Form 27: Remediation Workplan

Rangely C-4 Incident

Rangely, Colorado

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1.0 BACKGROUND

On March 5, 2017, Chevron Pipe Line Company (CPL) was notified of a release of crude oil near Rangely, Colorado, approximately 7.1 miles west-northwest of Rangely, Colorado in Rio Blanco County from the Rangely C-4 pad (Site). Product flowed overland approximately 1.8 miles from Rangely C-4 from coordinates 40° 7' 51.86" N, -108° 55' 11.05" W to the Syphon V dam at coordinates 40° 7' 48.76" N, -108° 53' 30.87" W, where it was contained by a permanent siphon dam. The general location of the Site is presented in Figure 1.

Following notifications to United States Environmental Protection Agency (USEPA) Region 8, Colorado Oil and Gas Conservation Commission (COGCC), and other regulatory agencies, as appropriate, CPL contacted emergency response contractors to initiate oil recovery operations and deployment of containment and recovery equipment. Additional resources to assist with air monitoring, environmental sampling and visual oil assessments (SCAT) associated with the release, were subsequently dispatched to the Site on March 6, 2017.

1.1 A summary of the event from the NTL 3A form is cited below

On Sunday, March 5, 2017 at 1155, a spill was confirmed by site personnel and the pipeline was shut-in at 1215. 115 barrels of crude oil spilled into an unnamed dry drainage feature, where all crude oil mobility was stopped at the Siphon Dam V approximately 1.8 miles downstream of the leak site. The cause of the event is under investigation. The impacted area is approximately 9,815 feet long with an average width varying between 2 and 5 feet.

1.2 Immediate Action Taken to Control and Contain

Valves were closed to isolate the leaking section of pipe and clamps were installed on the pipe to control the leak. The pipe was cut around the leak locations and a new pipe was welded in place. The pipeline was shut in, purged of free liquid, and will be plugged and abandoned. A catchment basin was constructed approximately 0.8 miles downgradient from the release site for the recovery of spilled product. All spilled product was stopped from migrating further downstream and contained by a previously constructed weir dam located approximately1.8 miles from the spill. Vacuum trucks were mobilized on March 5, 2017 to recover fluids from the up gradient side of the berm and the dam. Water flushing of product was conducted to mobilize this material to catchment basins where the product and recoverable water was removed via vacuum truck and introduced into the Chevron North America Exploration and Production Company's (CNAEP) East End Water Plant. Impacted and/or stained soils are being removed via excavator / hand shoveling and transferred to the Chevron Upstream landfarm for remediation compliant to COGCC rules and standards.

1.3 Unified Command Communications

Situation Report-Outs (Sitrep) were developed to document daily field activities for operations, cumulative/daily material recovery (oily water, oily soils, water flushing volumes), wildlife impacts if observed, SCAT findings/observations, and photologs of pre-defined sites for illustrating site clean-up over time. Sitreps were/are provided to stakeholders (CPL, EPA, BLM, USFWS, and COGCC) for communication and review.

- March 9th through April 7th 2017: Daily Sitreps
- April 7th through May 1st 2017: Weekly Sitreps
- May 1st Onward (Remediation Phase): Monthly Status Reports

2.0 SITE DESCRIPTION

The Site is located approximately 0.25-miles west-northwest of Highway 64 and approximately 7.1 miles west-northwest of Rangely, Rio Blanco County, Colorado. Representatives determined that the Site is underlain by the Billings silty clay loam (bottom portions) and Chipeta silty clay loam (upper portions), per information obtained from Bureau of Land Management (BLM), found at the USDA Web Soil Survey website (https://websoilsurvey.nrcs.usda.gov/app/). Areas impacted by the spill are dominantly non-cropland rangeland. Surface water is not present at the Site except during active rain events. Groundwater at the Site is typically encountered at depths exceeding 5,000 feet below grade. To assist with focusing response and remediation efforts during this event, the Site was divided into operational units (i.e., Divisions), as presented in Figure 1. Of note, the site map was updated in mid-March to sub-divide Division 3 to include Division 4 and Division 5. Figure 1 is the updated site map.

3.0 HEALTH AND SAFETY

Site personnel reviewed and adhered to the site-specific Health and Safety Plan (HASP), as presented in the Incident Command System (ICS) form ICS-208. All operations were conducted under weather and–environmental conditions which did not create unsafe working conditions. Safety issues or concerns were immediately addressed to the CPL Incident Commander and safety representatives. No injuries or first aid-required incidents occurred during the event and subsequent response operations.

4.0 PHASES

There are three phases that will be utilized following this event. These phases are defined below and are described in greater detail in Sections 5.0 and 6.0.

- Phase I (Emergency Response Phase) – Started when the release was detected on March 5, 2017 and will conclude once all removable free oil is recovery and remedial activities are solely determined based on analytical endpoints.
- Phase II (Site Remediation Phase) – Expected to begin May 1st 2017 and will conclude when remediation limits are achieved in concurrence with COGCC.
- Phase III (Site Restoration) – This activity is expected to start in August 2017 with BLM approval of a site restoration plan. Some early restoration activities may occur before August 2017 with BLM approval. Completion of the Site Restoration scope will be obtained based on parameters established in the plan and will conclude once restoration goals and monitoring are achieved in concurrence with BLM.

See attached Figure A, below, for a schematic flow diagram of these phases (excluding specifics on Phase III as plans are still under development at the time of this submittal).

5.0 PHASE I: EMERGENCY RESPONSE PLAN (MARCH 5-APRIL 30, 2017)

5.1 Initial Response Operations

5.1.1 *Site Assessment*

A Shoreline Cleanup and Assessment Technique (SCAT) was implemented for this response as an impact assessment supporting the ICS planning and operations staff based on accepted methodology defined by National Oceanic and Atmospheric Administration (NOAA). SCAT was initiated on March 6, 2017 (fully implemented on March 8, 2017), and continued daily throughout the areas of operations until late March at which time SCAT was reduced to once per week based on minimal impacts observed on-site.

5.1.2 *Perform Initial Response and Oil Recovery Operations*

As of the date of this document, the following key actions have been undertaken in response to this incident:

a. Initial Source was controlled by shutting the block valves on both sides of the compromised section of pipeline and pigging was used to displace the residual oil, once access was safely granted.

b. Damaged section of pipeline was cut out and replaced on March 16, 2017 and was sent in for analysis. This pipeline section is permanently abandoned.

c. CPL has prepared and submitted response plans to the IC for review and for comment which are to be used to control the work and internal/external reporting. Plans generated for this effort include:

    a. Safety Action Plan
    b. Incident Action Plans
    c. Air Monitoring Plan
    d. SCAT Plan
    e. Waste Management Plan
    f. Decontamination Plan
    g. Wildlife Management Plan
    h. Wildlife Deterrence Plan
    i. Response Sampling Plan

d. Security: Access to the Source Area was limited by construction fencing.

e. SCAT: Teams have conducted regular reconnaissance and observations from the Incident Location to Siphon V Dam, visually assessing the condition of the dry drainage feature and the adjoining sidewalls. Data generated by the assessment have been used to help prioritize recovery operations and determine appropriate resources on the response.

f. Source Area Soil Excavation: Oil impacted soils at the release location were excavated to a depth ranging from approximately 1 to 6 feet below grade and 2 to 6 inches below grade within the dry drainage feature of Division 2 to the Siphon

Dam. Approximately 2,377 cubic yards (as of April 11, 2017) of material have been transported to Chevron North America Exploration & Production (CNAEP)-owned facilities for land farming. Three isolated excavation areas (immediately under release pipeline, adjacent to the release pipeline, and one area approximately 200 feet from the release area; See Appendix IV map) that were non-representative of the general excavation operation occurred in Division 1. Soils in these excavation areas were sampled for analytical measurements per COGCC Table 910-1, and backfilled with clean fill material before results were available to ensure safe site conditions. Chevron has agreed to further remediate these three isolated excavation areas if warranted based on analytical measurements of the soil. These data will be provided as part of the May 17, 2017 response sampling and results report.

g. Oil and Water Containment and Recovery: Water flushing operations were conducted to liberate and mobilize residual hydrocarbons from center channel sediments in tandem with manual brooming and vacuum truck operations along the length of Divisions 2, 3, and 4. Recovered solids have been delivered to CNAEP's landfarming and liquids are introduced CNAEP's East End Water Plant. As of April 11, 2017, there have been 11,636 barrels of recovery liquid and 2,377 cubic yards of impacted soils removed. Recovered fluids includes water present from snow melt, rainwater, and introduction of flushing water.

h. Initial Wildlife Receptor Survey: An initial wildlife receptor survey was conducted and will be updated during Phase II post-response activities to identify and quantify potential wildlife species affected by the release and subsequent response activities.

i. Wildlife Deterrents: To reduce the likelihood of wildlife impacts resulting from this incident and subsequent response activities, Mylar reflective ribbon and Terror-eyes were placed throughout the area of operations at targeted locations identified by SCAT and Wildlife Survey teams as indicative of wildlife activity (e.g., catchment basins, etc.). Assessment of the wildlife deterrent measures deployed was documented daily by the wildlife survey teams.

j. Environmental Sampling and Exposure Reduction: CPL has performed preliminary sampling of environmental media (dry drainage feature and non-affected background locations and associated soils) to characterize site impacts and validate the sampling and analyses procedures. Appendix III presents analytical results from samples collected during the response phase from March 9 to 19, 2017. All sampling locations excluding the excavation bottom soils have been further remediated and do not represent current site conditions. From the results presented in Appendix III a few key conclusions and statements can be drawn from these data including:

k. Sampling locations designated as HER (Horizontal Extent, Right Bank Descending) and HEL (Horizontal Extent, Left Bank Descending) should serve as surrogate background samples for determining background levels as to Table 910-1 constituents based on lack the of hydrocarbon impacts as these samples were located outside the zone of incident exposure to oil. CUL (centerline) samples were collected from the centerline of the dry drainage feature and should

represent hydrocarbon impacts. The assumptions stated above are validated based on results from Appendix III.

i. Arsenic concentrations in surrogate background samples exceed the Table 910-1 limits which is expected due to natural geological conditions at the site. Arsenic ranged from 5.7 to 7.8 mg/kg in all samples with no apparent increase for samples with hydrocarbon impacts.

ii. Benzo(a)pyrene and Dibenz(a,h)anthracene are not likely to be a driver for site remediation, rather total petroleum hydrocarbons (TPH) thresholds will be the key constituent determining additional remediation. Reporting limits for these two polycyclic aromatic hydrocarbons (PAH) will be targeted for improvement by the analytical laboratory for future confirmation sampling; however, due to the lack of J-flagged data, these constituents are not expected to exceed Table 910-1 limits once final remediation activities are completed.

iii. Additional remediation activities will occur for the three excavation areas and these actions will be developed once additional soil sampling results are available from the March 30, 2017 sampling event. Approximately 15-20 samples were collected adjacent to the three excavation sites and will aid in the development of a remediation plan for Division I around the leak site. TPH values exceeded the Table 910-1 limit of 500 mg/kg as total TPH and RC4-EX-16-0.25 slightly exceeded the benzene limit.

iv. The full analytical laboratory reports for data presented in Appendix III will be provided to COGCC as part of the May 17, 2017 response phase sampling and analysis report.

l. Worker Exposure Air Monitoring: Monitoring for benzene and total VOCs was conducted in accordance with the Air Monitoring Plan developed for this response.

m. Federal and State Approvals: the RP has coordinated efforts with Federal and State level environmental stakeholders, both on-site and off-site including:

- U.S. Environmental Protection Agency (USEPA);
- U.S. Fish and Wildlife Service (USFWS);
- Bureau of Land Management (BLM);
- Colorado Oil & Gas Conservation Commission (COGCC);
- Colorado Department of Parks and Wildlife (CDPW); and,
- Colorado Department of Public Health and Environment (CDPHE).

5.2 Secondary Response Operations

The following sections describe operations that were or continue to be completed during Phase I.

5.2.1 *Qualitative and Initial Quantitative Assessment - Support Response Operations*

An initial assessment of the dry drainage feature between Point of Release (POR) [40° 7' 51.86" N, -108° 55' 11.05" W] to Siphon V dam [40° 7' 48.76" N, -108° 53' 30.87" W] will be conducted to delineate hydrocarbon impacts related to this incident. The assessment will include qualitative (e.g., the use of Photo-ionization Detectors (PIDs), observations and documentation consistent with accepted SCAT principles, etc.). and/or quantitative (e.g., collection of surface soil samples for laboratory analysis of Total Petroleum Hydrocarbons) analysis components. This initial soil screening analysis for TPH was conducted to serve as a measurement to determine where additional soil excavation was warranted during the response phase when visual observations could not discriminate this need. The following paragraphs summarize these activities:

- Visual SCAT assessment of the entire spill impacted area occurred daily from March 10, 2017 to March 24, 2017 when after this date, SCAT was reduced in frequency to once per week (every Monday). SCAT results were used to develop operational clean-up activities during the response phase as part of ICS-204 work assignments.
- A soil screening quantitative assessment comprised of total petroleum hydrocarbon analysis (TPH) via EPA Method 8015C was conducted on March 20 and 21, 2017 for Division 3 (AC McLaughlin #4 to downstream approximately 1900 feet) and from release site to Drip Trap 18 on March 29, 2017, respectively. Additional soil TPH samples were collected on April 4, 2017 to characterize soils for TPH between Drip Trap 18 and AC McLaughlin 4. Approximately 18, 90, and 10 discrete surface soil samples to a depth of 3 inches were collected and submitted for Total Petroleum Hydrocarbons (TPH) analysis by Method 8015C to TestAmerica Laboratory Inc (Denver, Colorado).

