TEL 303.237.2072  
 FAX 303.237.2659

**FIGURE**  
**3**



**CMOW-WP@6NW**  
 As **2.6**  
 Ba 248  
 Cr 10.3  
 Cu 115  
 Pb 12.9  
 Ni 10.1  
 Zn 222  
 pH 9.56  
 EC 0.900  
 SAR **15**

**CMOW-BG1 @ 0.2**  
 As **3.6**  
 Ba 157  
 Cd < 1.1  
 Cr 7.9  
 Cu 11.8  
 Pb 10.5  
 Hg < 0.091  
 Ni 8.1  
 Se < 5.7  
 Ag < 3.4  
 Zn 53.2  
 pH 7.83  
 EC 1.170  
 SAR 0.811

**CMOW-BG2 @ 0.2**  
 As **2.6**  
 Ba 142  
 Cd < 1.1  
 Cr 6.1  
 Cu 8.4  
 Pb 8.8  
 Hg < 0.088  
 Ni 6.9  
 Se < 5.3  
 Ag < 3.2  
 Zn 37.3  
 pH 8.38  
 EC 0.534  
 SAR 0.930

**CMOW-EP@4.5E**  
 As **2.4**  
 Ba 166  
 Cr 11.4  
 Cu 27.9  
 Pb 88.9  
 Ni 17.2  
 Zn 1790  
 pH 8.31  
 EC 0.792  
 SAR **12.4**

BG-1 Background sample collected northeast of the produced water pit

Base map/aerial photograph was adapted from the NRCS Web Soil Survey

BG-2 Background soil sample collected southeast of the Oliver Warren #1 Tank Battery

Note: Only the total metal concentrations detected are shown. All results are reported in milligrams per kilogram (mg/kg) unless otherwise indicated. Concentrations above the COGCC Table 910-1 are shown in bold font. Table 910-1 concentration levels are shown in parentheses after analyte name in the legend.

--- Former Skim Pit Location  
 - - - Buried Water Line

As - Arsenic (0.39 mg/kg)  
 Ba - Barium (15,000 mg/kg)  
 Cd - Cadmium (70 mg/kg)  
 Cr - Chromium (Cr 3+ 120,000 mg/kg)  
 Cr - Chromium (Cr 6+ 23 mg/kg)  
 Cu - Copper (3,100 mg/kg)  
 Pb - Lead (400 mg/kg)  
 Hg - Mercury (23 mg/kg)  
 Ni - Nickel (soluble salts) (1,600 mg/kg)  
 Se - Selenium (390 mg/kg)

< - not detected  
 pH - standard units  
 EC - Electrical Conductivity (< 4 mmhos/cm)  
 SAR - sodium adsorption ratio (< 12)

PROJECT NO: 013-1681  
 DRAWN BY: JWH  
 DATE: 04/14/14

**CM Production, LLC**  
**Oliver Warren #1 Skim Pits - Metals, EC, pH, SAR Results**  
**Hyde Field, Washington County, Colorado**

**OLSSON ASSOCIATES**  
 4690 Table Mountain Drive #200  
 Golden, Colorado 80403  
 TEL 303.237.2072  
 FAX 303.237.2659

FIGURE  
**4**

---

**APPENDIX A**  
**SITE PHOTOGRAPHS**



**Subject:** Oliver Warren #1 tank battery. Surrounding land use is agricultural.

**Date:** March 27, 2014

**View:** East



**Subject:** Oliver Warren #1 vertical separator and berm, 300-barrel produced water tank, and produced water pit. The location of the former skim pits is between the separator and the produced water tank.

**Date:** March 27, 2014

**View:** North



**Subject:** The location of the two skim pits at the Oliver Warren #1 site is shown in the partially bermed area in front of the 300-barrel produced water tank. Surrounding land use is agricultural and for oil production.

**Date:** March 27, 2014

**View:** Northeast



**Subject:** Photograph shows the area of the former west skim pit at the Oliver Warren #1 tank battery site. The pit was shown in a 2009 aerial photograph as being located to the southwest (right) of the stairs to the produced water tank. A partial earthen berm was present on the west side of the

**Date:** March 27, 2014

**View:** Southeast



**Subject:** Photograph shows the location of the east skim pit at the Oliver Warren #1 site facing County Road YY and an adjoining separator and battery across the road to the west. A produced water line is reportedly present from the vertical separator in the upper left corner of the picture running to the 300-bbl produced water tank, and located to the right of the stairs shown on the right.

**Date:** March 27, 2014

**View:** Southwest



**Subject:** A Waste Management roll off dumpster was brought on location to haul off impacted soil from an April 2013 release from the vertical separator. The soil was stored on plastic and was loaded into the dumpster.

**Date:** March 27, 2014

**View:** South



**Subject:** Photograph shows the soil stockpile from the vertical separator spill. The soil stockpile was loaded into the dumpster and was subsequently hauled offsite.

**Date:** March 27, 2014

**View:** Southeast



**Subject:** Assessment of the west pit began in a low area on the northwest corner of where the pit was shown in the 2009 aerial photo. Impacted soils were encountered at approximately 6 feet below ground surface (bgs). A partial earthen berm was observed on the west side of the former pit area.

**Date:** March 27, 2014

**View:** Northeast



**Subject:** Dessication cracks were noted in the low area where the northwest trench was excavated. Shallow soils did not exhibit signs of impact.

**Date:** March 27, 2014

**View:** East



**Subject:** Shallow soils in the northwest trench were not impacted. Impacted soils were encountered at approximately six feet bgs. Soil sample CMOW-WP @ 6NW was collected in this area. Olsson directed the excavation to be advanced to ten feet bgs to define the vertical extent of impacts, and collected CMOW-WP @ 10NW.

**Date:** March 27, 2014

**View:** East



**Subject:** Soils did not exhibit staining or odor, nor were elevated PID readings recorded for the southwest trench in the west skim pit area.

**Date:** March 27, 2014

**View:** Southeast



**Subject:** The southwest trench in the west pit area was advanced to a total depth of 8 feet bgs. No E&P waste or impacted soils were encountered in the trench.

**Date:** March 27, 2014

**View:** East - Southeast



**Subject:** A trench excavated on the east side of the west pit did not show evidence of staining or impact. There was no odor or elevated PID readings recorded for soils down to nine feet bgs. A confirmation soil sample CMOW-WP @ 9E was collected.

**Date:** March 27, 2014

**View:** East



**Subject:** A north trench was excavated on the northeast side of the west pit area. Impacted soils were encountered at approximately 4 feet bgs. Excavated trench to a total depth of 11 feet bgs.

**Date:** March 27, 2014

**View:** North



**Subject:** A trench was excavated on the west side of the west pit. Some impacted soils were encountered in the northern part of the trench at approximately 3 feet to 5 feet bgs. A soil sample CMOW-WP @ 7W was collected at 7 feet bgs and submitted for laboratory analysis.

**Date:** March 27, 2014

**View:** East



**Subject:** A trench was excavated on the north side of the east skim pit location near the produced water tank berm. Impacted soils were not encountered in the trench down to a total depth

**Date:** March 27, 2014

**View:** North



**Subject:** A trench was excavated on the east side of the east pit. Impacted soil and E&P waste was encountered at about 4.5 feet bgs.

**Date:** March 27, 2014

**View:** Northeast



**Subject:** Impacted soil was encountered in the east trench of the east pit at approximately 4.5 feet bgs. Photograph shows excavated soils.

**Date:** March 27, 2014

**View:** South



**Subject:** A trench was excavated on the southeast corner of the east pit. Impacted soils were encountered in the excavation. Photograph shows the location of the east trench in relation to the earthen berm for the vertical separator.

**Date:** March 27, 2014

**View:** East



**Subject:** A trench was excavated on the southeast corner of the east pit. Impacted soils were encountered in the excavation. Photograph shows the location of the east trench in relation to the earthen berm for the vertical separator.

**Date:** March 27, 2014

**View:** North



**Subject:** A buried produced water line was reportedly located on the east side of the stairs of the 300-barrel produced water tank and connected the tank to the vertical separator. A trench was not advanced in this area due to the presence of the line. Photograph shows an overview of the former east skim pit area.

**Date:** March 27, 2014

**View:** Southeast

---

**APPENDIX B**  
**ACCUTEST LABORATORIES**  
**SOIL SAMPLE RESULTS**

**Technical Report for**

**Olsson Associates - Denver**

**CM Production-Oliver Warren #1**

**013-1681**

**Accutest Job Number: D56366**

**Sampling Date: 03/27/14**

**Report to:**

**Olsson Associates  
4690 Table Mountain Drive #200 Suite 200  
Golden, CO 80403  
jhix@olssonassociates.com**

**ATTN: James Hix**

**Total number of pages in report: 112**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



**Scott Heideman  
Laboratory Director**

**Client Service contact: Renea Jackson 303-425-6021**

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), TX (T104704511)

This report shall not be reproduced, except in its entirety, without the written approval of Accutest Laboratories.  
Test results relate only to samples analyzed.

# Table of Contents

-1-

<b>Section 1: Sample Summary .....</b>	<b>3</b>
<b>Section 2: Case Narrative/Conformance Summary .....</b>	<b>4</b>
<b>Section 3: Summary of Hits .....</b>	<b>7</b>
<b>Section 4: Sample Results .....</b>	<b>10</b>
<b>4.1:</b> D56366-1: CMOW-WP@6NW .....	11
<b>4.2:</b> D56366-1A: CMOW-WP@6NW .....	16
<b>4.3:</b> D56366-2: CMOW-WP@10NW .....	18
<b>4.4:</b> D56366-3: CMOW-WP@8SW .....	20
<b>4.5:</b> D56366-4: CMOW-WP@9E .....	23
<b>4.6:</b> D56366-5: CMOW-WP@11N .....	26
<b>4.7:</b> D56366-6: CMOW-WP@7W .....	28
<b>4.8:</b> D56366-7: CMOW-EP@8N .....	31
<b>4.9:</b> D56366-8: CMOW-EP@4.5E .....	34
<b>4.10:</b> D56366-8A: CMOW-EP@4.5E .....	39
<b>4.11:</b> D56366-9: CMOW-EP@7E .....	41
<b>4.12:</b> D56366-10: CMOW-EP@10E .....	43
<b>4.13:</b> D56366-11: CMOW-EP@7SE .....	46
<b>Section 5: Misc. Forms .....</b>	<b>49</b>
<b>5.1:</b> Chain of Custody .....	50
<b>Section 6: GC/MS Volatiles - QC Data Summaries .....</b>	<b>51</b>
<b>6.1:</b> Method Blank Summary .....	52
<b>6.2:</b> Blank Spike Summary .....	55
<b>6.3:</b> Matrix Spike Summary .....	61
<b>6.4:</b> Duplicate Summary .....	67
<b>Section 7: GC/MS Semi-volatiles - QC Data Summaries .....</b>	<b>70</b>
<b>7.1:</b> Method Blank Summary .....	71
<b>7.2:</b> Blank Spike Summary .....	72
<b>7.3:</b> Matrix Spike/Matrix Spike Duplicate Summary .....	73
<b>Section 8: GC Semi-volatiles - QC Data Summaries .....</b>	<b>74</b>
<b>8.1:</b> Method Blank Summary .....	75
<b>8.2:</b> Blank Spike Summary .....	76
<b>8.3:</b> Matrix Spike/Matrix Spike Duplicate Summary .....	77
<b>Section 9: Metals Analysis - QC Data Summaries .....</b>	<b>78</b>
<b>9.1:</b> Prep QC MP12622: Ba,Cd,Cr,Cu,Pb,Ni,Se,Ag,Zn .....	79
<b>9.2:</b> Prep QC MP12624: As .....	89
<b>9.3:</b> Prep QC MP12634: Ca,Mg,Na,Sodium Adsorption Ratio .....	94
<b>9.4:</b> Prep QC MP12638: Hg .....	104
<b>Section 10: General Chemistry - QC Data Summaries .....</b>	<b>108</b>
<b>10.1:</b> Method Blank and Spike Results Summary .....	109
<b>10.2:</b> Duplicate Results Summary .....	110
<b>10.3:</b> Matrix Spike Results Summary .....	111
<b>10.4:</b> Matrix Spike Duplicate Results Summary .....	112



## Sample Summary

Olsson Associates - Denver

Job No: D56366

CM Production-Oliver Warren #1  
Project No: 013-1681

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D56366-1	03/27/14	09:20 JH	03/28/14	SO	Soil	CMOW-WP@6NW
D56366-1A	03/27/14	09:20 JH	03/28/14	SO	Soil	CMOW-WP@6NW
D56366-2	03/27/14	09:54 JH	03/28/14	SO	Soil	CMOW-WP@10NW
D56366-3	03/27/14	10:25 JH	03/28/14	SO	Soil	CMOW-WP@8SW
D56366-4	03/27/14	10:40 JH	03/28/14	SO	Soil	CMOW-WP@9E
D56366-5	03/27/14	11:15 JH	03/28/14	SO	Soil	CMOW-WP@11N
D56366-6	03/27/14	11:44 JH	03/28/14	SO	Soil	CMOW-WP@7W
D56366-7	03/27/14	12:06 JH	03/28/14	SO	Soil	CMOW-EP@8N
D56366-8	03/27/14	12:25 JH	03/28/14	SO	Soil	CMOW-EP@4.5E
D56366-8A	03/27/14	12:25 JH	03/28/14	SO	Soil	CMOW-EP@4.5E
D56366-9	03/27/14	12:35 JH	03/28/14	SO	Soil	CMOW-EP@7E
D56366-10	03/27/14	12:40 JH	03/28/14	SO	Soil	CMOW-EP@10E
D56366-11	03/27/14	13:16 JH	03/28/14	SO	Soil	CMOW-EP@7SE

---

Soil samples reported on a dry weight basis unless otherwise indicated on result page.



## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** Olsson Associates - Denver

**Job No** D56366

**Site:** CM Production-Oliver Warren #1

**Report Date** 4/11/2014 11:59:51 AM

On 03/28/2014, 11 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.5 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D56366 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

### Volatiles by GCMS By Method SW846 8260B

<b>Matrix</b> SO	<b>Batch ID:</b> V3V1751
------------------	--------------------------

- All samples were analyzed within the recommended method holding time.
- Sample(s) D56609-10MS, D56609-11DUP were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

<b>Matrix</b> SO	<b>Batch ID:</b> V5V1881
------------------	--------------------------

- All samples were analyzed within the recommended method holding time.
- Sample(s) D56386-1MS, D56386-2DUP were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

<b>Matrix</b> SO	<b>Batch ID:</b> V5V1885
------------------	--------------------------

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56366-2MS, D56366-3DUP were used as the QC samples indicated.

### Extractables by GCMS By Method SW846 8270C BY SIM

<b>Matrix</b> SO	<b>Batch ID:</b> OP9676
------------------	-------------------------

- All samples were extracted within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- Sample(s) D56387-6MS, D56387-6MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.
- The matrix spike (MS) recovery(s) of Anthracene, Benzo(a)pyrene, Fluorene are outside control limits. Outside control limits due to possible matrix interference.
- The matrix spike duplicate (MSD) recovery(s) of Benzo(a)pyrene are outside control limits. Probable cause due to matrix interference.
- The RPD(s) for the MS and MSD recoveries of Anthracene are outside control limits for sample OP9676-MSD. Variability of recovery may be due to sample matrix/homogeneity.
- D56366-11: Dilution required due to matrix interference. Internal standard failure without dilution.
- D56366-8 for Nitrobenzene-d5: Outside control limits due to dilution.
- D56366-1 for Nitrobenzene-d5: Outside control limits due to dilution.

## Extractables by GC By Method SW846-8015B

<b>Matrix</b> SO	<b>Batch ID:</b> OP9681
------------------	-------------------------

- All samples were extracted within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56366-6MS, D56366-6MSD were used as the QC samples indicated.

## Metals By Method SW846 6010C

<b>Matrix</b> AQ	<b>Batch ID:</b> MP12634
------------------	--------------------------

- All samples were digested within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56271-13AMS, D56271-13AMSD, D56271-13ASDL were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Sodium are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

<b>Matrix</b> SO	<b>Batch ID:</b> MP12622
------------------	--------------------------

- All samples were digested within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56366-1MS, D56366-1MSD, D56366-1SDL were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Silver are outside control limits. Spike recovery indicates possible matrix interference.
- The serial dilution RPD(s) for Cadmium, Lead, Barium, Chromium, Copper, Zinc are outside control limits for sample MP12622-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).
- MP12622-SD1 for Chromium: Serial dilution indicates possible matrix interference.
- MP12622-SD1 for Zinc: Serial dilution indicates possible matrix interference.
- MP12622-SD1 for Copper: Serial dilution indicates possible matrix interference.
- MP12622-SD1 for Barium: Serial dilution indicates possible matrix interference.

## Metals By Method SW846 6020A

<b>Matrix</b> SO	<b>Batch ID:</b> MP12624
------------------	--------------------------

- All samples were digested within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56366-1MS, D56366-1MSD, D56366-1SDL were used as the QC samples for the metals analysis.

## Metals By Method SW846 7471B

<b>Matrix</b> SO	<b>Batch ID:</b> MP12638
------------------	--------------------------

- All samples were digested within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56366-1MS, D56366-1MSD were used as the QC samples for the metals analysis.

## Wet Chemistry By Method ASTM D1498-76M

<b>Matrix</b> SO	<b>Batch ID:</b> GN24155
------------------	--------------------------

- Sample(s) D56387-3DUP were used as the QC samples for the Redox Potential Vs H2 analysis.

### Wet Chemistry By Method SM 2510B-2011 MOD

<b>Matrix</b> SO	<b>Batch ID:</b> GP12270
------------------	--------------------------

- The data for SM 2510B-2011 MOD meets quality control requirements.

### Wet Chemistry By Method SM2540G-2011 M

<b>Matrix</b> SO	<b>Batch ID:</b> GN24166
------------------	--------------------------

- The data for SM2540G-2011 M meets quality control requirements.

### Wet Chemistry By Method SW846 3060A/7196A

<b>Matrix</b> SO	<b>Batch ID:</b> GP12302
------------------	--------------------------

- All samples were prepared within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56390-2DUP, D56390-2MS, D56390-2MSD were used as the QC samples for the Chromium, Hexavalent analysis.

### Wet Chemistry By Method SW846 3060A/7196A M

<b>Matrix</b> SO	<b>Batch ID:</b> R21057
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D56366-1 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

<b>Matrix</b> SO	<b>Batch ID:</b> R21071
------------------	-------------------------

- The data for SW846 3060A/7196A M meets quality control requirements.
- D56366-8 for Chromium, Trivalent: Calculated as: (Chromium) - (Chromium, Hexavalent)

### Wet Chemistry By Method SW846 9045D

<b>Matrix</b> SO	<b>Batch ID:</b> GN24162
------------------	--------------------------

- The following samples were run outside of holding time for method SW846 9045D: D56366-1, D56366-8

### Wet Chemistry By Method USDA HANDBOOK 60

<b>Matrix</b> SO	<b>Batch ID:</b> MP12634
------------------	--------------------------

- D56366-1A for Sodium Adsorption Ratio: Calculated as:  $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$
- D56366-8A for Sodium Adsorption Ratio: Calculated as:  $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

## Summary of Hits

**Job Number:** D56366  
**Account:** Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1  
**Collected:** 03/27/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

**D56366-1 CMOW-WP@6NW**

Benzene	208	70	26	ug/kg	SW846 8260B
Ethylbenzene	21600	280	53	ug/kg	SW846 8260B
TPH-GRO (C6-C10)	535000	14000	7000	ug/kg	SW846 8260B
Benzo(b)fluoranthene	1220	130	80	ug/kg	SW846 8270C BY SIM
Chrysene	7400	130	63	ug/kg	SW846 8270C BY SIM
Fluorene	15500	130	93	ug/kg	SW846 8270C BY SIM
Naphthalene	41900	130	78	ug/kg	SW846 8270C BY SIM
Pyrene	4390	130	76	ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)	27300	400	300	mg/kg	SW846-8015B
Arsenic	2.6	0.11		mg/kg	SW846 6020A
Barium	248	1.1		mg/kg	SW846 6010C
Chromium	10.3	1.1		mg/kg	SW846 6010C
Copper	115	1.1		mg/kg	SW846 6010C
Lead	12.9	5.4		mg/kg	SW846 6010C
Nickel	10.1	3.2		mg/kg	SW846 6010C
Zinc	222	3.2		mg/kg	SW846 6010C
Specific Conductivity	900	1.0		umhos/cm	SM 2510B-2011 MOD
Chromium, Trivalent <sup>a</sup>	10.3	2.1		mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2	232			mv	ASTM D1498-76M
pH	9.56			su	SW846 9045D

**D56366-1A CMOW-WP@6NW**

Calcium	10.7	2.0		mg/l	SW846 6010C
Magnesium	2.03	1.0		mg/l	SW846 6010C
Sodium	204	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>b</sup>	15.0			ratio	USDA HANDBOOK 60

**D56366-2 CMOW-WP@10NW**

TPH-DRO (C10-C28)	73.5	8.4	6.3	mg/kg	SW846-8015B
-------------------	------	-----	-----	-------	-------------

**D56366-3 CMOW-WP@8SW**

Naphthalene	4.4 J	5.1	3.0	ug/kg	SW846 8270C BY SIM
-------------	-------	-----	-----	-------	--------------------

**D56366-4 CMOW-WP@9E**

Naphthalene	7.4	5.1	3.1	ug/kg	SW846 8270C BY SIM
-------------	-----	-----	-----	-------	--------------------

**D56366-5 CMOW-WP@11N**

Ethylbenzene	340	150	29	ug/kg	SW846 8260B
--------------	-----	-----	----	-------	-------------

## Summary of Hits

**Job Number:** D56366  
**Account:** Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1  
**Collected:** 03/27/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

TPH-GRO (C6-C10)		31000	15000	7700	ug/kg	SW846 8260B
TPH-DRO (C10-C28)		371	8.5	6.3	mg/kg	SW846-8015B

### D56366-6 CMOW-WP@7W

Chrysene		9.4	5.1	2.5	ug/kg	SW846 8270C BY SIM
Naphthalene		10.6	5.1	3.1	ug/kg	SW846 8270C BY SIM
Pyrene		5.1	5.1	3.0	ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)		8.43	7.9	5.9	mg/kg	SW846-8015B

### D56366-7 CMOW-EP@8N

No hits reported in this sample.

### D56366-8 CMOW-EP@4.5E

Benzene		116	91	35	ug/kg	SW846 8260B
Ethylbenzene		11200	180	35	ug/kg	SW846 8260B
TPH-GRO (C6-C10)		237000	18000	9100	ug/kg	SW846 8260B
Benzo(b)fluoranthene		2660	310	190	ug/kg	SW846 8270C BY SIM
Benzo(a)pyrene		1370	310	150	ug/kg	SW846 8270C BY SIM
Chrysene		16700	310	150	ug/kg	SW846 8270C BY SIM
Fluoranthene		3780	310	170	ug/kg	SW846 8270C BY SIM
Fluorene		35700	310	220	ug/kg	SW846 8270C BY SIM
Naphthalene		95800	310	180	ug/kg	SW846 8270C BY SIM
Pyrene		10000	310	180	ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)		4610	190	140	mg/kg	SW846-8015B
Arsenic		2.4	0.14		mg/kg	SW846 6020A
Barium		166	1.4		mg/kg	SW846 6010C
Chromium		11.4	1.4		mg/kg	SW846 6010C
Copper		27.9	1.4		mg/kg	SW846 6010C
Lead		88.9	6.9		mg/kg	SW846 6010C
Nickel		17.2	4.1		mg/kg	SW846 6010C
Zinc		1790	4.1		mg/kg	SW846 6010C
Specific Conductivity		792	1.0		umhos/cm	SM 2510B-2011 MOD
Chromium, Trivalent <sup>a</sup>		11.4	2.4		mg/kg	SW846 3060A/7196A M
Redox Potential Vs H2		60.9			mv	ASTM D1498-76M
pH		8.31			su	SW846 9045D

### D56366-8A CMOW-EP@4.5E

Calcium		9.40	2.0		mg/l	SW846 6010C
Magnesium		2.62	1.0		mg/l	SW846 6010C
Sodium		167	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>b</sup>		12.4			ratio	USDA HANDBOOK 60

## Summary of Hits

**Job Number:** D56366  
**Account:** Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1  
**Collected:** 03/27/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

### D56366-9 CMOW-EP@7E

Benzene	124	81	31	ug/kg	SW846 8260B
Ethylbenzene	7550	160	31	ug/kg	SW846 8260B
TPH-GRO (C6-C10)	374000	16000	8100	ug/kg	SW846 8260B
TPH-DRO (C10-C28)	18900	440	330	mg/kg	SW846-8015B