A summary map and table of soil TPH results, up to March 22 2017, is presented in Appendix IV. These TPH results were used to guide response phase operations, specifically work occurring from March 21 to April 30, 2017. To date, all locations have been further remediated and do not reflect current site soil TPH concentrations. Sample RC4-SC-36 and RC4-SC-37 were, however, collected after the initial soil excavation method (March 20, 2017) and reflect a composite sample of the top 12 inches. TPH results for these two samples were below the Table 910-1 TPH limit and were reported as 174 and 247 mg/kg, respectively.

5.2.2 *Limited Surficial Excavation for Purpose of Contaminant Removal*

Soil excavation will be conducted to remove impacted and stained soils to sufficiently mitigate the mobility of residual oil contamination during precipitation/storm events and lower contamination levels to meet COGCC Table 910-1constituent limits or reduce these levels to a point in which natural biodegradation can further reduce these levels to Table 910-1 limits over a 6 to 16-month period. Excavation activities will include techniques to minimize soil and plant disturbances to the most practical extent possible by scraping

with hand tools until staining is no longer observed and introducing heavy equipment only where warranted.

5.2.3 *Flushing and Targeted Recovery of Residual Material*

Water flushing may be conducted to liberate and mobilize residual hydrocarbons from center channel sediments. This activity may be conducted in tandem with manual agitation using brooms and residual oil recovery using vacuum trucks recovery along the length of Divisions 2, 3, 4, and 5. Based on the oil recovery efficiency to date, future water flushing operations are not currently planned, but this technique will serve as an option to further enhance remediation efforts if warranted. The last flushing operation occurred on March 18, 2017. Recovered solids and liquids have been land farmed and introduced into production, respectively, at CNAEP facilities.

5.2.4 *Catchment Basin Construction*

On March 19 and 20, 2017 three (3) catch basins were constructed by Operations personnel to limit or arrest mobility of residual hydrocarbons in Division 1 and 2 as Division 3 had a catchment basin built at Drip Trap 18 and the final catchment basin, Siphon V, was already constructed prior to the incident (Division 5). The basins, in general, are constructed approximately 6-8 feet below grade surface (ft-bgs), and lined with plastic sheeting (i.e. visqueen). Water collecting in all basins was removed via vacuum trucks when sufficient volumes were present or residual oil was observed and required removal. Based on site inspections of water collecting in all catchment basins during the week of April 3 2017, only Drip Trap 18 had visual signs of a minimal amount of residual oil. Further inspection of Drip Trap 18 indicated that catchment basin banks had stained soil causing this observation and thus these soils were excavated to remove residual oil on April 4th and 5th 2017.

5.2.5 *Carbon and Sorbent Boom*

CPL directed the filling and strategic placement of Granular Activated Carbon (GAC)-filled mesh sacks and sorbent booms to adsorb residual hydrocarbons from the dry drainage feature during precipitation and/or introduced flushing events. Sorbents booms were staked to maintain position. Locations of booms and GAC-filled sacks were documented and strategically placed in locations based on field conditions, to maximize efficacy of hydrocarbon capture. Locations of the GAC-filled mesh and sorbent placements are illustrated on Figures 4 through 13.

5.2.6 *Mechanic Tilling*

CPL will implement mechanical tilling of impacted soils to enhance the rate of natural biodegradation by increasing the surface area of residual oil contaminants in soil and promoting aerobic conditions to favor higher degradation rates.

5.2.7 *Air Monitoring*

In accordance with the IC approved Air Monitoring Plan, worker exposure air monitoring was initiated on March 8, 2017 and will be continued until evaluation of the data provides sufficient justification to cease this activity, or as otherwise directed by IC.

5.2.8 *Background Sampling*

To understand site background conditions, CPL is proposing to collect soil from 10 sampling locations from non-contaminated dry drainage features illustrated in Figure 11. Surface soil samples will be collected from the 0-3 inches below grade surface or sidewall and follow sampling guidelines in accordance with the IC-approved *Response Sampling Plan*. Sampling chain-of-custody and analytical procedures will also comply to the *Rangely C4 Response Sampling Plan (Appendix I)*. Background soil analytical data will be presented to COGCC as part of the Response Phase Analytical Report by May 17, 2017.

5.2.9 *Response Remedial Activities – Current (April to May 1, 2017)*

Figures 2 through 10 illustrate the current remediation activities that will occur from April 1 to May 1, 2017 to recover and remediate impacted soils previously identified through SCAT observations and available soil TPH sampling results. Upon completion of these activities, the incident will progress from the response phase to the remediation phase, signaling the need to develop a baseline TPH, selected polyaromatic hydrocarbons (PAH), and Benzene, Toluene, Ethylbenzene, and xylene (BTEX) survey of site soils impacted by the release.

6.0 PHASE II: REMEDIATION PHASE

Planned to begin May 1, 2017 onward.

The following section describes operations that are anticipated to be initiated after the Response Phase, and will continue through the end of remediation and site restoration. Figure 1 is included below to illustrate the proposed Remediation Phase activities with key comments listed on the right-hand side of this figure. Additionally, all proposed deliverables from CPL to COGCC during this phase are presented in Table 1 below.

6.1 Remediation Phase Sampling

6.1.1 Remediation Sampling: Post Response Phase

Since response phase sampling was conducted to assist operations staff in determining additional excavation areas, some sample results are no longer representative of current site conditions as this additional stained or impacted soil was removed and is no longer located at the incident site. To develop a current soil characterization map for site soil TPH levels, a baseline sampling event is warranted along with selected PAH and BTEX measurements. CPL will collect discrete soil samples in all Divisions impacted by the release and analyze these samples for TPH, PAHs, and BTEX in accordance with applicable Colorado regulations (SW-846 Methods). These results will be incorporated into a site incident map which delineates the incident site (dry drainage feature) into three categories for future remedial actions:

(1) confirmation sampling,

(2) enhanced biodegradation and monitoring, and

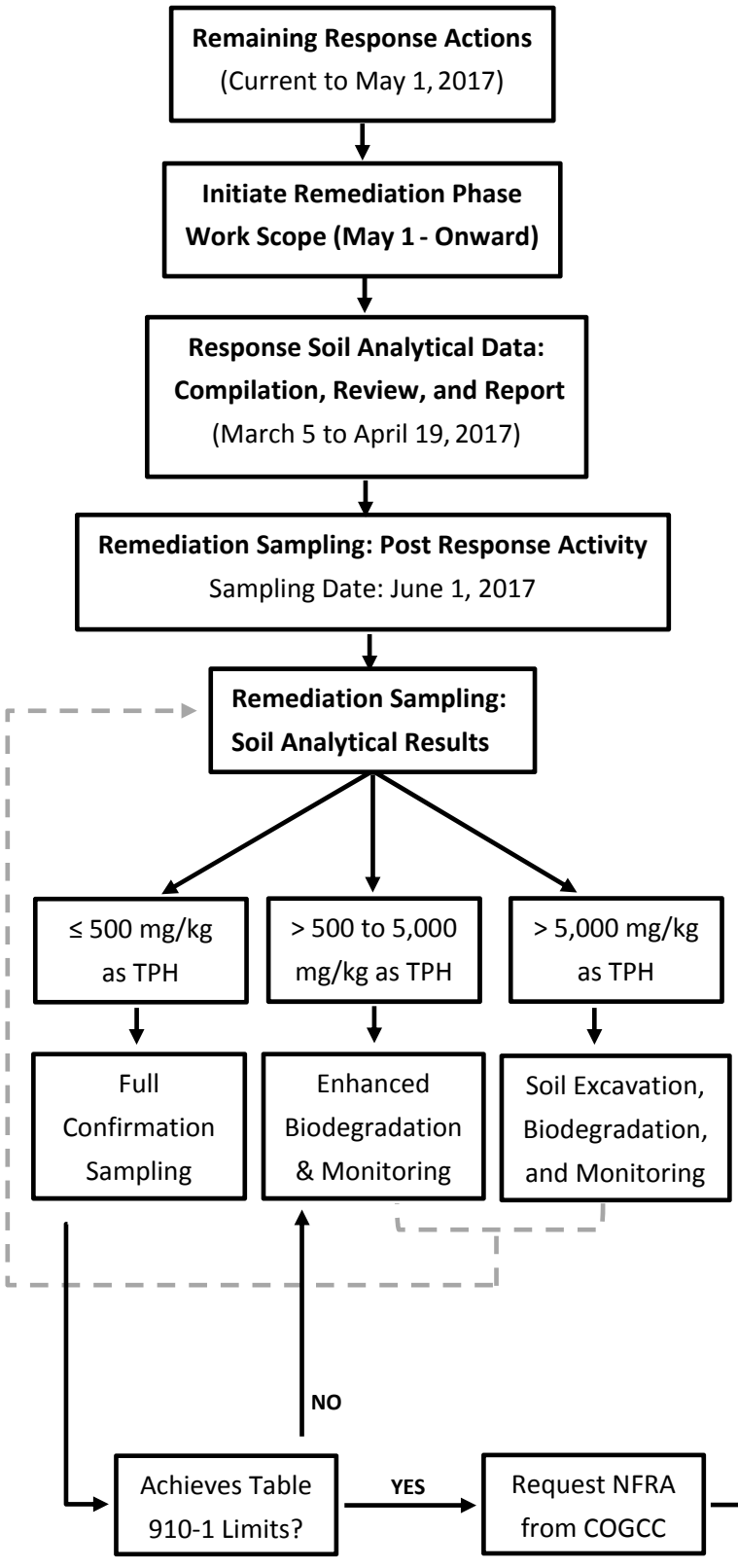
(3) excavation, biodegradation, and monitoring.

6.1.2 **Confirmation Sampling**

Soils with TPH concentrations ≤ 500 mg/kg are anticipated to additionally meet all other Table 910-1 analyte limits. Areas delineated as needing confirmation sampling will be communicated to the COGCC and a sampling and analysis plan will be delivered to COGCC for approval and coordination on the date of sampling. The number and location of surface soil samples will be determined in consultation with COGCC. All soil samples will be collected from 0-3 inches below grade surface. Delineated soil areas meeting applicable analyte limits in Table 910-1 will be requested for no further remedial action and further protected from any future contamination through installation of activated carbon bags immediately upstream of these areas, as warranted. Sampling methodology is described in detail in Appendix I and will be used for all future sampling events contingent with COGCC approval of this Form 27 remediation work plan.

Following receipt of the analytical results from the laboratory, CPL and/or their consultants will review the data obtained, ensure adequate QA/QC limits are achieved, and provide a summary report to COGCC by July 15, 2017. Site delineation, by remedial action status, will also accompany this report.

Figure A: Proposed Remediation Phase Activity Flowchart



- Reference Section 5.2.9 and Figures 2 through 10
- Recovery Operations for impacted soils, maintenance of site, and expanded scope post-June sampling
- Present Response and Background Sample Results in a Report Format
- Submitted to COGCC (May 17, 2017)
- Soil Analytical Baseline: Post Response
- Includes selected PAH/BTEX analyses
- Remediation Sampling Report
- Submitted to COGCC (July 15, 2017)
- Perform Remediation Activity (July 2017)
- Selected Soil Sampling - Monitoring
- Remediation Monitoring Report to COGCC on November 30, 2017
- Confirmation Sampling and Report as Warranted
- No Further Remedial Action (NFRA) request as warranted per delineated area

Table A. Deliverables prepared by CPL for COGCC during the Rangely C4 Remediation Phase.

Date	Deliverable	Content
5/17/2017	Response Sampling and Analysis Report	Documents all samples collected during the response phase and discusses actions selected based on results.
7/15/2017	Remediation Baseline Sampling Report	Documents all samples collected to characterize soil TPH and targeted PAH/BTEX concentrations after all response phase activities. The full Table 910-1 analyses will be conducted on approximately 5 to 10 samples.
9/1/2107	Remediation Phase Status Report	Documents remediation activities conducted during this phase and available soil monitoring data for TPH and other Table 910-1 analytes as warranted.
12/29/2017	Remediation Phase Status Report	Documents remediation activities conducted during this phase and available soil monitoring data for TPH and other Table 910-1 analytes as warranted.
4/9/2018	Remediation Phase Status Report	Documents remediation activities conducted during this phase and available soil monitoring data for TPH and other Table 910-1 analytes as warranted. Document will include next report deliverable date.
TBD	Confirmation Sampling Report(s)	Documents confirmation sampling events and will include recommendations as to future actions (No further action or specified remedial work) per delineated segment or division.
TBD	Microbial Stimulant Request	Document may be prepared and submitted for COGCC approval of any requested microbial stimulant as part of the "enhanced biodegradation process".

6.1.3 **Enhanced Biodegradation and Monitoring**

CPL will implement mechanical tilling of impacted soils to enhance the rate of natural biodegradation by increasing the surface area of residual oil contaminants in soil and promoting aerobic conditions to favor higher degradation rates. Tilling operations will be conducted utilizing walk-behind tillers or, in areas sufficiently wide, tiller implements on skid-steers where applicable. A tilling depth of 6 to 12 inches will be the targeted zone for aerating and lifting soils to enhance biodegradation. The introduction of low flow water addition may be utilized in the impacted soils to ensure sufficient moisture levels to support microbial community structures and abundance. Water additions will be on an as needed basis. Tilling is expected to occur monthly starting in April and proceed as needed or until analytical results indicate that the soil has been remediated below COGCC action levels. Tilling operations will; however, be subject to alterations in the schedule based on soil TPH data collected during 2017.