### D56366-10 CMOW-EP@10E

Ethylbenzene	854	150	29	ug/kg	SW846 8260B
TPH-GRO (C6-C10)	32400	15000	7500	ug/kg	SW846 8260B
Acenaphthene	70.6	5.5	4.2	ug/kg	SW846 8270C BY SIM
Benzo(a)anthracene	32.6	5.5	2.6	ug/kg	SW846 8270C BY SIM
Benzo(b)fluoranthene	31.7	5.5	3.4	ug/kg	SW846 8270C BY SIM
Benzo(a)pyrene	69.3	5.5	2.6	ug/kg	SW846 8270C BY SIM
Chrysene	155	5.5	2.6	ug/kg	SW846 8270C BY SIM
Fluorene	406	5.5	3.9	ug/kg	SW846 8270C BY SIM
Naphthalene	522	5.5	3.3	ug/kg	SW846 8270C BY SIM
Pyrene	100	5.5	3.2	ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)	1170	84	63	mg/kg	SW846-8015B

### D56366-11 CMOW-EP@7SE

Benzene	28.0 J	68	26	ug/kg	SW846 8260B
Ethylbenzene	1520	140	26	ug/kg	SW846 8260B
TPH-GRO (C6-C10)	46400	14000	6800	ug/kg	SW846 8260B
Acenaphthene <sup>c</sup>	371	21	16	ug/kg	SW846 8270C BY SIM
Benzo(b)fluoranthene <sup>c</sup>	252	21	13	ug/kg	SW846 8270C BY SIM
Benzo(a)pyrene <sup>c</sup>	459	21	10	ug/kg	SW846 8270C BY SIM
Chrysene <sup>c</sup>	1160	21	10	ug/kg	SW846 8270C BY SIM
Fluorene <sup>c</sup>	2100	21	15	ug/kg	SW846 8270C BY SIM
Naphthalene <sup>c</sup>	1910	21	12	ug/kg	SW846 8270C BY SIM
Pyrene <sup>c</sup>	504	21	12	ug/kg	SW846 8270C BY SIM
TPH-DRO (C10-C28)	7800	79	59	mg/kg	SW846-8015B

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

(b) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+(Mg meq/L)/2]

(c) Dilution required due to matrix interference. Internal standard failure without dilution.

Sample Results

---

Report of Analysis

---

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW		<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-1		<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> 83.3
<b>Method:</b> SW846 8260B		
<b>Project:</b> CM Production-Oliver Warren #1		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31394.D	1	04/02/14	JL	n/a	n/a	V5V1881
Run #2	3V29960.D	1	04/09/14	JL	n/a	n/a	V3V1751

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.04 g	5.0 ml	100 ul
Run #2	5.04 g	5.0 ml	50.0 ul

**Purgeable Aromatics+ GRO**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	208	70	26	ug/kg	
108-88-3	Toluene	ND	140	70	ug/kg	
100-41-4	Ethylbenzene	21600 <sup>a</sup>	280	53	ug/kg	
1330-20-7	Xylene (total)	ND	280	140	ug/kg	
	TPH-GRO (C6-C10)	535000	14000	7000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	96%	99%	64-130%
460-00-4	4-Bromofluorobenzene	126%	129%	62-131%
17060-07-0	1,2-Dichloroethane-D4	77%	100%	70-130%

(a) Result is from Run# 2

---

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.1  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW		
<b>Lab Sample ID:</b> D56366-1		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 83.3
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18923.D	5	04/05/14	DC	04/03/14	OP9676	E3G938
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	5.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	130	100	ug/kg	
120-12-7	Anthracene	ND	130	90	ug/kg	
56-55-3	Benzo(a)anthracene	ND	130	63	ug/kg	
205-99-2	Benzo(b)fluoranthene	1220	130	80	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	130	64	ug/kg	
50-32-8	Benzo(a)pyrene	ND	130	63	ug/kg	
218-01-9	Chrysene	7400	130	63	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	130	63	ug/kg	
206-44-0	Fluoranthene	ND	130	73	ug/kg	
86-73-7	Fluorene	15500	130	93	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	130	63	ug/kg	
91-20-3	Naphthalene	41900	130	78	ug/kg	
129-00-0	Pyrene	4390	130	76	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	251% <sup>a</sup>		10-175%
321-60-8	2-Fluorobiphenyl	110%		25-130%
1718-51-0	Terphenyl-d14	130%		41-133%

(a) Outside control limits due to dilution.

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.1  
 4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-1	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 83.3
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11621.D	10	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	5.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	27300	400	300	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	85%		20-130%		

---

ND = Not detected	MDL = Method Detection Limit	J = Indicates an estimated value
RL = Reporting Limit		B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range		N = Indicates presumptive evidence of a compound

4.1  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-1	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 83.3
<b>Project:</b> CM Production-Oliver Warren #1	

## Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	2.6	0.11	mg/kg	5	04/01/14	04/04/14 NT	SW846 6020A <sup>4</sup>	SW846 3050B <sup>6</sup>
Barium	248	1.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Cadmium	< 1.1	1.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Chromium	10.3	1.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Copper	115	1.1	mg/kg	1	04/01/14	04/02/14 KV	SW846 6010C <sup>2</sup>	SW846 3050B <sup>5</sup>
Lead	12.9	5.4	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Mercury	< 0.11	0.11	mg/kg	1	04/03/14	04/03/14 KV	SW846 7471B <sup>3</sup>	SW846 7471B <sup>7</sup>
Nickel	10.1	3.2	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Selenium	< 5.4	5.4	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Silver	< 3.2	3.2	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Zinc	222	3.2	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>

- (1) Instrument QC Batch: MA4609
- (2) Instrument QC Batch: MA4617
- (3) Instrument QC Batch: MA4621
- (4) Instrument QC Batch: MA4626
- (5) Prep QC Batch: MP12622
- (6) Prep QC Batch: MP12624
- (7) Prep QC Batch: MP12638

---

RL = Reporting Limit

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW <b>Lab Sample ID:</b> D56366-1 <b>Matrix:</b> SO - Soil <b>Project:</b> CM Production-Oliver Warren #1	<b>Date Sampled:</b> 03/27/14 <b>Date Received:</b> 03/28/14 <b>Percent Solids:</b> 83.3
--	--

**General Chemistry**

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>%solids</b>							
Solids, Percent	83.3		%	1	04/01/14	SWT	SM2540G-2011 M
<b>prep: DEPT.OF AG, BOOK N9</b>							
Specific Conductivity	900	1.0	umhos/cm	1	04/01/14	AK	SM 2510B-2011 MOD
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	04/07/14	AK	SW846 3060A/7196A
Chromium, Trivalent <sup>a</sup>	10.3	2.1	mg/kg	1	04/07/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	232		mv	1	03/31/14	JD	ASTM D1498-76M
pH	9.56		su	1	03/31/14 13:00	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

---

RL = Reporting Limit

4.1  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-1A	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 83.3
<b>Project:</b> CM Production-Oliver Warren #1	

### SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	10.7	2.0	mg/l	1	04/02/14	04/03/14 JB	SW846 6010C <sup>2</sup>	SW846 3010A/M <sup>3</sup>
Magnesium	2.03	1.0	mg/l	1	04/02/14	04/02/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>3</sup>
Sodium	204	2.0	mg/l	1	04/02/14	04/03/14 JB	SW846 6010C <sup>2</sup>	SW846 3010A/M <sup>3</sup>

- (1) Instrument QC Batch: MA4617
- (2) Instrument QC Batch: MA4620
- (3) Prep QC Batch: MP12634

RL = Reporting Limit

4.2  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@6NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-1A	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 83.3
<b>Project:</b> CM Production-Oliver Warren #1	

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	15.0		ratio	1	04/03/14 18:24	JB	USDA HANDBOOK 60

(a) Calculated as:  $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

RL = Reporting Limit

4.2  
 4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@10NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-2	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.4
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31469.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.01 g	5.0 ml	100 ul
Run #2			

### Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	76	29	ug/kg	
108-88-3	Toluene	ND	150	76	ug/kg	
100-41-4	Ethylbenzene	ND	150	29	ug/kg	
1330-20-7	Xylene (total)	ND	300	150	ug/kg	
	TPH-GRO (C6-C10)	ND	15000	7600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	85%		64-130%
460-00-4	4-Bromofluorobenzene	108%		62-131%
17060-07-0	1,2-Dichloroethane-D4	77%		70-130%

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.3  
 4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@10NW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-2	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.4
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FII1623.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	73.5	8.4	6.3	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	85%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.3  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@8SW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-3	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 85.2
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31470.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.10 g	5.0 ml	100 ul
Run #2			

### Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	66	25	ug/kg	
108-88-3	Toluene	ND	130	66	ug/kg	
100-41-4	Ethylbenzene	ND	130	25	ug/kg	
1330-20-7	Xylene (total)	ND	270	130	ug/kg	
	TPH-GRO (C6-C10)	ND	13000	6600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	86%		64-130%
460-00-4	4-Bromofluorobenzene	106%		62-131%
17060-07-0	1,2-Dichloroethane-D4	83%		70-130%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.4  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@8SW		
<b>Lab Sample ID:</b> D56366-3		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 85.2
<b>Project:</b> CM Production-Oliver Warren #1		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18916.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.1	3.9	ug/kg	
120-12-7	Anthracene	ND	5.1	3.5	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.1	2.5	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.1	3.1	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.1	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.1	2.5	ug/kg	
218-01-9	Chrysene	ND	5.1	2.5	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.1	2.5	ug/kg	
206-44-0	Fluoranthene	ND	5.1	2.9	ug/kg	
86-73-7	Fluorene	ND	5.1	3.6	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.1	2.5	ug/kg	
91-20-3	Naphthalene	4.4	5.1	3.0	ug/kg	J
129-00-0	Pyrene	ND	5.1	3.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	84%		10-175%
321-60-8	2-Fluorobiphenyl	71%		25-130%
1718-51-0	Terphenyl-d14	93%		41-133%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.4  
 4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@8SW	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-3	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 85.2
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FII1625.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.8	5.9	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	71%		20-130%		

---

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.4  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@9E		
<b>Lab Sample ID:</b> D56366-4		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8260B		<b>Percent Solids:</b> 84.8
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31472.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.01 g	5.0 ml	100 ul
Run #2			

### Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	68	26	ug/kg	
108-88-3	Toluene	ND	140	68	ug/kg	
100-41-4	Ethylbenzene	ND	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	
	TPH-GRO (C6-C10)	ND	14000	6800	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	87%		64-130%
460-00-4	4-Bromofluorobenzene	109%		62-131%
17060-07-0	1,2-Dichloroethane-D4	80%		70-130%

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.5  
 4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@9E		
<b>Lab Sample ID:</b> D56366-4		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 84.8
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18917.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

### COGCC Table 910-1 PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.1	3.9	ug/kg	
120-12-7	Anthracene	ND	5.1	3.5	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.1	2.5	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.1	3.1	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.1	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.1	2.5	ug/kg	
218-01-9	Chrysene	ND	5.1	2.5	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.1	2.5	ug/kg	
206-44-0	Fluoranthene	ND	5.1	2.9	ug/kg	
86-73-7	Fluorene	ND	5.1	3.6	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.1	2.5	ug/kg	
91-20-3	Naphthalene	7.4	5.1	3.1	ug/kg	
129-00-0	Pyrene	ND	5.1	3.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	100%		10-175%
321-60-8	2-Fluorobiphenyl	84%		25-130%
1718-51-0	Terphenyl-d14	100%		41-133%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.5  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@9E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-4	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 84.8
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FII1627.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.8	5.9	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	88%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.5  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@11N	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-5	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 78.7
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31473.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.01 g	5.0 ml	100 ul
Run #2			

**Purgeable Aromatics+ GRO**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	77	29	ug/kg	
108-88-3	Toluene	ND	150	77	ug/kg	
100-41-4	Ethylbenzene	340	150	29	ug/kg	
1330-20-7	Xylene (total)	ND	310	150	ug/kg	
	TPH-GRO (C6-C10)	31000	15000	7700	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	87%		64-130%
460-00-4	4-Bromofluorobenzene	128%		62-131%
17060-07-0	1,2-Dichloroethane-D4	80%		70-130%

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.6  
 4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@11N	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-5	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 78.7
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11629.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	371	8.5	6.3	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	82%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.6  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@7W	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-6	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 84.0
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31474.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.04 g	5.0 ml	100 ul
Run #2			

## Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	69	26	ug/kg	
108-88-3	Toluene	ND	140	69	ug/kg	
100-41-4	Ethylbenzene	ND	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	
	TPH-GRO (C6-C10)	ND	14000	6900	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	85%		64-130%
460-00-4	4-Bromofluorobenzene	108%		62-131%
17060-07-0	1,2-Dichloroethane-D4	71%		70-130%

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@7W	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-6	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 84.0
<b>Method:</b> SW846 8270C BY SIM SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18918.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.1	4.0	ug/kg	
120-12-7	Anthracene	ND	5.1	3.6	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.1	2.5	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.1	3.2	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.1	2.5	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.1	2.5	ug/kg	
218-01-9	Chrysene	9.4	5.1	2.5	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.1	2.5	ug/kg	
206-44-0	Fluoranthene	ND	5.1	2.9	ug/kg	
86-73-7	Fluorene	ND	5.1	3.7	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.1	2.5	ug/kg	
91-20-3	Naphthalene	10.6	5.1	3.1	ug/kg	
129-00-0	Pyrene	5.1	5.1	3.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	106%		10-175%
321-60-8	2-Fluorobiphenyl	93%		25-130%
1718-51-0	Terphenyl-d14	103%		41-133%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.7  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-WP@7W	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-6	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 84.0
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11613.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	8.43	7.9	5.9	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	83%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.7  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@8N	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-7	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 80.4
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31475.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.04 g	5.0 ml	100 ul
Run #2			

**Purgeable Aromatics+ GRO**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	74	28	ug/kg	
108-88-3	Toluene	ND	150	74	ug/kg	
100-41-4	Ethylbenzene	ND	150	28	ug/kg	
1330-20-7	Xylene (total)	ND	300	150	ug/kg	
	TPH-GRO (C6-C10)	ND	15000	7400	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	86%		64-130%
460-00-4	4-Bromofluorobenzene	107%		62-131%
17060-07-0	1,2-Dichloroethane-D4	82%		70-130%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.8  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@8N		
<b>Lab Sample ID:</b> D56366-7		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 80.4
<b>Project:</b> CM Production-Oliver Warren #1		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18919.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	5.4	4.1	ug/kg	
120-12-7	Anthracene	ND	5.4	3.7	ug/kg	
56-55-3	Benzo(a)anthracene	ND	5.4	2.6	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	5.4	3.3	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.4	2.6	ug/kg	
50-32-8	Benzo(a)pyrene	ND	5.4	2.6	ug/kg	
218-01-9	Chrysene	ND	5.4	2.6	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.4	2.6	ug/kg	
206-44-0	Fluoranthene	ND	5.4	3.0	ug/kg	
86-73-7	Fluorene	ND	5.4	3.8	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.4	2.6	ug/kg	
91-20-3	Naphthalene	ND	5.4	3.2	ug/kg	
129-00-0	Pyrene	ND	5.4	3.1	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	96%		10-175%
321-60-8	2-Fluorobiphenyl	84%		25-130%
1718-51-0	Terphenyl-d14	102%		41-133%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.8  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@8N	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-7	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 80.4
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11631.D	1	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	8.3	6.2	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	76%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.8  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 70.4
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31476.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.05 g	5.0 ml	100 ul
Run #2			

**Purgeable Aromatics+ GRO**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	116	91	35	ug/kg	
108-88-3	Toluene	ND	180	91	ug/kg	
100-41-4	Ethylbenzene	11200	180	35	ug/kg	
1330-20-7	Xylene (total)	ND	370	180	ug/kg	
	TPH-GRO (C6-C10)	237000	18000	9100	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	92%		64-130%
460-00-4	4-Bromofluorobenzene	119%		62-131%
17060-07-0	1,2-Dichloroethane-D4	78%		70-130%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.9  
4

# Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	
<b>Lab Sample ID:</b> D56366-8	<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil	<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546	<b>Percent Solids:</b> 70.4
<b>Project:</b> CM Production-Oliver Warren #1	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18924.D	5	04/05/14	DC	04/03/14	OP9676	E3G938
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	10.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	310	240	ug/kg	
120-12-7	Anthracene	ND	310	210	ug/kg	
56-55-3	Benzo(a)anthracene	ND	310	150	ug/kg	
205-99-2	Benzo(b)fluoranthene	2660	310	190	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	310	150	ug/kg	
50-32-8	Benzo(a)pyrene	1370	310	150	ug/kg	
218-01-9	Chrysene	16700	310	150	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	310	150	ug/kg	
206-44-0	Fluoranthene	3780	310	170	ug/kg	
86-73-7	Fluorene	35700	310	220	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	310	150	ug/kg	
91-20-3	Naphthalene	95800	310	180	ug/kg	
129-00-0	Pyrene	10000	310	180	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	341% <sup>a</sup>		10-175%
321-60-8	2-Fluorobiphenyl	121%		25-130%
1718-51-0	Terphenyl-d14	119%		41-133%

(a) Outside control limits due to dilution.

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.9  
**4**

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 70.4
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11755.D	20	04/09/14	JJ	04/04/14	OP9681	GF1740
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.3 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	4610	190	140	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	61%		20-130%		

---

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.9  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 70.4
<b>Project:</b> CM Production-Oliver Warren #1	

## Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	2.4	0.14	mg/kg	5	04/01/14	04/04/14 NT	SW846 6020A <sup>4</sup>	SW846 3050B <sup>6</sup>
Barium	166	1.4	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Cadmium	< 1.4	1.4	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Chromium	11.4	1.4	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Copper	27.9	1.4	mg/kg	1	04/01/14	04/02/14 KV	SW846 6010C <sup>2</sup>	SW846 3050B <sup>5</sup>
Lead	88.9	6.9	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Mercury	< 0.11	0.11	mg/kg	1	04/03/14	04/03/14 KV	SW846 7471B <sup>3</sup>	SW846 7471B <sup>7</sup>
Nickel	17.2	4.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Selenium	< 6.9	6.9	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Silver	< 4.1	4.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>
Zinc	1790	4.1	mg/kg	1	04/01/14	04/01/14 KV	SW846 6010C <sup>1</sup>	SW846 3050B <sup>5</sup>

- (1) Instrument QC Batch: MA4609  
(2) Instrument QC Batch: MA4617  
(3) Instrument QC Batch: MA4621  
(4) Instrument QC Batch: MA4626  
(5) Prep QC Batch: MP12622  
(6) Prep QC Batch: MP12624  
(7) Prep QC Batch: MP12638

RL = Reporting Limit

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 70.4
<b>Project:</b> CM Production-Oliver Warren #1	

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>%solids</b>							
Solids, Percent	70.4		%	1	04/01/14	SWT	SM2540G-2011 M
<b>prep: DEPT.OF AG, BOOK N9</b>							
Specific Conductivity	792	1.0	umhos/cm	1	04/01/14	AK	SM 2510B-2011 MOD
Chromium, Hexavalent	< 1.0	1.0	mg/kg	1	04/07/14	AK	SW846 3060A/7196A
Chromium, Trivalent <sup>a</sup>	11.4	2.4	mg/kg	1	04/07/14	AK	SW846 3060A/7196A M
Redox Potential Vs H2	60.9		mv	1	03/31/14	JD	ASTM D1498-76M
pH	8.31		su	1	03/31/14 13:00	JB	SW846 9045D

(a) Calculated as: (Chromium) - (Chromium, Hexavalent)

RL = Reporting Limit

4.9  
 4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8A	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 70.4
<b>Project:</b> CM Production-Oliver Warren #1	

### SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	9.40	2.0	mg/l	1	04/02/14	04/03/14 JB	SW846 6010C <sup>2</sup>	SW846 3010A/M <sup>3</sup>
Magnesium	2.62	1.0	mg/l	1	04/02/14	04/02/14 KV	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>3</sup>
Sodium	167	2.0	mg/l	1	04/02/14	04/03/14 JB	SW846 6010C <sup>2</sup>	SW846 3010A/M <sup>3</sup>

- (1) Instrument QC Batch: MA4617
- (2) Instrument QC Batch: MA4620
- (3) Prep QC Batch: MP12634

---

RL = Reporting Limit

4.10  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@4.5E		<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-8A		<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> 70.4
<b>Project:</b> CM Production-Oliver Warren #1		

4.10  
4

### General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	12.4		ratio	1	04/03/14 18:43	JB	USDA HANDBOOK 60

(a) Calculated as:  $(Na \text{ meq/L}) / \sqrt{[(Ca \text{ meq/L}) + (Mg \text{ meq/L})/2]}$

---

RL = Reporting Limit

# Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@7E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-9	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 76.1
<b>Method:</b> SW846 8260B	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31477.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

Run #	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.03 g	5.0 ml	100 ul
Run #2			

**Purgeable Aromatics+ GRO**

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	124	81	31	ug/kg	
108-88-3	Toluene	ND	160	81	ug/kg	
100-41-4	Ethylbenzene	7550	160	31	ug/kg	
1330-20-7	Xylene (total)	ND	320	160	ug/kg	
	TPH-GRO (C6-C10)	374000	16000	8100	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	93%		64-130%
460-00-4	4-Bromofluorobenzene	125%		62-131%
17060-07-0	1,2-Dichloroethane-D4	73%		70-130%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.11  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@7E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-9	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 76.1
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FII1635.D	10	04/04/14	JS	04/04/14	OP9681	GFI734
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	5.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	18900	440	330	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	96%		20-130%		

---

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.11  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@10E		<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-10		<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> 79.2
<b>Method:</b> SW846 8260B		
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31478.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.07 g	5.0 ml	100 ul
Run #2			

## Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	75	29	ug/kg	
108-88-3	Toluene	ND	150	75	ug/kg	
100-41-4	Ethylbenzene	854	150	29	ug/kg	
1330-20-7	Xylene (total)	ND	300	150	ug/kg	
	TPH-GRO (C6-C10)	32400	15000	7500	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	89%		64-130%
460-00-4	4-Bromofluorobenzene	112%		62-131%
17060-07-0	1,2-Dichloroethane-D4	76%		70-130%

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

# Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@10E		
<b>Lab Sample ID:</b> D56366-10		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 79.2
<b>Project:</b> CM Production-Oliver Warren #1		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3G18920.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	70.6	5.5	4.2	ug/kg	
120-12-7	Anthracene	ND	5.5	3.8	ug/kg	
56-55-3	Benzo(a)anthracene	32.6	5.5	2.6	ug/kg	
205-99-2	Benzo(b)fluoranthene	31.7	5.5	3.4	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	5.5	2.7	ug/kg	
50-32-8	Benzo(a)pyrene	69.3	5.5	2.6	ug/kg	
218-01-9	Chrysene	155	5.5	2.6	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	5.5	2.6	ug/kg	
206-44-0	Fluoranthene	ND	5.5	3.1	ug/kg	
86-73-7	Fluorene	406	5.5	3.9	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	5.5	2.6	ug/kg	
91-20-3	Naphthalene	522	5.5	3.3	ug/kg	
129-00-0	Pyrene	100	5.5	3.2	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	92%		10-175%
321-60-8	2-Fluorobiphenyl	78%		25-130%
1718-51-0	Terphenyl-d14	101%		41-133%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@10E	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-10	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 79.2
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11672.D	10	04/07/14	JJ	04/04/14	OP9681	GF1735
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	1170	84	63	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	79%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.12  
4

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@7SE		<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-11		<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> 83.9
<b>Method:</b> SW846 8260B		
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V31479.D	1	04/04/14	JL	n/a	n/a	V5V1885
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.08 g	5.0 ml	100 ul
Run #2			

## Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	28.0	68	26	ug/kg	J
108-88-3	Toluene	ND	140	68	ug/kg	
100-41-4	Ethylbenzene	1520	140	26	ug/kg	
1330-20-7	Xylene (total)	ND	270	140	ug/kg	
	TPH-GRO (C6-C10)	46400	14000	6800	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	89%		64-130%
460-00-4	4-Bromofluorobenzene	117%		62-131%
17060-07-0	1,2-Dichloroethane-D4	70%		70-130%

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

# Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@7SE		
<b>Lab Sample ID:</b> D56366-11		<b>Date Sampled:</b> 03/27/14
<b>Matrix:</b> SO - Soil		<b>Date Received:</b> 03/28/14
<b>Method:</b> SW846 8270C BY SIM SW846 3546		<b>Percent Solids:</b> 83.9
<b>Project:</b> CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	3G18987.D	4	04/08/14	DC	04/03/14	OP9676	E3G940
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

**COGCC Table 910-1 PAH List**

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	371	21	16	ug/kg	
120-12-7	Anthracene	ND	21	14	ug/kg	
56-55-3	Benzo(a)anthracene	ND	21	10	ug/kg	
205-99-2	Benzo(b)fluoranthene	252	21	13	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	21	10	ug/kg	
50-32-8	Benzo(a)pyrene	459	21	10	ug/kg	
218-01-9	Chrysene	1160	21	10	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	21	10	ug/kg	
206-44-0	Fluoranthene	ND	21	12	ug/kg	
86-73-7	Fluorene	2100	21	15	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	21	10	ug/kg	
91-20-3	Naphthalene	1910	21	12	ug/kg	
129-00-0	Pyrene	504	21	12	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	87%		10-175%
321-60-8	2-Fluorobiphenyl	89%		25-130%
1718-51-0	Terphenyl-d14	82%		41-133%

(a) Dilution required due to matrix interference. Internal standard failure without dilution.