Biodegradation monitoring will be accomplished by comparing TPH soil data from the June 1, 2017 sampling event or previous sampling events if representative, to selected sampling events after this period to understand changes in hydrocarbon concentration as a function of time. It is anticipated that approximately10-20 samples for soil TPH will be collected per month (July 2017 to NFRA) to determine biodegradation monitoring and will also serve as a parameter to delineate sufficiently remediated or impacted areas requiring additional remediation. Areas identified as meeting the COGCC TPH limit of ≤500 mg/kg as Gas Range Organics (GRO) and Diesel Range Organics (DRO) will be further sampled for the entire analyte list in Table 910-1 including samples which would delineate spill site soil segments achieving and not achieving Table 910-1 limits.

6.1.3.1 **Contingent Bioremediation Stimulants**

To further facilitate the break down, degradation, and digestion of residual hydrocarbons related to this incident, the application of a commercially available enhanced bioremediation stimulant containing microbes may be added to impacted soils in conjunction with mechanical tilling activities. CPL will provide COGCC specific and/or requested information on any bioremediation stimulants for approval prior to application. Monitoring of these areas will also be considered to support future applications if applicable.

6.1.4 **Soil Excavation, Biodegradation, and Monitoring**

Impacted soils identified as containing >5,000 mg/kg as TPH will be excavated and transported to CNAEP facilities for land farming. Residual soil will then be re-sampled to confirm addition removal is not warranted. Excavated areas confirmed as <5,000 mg/kg will be mechanically tilled in place and monitored to determine biodegradation extents. Additional excavation may occur for soils determined as having marginal degradation extents over 3 to 5 months and if stimulants are either not approved or ineffective. Sampling frequency of these areas will follow the guidance discussed above in 6.1.3. Of note, areas requiring excavation that present a considerable safety concern (i.e. Stop Work Authority is issued for that task and remains in-effect) will be discussed with COGCC, BLM, or other required stakeholder to determine subsequent actions.

6.1.5 Siphon V Dam – Water Management

Water collected in Siphon V Dam will be removed by vacuum truck and introduced in CNAEP's East End Water Plant until the following actions are completed to the satisfaction of COGCC:

- Soils in Siphon V Dam meet COGCC Table 910-1 limits.
- Water accumulated in Siphon V Dam is sampled and meets COGCC or equivalent state/federal water quality standards.
- Activated carbon bags are placed ahead of Siphon V Dam as a contingency water treatment option and will stay in place for at least 3 months after soil and water quality standards are achieved as described above.
- COGCC approval is granted before restoring pre-incident water management practices for Siphon V Dam.

6.2 Site Inspection and Maintenance

CPL will direct the weekly inspection of the GAC-filled sacks, sorbent boom locations, and associated catchment basins to document the presence and/or absence of visual indications of hydrocarbons related to this incident. Additional inspections will also be conducted the day following precipitation events exceeding 0.5 inches in a 24-hour period. Individuals performing this activity will complete the Site Monitoring and Maintenance form found in Appendix II.

6.3 Site Restoration

6.3.1 General Restoration

Biological disturbance (impacts to soil and vegetation) due to response operations will be restored to most closely match site topography and natural vegetative communities. CPL or its contractor will provide BLM shape files documenting all Rangely C4 response disturbances by type (temporary access road, damage from light equipment and heavy equipment, excavation sites, staging areas, etc.). These files will be provided by April 19, 2017 to BLM staff.

The dry drainage feature, after excavation, remedial actions, and NFRA from COGCC, will be surveyed and regraded to restore the natural topography and contours and include noninvasive techniques to minimize soil erosion (e.g. jute mat), where applicable. Disturbed areas with loss of vegetative species will be seeded in the fall season or during other season periods based on agreement with Bureau of Land Management (BLM) biologist or environmental specialist. Monitoring of plant community re-establishment will occur during 2017, 2018 and in future periods where warranted. Re-seeding of areas will occur where re-establishment was not effective and alternative methods may be sought in conjunction with BLM. Control of exotic or invasive species will be managed through non-native invasive plant surveys and selection of effective and approved herbicides as appropriate.

6.3.2 **Detailed Site Restoration Plan**

CPL or its contractor will submit a detailed site restoration plan that includes the specific actions that will be conducted to restore biological disturbance caused by the response and remediation phases including required resources~~,~~ and estimated schedule. This plan will be provided to BLM on August 1, 2017.

Table B. Site Restoration deliverables prepared by CPL for BLM

Date	Deliverable	Content
4/19/2017	Response disturbance shape files	Documents Rangely C4 incident disturbances by type categories.
8/1/2017	Detailed Site Restoration Plan	Documents specific actions that will be conducted to restore biological disturbance caused by the response and remediation phases including required resources, and estimated schedule.
TBD	Supplemental Site Restoration Plan	Example: may include an updated or additional plan for impacted areas remediated after the "Detailed Site Restoration Plan."

Figure 1. Rangely C4 Incident Site Map. Illustration below documents the Division Segments (1-5), passive remedial site locations (sorbent boom, pom poms, and activated carbon), and catchment basins.

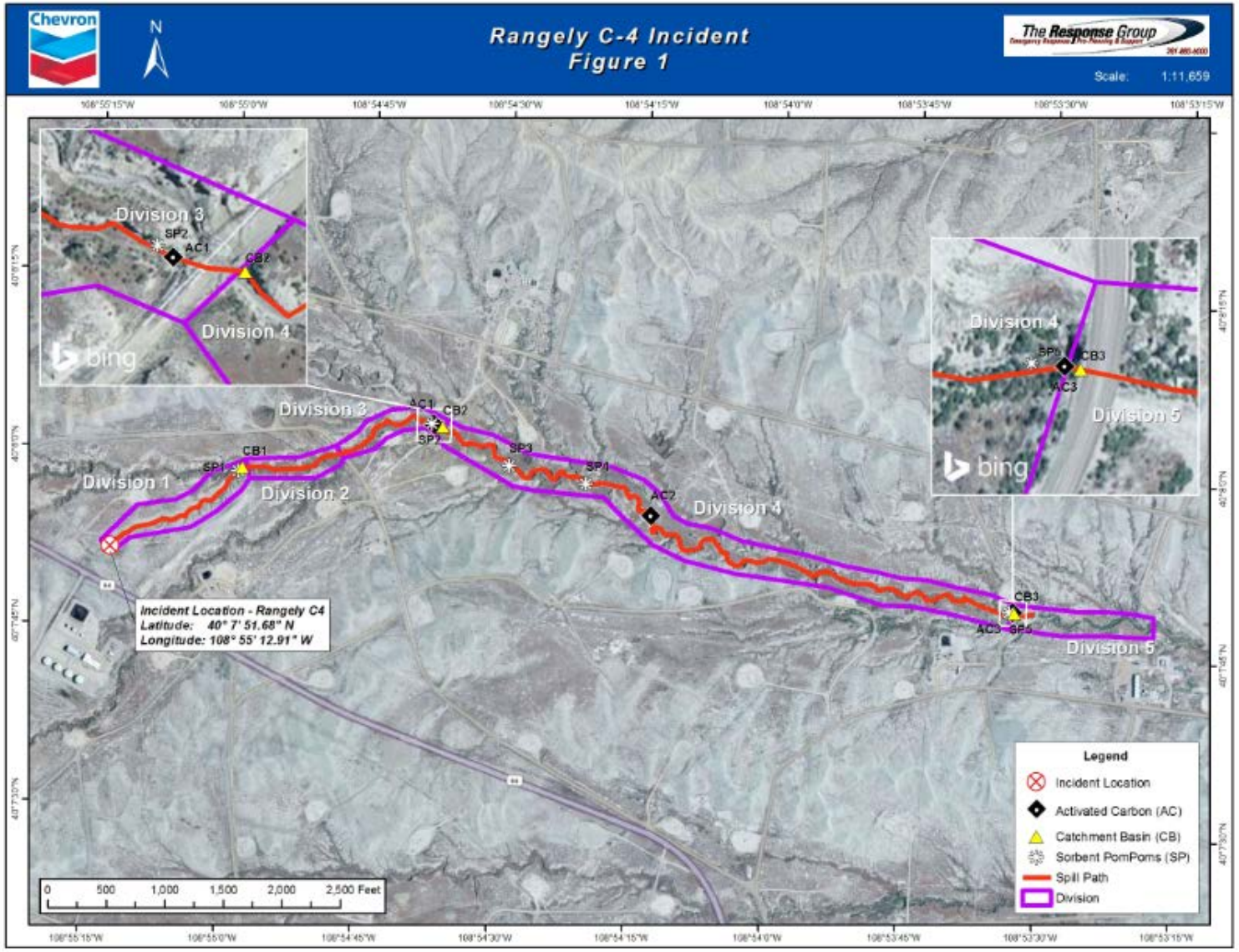


Figure 2. Response Remedial Activities – Current (April to May 1, 2017). Illustrating Spill site and part of Division 1. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

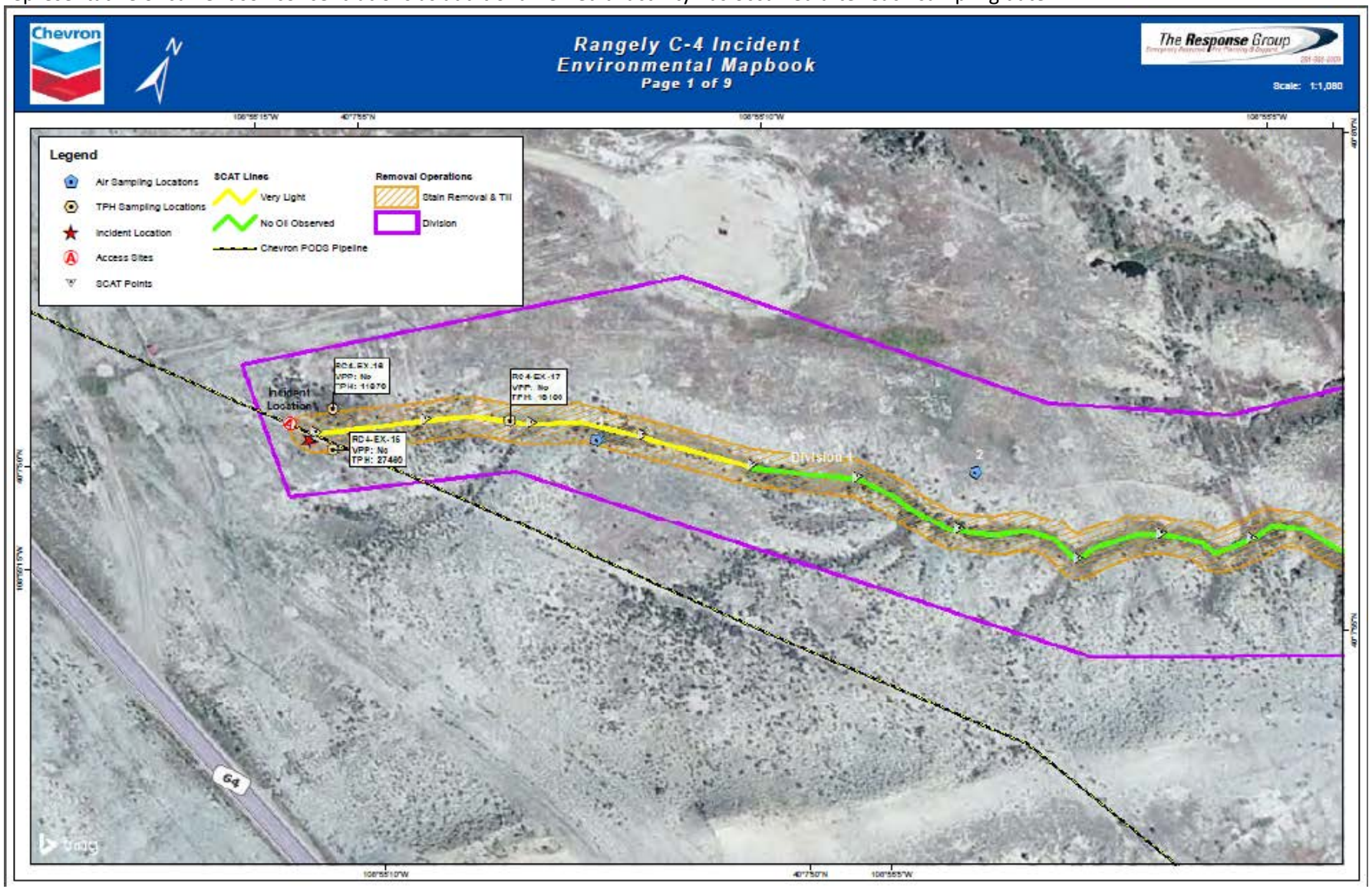


Figure 3. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 1 and 2. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

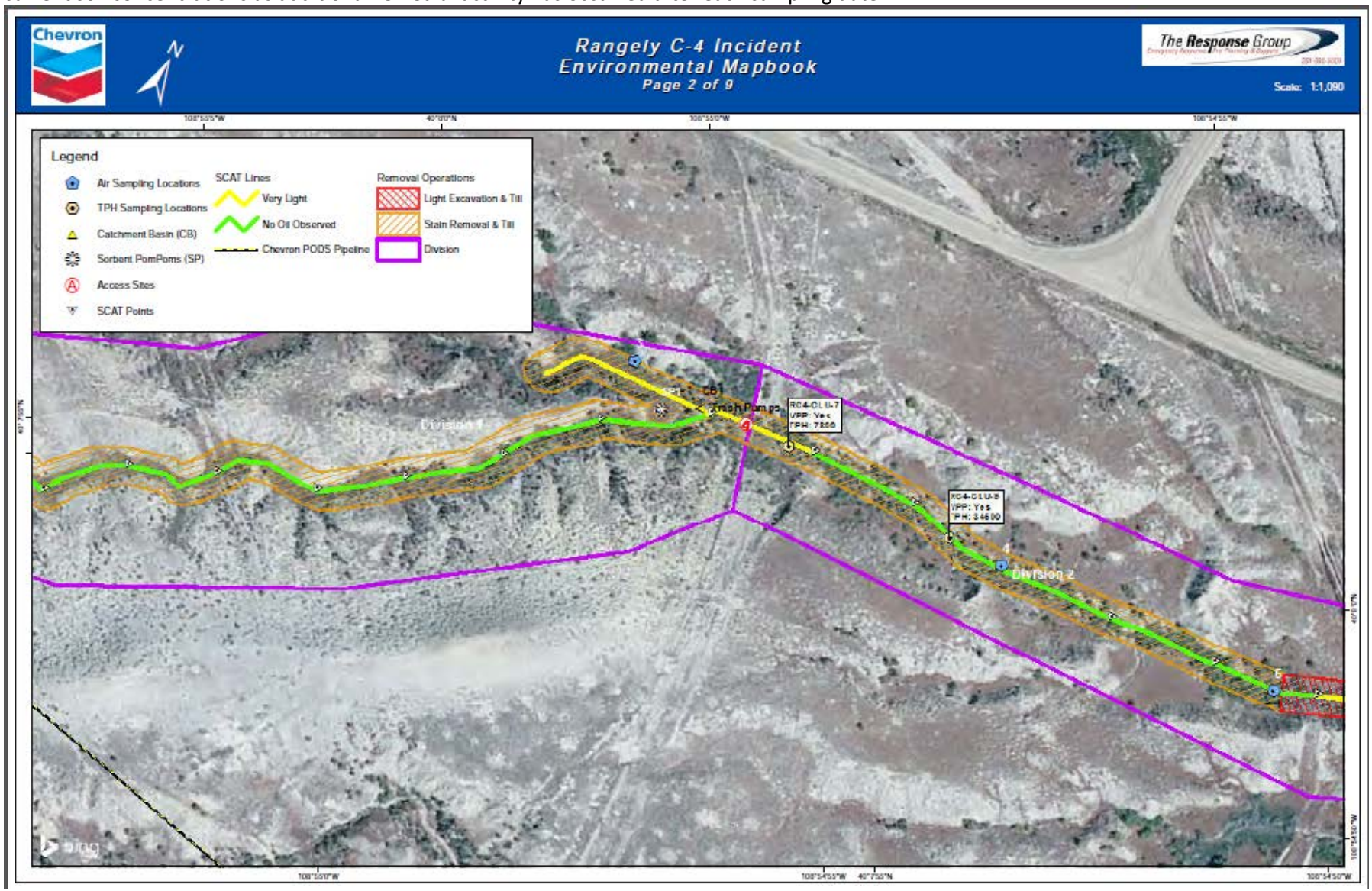


Figure 4. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 2 and start of Division 3. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

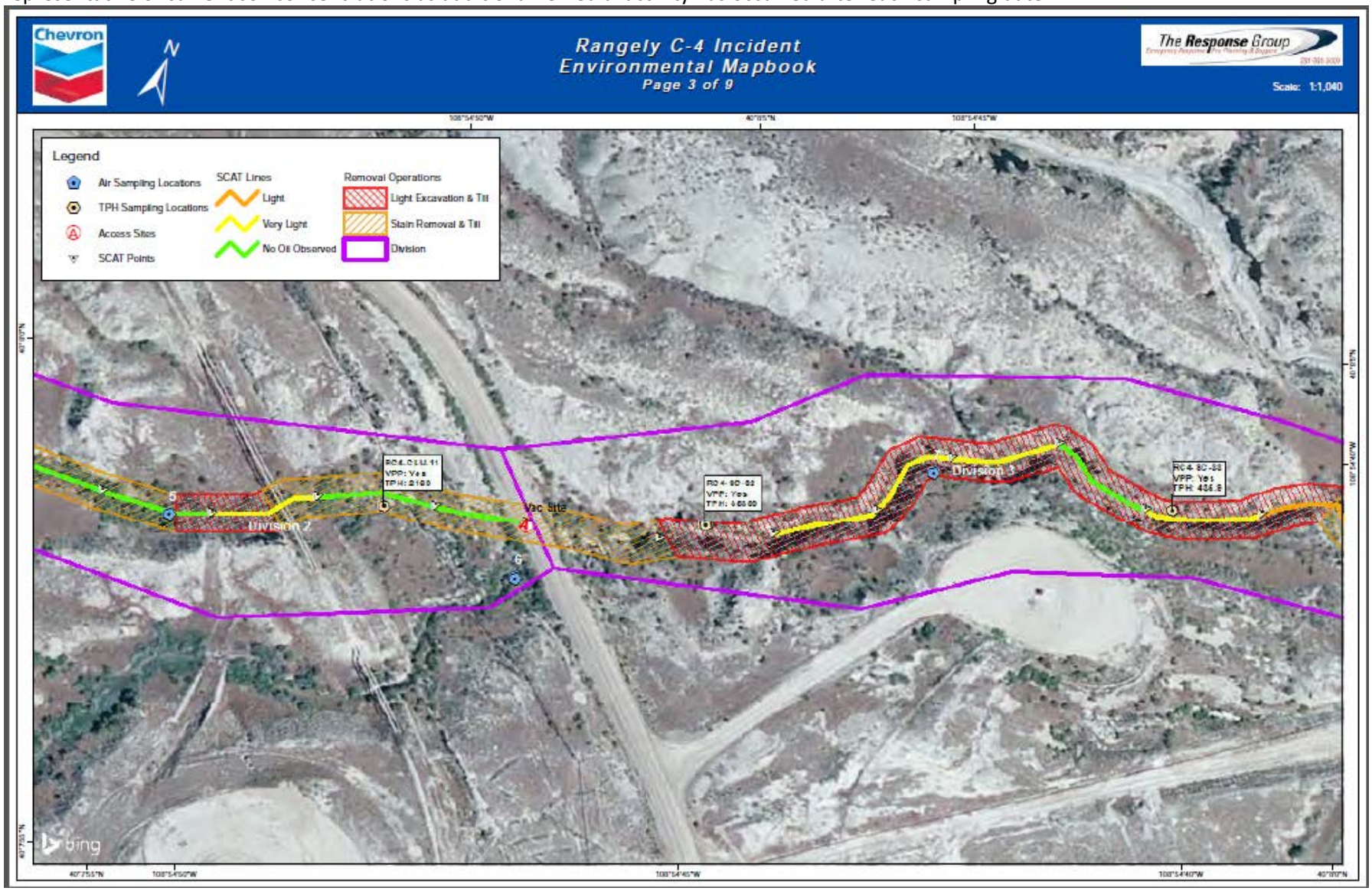


Figure 5. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 3 (includes Drip Trap 18) and start of Division 4. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

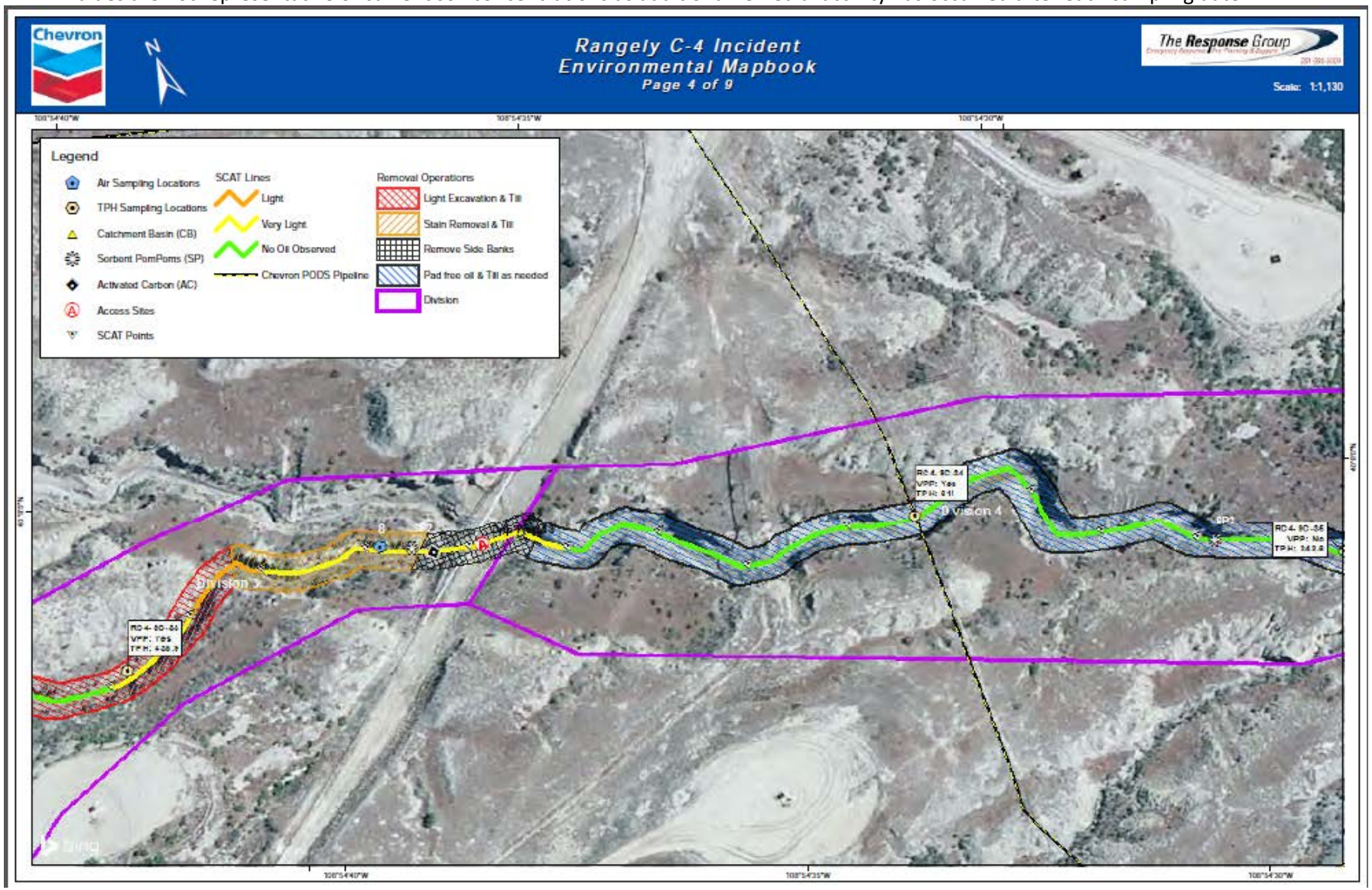


Figure 6. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 4. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

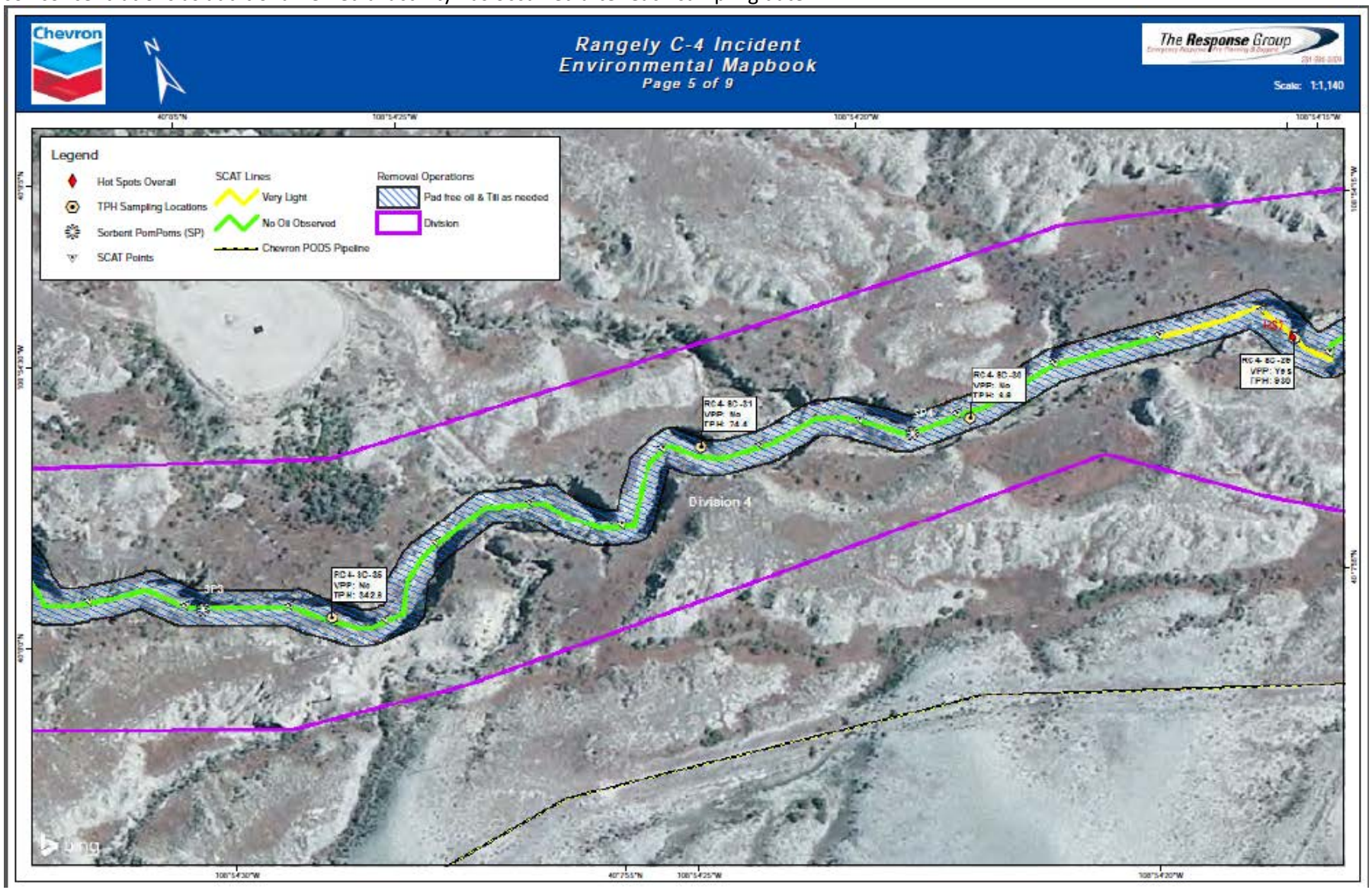


Figure 7. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 4. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