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 RL = Reporting Limit      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.13  
**4**

## Report of Analysis

<b>Client Sample ID:</b> CMOW-EP@7SE	<b>Date Sampled:</b> 03/27/14
<b>Lab Sample ID:</b> D56366-11	<b>Date Received:</b> 03/28/14
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> 83.9
<b>Method:</b> SW846-8015B SW846 3546	
<b>Project:</b> CM Production-Oliver Warren #1	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FI11624.D	10	04/04/14	JS	04/04/14	OP9681	GFI733
Run #2							

Run #	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	7800	79	59	mg/kg	
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits		
84-15-1	o-Terphenyl	69%		20-130%		

ND = Not detected      MDL = Method Detection Limit  
 RL = Reporting Limit  
 E = Indicates value exceeds calibration range

J = Indicates an estimated value  
 B = Indicates analyte found in associated method blank  
 N = Indicates presumptive evidence of a compound

4.13  
4

## Misc. Forms

---

5

## Custody Documents and Other Forms

---

Includes the following where applicable:

- Chain of Custody



## GC/MS Volatiles

---

## QC Data Summaries

---

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

## Method Blank Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1881-MB	5V31375.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	50	19	ug/kg	
108-88-3	Toluene	ND	100	50	ug/kg	
1330-20-7	Xylene (total)	ND	200	100	ug/kg	
	TPH-GRO (C6-C10)	ND	10000	5000	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
2037-26-5	Toluene-D8	90%	64-130%
460-00-4	4-Bromofluorobenzene	97%	62-131%
17060-07-0	1,2-Dichloroethane-D4	87%	70-130%

# Method Blank Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1885-MB	5V31463.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	50	19	ug/kg	
100-41-4	Ethylbenzene	ND	100	19	ug/kg	
108-88-3	Toluene	ND	100	50	ug/kg	
1330-20-7	Xylene (total)	ND	200	100	ug/kg	
	TPH-GRO (C6-C10)	ND	10000	5000	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
2037-26-5	Toluene-D8	89%	64-130%
460-00-4	4-Bromofluorobenzene	98%	62-131%
17060-07-0	1,2-Dichloroethane-D4	83%	70-130%

## Method Blank Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1751-MB	3V29940.D	1	04/08/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Result	RL	MDL	Units	Q
100-41-4	Ethylbenzene	ND	100	19	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
2037-26-5	Toluene-D8	98%	64-130%
460-00-4	4-Bromofluorobenzene	95%	62-131%
17060-07-0	1,2-Dichloroethane-D4	105%	70-130%

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1881-BS	5V31376.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	2500	2530	101	70-130
108-88-3	Toluene	2500	2360	94	70-130
1330-20-7	Xylene (total)	7500	7400	99	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	92%	64-130%
460-00-4	4-Bromofluorobenzene	101%	62-131%
17060-07-0	1,2-Dichloroethane-D4	77%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1881-BS	5V31378.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
	TPH-GRO (C6-C10)	110000	81700	74	58-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	92%	64-130%
460-00-4	4-Bromofluorobenzene	96%	62-131%
17060-07-0	1,2-Dichloroethane-D4	77%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1885-BS	5V31464.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	2500	2460	98	70-130
100-41-4	Ethylbenzene	2500	2550	102	70-130
108-88-3	Toluene	2500	2320	93	70-130
1330-20-7	Xylene (total)	7500	7270	97	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	92%	64-130%
460-00-4	4-Bromofluorobenzene	104%	62-131%
17060-07-0	1,2-Dichloroethane-D4	79%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1885-BS	5V31465.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
	TPH-GRO (C6-C10)	110000	77300	70	58-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	92%	64-130%
460-00-4	4-Bromofluorobenzene	96%	62-131%
17060-07-0	1,2-Dichloroethane-D4	73%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1751-BS	3V29941.D	1	04/08/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
100-41-4	Ethylbenzene	2500	2550	102	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	100%	64-130%
460-00-4	4-Bromofluorobenzene	100%	62-131%
17060-07-0	1,2-Dichloroethane-D4	100%	70-130%

\* = Outside of Control Limits.

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V3V1751-BS	3V29942.D	1	04/08/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
---------	----------	----------------	--------------	----------	--------

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	100%	64-130%
460-00-4	4-Bromofluorobenzene	97%	62-131%
17060-07-0	1,2-Dichloroethane-D4	100%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56386-1MS	5V31381.D	1	04/02/14	JL	n/a	n/a	V5V1881
D56386-1	5V31383.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56386-1 ug/kg	Spike Q	MS ug/kg	MS %	Limits
71-43-2	Benzene	ND		2800	2660	95 64-139
108-88-3	Toluene	ND		2800	2410	86 60-130
1330-20-7	Xylene (total)	ND		8410	7810	93 58-142

CAS No.	Surrogate Recoveries	MS	D56386-1	Limits
2037-26-5	Toluene-D8	88%	86%	64-130%
460-00-4	4-Bromofluorobenzene	110%	105%	62-131%
17060-07-0	1,2-Dichloroethane-D4	81%	84%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56386-1MS	5V31382.D	1	04/02/14	JL	n/a	n/a	V5V1881
D56386-1	5V31383.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56386-1 ug/kg	Spike Q	MS ug/kg	MS %	Limits
	TPH-GRO (C6-C10)	ND		123000	86500	70 14-174

CAS No.	Surrogate Recoveries	MS	D56386-1	Limits
2037-26-5	Toluene-D8	87%	86%	64-130%
460-00-4	4-Bromofluorobenzene	104%	105%	62-131%
17060-07-0	1,2-Dichloroethane-D4	76%	84%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56366-2MS	5V31467.D	1	04/04/14	JL	n/a	n/a	V5V1885
D56366-2	5V31469.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	D56366-2 ug/kg	Spike Q	MS ug/kg	MS %	Limits
71-43-2	Benzene	ND	3790	3400	90	64-139
100-41-4	Ethylbenzene	ND	3790	3330	88	68-136
108-88-3	Toluene	ND	3790	3030	80	60-130
1330-20-7	Xylene (total)	ND	11400	9700	85	58-142

CAS No.	Surrogate Recoveries	MS	D56366-2	Limits
2037-26-5	Toluene-D8	85%	85%	64-130%
460-00-4	4-Bromofluorobenzene	105%	108%	62-131%
17060-07-0	1,2-Dichloroethane-D4	77%	77%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56366-2MS	5V31468.D	1	04/04/14	JL	n/a	n/a	V5V1885
D56366-2	5V31469.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	D56366-2 ug/kg	Spike Q	MS ug/kg	MS %	Limits
	TPH-GRO (C6-C10)	ND	167000	117000	70	14-174

CAS No.	Surrogate Recoveries	MS	D56366-2	Limits
2037-26-5	Toluene-D8	88%	85%	64-130%
460-00-4	4-Bromofluorobenzene	106%	108%	62-131%
17060-07-0	1,2-Dichloroethane-D4	73%	77%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56609-10MS	3V29943.D	1	04/09/14	JL	n/a	n/a	V3V1751
D56609-10	3V29945.D	1	04/09/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56609-10 ug/kg	Spike Q	MS ug/kg	MS %	Limits
100-41-4	Ethylbenzene	ND	3610	3410	94	68-136

CAS No.	Surrogate Recoveries	MS	D56609-10	Limits
2037-26-5	Toluene-D8	91%	90%	64-130%
460-00-4	4-Bromofluorobenzene	104%	99%	62-131%
17060-07-0	1,2-Dichloroethane-D4	98%	104%	70-130%

\* = Outside of Control Limits.

# Matrix Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56609-10MS	3V29944.D	1	04/09/14	JL	n/a	n/a	V3V1751
D56609-10	3V29945.D	1	04/09/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56609-10 ug/kg	Spike Q	MS ug/kg	MS %	Limits
---------	----------	--------------------	------------	-------------	---------	--------

CAS No.	Surrogate Recoveries	MS	D56609-10	Limits
2037-26-5	Toluene-D8	92%	90%	64-130%
460-00-4	4-Bromofluorobenzene	103%	99%	62-131%
17060-07-0	1,2-Dichloroethane-D4	99%	104%	70-130%

\* = Outside of Control Limits.

# Duplicate Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56386-2DUP	5V31385.D	1	04/02/14	JL	n/a	n/a	V5V1881
D56386-2	5V31384.D	1	04/02/14	JL	n/a	n/a	V5V1881

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56386-2 ug/kg	DUP Q	RPD	Limits
71-43-2	Benzene	ND	ND	nc	30
108-88-3	Toluene	ND	ND	nc	30
1330-20-7	Xylene (total)	ND	ND	nc	30
	TPH-GRO (C6-C10)	ND	ND	nc	30

CAS No.	Surrogate Recoveries	DUP	D56386-2	Limits
2037-26-5	Toluene-D8	87%	87%	64-130%
460-00-4	4-Bromofluorobenzene	104%	107%	62-131%
17060-07-0	1,2-Dichloroethane-D4	82%	80%	70-130%

\* = Outside of Control Limits.

# Duplicate Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56366-3DUP	5V31471.D	1	04/04/14	JL	n/a	n/a	V5V1885
D56366-3	5V31470.D	1	04/04/14	JL	n/a	n/a	V5V1885

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	D56366-3 ug/kg	DUP Q	RPD	Limits
71-43-2	Benzene	ND	ND	nc	30
100-41-4	Ethylbenzene	ND	ND	nc	30
108-88-3	Toluene	ND	ND	nc	30
1330-20-7	Xylene (total)	ND	ND	nc	30
	TPH-GRO (C6-C10)	ND	ND	nc	30

CAS No.	Surrogate Recoveries	DUP	D56366-3	Limits
2037-26-5	Toluene-D8	86%	86%	64-130%
460-00-4	4-Bromofluorobenzene	106%	106%	62-131%
17060-07-0	1,2-Dichloroethane-D4	80%	83%	70-130%

\* = Outside of Control Limits.

# Duplicate Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D56609-11DUP	3V29947.D	1	04/09/14	JL	n/a	n/a	V3V1751
D56609-11	3V29946.D	1	04/09/14	JL	n/a	n/a	V3V1751

The QC reported here applies to the following samples:

Method: SW846 8260B

D56366-1

CAS No.	Compound	D56609-11 ug/kg	DUP Q	D56609-11 ug/kg	Q	RPD	Limits
100-41-4	Ethylbenzene	ND		ND		nc	30

CAS No.	Surrogate Recoveries	DUP	D56609-11	Limits
2037-26-5	Toluene-D8	90%	90%	64-130%
460-00-4	4-Bromofluorobenzene	100%	100%	62-131%
17060-07-0	1,2-Dichloroethane-D4	102%	104%	70-130%

\* = Outside of Control Limits.