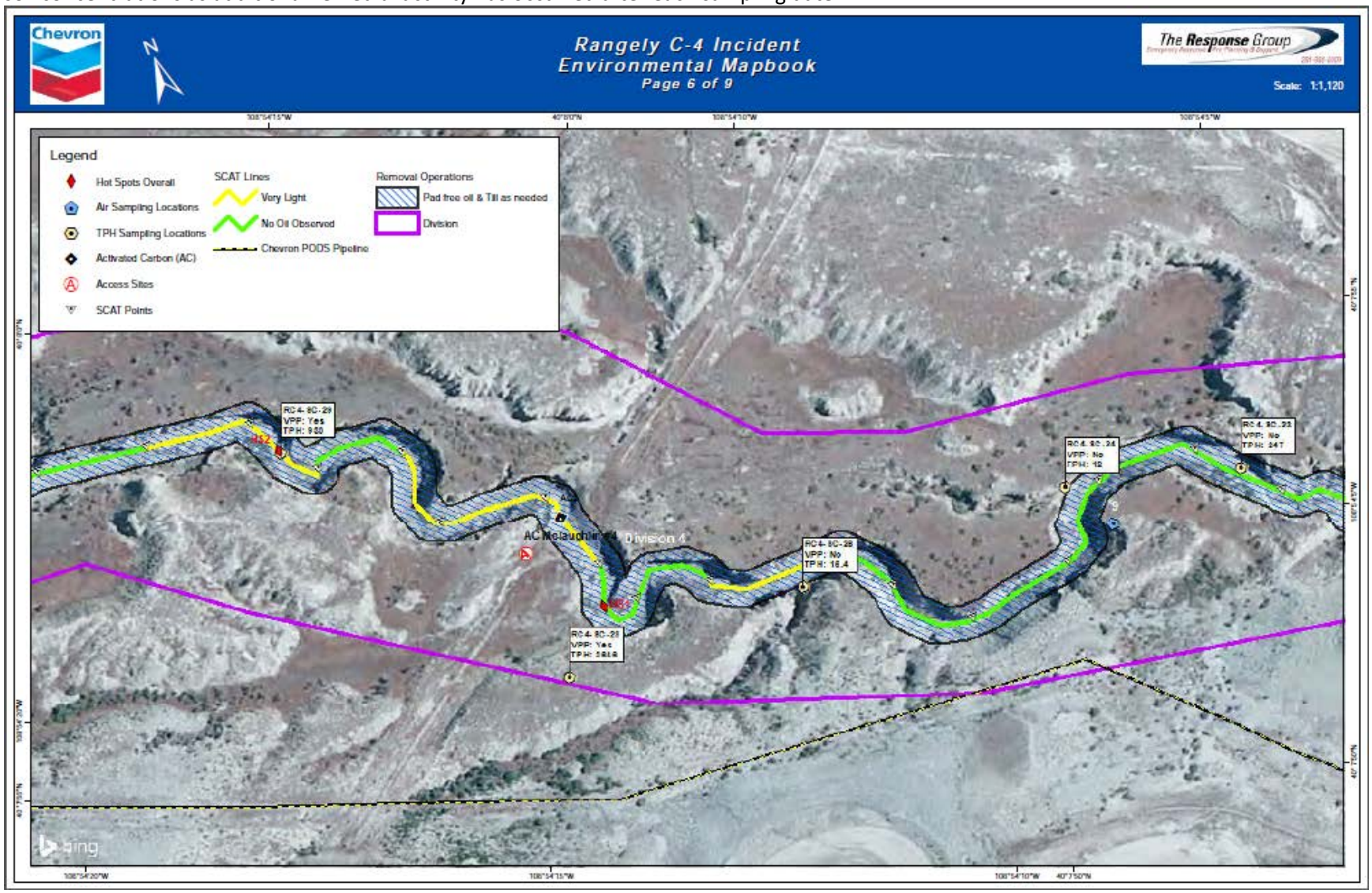


Figure 8. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 4. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

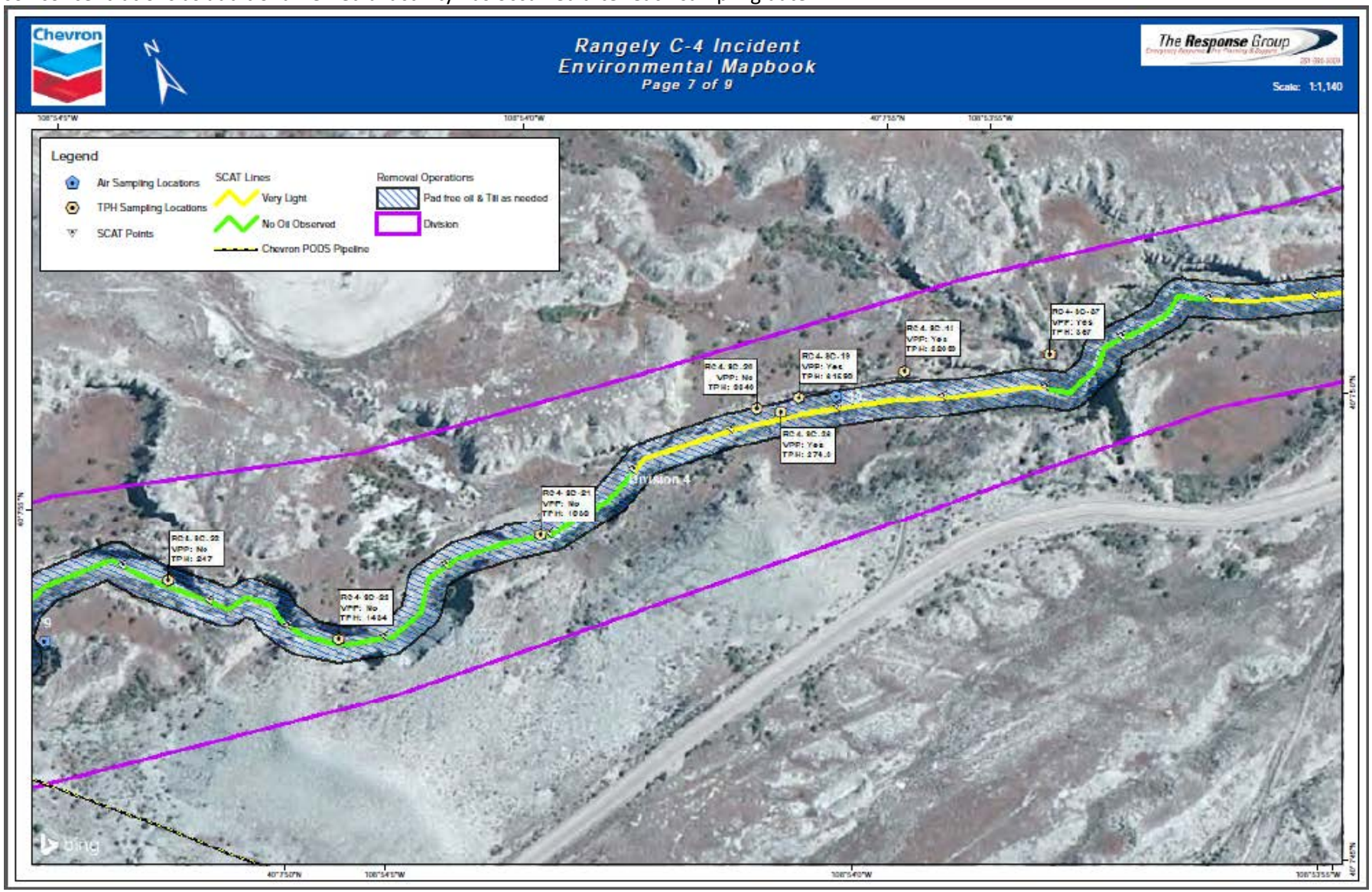


Figure 9. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 4. TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

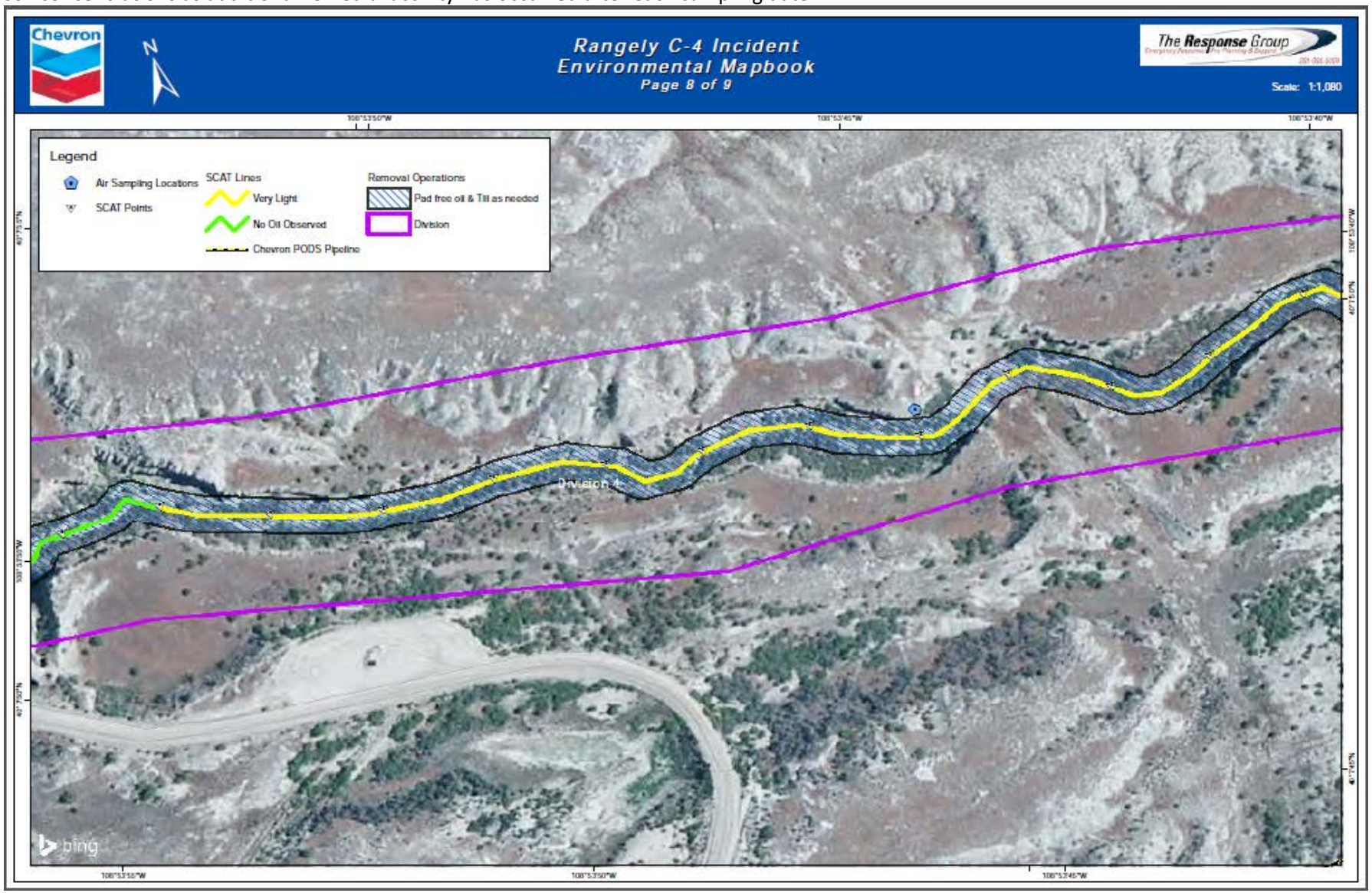


Figure 10. Response Remedial Activities – Current (April to May 1, 2017). Illustrating part of Division 4 and Division 5 (Siphon V Dam). TPH values are not representative of current soil concentrations as additional remedial activity has occurred after each sampling date.

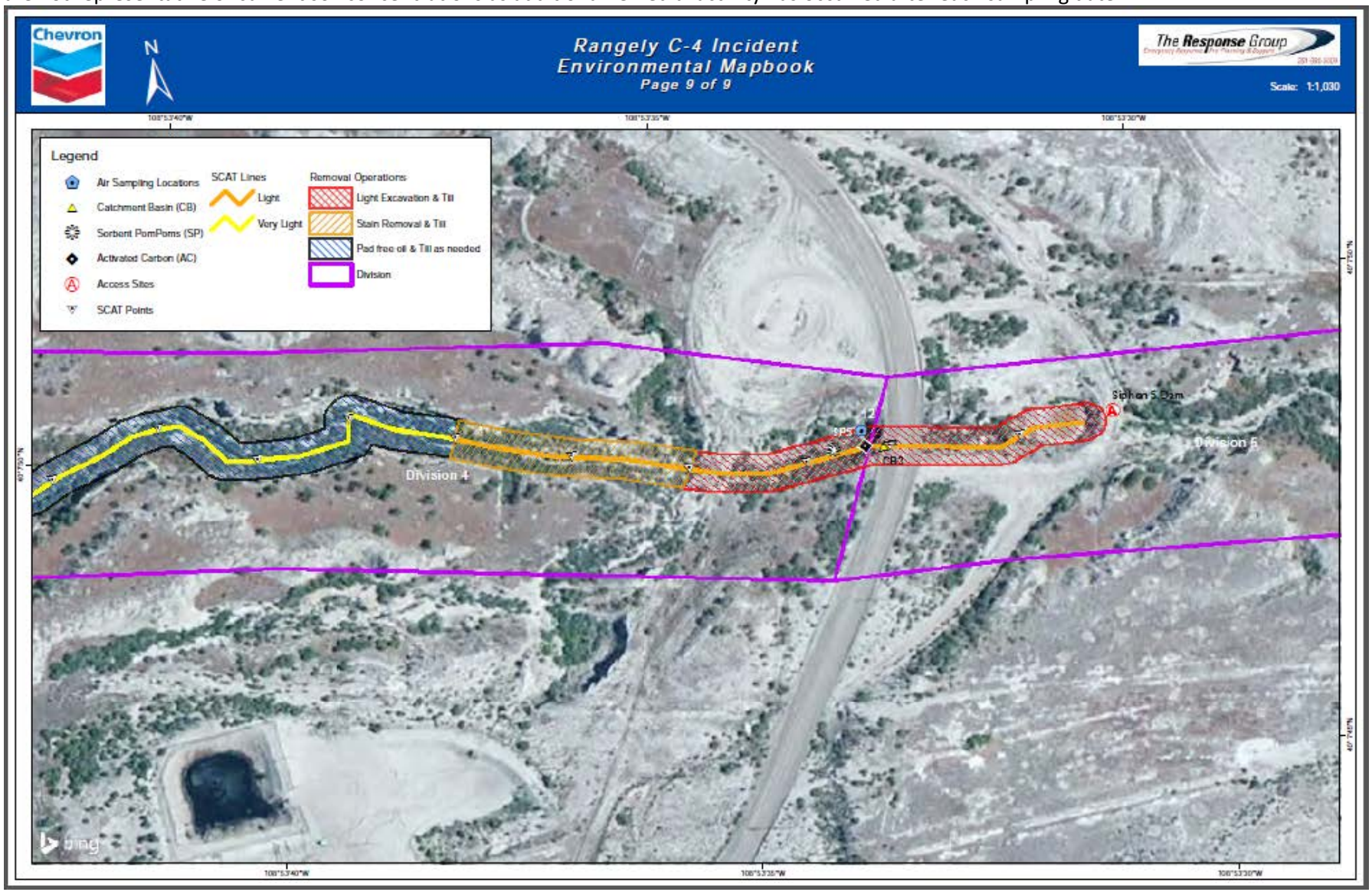
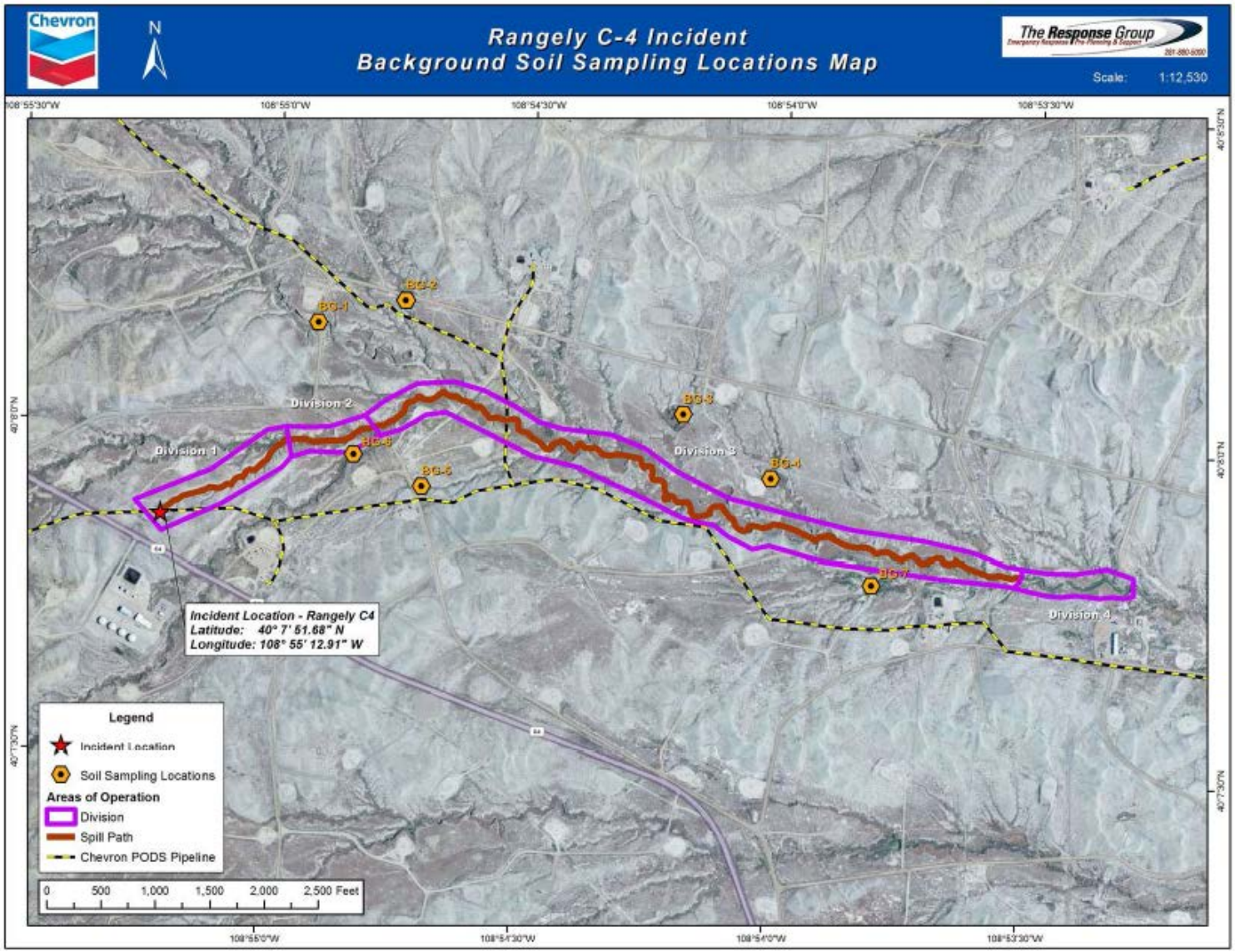


Figure 11. Background sampling locations for the Rangely C4 Incident (n=10). Three additional samples will be collected downstream of Siphon V Dam within the first 300 feet and recorded as to GPS for incorporation into this map.



Appendix I

Response Sampling Plan

Rangely C-4

Rangely, Colorado

Prepared on Behalf Of:

Chevron Pipe Line Company

April 7, 2017

	Position/Name	Signature	Date Signed
Prepared by:	James McCormack, EU Support		
Reviewed by:	Gretsel Marshall, EUL		
Approved by:	Steven Sewell, PSC		
Approved by:	Monica Rodriguez, OSC		
Approved by:	Patrick Green, IC		

1.0 INTRODUCTION AND PURPOSE

This Response Sampling Plan (SAP) was prepared on behalf of the Environmental Unit (EU) supporting Incident Command (IC), to present the high-level rationale and basis for the collection of environmental samples to assess pre-impact conditions and evaluate impacts as a result of the release of crude oil and associated response activities during the Rangely C-4 Incident, Rangely, Colorado. For this SAP, soil and sediment matrices have been considered. Sampling of surface water is not being considered now since no surface water bodies have been impacted. If directed by the IC, a separate plan addressing sampling of surface water will be prepared. Sampling of wastes, including but not limited to, oiled sorbents, vegetation, and debris if necessary, will be addressed in the Waste Management Plan (WMP) which has been prepared separately and was submitted under a separate cover letter. Sampling and monitoring of worker exposure air is covered under the Air Monitoring Plan (AMP), which was prepared separately by the Safety Section and submitted under a separate cover letter. Additionally, excluded from this SAP is the discussion on an end-point. That topic will be discussed in the Shoreline Clean-up Recommendations (STRs) prepared by the Environmental Unit following Shoreline Cleanup Assessment Technique (SCAT) principles, for each Operational Division and/or discrete sub-division.

The specific objectives of the investigations and proposed sampling are discussed further in the site-specific sections contained within this plan; however, the main objectives in general are:

1) The collection of source samples for comparative fingerprint analysis to evaluate whether hydrocarbons observed in site soils are related to this event or an unrelated event;
2) The collection of water and sediment samples to coarsely delineate areas of potential impact related to the release of hydrocarbons and associated response activities and assess the need for and effectiveness of the containment and cleanup activities; and,
3) The collection of background samples to develop the range of potential background concentrations for comparative purposes and to distinguish between hydrocarbons related to this incident and historic, non-related hydrocarbons. Background samples may additionally refer to samples collected from pre-impact locations associated with vessel decontamination and waste and/or equipment staging areas, as directed.

This SAP will officially be implemented after approval by IC; however, in practice this SAP will be implemented immediately based on the recognized urgency to collect samples from the environment. Sampling activities described herein will be undertaken by The Environmental Support Group of the Operations Section as identified in ICS Form 204.

2.0 HEALTH AND SAFETY

Safety is the most important consideration when implementing this plan. All site personnel will review and adhere to the incident Site Safety and Control Plan (ICS Form 208) and company/contractor-specific Health and Safety Plans (HASP), as applicable. Daily tailgate safety briefings will be conducted prior to going into the field. Additional safety briefings may be given prior to undertaking activities such as vessel operations, sampling near water, etc. In general, sampling will only be conducted during daylight hours by qualified, 3rd party personnel and under weather or other environmental conditions that do not create unsafe working conditions. The appropriate personal protective equipment (PPE) will be utilized for each task. Any incident will be promptly reported in accordance with the site-specific site safety plan and IC-objectives.

3.0 DATA QUALITY OBJECTIVES

The data collected during field activities will be used to assess potential exposures of members of the public and ecological receptors to constituents potentially related to the release of crude oil from the Rangely C-4 event. Because changes in environmental conditions are likely during the response, this will be done by reporting on chemical constituents found in the environment at the time and location of sample collection.

A strategic planning approach based on scientific method will be employed for data collection activities providing a systematic procedure to ensure that the type, quantity, and quality of data used in decision-making will be appropriate for the intended application.

4.0 SOURCE SAMPLE EVALUATION AND SAMPLING METHODOLOGY

Source samples will be collected to determine whether hydrocarbons observed/ discovered in the dry drainage feature are related to this incident or an unrelated incident.

Source samples will be collected and decanted into laboratory supplied sample containers and submitted to a NELAP (National Environmental Laboratory Accreditation Program) accredited laboratory for analyses as presented on Table 1. To meet the potential data needs for this response related to source samples, a sufficient volume (e.g., approximately 1 quart) will be collected.

5.0 SOIL SAMPLE METHODOLOGY

Delineation soil samples will be collected to determine the extent of impacts from the Rangely C-4 release. Qualitative visual oiling observations consistent with SCAT principles will be used to evaluate the site and support the sample location selection to

characterize areas most likely to be impacted per the COGCC Series 900 rules. The soil sampling will be conducted to determine the vertical and horizontal extent of impacts. The number and location of samples shall be appropriate to determine the extent of impacts and to assist in characterization of impacted soil for remediation purposes. Following collection of initial delineation samples, analytical results will be reviewed to determine a list of hydrocarbons indicative of this incident for post-excavation samples.

Response Soil samples will be collected from locations which will be determined in the field based on qualitative indicators (e.g., PIDs, SCAT observations, etc.)

A Plan to address post-excavation soils will be prepared as part of the Phase II Post-Emergency Response Confirmation Sampling Plan. This remediation phase plan will be included in the Form 27 document submitted for approval with COGCC.

6.0 SOIL SCREENING METHODOLOGY

Concurrent with soil sample collection, headspace will be field screened using Photoionization Detectors (PID). Field screening measurements will be compared to analytical results in attempt to correlate quantitative data with field screening measurement (qualitative data).

The following method is to be used for headspace screening:

- The portion of the soil sample (for headspace screening) will be placed into an appropriately sized re-sealable Ziploc® or equivalent bag;
- The bag will be sealed and labeled with the location identification and the depth of the sample;
- The sample will be allowed to equilibrate for approximately 10 minutes; and
- The probe tip of the PID will be inserted into the bag, and a measurement obtained using the PID.

7.0 LABORATORY ANALYSIS

- Source samples will be collected by CPL Operations personnel following pigging of the compromised pipeline. The source sample will be transported to Pace Energy Labs, for forensic fingerprint analysis.
- Soil samples will be collected by Environmental Unit representatives following Stantec's Standard Operating Procedures (SOPs) and analyzed for constituents indicative of hydrocarbons for the incident. Copies of Stantec's Sampling SOPs are included in Appendix A.
- Soil samples will be submitted for laboratory analysis to TestAmerica located in Denver, CO under chain-of-custody record (CoC) or another Colorado certified laboratory for the methods specified in Table 1.
- Sample Labels will include:
    - Unique sample designation;

- Sample Type (discrete or composite area);
- Sampler name or initials;
- Date sample collected;
- Time sample collected; and,
- Analysis to be performed.