## GC/MS Semi-volatiles

---

### QC Data Summaries

---

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

## Method Blank Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9676-MB	3G18904.D	1	04/04/14	DC	04/03/14	OP9676	E3G938

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D56366-1, D56366-3, D56366-4, D56366-6, D56366-7, D56366-8, D56366-10, D56366-11

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	4.3	3.3	ug/kg	
120-12-7	Anthracene	ND	4.3	3.0	ug/kg	
56-55-3	Benzo(a)anthracene	ND	4.3	2.1	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	4.3	2.7	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	4.3	2.1	ug/kg	
50-32-8	Benzo(a)pyrene	ND	4.3	2.1	ug/kg	
218-01-9	Chrysene	ND	4.3	2.1	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	4.3	2.1	ug/kg	
206-44-0	Fluoranthene	ND	4.3	2.4	ug/kg	
86-73-7	Fluorene	ND	4.3	3.1	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	4.3	2.1	ug/kg	
91-20-3	Naphthalene	ND	4.3	2.6	ug/kg	
129-00-0	Pyrene	ND	4.3	2.5	ug/kg	

CAS No.	Surrogate Recoveries	Limits
4165-60-0	Nitrobenzene-d5	98% 10-175%
321-60-8	2-Fluorobiphenyl	97% 25-130%
1718-51-0	Terphenyl-d14	110% 41-133%

711  
7

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9676-BS	3G18905.D	1	04/04/14	DC	04/03/14	OP9676	E3G938

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D56366-1, D56366-3, D56366-4, D56366-6, D56366-7, D56366-8, D56366-10, D56366-11

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
83-32-9	Acenaphthene	83.3	81.7	98	55-130
120-12-7	Anthracene	83.3	74.8	90	60-130
56-55-3	Benzo(a)anthracene	83.3	84.0	101	62-130
205-99-2	Benzo(b)fluoranthene	83.3	64.1	77	55-130
207-08-9	Benzo(k)fluoranthene	83.3	106	127	59-130
50-32-8	Benzo(a)pyrene	83.3	82.3	99	64-130
218-01-9	Chrysene	83.3	89.8	108	70-130
53-70-3	Dibenzo(a,h)anthracene	83.3	84.8	102	56-130
206-44-0	Fluoranthene	83.3	71.5	86	59-130
86-73-7	Fluorene	83.3	79.9	96	58-130
193-39-5	Indeno(1,2,3-cd)pyrene	83.3	84.6	102	60-130
91-20-3	Naphthalene	83.3	82.8	99	56-130
129-00-0	Pyrene	83.3	80.6	97	65-130

CAS No.	Surrogate Recoveries	BSP	Limits
4165-60-0	Nitrobenzene-d5	100%	10-175%
321-60-8	2-Fluorobiphenyl	95%	25-130%
1718-51-0	Terphenyl-d14	107%	41-133%

\* = Outside of Control Limits.

7.2.1  
 7

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9676-MS	3G18907.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
OP9676-MSD	3G18908.D	1	04/04/14	DC	04/03/14	OP9676	E3G938
D56387-6	3G18906.D	1	04/04/14	DC	04/03/14	OP9676	E3G938

The QC reported here applies to the following samples:

Method: SW846 8270C BY SIM

D56366-1, D56366-3, D56366-4, D56366-6, D56366-7, D56366-8, D56366-10, D56366-11

CAS No.	Compound	D56387-6 ug/kg	Spike Q ug/kg	MS ug/kg	MS %	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
83-32-9	Acenaphthene	ND	92.2	97.0	105	82.9	90	16	29-139/30
120-12-7	Anthracene	ND	92.2	902	978* a	98.9	107	160* b	10-182/30
56-55-3	Benzo(a)anthracene	ND	92.2	108	117	109	118	1	35-149/30
205-99-2	Benzo(b)fluoranthene	ND	92.2	82.1	89	76.3	83	7	22-174/30
207-08-9	Benzo(k)fluoranthene	ND	92.2	113	123	101	110	11	10-185/30
50-32-8	Benzo(a)pyrene	154	92.2	118	-39* a	94.7	-64* a	22	10-168/30
218-01-9	Chrysene	476	92.2	522	50	442	-37* c	17	10-168/30
53-70-3	Dibenzo(a,h)anthracene	ND	92.2	97.4	106	98.1	106	1	12-160/30
206-44-0	Fluoranthene	ND	92.2	115	125	109	118	5	20-156/30
86-73-7	Fluorene	175	92.2	447	295* a	350	190* a	24	10-164/30
193-39-5	Indeno(1,2,3-cd)pyrene	ND	92.2	102	111	95.3	103	7	29-136/30
91-20-3	Naphthalene	428	92.2	639	229	562	145	13	10-258/30
129-00-0	Pyrene	87.2	92.2	212	135	196	118	8	10-196/30

CAS No.	Surrogate Recoveries	MS	MSD	D56387-6	Limits
4165-60-0	Nitrobenzene-d5	137%	135%	113%	10-175%
321-60-8	2-Fluorobiphenyl	84%	77%	69%	25-130%
1718-51-0	Terphenyl-d14	109%	104%	105%	41-133%

- (a) Outside control limits due to possible matrix interference.
- (b) Variability of recovery may be due to sample matrix/homogeneity.
- (c) Outside control limits due to high level in sample relative to spike amount.

\* = Outside of Control Limits.

## GC Semi-volatiles

---

### QC Data Summaries

---

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

# Method Blank Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9681-MB	FI11606.D	1	04/04/14	JS	04/04/14	OP9681	GFI733

The QC reported here applies to the following samples:

Method: SW846-8015B

D56366-1, D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	6.7	5.0	mg/kg	

CAS No.	Surrogate Recoveries	Limits
84-15-1	o-Terphenyl	95% 20-130%

# Blank Spike Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9681-BS	FI11608.D	1	04/04/14	JS	04/04/14	OP9681	GFI733

The QC reported here applies to the following samples:

Method: SW846-8015B

D56366-1, D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-DRO (C10-C28)	167	115	69	42-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	98%	20-130%

8.2.1

8

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D56366  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9681-MS	FI11610.D	1	04/04/14	JS	04/04/14	OP9681	GFI733
OP9681-MSD	FI11612.D	1	04/04/14	JS	04/04/14	OP9681	GFI733
D56366-6	FI11613.D	1	04/04/14	JS	04/04/14	OP9681	GFI734

The QC reported here applies to the following samples:

Method: SW846-8015B

D56366-1, D56366-2, D56366-3, D56366-4, D56366-5, D56366-6, D56366-7, D56366-8, D56366-9, D56366-10, D56366-11

CAS No.	Compound	D56366-6 mg/kg	Spike mg/kg	MS mg/kg	MS %	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	8.43	198	135	64	132	62	2	20-150/30

CAS No.	Surrogate Recoveries	MS	MSD	D56366-6	Limits
84-15-1	o-Terphenyl	88%	87%	83%	20-130%

8.3.1  
8

\* = Outside of Control Limits.

## Metals Analysis

---

### QC Data Summaries

---

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 04/02/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	10	.86	1.8		
Antimony	3.0	.21	.5		
Arsenic	2.5	.38	.63		
Barium	1.0	.02	.36	0.080	<1.0
Beryllium	1.0	.08	.06		
Boron	5.0	.08	.16		
Cadmium	1.0	.02	.28	-0.010	<1.0
Calcium	40	.22	6.8		
Chromium	1.0	.03	.03	0.020	<1.0
Cobalt	0.50	.04	.039		
Copper	1.0	.08	.13	0.030	<1.0
Iron	7.0	.15	1.8		
Lead	5.0	.21	.25	-0.25	<5.0
Lithium	0.50	.04	.13		
Magnesium	20	.68	1.8		
Manganese	0.50	.001	.038		
Molybdenum	1.0	.04	.13		
Nickel	3.0	.05	.07	0.030	<3.0
Phosphorus	10	1.5	1.2		
Potassium	200	9.9	12		
Selenium	5.0	.71	1.1	0.49	<5.0
Silicon	5.0	.47	1.1		
Silver	3.0	.03	.05	0.060	<3.0
Sodium	40	.49	3.7		
Strontium	5.0	.001	.022		
Thallium	1.0	.18	.46		
Tin	5.0	1.2	2.3		
Titanium	1.0	.01	.46		
Uranium	5.0	.29	.31		
Vanadium	1.0	.04	.043		
Zinc	3.0	.04	.16	1.2	<3.0

Associated samples MP12622: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
(\* ) Outside of QC limits

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

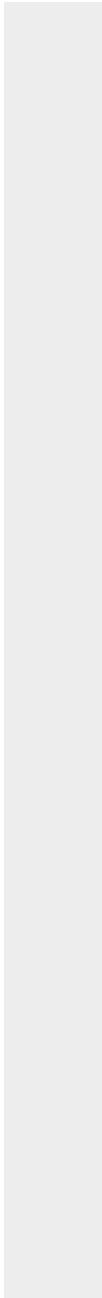
QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 04/02/14

Metal	RL	IDL	MDL	MB raw	final
-------	----	-----	-----	-----------	-------

(anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 04/02/14

Metal	D56366-1 Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic	anr				
Barium	248	433	231	80.1	75-125
Beryllium					
Boron					
Cadmium	0.23	47.5	57.7	81.9	75-125
Calcium					
Chromium	10.5	58.3	57.7	83.2	75-125
Cobalt					
Copper	115	166	57.7	88.4	75-125
Iron					
Lead	10.8	107	115	81.5	75-125
Lithium					
Magnesium					
Manganese					
Molybdenum					
Nickel	9.5	57.0	57.7	81.3	75-125
Phosphorus					
Potassium					
Selenium	0.0	89.4	115	77.4	75-125
Silicon					
Silver	0.0	17.1	23.1	74.1N(a)	75-125
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc	222	284	57.7	107.4	75-125

Associated samples MP12622: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.1.2  
 9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 04/02/14

Metal	D56366-1 Original MS	SpikeLot ICPALL2	% Rec	QC Limits
-------	-------------------------	---------------------	-------	--------------

(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested  
(a) Spike recovery indicates possible matrix interference.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 04/02/14

Metal	D56366-1 Original MSD		SpikeLot ICPAL2 % Rec		MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic	anr					
Barium	248	435	229	81.8	0.5	20
Beryllium						
Boron						
Cadmium	0.23	46.8	57.2	81.5	1.5	20
Calcium						
Chromium	10.5	57.9	57.2	83.3	0.7	20
Cobalt						
Copper	115	166	57.2	89.2	0.0	20
Iron						
Lead	10.8	105	114	80.6	1.9	20
Lithium						
Magnesium						
Manganese						
Molybdenum						
Nickel	9.5	56.3	57.2	80.8	1.2	20
Phosphorus						
Potassium						
Selenium	0.0	88.5	114	77.4	1.0	20
Silicon						
Silver	0.0	17.3	22.9	75.7	1.2	20
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc	222	279	57.2	99.7	1.8	20

Associated samples MP12622: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.1.2  
 9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

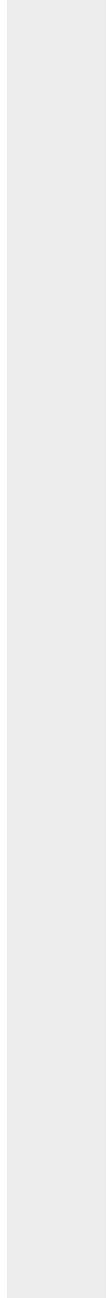
QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 04/02/14

Metal	D56366-1 Original MSD	SpikeLot ICPALL2	% Rec	MSD RPD	QC Limit
-------	--------------------------	---------------------	-------	------------	-------------

(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



9.1.2  
9

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: mg/kg

Prep Date: 04/02/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	180	200	90.0	80-120
Beryllium				
Boron				
Cadmium	46.7	50	93.4	80-120
Calcium				
Chromium	48.5	50	97.0	80-120
Cobalt				
Copper	46.1	50	92.2	80-120
Iron				
Lead	96.9	100	96.9	80-120
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel	49.1	50	98.2	80-120
Phosphorus				
Potassium				
Selenium	95.6	100	95.6	80-120
Silicon				
Silver	19.7	20	98.5	80-120
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	52.6	50	105.2	80-120

Associated samples MP12622: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.1.3  
 9

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: mg/kg

Prep Date: 04/02/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
 Matrix Type: SOLID

Methods: SW846 6010C  
 Units: ug/l

Prep Date: 04/02/14

Metal	D56366-1 Original SDL 1:5		%DIF	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	2300	2830	23.3*(a)	0-10
Beryllium				
Boron				
Cadmium	2.10	0.00	100.0(b)	0-10
Calcium				
Chromium	96.7	119	24.2*(a)	0-10
Cobalt				
Copper	1070	1180	11.0*(a)	0-10
Iron				
Lead	120	171	42.9 (b)	0-10
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel	88.1	91.0	2.7	0-10
Phosphorus				
Potassium				
Selenium	0.00	0.00	NC	0-10
Silicon				
Silver	0.00	0.00	NC	0-10
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	2050	2790	35.8*(a)	0-10