- **8.0 SAMPLE LABELING AND NOMENCLATURE**
  - Soil sample identification nomenclature will be designated as follows:

    Site – Sample Type/Location – Sample Number - Depth Interval (feet)

    Site: RC4 –Rangely C4

    Sample Type/Location List:

    - SO – Source Area
    - BA – Background
    - CLU – Centerline of Impacted Area, Undisturbed by Operations
    - CLD - Centerline of Impacted Area, Disturbed by Operations
    - HER – Horizontal Extent, Right Bank Descending
    - HEL – Horizontal Extent, Left Bank Descending
    - VF – Vertical Face (for narrow portions of draw where oiled area extends to vertical banks)
    - PE – Post Excavation (surface samples from center of impacted area, following removal of visually impacted soil)
    - IMP – Import Material
    - EX – Excavation Sample
    - SB – Soil Boring
    - SC – Screening Sample
    - DUP – Duplicate
    - MS – Matrix Spike
    - MSD – Matrix Spike Duplicate

    Sample Number: This will be based on total number of samples collected, regardless of type of sample. For example, if the first sample collected is numbered as 01, the next sample, regardless of its location or type will be assigned 02.

    Depth Interval: Total depth of sample boring in feet, expressed in decimal form to the nearest 0.25 feet.

    Sample ID Example: RC4-SO-01-0.25

- **9.0 SAMPLE HANDLING**

  - Samples will be placed in laboratory supplied sample containers, appropriate for the intended analysis, and labeled with sample identification number, sample depth (for water sampling), sampler name, sample date, analysis and methodology requested, and time of sample collection, and immediately placed in a cooler on ice pending laboratory analysis. Samples will be packaged, labeled, retained on ice, and documented in an area which is free of impact and provides for secure storage. Custody seals will be placed on each sample containing cooler, and chain-of-custody procedures will be maintained from the time of sample collection until arrival at the laboratory to protect sample integrity. Shipping or transporting of samples to the laboratory will be done within a timeframe such that recommended holding times are met.

10.0 QUALITY ASSURANCE

- Sampling will be carried out in conjunction with a well-defined quality assurance (QA) program. The goal of the field QA program is to document that samples are collected without the effects of accidental cross- or systematic contamination and refers to the sampling, analysis, and data validation procedures for generating valid and defensible data. The following QA sampling will be conducted for this incident:
  - Field Duplicates – Samples duplicates will be collected at a rate of approximately 1 for every 10 analytical samples collected. Each duplicate set will be collected for each analysis to be run at that sampling location.
  - MS/MSD – MS/MSD samples will be collected at a rate of approximately 1 for every 20 samples collected per analysis. MS/MSD sets will be collected for 8260b and 8270d analysis, one per method.

REFERENCE

Colorado Oil and Gas Conservation Commission. 900 Series rules, January 30, 2015

Colorado Department of Public Health and Environment. Emergency Petroleum Spill Waste Management Guidance, First Edition, January 2014

Stantec Standard Operating Procedure for Soil Sampling, ESPA-001, Most Recent Version

Stantec Standard Operating Procedure for Field Notebook, ESPA-011, Most Recent Version

ANALYSIS	METHOD	SAMPLE CONTAINER	PRESERVATIVE	HOLD TIME
Volatile Organics	8260b	2 x 40ml VOA Vials	Ice, maintained at 0-6oC	Unlimited If solid or water – 14 days.
Alkyl polycyclic aromatic hydrocarbons (PAHs)	8270D (SIM)	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.
TAL Metals	6010c	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.
Comparison of Waterborne Petroleum Oils by Gas Chromatography	ASTM D3328	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.
Total Petroleum Hydrocarbon (TPH)	8015C	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.
Oil Spill Source Identification by Gas Chromatography and Positive Ion Electron Impact Low Resolution Mass Spectrometry	ASTM D5739	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.
Boiling Range Distribution of Petroleum Fractions by Gas Chromatography	ASTM 2887	1 x 4oz. jar.	Ice, maintained at 0-6°C	Unlimited If solid or water – 14 days.

Analyte	Method	Container Number, Size, and Type	Sample Preservation	Hold Time
BTEX	8260B	2 - 40 mL vial glass 1 - 40 mL vial glass or 1 – 4 oz glass jar	2 - NaHSO4 1 - MeOH Unpreserved	14 Days
GRO – TEPH[1] (C6-C10)	8015C	2 – 40 mL vial glass Or 1- 4 oz glass jar	2 – MeOH Unpreserved	14 days to Extraction/40 days from Extraction to analysis
DRO – TEPH[1] (C10-C28)	8015C	1- 8 oz glass jar	Unpreserved	14 days to Extraction/40 days from Extraction to analysis
PAHs	8270D SIM			
EC/SAR	SAR	1 - 8 oz glass jar	Unpreserved	180 days
As, Ba, B, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn	6010c		Unpreserved	180 days
Hg	7171A		Unpreserved	28 days
pH	9045D	1 - 4 oz glass jar	Unpreserved	As Soon As Possible
Moisture	Moisture			
CrIII/CrVI	7196A	1 - 4 oz glass jar	Unpreserved	24 hours

Notes: [1]. Analyses for Total Petroleum Hydrocarbons (TPH) will be utilized for screening purposes to coarsely delineate impacts. Full suite analyses as presented in Table 2 may be done based on the results of the TPH screening.

Appendix II

Site Monitoring and Maintenance Form

C-4 Incident
Monitoring and Maintenance Form

Date:__________________

Location	Time	Task	Check	Task	Yes/No	Task	Yes/No*	Task	Yes/No	Comments if Maintenance Perfomed
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		
		Pom Poms and Granular Activated Carbon (GAC) sacks intact and properly secured	▫	Pom Poms oiled and need to be changed?	Y / N	Enough Product to Recover?	Y / N	Visible Stain and/or Sheen?		

Greater than 0.5" of rain in past 24 hours: Y / N

Rain expected in next 7 Days: Y / N

**If yes, immediatley notify the Gretzel Marshall at 801-583-8836*

Signature #1__________________________ Date / Time: __________ Signature #1__________________________ Date / Time: ____________

Appendix III

Soil Analytical Data

March 9 to March 19, 2017

Initial Response Phase Sampling and Analysis

Sample Location			RC4-SOURCE-TRUCK	RC4-HEL02-0.25	RC4-HEL03-0.25	RC4-HEL06-0.25	RC4-HEL08-0.25	RC4-HEL10-0.25	RC4-HER04-0.25	RC4-HER05-0.25	RC4-HER12-0.25
Sample Date			6-Mar-17	9-Mar-17	9-Mar-17	10-Mar-17	10-Mar-17	11-Mar-17	9-Mar-17	9-Mar-17	12-Mar-17
Sample ID			RC4-SOURCE-TRUCK	RC4-HEL02-0.25	RC4-HEL03-0.25	RC4-HEL06-0.25	RC4-HEL08-0.25	RC4-HEL10-0.25	RC4-HER04-0.25	RC4-HER05-0.25	RC4-HER12-0.25
Sample Depth (Feet)				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Relative Organic Vapor, with PID (ppmv-as-iso-b)				1.8	0.3	0.0	2.5	1.9	0.4	0.0	0.5
Electrical Conductivity, Field (ms/cm)				0.090	0.074	0.078	0.163	0.068	0.078	0.128	0.097
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN
Laboratory Sample ID			280-94601-1	280-94682-1	280-94682-2	280-94768-1	280-94768-3	280-94768-5	280-94682-3	280-94682-4	280-94790-1
	Units	Table 910-1 Limit[1]									
General Chemistry											
Electrical Conductivity, Lab	mmhos/cm	< 4 or 2x BG	7.7	0.42	0.55	0.38	0.84	0.48	0.29	0.51	0.39
Percent Moisture	%	--	10.6	12.1	14.9	19.2	14.2	7.2	15.0	21.0	20.0
Percent Solids	%	--	89.4	87.9	85.1	80.8	85.8	92.8	85.0	79.0	80.0
pH adj. to 25 deg C	S.U.	--	7.9 HF	8.5 HF	8.3 HF	8.4 HF	9.1 HF	9.5 HF	8.4 HF	8.1 HF	8.3 HF
Sodium Adsorption Ratio (SAR)	none	< 12	0.80	2.8	4.2	3.1	9.1	<1.2	<1.2	<1.2	<1.2
Sodium	mg/kg	--	110	86	130	91	380	36	32	<10	39
Calcium	mg/kg	--	96	53	59	52	97	260	64	110	87
Magnesium	mg/kg	--	29	11	7.6	8.6	20	50	12	11	13
Temperature, Lab	deg C	--	20.8 HF	21.5 HF	21.2 HF	21.5 HF	21.3 HF	21.3 HF	21.9 HF	21.7 HF	24.3 HF
Petroleum Hydrocarbons											
GRO - Gasoline Range Organics (C6-C10)	mg/kg	500	2,700	<0.59	<0.47	<1.1	<1.4	<1.2	<0.56	<0.42	<1.3
GRO - Gasoline Range Organics (C6-C10) - RE	mg/kg		--	--	--	--	--	--	--	--	--
DRO - Diesel Range Organics (C10-C28)	mg/kg		9,200	4.2	2.5 J	1.5 J	2.9 J,F2	7.6	5.5	2.5 J	1.6 J
DRO - Diesel Range Organics (C10-C28) - RE	mg/kg		--	--	--	--	--	--	--	--	--
Metals											
Arsenic[2]	mg/kg	0.39	7.8	6.9	7.2	7.1	7.2	6.3	7.6	7.0	7.0 F2
Barium	mg/kg	15,000	240 B	310	120	130 B	120 B	120 B	<1.1	150	100
Boron[3]	mg/kg	--	15	12 B,F2	14 B	13 B	11 B	10 B	1.9 J,B	17 B	12
Cadmium	mg/kg	70	0.51	0.38 J,F2	0.39 J	0.22 J,F2	0.21 J	0.17 J	<0.53	0.43 J	0.31 J
Calcium	mg/kg	--	28,000 B	22,000 B	22,000 B	22,000 B	23,000 B	17,000 B	<53	26,000 B	22,000 B
Chromium	mg/kg	--	-	14 B	17 B	15	14	12	0.063 J,B	19 B	13 B
Chromium, hex	mg/kg	23	7.3 J	3.8 J	3.2 J	5.8 J	7.3 F1	5.5	<5.8	3.0 J	6.7
Chromium, trivalent	mg/kg	120,000	11	10	14	9.2	6.7	6.5	<5.9	16	6.3
Copper	mg/kg	3,100	17 B	13 F2	14	13	13	10	<2.1	16	13
Lead	mg/kg	400	18	14 F2	15	15	14	12	<0.96	18	14 F2
Magnesium	mg/kg	--	12,000 B	11,000 B	11,000 B	9,500 B	10,000 B	7,500 B	<21	12,000 B	9,300 B
Mercury	mg/kg	23	0.018 J	0.020 J,F2,F1	0.018 J	0.024	0.013 J	0.018 J	0.013 J	0.028	0.025
Nickel	mg/kg	1,600	18 B	13 F2	15	15	13	12	<4.3	17	15