Associated samples MP12622: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.1.4  
 9

SERIAL DILUTION RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12622  
Matrix Type: SOLID

Methods: SW846 6010C  
Units: ug/l

Prep Date: 04/02/14

Metal	D56366-1	QC
	Original SDL 1:5 %DIF	Limits

- (anr) Analyte not requested
- (a) Serial dilution indicates possible matrix interference.
- (b) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12624  
Matrix Type: SOLID

Methods: SW846 6020A  
Units: mg/kg

Prep Date: 04/01/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	25	.55	.75		
Antimony	0.20	.0011	.029		
Arsenic	0.10	.0085	.024	-0.0070	<0.10
Barium	1.0	.008	.16		
Beryllium	0.10	.008	.049		
Boron	20	.25	.07		
Cadmium	0.050	.018	.038		
Calcium	200	2.8	13		
Chromium	1.0	.027	.11		
Cobalt	0.10	.0025	.0085		
Copper	1.0	.03	.1		
Iron	5.0	1.8	1.8		
Lead	0.25	.004	.0075		
Magnesium	50	.65	.65		
Manganese	0.50	.06	.07		
Molybdenum	0.50	.025	.046		
Nickel	1.0	.0044	.17		
Phosphorus	30	1.3	4.9		
Potassium	100	1.5	2.5		
Selenium	0.20	.03	.13		
Silver	0.050	.00095	.01		
Sodium	250	2.5	5.5		
Strontium	10	.005	.027		
Thallium	0.10	.0012	.0075		
Tin	5.0	.032	2.3		
Titanium	1.0	.03	.085		
Uranium	0.25	.00085	.0015		
Vanadium	2.0	.019	.11		
Zinc	5.0	.11	1.4		

Associated samples MP12624: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
(\* ) Outside of QC limits  
(anr) Analyte not requested

9.2.1  
9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12624  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 04/01/14

Metal	D56366-1 Original MS		SpikeLot ICPALL2 % Rec		QC Limits
Aluminum					
Antimony					
Arsenic	2.6	123	115	104.3	75-125
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium	anr				
Vanadium					
Zinc					

Associated samples MP12624: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested

9.2.2  
 9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12624  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 04/01/14

Metal	D56366-1 Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic	2.6	121	114	103.6	1.6	20
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Magnesium						
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium	anr					
Vanadium						
Zinc						

Associated samples MP12624: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested

9.2.2  
 9

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12624  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: mg/kg

Prep Date: 04/01/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	102	100	102.0	80-120
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium	anr			
Vanadium				
Zinc				

Associated samples MP12624: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (anr) Analyte not requested

9.2.3  
 9

SERIAL DILUTION RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12624  
 Matrix Type: SOLID

Methods: SW846 6020A  
 Units: ug/l

Prep Date: 04/01/14

Metal	D56366-1		QC	
	Original	SDL 5:25	%DIF	Limits
Aluminum				
Antimony				
Arsenic	24.0	22.9	4.4	0-10
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium	anr			
Vanadium				
Zinc				

Associated samples MP12624: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (anr) Analyte not requested

9.2.4  
 9

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	43	210		
Antimony	150	11	95		
Arsenic	130	19	28		
Barium	50	1	7		
Beryllium	50	4	6		
Boron	250	4	33		
Cadmium	50	1	1.8		
Calcium	2000	11	210	-1.5	<2000
Chromium	50	1.5	2		
Cobalt	25	2	2.9		
Copper	50	4	9.5		
Iron	350	7.5	48		
Lead	250	11	110		
Lithium	25	2	14		
Magnesium	1000	34	95	9.5	<1000
Manganese	25	.05	2.3		
Molybdenum	50	2	4.2		
Nickel	150	2.5	4.4		
Phosphorus	500	75	100		
Potassium	5000	500	1400		
Selenium	250	36	55		
Silicon	250	24	26		
Silver	150	1.5	3		
Sodium	2000	25	850	151	<2000
Strontium	25	.05	.6		
Thallium	50	9	20		
Tin	250	60	80		
Titanium	50	.5	11		
Uranium	250	15	28		
Vanadium	50	2	2		
Zinc	150	2	16		

Associated samples MP12634: D56366-1A, D56366-8A

Results < IDL are shown as zero for calculation purposes  
(\* ) Outside of QC limits

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

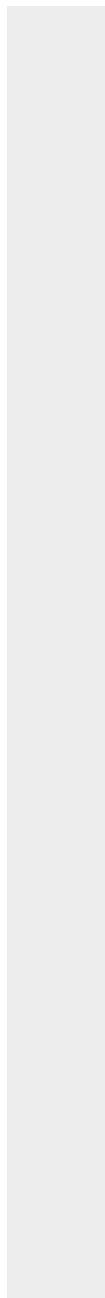
QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	RL	IDL	MDL	MB raw	final
-------	----	-----	-----	-----------	-------

(anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	45600	186000	125000	112.3	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	3300	135000	125000	105.4	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	583000	752000	125000	135.2(a)	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP12634: D56366-1A, D56366-8A

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.3.2  
 9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A Original MS	SpikeLot ICPAL2	% Rec	QC Limits
-------	---------------------------	--------------------	-------	--------------

- (N) Matrix Spike Rec. outside of QC limits
- (anr) Analyte not requested
- (a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

9.3.2  
9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit	
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	45600	191000	125000	116.3	2.7	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	3300	136000	125000	106.2	0.7	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	583000	778000	125000	156.0(a)	3.4	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP12634: D56366-1A, D56366-8A

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.3.2  
9

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
-------	----------------------------	---------------------------	------------	-------------

- (N) Matrix Spike Rec. outside of QC limits
- (anr) Analyte not requested
- (a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

9.3.2  
9

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 04/02/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	137000	125000	109.6	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	130000	125000	104.0	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	132000	125000	105.6	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP12634: D56366-1A, D56366-8A

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.3.3  
 9

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

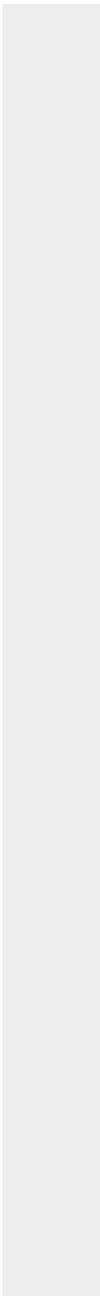
QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12634  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A Original SDL 1:5		%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	9160	9070	0.7	0-10
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	660	703	6.2	0-10
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	117000	119000	1.9	0-10
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP12634: D56366-1A, D56366-8A

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

9.3.4  
 9

SERIAL DILUTION RESULTS SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

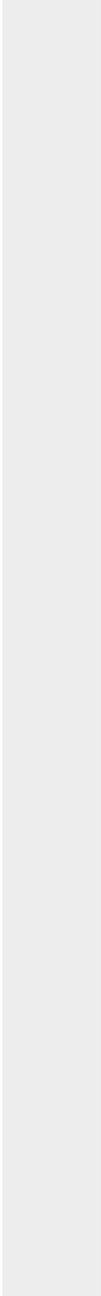
QC Batch ID: MP12634  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 04/02/14

Metal	D56271-13A	QC
	Original SDL 1:5 %DIF	Limits

(anr) Analyte not requested



BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12638  
Matrix Type: SOLID

Methods: SW846 7471B  
Units: mg/kg

Prep Date: 04/03/14

Metal	RL	IDL	MDL	MB raw	final
Mercury	0.083	.00088	.0067	-0.0032	<0.083

Associated samples MP12638: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
(\* ) Outside of QC limits  
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12638  
 Matrix Type: SOLID

Methods: SW846 7471B  
 Units: mg/kg

Prep Date: 04/03/14

Metal	D56366-1 Original MS	Spikelot HGWSR1	% Rec	QC Limits
Mercury	0.0050	0.39	0.414	93.0 75-125

Associated samples MP12638: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

QC Batch ID: MP12638  
 Matrix Type: SOLID

Methods: SW846 7471B  
 Units: mg/kg

Prep Date: 04/03/14

Metal	D56366-1 Original MSD	SpikeLot HGWSR1	% Rec	MSD RPD	QC Limit
-------	--------------------------	--------------------	-------	------------	-------------

Mercury	0.0050	0.40	0.407	97.1	2.5	20
---------	--------	------	-------	------	-----	----

Associated samples MP12638: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits  
 (N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

QC Batch ID: MP12638  
Matrix Type: SOLID

Methods: SW846 7471B  
Units: mg/kg

Prep Date: 04/03/14

Metal	BSP Result	Spikelot HGWSR1	% Rec	QC Limits
Mercury	0.31	0.333	93.0	80-120

Associated samples MP12638: D56366-1, D56366-8

Results < IDL are shown as zero for calculation purposes  
(\* ) Outside of QC limits  
(anr) Analyte not requested

## General Chemistry

---

### QC Data Summaries

---

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY  
 GENERAL CHEMISTRY

Login Number: D56366  
 Account: COCSCOG - Olsson Associates - Denver  
 Project: CM Production-Oliver Warren #1

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Chromium, Hexavalent	GP12302/GN24234	1.0	0.0	mg/kg	141	142	100.7	80-120%
Specific Conductivity	GN24184			umhos/cm	9995	10000	100.1	90-110%
pH	GN24162			su	8.00	8.03	100.4	99.3-100.7%

Associated Samples:

Batch GN24162: D56366-1, D56366-8

Batch GN24184: D56366-1, D56366-8

Batch GP12302: D56366-1, D56366-8

(\* ) Outside of QC limits

10.1  
10

DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Chromium, Hexavalent	GP12302/GN24234	D56390-2	mg/kg	0.0	0.0	0.0	0-20%
Redox Potential Vs H2	GN24155	D56387-3	mv	418	430	2.8	0-20%

Associated Samples:

Batch GN24155: D56366-1, D56366-8

Batch GP12302: D56366-1, D56366-8

(\*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Chromium, Hexavalent	GP12302/GN24234	D56390-2	mg/kg	0.0	40	35.9	89.7	75-125%

Associated Samples:

Batch GP12302: D56366-1, D56366-8

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

10.3  
10

MATRIX SPIKE DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: D56366  
Account: COCSCOG - Olsson Associates - Denver  
Project: CM Production-Oliver Warren #1

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Chromium, Hexavalent	GP12302/GN24234	D56390-2	mg/kg	0.0	40	38.8	7.8	20%

Associated Samples:

Batch GP12302: D56366-1, D56366-8

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

10.4  
10



04/29/14

Technical Report for

Olsson Associates - Denver

CM Production-Oliver Warren #1

013-1681

Accutest Job Number: D56366R

Sampling Date: 03/27/14

Report to:

Olsson Associates  
4690 Table Mountain Drive #200 Suite 200  
Golden, CO 80403  
jhix@olssonassociates.com

ATTN: James Hix

Total number of pages in report: **14**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Scott Heideman  
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), TX (T104704511)

This report shall not be reproduced, except in its entirety, without the written approval of Accutest Laboratories.  
Test results relate only to samples analyzed.

# Table of Contents

-1-

<b>Section 1: Sample Summary</b> .....	<b>3</b>
<b>Section 2: Case Narrative/Conformance Summary</b> .....	<b>4</b>
<b>Section 3: Summary of Hits</b> .....	<b>5</b>
<b>Section 4: Sample Results</b> .....	<b>6</b>
<b>4.1: D56366-2R: CMOW-WP@10NW</b> .....	7
<b>4.2: D56366-5R: CMOW-WP@11N</b> .....	8
<b>Section 5: Misc. Forms</b> .....	<b>9</b>
<b>5.1: Chain of Custody</b> .....	10
<b>Section 6: GC/MS Semi-volatiles - QC Data Summaries</b> .....	<b>11</b>
<b>6.1: Method Blank Summary</b> .....	12
<b>6.2: Blank Spike Summary</b> .....	13
<b>6.3: Matrix Spike/Matrix Spike Duplicate Summary</b> .....	14

1

2

3

4

5

6



## Sample Summary

Olsson Associates - Denver

Job No: D56366R

CM Production-Oliver Warren #1

Project No: 013-1681

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
D56366-2R	03/27/14	09:54 JH	03/28/14	SO	Soil	CMOW-WP@10NW
D56366-5R	03/27/14	11:15 JH	03/28/14	SO	Soil	CMOW-WP@11N

---

Soil samples reported on a dry weight basis unless otherwise indicated on result page.



## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** Olsson Associates - Denver

**Job No** D56366R

**Site:** CM Production-Oliver Warren #1

**Report Date** 4/29/2014 9:20:52 AM

On 03/28/2014, 2 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.5 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D56366R was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

### Extractables by GCMS By Method SW846 8270C

<b>Matrix</b> SO	<b>Batch ID:</b> OP9781
------------------	-------------------------

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D56951-5MS, D56951-5MSD were used as the QC samples indicated.
- The following samples were extracted outside of holding time for method SW846 8270C: D56366-2R, D56366-5R Analysis performed past the recommended method holding time as per client instructions.
- D56366-5R: Analysis performed past the recommended method holding time as per client instructions.
- D56366-2R: Analysis performed past the recommended method holding time as per client instructions.

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

## Summary of Hits

**Job Number:** D56366R  
**Account:** Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1  
**Collected:** 03/27/14



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

**D56366-2R**      **CMOW-WP@10NW**

No hits reported in this sample.

**D56366-5R**      **CMOW-WP@11N**

Benzo(g,h,i)perylene <sup>a</sup>	75.4 J	85	21	ug/kg	SW846 8270C
Chrysene <sup>a</sup>	374	85	21	ug/kg	SW846 8270C
Fluoranthene <sup>a</sup>	74.0 J	85	21	ug/kg	SW846 8270C
Fluorene <sup>a</sup>	595	85	21	ug/kg	SW846 8270C
1-Methylnaphthalene <sup>a</sup>	2350	85	21	ug/kg	SW846 8270C
2-Methylnaphthalene <sup>a</sup>	3220	85	42	ug/kg	SW846 8270C
Naphthalene <sup>a</sup>	856	85	21	ug/kg	SW846 8270C
Phenanthrene <sup>a</sup>	1240	85	21	ug/kg	SW846 8270C
Pyrene <sup>a</sup>	133	85	21	ug/kg	SW846 8270C

(a) Analysis performed past the recommended method holding time as per client instructions.

Sample Results

---

Report of Analysis

---

## Report of Analysis

<b>Client Sample ID:</b>	CMOW-WP@10NW	<b>Date Sampled:</b>	03/27/14
<b>Lab Sample ID:</b>	D56366-2R	<b>Date Received:</b>	03/28/14
<b>Matrix:</b>	SO - Soil	<b>Percent Solids:</b>	79.4
<b>Method:</b>	SW846 8270C SW846 3546		
<b>Project:</b>	CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	3G19264.D	1	04/23/14	DC	04/22/14	OP9781	E3G954
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

## BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	84	21	ug/kg	
208-96-8	Acenaphthylene	ND	84	21	ug/kg	
120-12-7	Anthracene	ND	84	21	ug/kg	
56-55-3	Benzo(a)anthracene	ND	84	21	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	84	21	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	84	21	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	84	21	ug/kg	
50-32-8	Benzo(a)pyrene	ND	84	21	ug/kg	
218-01-9	Chrysene	ND	84	21	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	84	21	ug/kg	
206-44-0	Fluoranthene	ND	84	21	ug/kg	
86-73-7	Fluorene	ND	84	21	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	84	21	ug/kg	
90-12-0	1-Methylnaphthalene	ND	84	21	ug/kg	
91-57-6	2-Methylnaphthalene	ND	84	42	ug/kg	
91-20-3	Naphthalene	ND	84	21	ug/kg	
85-01-8	Phenanthrene	ND	84	21	ug/kg	
129-00-0	Pyrene	ND	84	21	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
321-60-8	2-Fluorobiphenyl	80%		30-130%
4165-60-0	Nitrobenzene-d5	85%		19-130%
1718-51-0	Terphenyl-d14	82%		40-130%

(a) Analysis performed past the recommended method holding time as per client instructions.

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

## Report of Analysis

<b>Client Sample ID:</b>	CMOW-WP@11N	<b>Date Sampled:</b>	03/27/14
<b>Lab Sample ID:</b>	D56366-5R	<b>Date Received:</b>	03/28/14
<b>Matrix:</b>	SO - Soil	<b>Percent Solids:</b>	78.7
<b>Method:</b>	SW846 8270C SW846 3546		
<b>Project:</b>	CM Production-Oliver Warren #1		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 <sup>a</sup>	3G19265.D	1	04/23/14	DC	04/22/14	OP9781	E3G954
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

## BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	85	21	ug/kg	
208-96-8	Acenaphthylene	ND	85	21	ug/kg	
120-12-7	Anthracene	ND	85	21	ug/kg	
56-55-3	Benzo(a)anthracene	ND	85	21	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	85	21	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	85	21	ug/kg	
191-24-2	Benzo(g,h,i)perylene	75.4	85	21	ug/kg	J
50-32-8	Benzo(a)pyrene	ND	85	21	ug/kg	
218-01-9	Chrysene	374	85	21	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	85	21	ug/kg	
206-44-0	Fluoranthene	74.0	85	21	ug/kg	J
86-73-7	Fluorene	595	85	21	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	85	21	ug/kg	
90-12-0	1-Methylnaphthalene	2350	85	21	ug/kg	
91-57-6	2-Methylnaphthalene	3220	85	42	ug/kg	
91-20-3	Naphthalene	856	85	21	ug/kg	
85-01-8	Phenanthrene	1240	85	21	ug/kg	
129-00-0	Pyrene	133	85	21	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
321-60-8	2-Fluorobiphenyl	86%		30-130%
4165-60-0	Nitrobenzene-d5	77%		19-130%
1718-51-0	Terphenyl-d14	93%		40-130%

(a) Analysis performed past the recommended method holding time as per client instructions.

ND = Not detected MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

## Misc. Forms

---

### Custody Documents and Other Forms

---

Includes the following where applicable:

- Chain of Custody



## GC/MS Semi-volatiles

---

### QC Data Summaries

---

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

## Method Blank Summary

**Job Number:** D56366R  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9781-MB	3G19259.D	1	04/23/14	DC	04/22/14	OP9781	E3G954

The QC reported here applies to the following samples:

Method: SW846 8270C

D56366-2R, D56366-5R

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	67	17	ug/kg	
208-96-8	Acenaphthylene	ND	67	17	ug/kg	
120-12-7	Anthracene	ND	67	17	ug/kg	
56-55-3	Benzo(a)anthracene	ND	67	17	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	67	17	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	67	17	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	67	17	ug/kg	
50-32-8	Benzo(a)pyrene	ND	67	17	ug/kg	
218-01-9	Chrysene	ND	67	17	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	67	17	ug/kg	
206-44-0	Fluoranthene	ND	67	17	ug/kg	
86-73-7	Fluorene	ND	67	17	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	67	17	ug/kg	
90-12-0	1-Methylnaphthalene	ND	67	17	ug/kg	
91-57-6	2-Methylnaphthalene	ND	67	33	ug/kg	
91-20-3	Naphthalene	ND	67	17	ug/kg	
85-01-8	Phenanthrene	ND	67	17	ug/kg	
129-00-0	Pyrene	ND	67	17	ug/kg	

CAS No.	Surrogate Recoveries	Limits	
321-60-8	2-Fluorobiphenyl	94%	30-130%
367-12-4	2-Fluorophenol	95%	16-130%
4165-60-0	Nitrobenzene-d5	98%	19-130%
4165-62-2	Phenol-d5	98%	18-130%
1718-51-0	Terphenyl-d14	90%	40-130%
118-79-6	2,4,6-Tribromophenol	87%	17-130%

# Blank Spike Summary

**Job Number:** D56366R  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9781-BS	3G19260.D	1	04/23/14	DC	04/22/14	OP9781	E3G954

The QC reported here applies to the following samples:

Method: SW846 8270C

D56366-2R, D56366-5R

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
83-32-9	Acenaphthene	1670	1400	84	58-130
208-96-8	Acenaphthylene	1670	1440	86	58-130
120-12-7	Anthracene	1670	1590	95	67-130
56-55-3	Benzo(a)anthracene	1670	1550	93	63-130
205-99-2	Benzo(b)fluoranthene	1670	1560	94	42-157
207-08-9	Benzo(k)fluoranthene	1670	1530	92	38-175
191-24-2	Benzo(g,h,i)perylene	1670	1670	100	49-152
50-32-8	Benzo(a)pyrene	1670	1620	97	47-155
218-01-9	Chrysene	1670	1510	91	68-130
53-70-3	Dibenzo(a,h)anthracene	1670	1710	103	48-152
206-44-0	Fluoranthene	1670	1570	94	64-130
86-73-7	Fluorene	1670	1470	88	58-130
193-39-5	Indeno(1,2,3-cd)pyrene	1670	1680	101	45-153
90-12-0	1-Methylnaphthalene	1670	1300	78	55-130
91-57-6	2-Methylnaphthalene	1670	1350	81	54-130
91-20-3	Naphthalene	1670	1330	80	53-130
85-01-8	Phenanthrene	1670	1550	93	66-130
129-00-0	Pyrene	1670	1560	94	68-130

CAS No.	Surrogate Recoveries	BSP	Limits
321-60-8	2-Fluorobiphenyl	83%	30-130%
367-12-4	2-Fluorophenol	81%	16-130%
4165-60-0	Nitrobenzene-d5	84%	19-130%
4165-62-2	Phenol-d5	80%	18-130%
1718-51-0	Terphenyl-d14	97%	40-130%
118-79-6	2,4,6-Tribromophenol	90%	17-130%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** D56366R  
**Account:** COCSCOG Olsson Associates - Denver  
**Project:** CM Production-Oliver Warren #1

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP9781-MS	3G19262.D	1	04/23/14	DC	04/22/14	OP9781	E3G954
OP9781-MSD	3G19263.D	1	04/23/14	DC	04/22/14	OP9781	E3G954
D56951-5	3G19261.D	1	04/23/14	DC	04/22/14	OP9781	E3G954

The QC reported here applies to the following samples:

Method: SW846 8270C

D56366-2R, D56366-5R

CAS No.	Compound	D56951-5 ug/kg	Spike Q ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD	
83-32-9	Acenaphthene	ND		1900	1620	85	1900	1760	92	8	36-130/30
208-96-8	Acenaphthylene	ND		1900	1640	86	1900	1780	94	8	10-150/30
120-12-7	Anthracene	23.2	J	1900	1840	96	1900	2010	104	9	50-130/30
56-55-3	Benzo(a)anthracene	93.6		1900	1880	94	1900	1950	98	4	41-130/30
205-99-2	Benzo(b)fluoranthene	133		1900	1850	90	1900	2120	104	14	29-152/30
207-08-9	Benzo(k)fluoranthene	56.4	J	1900	1840	94	1900	1670	85	10	14-175/30
191-24-2	Benzo(g,h,i)perylene	73.5	J	1900	1910	97	1900	1960	99	3	15-164/30
50-32-8	Benzo(a)pyrene	95.6		1900	1930	96	1900	2000	100	4	27-151/30
218-01-9	Chrysene	112		1900	1890	94	1900	1940	96	3	46-130/30
53-70-3	Dibenzo(a,h)anthracene	ND		1900	1930	102	1900	1990	105	3	31-152/30
206-44-0	Fluoranthene	252		1900	2040	94	1900	2140	99	5	53-130/30
86-73-7	Fluorene	ND		1900	1730	91	1900	1850	97	7	24-134/30
193-39-5	Indeno(1,2,3-cd)pyrene	70.1	J	1900	1950	99	1900	2020	102	4	26-153/30
90-12-0	1-Methylnaphthalene	ND		1900	1430	75	1900	1700	89	17	21-130/30
91-57-6	2-Methylnaphthalene	ND		1900	1460	77	1900	1740	91	18	10-148/30
91-20-3	Naphthalene	21.1	J	1900	1410	73	1900	1690	88	18	27-130/30
85-01-8	Phenanthrene	206		1900	1960	92	1900	2090	99	6	38-130/30
129-00-0	Pyrene	198		1900	2050	97	1900	2060	98	0	53-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D56951-5	Limits
321-60-8	2-Fluorobiphenyl	82%	91%	89%	30-130%
367-12-4	2-Fluorophenol	67%	80%	85%	16-130%
4165-60-0	Nitrobenzene-d5	77%	91%	93%	19-130%
4165-62-2	Phenol-d5	69%	83%	92%	18-130%
1718-51-0	Terphenyl-d14	98%	99%	86%	40-130%
118-79-6	2,4,6-Tribromophenol	90%	93%	84%	17-130%

\* = Outside of Control Limits.