Sample Location			RC4-SOURCE-TRUCK	RC4-HEL02-0.25	RC4-HEL03-0.25	RC4-HEL06-0.25	RC4-HEL08-0.25	RC4-HEL10-0.25	RC4-HER04-0.25	RC4-HER05-0.25	RC4-HER12-0.25
Sample Date			6-Mar-17	9-Mar-17	9-Mar-17	10-Mar-17	10-Mar-17	11-Mar-17	9-Mar-17	9-Mar-17	12-Mar-17
Sample ID			RC4-SOURCE-TRUCK	RC4-HEL02-0.25	RC4-HEL03-0.25	RC4-HEL06-0.25	RC4-HEL08-0.25	RC4-HEL10-0.25	RC4-HER04-0.25	RC4-HER05-0.25	RC4-HER12-0.25
Sample Depth (Feet)				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Relative Organic Vapor, with PID (ppmv-as-iso-b)				1.8	0.3	0.0	2.5	1.9	0.4	0.0	0.5
Electrical Conductivity, Field (ms/cm)				0.090	0.074	0.078	0.163	0.068	0.078	0.128	0.097
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN
Laboratory Sample ID			280-94601-1	280-94682-1	280-94682-2	280-94768-1	280-94768-3	280-94768-5	280-94682-3	280-94682-4	280-94790-1
	Units	**Table 910-1 Limit[1]**									
Selenium	mg/kg	390	1.7	0.86 J,F2	1.1 J	<1.3 F2	<1.5	<1.5	<1.6	<1.7	<1.6 F2
Silver	mg/kg	390	< 0.82	<1.0 F2	<0.85	<0.84 F2	<0.97	<0.98	<1.1	<1.1	<1.0 *F2
Sodium	mg/kg	--	840	250 J,F2	290 J	250 J,B,F2	550 B	400 J,B	<530	140 J	180 J,F2
Zinc	mg/kg	23,000	80	62	67	62	57	49	<3.2	77	66
Semi - Volatile Organic Compounds											
Acenaphthene	mg/kg	1,000	<0.22 F1	<0.0055	<0.0059	<0.0059	<0.0056	<0.0053	<0.0057	<0.0060	<0.0057
Acenaphthylene	mg/kg	1,000	<0.22 F1	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,000	<0.22 F1	<0.0055	<0.0059	<0.0059	<0.0056	<0.0053	<0.0057	<0.0060	<0.0057
Benzo(a)anthracene	mg/kg	0.22	<0.22	0.0012 J	<0.0059	<0.0059	<0.0056	0.00096 J	<0.0057	0.0029 J	<0.0057
Benzo(a)pyrene	mg/kg	0.022	**<0.22 F1,F2**	<0.0055	<0.0059	<0.0059	<0.0056	0.0014 J	<0.0057	<0.0060	<0.0057
Benzo(b)fluoranthene	mg/kg	0.22	0.063 J,F1,F2	<0.0055	<0.0059	<0.0059	<0.0056	0.0029 J	<0.0057	<0.0060	<0.0057
Benzo(g,h,i)perylene	mg/kg	--	<0.22 F2	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	2.2	<0.22	<0.0055	<0.0059	<0.0059	<0.0056	0.0014 J	<0.0057	<0.0060	<0.0057
Chrysene	mg/kg	22	0.81	0.0012 J	<0.0059	<0.0059	<0.0056	0.0032 J	0.0011 J	0.0012 J	<0.0057
Dibenz (a,h)anthracene	mg/kg	0.022	**<0.22**	<0.0055	<0.0059	<0.0059	<0.0056	<0.0053	<0.0057	<0.0060	<0.0057
Fluoranthene	mg/kg	1,000	<0.22	<0.0055	<0.0059	<0.0059	<0.0056	0.0021 J,B	<0.0057	<0.0060	<0.0057
Fluorene	mg/kg	1,000	1.3	<0.0055	<0.0059	<0.0059	<0.0056	0.0013 J	<0.0057	<0.0060	<0.0057
Indeno(1,2,3-cd)pyrene	mg/kg	0.22	<0.22	<0.0055	<0.0059	<0.0059	<0.0056	0.0023 J	<0.0057	<0.0060	<0.0057
Methylnaphthalene, 1-	mg/kg	--	11	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	--	12	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	23	6	0.00084 J	0.0014 J	0.00073 J	0.0027 J	0.014	0.0012 J	0.0014 J	0.0066
Phenanthrene	mg/kg	--	3.5	-	-	-	-		-	-	-
Pyrene	mg/kg	1,000	0.39	0.0017 J,B	0.0013 J,B	<0.0059	<0.0056	0.0031 J,B	0.0014 J,B	0.0013 J,B	<0.0057
Volatile Organic Compounds											
Benzene	mg/kg	0.17	**1.3 J**	<0.0057	<0.0057	0.0021 J	0.0034 J	0.0019 J	<0.0059	<0.0061	0.0028 J
Ethylbenzene	mg/kg	100	7.9 F1	<0.0057	<0.0057	<0.0047	0.0016 J	0.0015 J	<0.0059	<0.0061	0.00093 J
Toluene	mg/kg	85	11	<0.0057	<0.0057	0.0028 J	0.0062	0.0039 J	<0.0059	<0.0061	0.0044 J
Xylenes, Total	mg/kg	175	53	<0.0057	<0.0057	0.0013 J	0.0076	0.0090	<0.0059	<0.0061	0.0030 J

Sample Location			RC4-HER13-0.25	RC4-HER14-0.25	RC4-CLU07-0.25	RC4-CLU09-0.25	RC4-CLU09-0.25	RC4-CLU11-0.25	RC4-EX-15-0.25	RC4-EX-16-0.25	RC4-EX-17-0.25
Sample Date			12-Mar-17	12-Mar-17	10-Mar-17	10-Mar-17	10-Mar-17	11-Mar-17	18-Mar-17	18-Mar-17	19-Mar-17
Sample ID			RC4-HER13-0.25	RC4-HER14-0.25	RC4-CLU07-0.25	RC4-CLU09-0.25	RC4-CLU09-0.25	RC4-CLU11-0.25	RC4-EX-15-0.25	RC4-EX-16-0.25	RC4-EX-17-0.25
Sample Depth (Feet)			0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Relative Organic Vapor, with PID (ppmv-as-iso-b)			0.4	1.0	2317	635.9	--	1217	--	--	--
Electrical Conductivity, Field (ms/cm)			0.119	0.093	0.080	0.120	--	0.057	--	--	--
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN
Laboratory Sample ID			280-94790-2	280-94790-3	280-94768-2	280-94768-4	280-94768-7	280-94768-6	280-95013-1	280-95013-2	280-95013-3
							DUPLICATE				
	Units	**Table 910-1 Limit[1]**									
General Chemistry											
Electrical Conductivity, Lab	mmhos/cm	< 4 or 2x BG	0.29	0.23	0.38	0.53	0.47	0.32	7.0	4.0	4.9
Percent Moisture	%	--	24.0	16.8	18.7	23.6	22.7	17.7	4.5	13.7	9.6
Percent Solids	%	--	76.0	83.2	81.3	76.4	77.3	82.3	95.5	86.3	90.4
pH adj. to 25 deg C	S.U.	--	8.5 HF	8.6 HF	8.5 HF	8.0 HF	8.2 HF	8.5 HF	8.0 HF	7.9 HF	8.0 HF
Sodium Adsorption Ratio (SAR)	none	< 12	<1.2	<1.2	1.2	1.5	6.8	1.5	5.1	2.0	7.0
Sodium	mg/kg	--	12	29	87	130	250	130	680	210	660
Calcium	mg/kg	--	89	66	310	430	75	390	870	610	520
Magnesium	mg/kg	--	13	9.7	57	89	16	78	290	120	84
Temperature, Lab	deg C	--	24.1 HF	24.1 HF	21.9 HF	22.1 HF	22.5 HF	22.2 HF	19.5 HF	19.7 HF	19.8 HF
Petroleum Hydrocarbons											
GRO - Gasoline Range Organics (C6-C10)	mg/kg	500	0.45 J	<1.3	**7,800**	**5,000**	**8,300**	280	**860**	220	340
GRO - Gasoline Range Organics (C6-C10) - RE	mg/kg		--	--	--	--	--	--	**1,000**	280	310
DRO - Diesel Range Organics (C10-C28)	mg/kg		1.8 J	3.7 J	**20,000**	**24,000**	**18,000**	**7,100**	**15,000 B**	**6,100 B**	**9,500 B**
DRO - Diesel Range Organics (C10-C28) - RE	mg/kg		--	--	--	--	--	--	**25,000**	**6,800**	**9,600**
Metals											
Arsenic[2]	mg/kg	0.39	**6.7**	**6.4**	**5.7**	**5.9**	**6.8**	**6.4**	**7.6**	**7.2**	**7.6**
Barium	mg/kg	15,000	110	110	100 B	91 B	99 B	110 B	290 F1	970	150
Boron[3]	mg/kg	--	10	8.4 J	10 B	10 B	9.4 B	9.0 B	14	14	12
Cadmium	mg/kg	70	0.29 J	0.25 J	0.20 J	0.17 J	0.17 J	0.19 J	0.57	0.60	0.46
Calcium	mg/kg	--	19,000 B	17,000 B	19,000 B	19,000 B	21,000 B	17,000 B	30,000 B	27,000 B	29,000 B
Chromium	mg/kg	--	11 B	9.3 B	12	12	13	11	18	18	16
Chromium, hex	mg/kg	23	6.0 J	6.1	5.8 J	6.2 J	5.8 J	4.6 J	2.2 J	3.4 J	2.6 J
Chromium, trivalent	mg/kg	120,000	5.0 J	3.2 J	6.2	5.8 J	7.2	6.4	16	15	13
Copper	mg/kg	3,100	12	9.9	11	11	12	9.8	18	18	17
Lead	mg/kg	400	13	12	12	12	13	12	20 F1	27	19
Magnesium	mg/kg	--	8,000 B	7,000 B	8,600 B	8,500 B	9,600 B	7,700 B	12,000 F1,B	11,000 B	12,000 B
Mercury	mg/kg	23	0.023 J	0.018 J	0.017 J	0.012 J	0.017 J	0.0078 J	0.029	0.029	0.035
Nickel	mg/kg	1,600	14	13	12	11	13	12	19 F1	19	18
Selenium	mg/kg	390	<1.4	<1.3	<1.3	<1.5	<1.4	<1.3	1.6 F1	1.5 J	0.97 J

Sample Location			RC4-HER13-0.25	RC4-HER14-0.25	RC4-CLU07-0.25	RC4-CLU09-0.25	RC4-CLU09-0.25	RC4-CLU11-0.25	RC4-EX-15-0.25	RC4-EX-16-0.25	RC4-EX-17-0.25
Sample Date			12-Mar-17	12-Mar-17	10-Mar-17	10-Mar-17	10-Mar-17	11-Mar-17	18-Mar-17	18-Mar-17	19-Mar-17
Sample ID			RC4-HER13-0.25	RC4-HER14-0.25	RC4-CLU07-0.25	RC4-CLU09-0.25	RC4-CLU09-0.25	RC4-CLU11-0.25	RC4-EX-15-0.25	RC4-EX-16-0.25	RC4-EX-17-0.25
Sample Depth (Feet)			0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Relative Organic Vapor, with PID (ppmv-as-iso-b)			0.4	1.0	2317	635.9	--	1217	--	--	--
Electrical Conductivity, Field (ms/cm)			0.119	0.093	0.080	0.120	--	0.057	--	--	--
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN	TALDEN
Laboratory Sample ID			280-94790-2	280-94790-3	280-94768-2	280-94768-4	280-94768-7 DUPLICATE	280-94768-6	280-95013-1	280-95013-2	280-95013-3
	Units	Table 910-1 Limit[1]									
Silver	mg/kg	390	<0.91 *	<0.86 *	<0.89	<1.0	<0.91	<0.87	<0.96	<1.0	<0.83
Sodium	mg/kg	--	130 J	130 J	200 J,B	250 J,B	270 J,B	130 J,B	960	330 J	570
Zinc	mg/kg	23,000	60	57	51	49	54	50	77 F1	73	74
Semi - Volatile Organic Compounds											
Acenaphthene	mg/kg	1,000	<0.0063	0.0066	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Acenaphthylene	mg/kg	1,000	-	-	-	-	-	-	--	--	--
Anthracene	mg/kg	1,000	<0.0063	0.0017 J	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Benzo(a)anthracene	mg/kg	0.22	<0.0063	0.027 B	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Benzo(a)pyrene	mg/kg	0.022	<0.0063	**0.046 B**	**<0.24**	**<0.26**	**<0.25**	**<0.12**	<0.42	<0.23	<0.22
Benzo(b)fluoranthene	mg/kg	0.22	<0.0063	0.071 B	0.13 J	0.074 J	0.098 J	<0.12	<0.42	<0.23	0.053 J
Benzo(g,h,i)perylene	mg/kg	--	-	-	-	-	-	-	--	--	--
Benzo(k)fluoranthene	mg/kg	2.2	<0.0063	0.026	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Chrysene	mg/kg	22	0.0018 J,B	0.072 B	1.5	1.0	1.2	0.23	1.5	0.45	0.73
Dibenz (a,h)anthracene	mg/kg	0.022	<0.0063	0.0086	**<0.24**	**<0.26**	**<0.25**	**<0.12**	<0.42	<0.23	<0.22
Fluoranthene	mg/kg	1,000	<0.0063	0.14 B	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Fluorene	mg/kg	1,000	<0.0063	0.0050 J	1.9	1.3	1.5	0.31	1.6	0.67	0.93
Indeno(1,2,3-cd)pyrene	mg/kg	0.22	<0.0063	0.037	<0.24	<0.26	<0.25	<0.12	<0.42	<0.23	<0.22
Methylnaphthalene, 1-	mg/kg	--	-	-	-	-	-	-	--	--	--
Methylnaphthalene, 2-	mg/kg	--	-	-	-	-	-	-	--	--	--
Naphthalene	mg/kg	23	0.0032 J	0.0076	12	10	12	2.0	5.9	2.2	5.0
Phenanthrene	mg/kg	--	-	-	-	-	-	-	--	--	--
Pyrene	mg/kg	1,000	<0.0063	0.12 B	0.75 B	0.46 B	0.56 B	0.11 J,B	0.73	0.10 J	0.33
Volatile Organic Compounds											
Benzene	mg/kg	0.17	0.012	0.0024 J	**11**	**6.5**	**5.5**	**2.2 J**	<0.26	**0.32**	<0.27
Ethylbenzene	mg/kg	100	0.00097 J	0.00086 J	19	19	16	6.3	0.70 F1	2.0	0.13 J
Toluene	mg/kg	85	0.0073	0.0039 J	41	36	31	12	0.39 F1	2.5	0.046 J
Xylenes, Total	mg/kg	175	0.0030 J	0.0036 J	120	130	110	42	5.7 F1	15	1.4

Notes:

ppmv-as-iso-b	parts per million volume as isobutylene
ms/cm	milliSiemens per centimeter
mmhos/cm	millimhos per centimeter
%	percent
S.U	standard unit
deg C	degrees Celsius
mg/kg	milligram per kilogram
mg/l	milligram per liter
15.2	Concentration was detected.
<0.03	Analyte was not detected at a concentration greater than the laboratory reportable detection limit.
-	Parameter not analyzed / not available.
>	Greater than.
B	Indicates analyte was found in associated blank, as well as in the sample.
E	Result exceeded calibration range.
J	The reported result is an estimated value.
F1	MS and/or MSD recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
HF	Field parameter with a holding time of 15 minutes. Test Performed by laboratory at client's request.
1	Concentrations for the Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 are taken from the Colorado Department of Public Health and the Environment, Hazardous Materials and Waste Management Division (CDPHE-HMWMD) Table 1 Colorado Soil Evaluation Values (December 2007)
2	Consideration shall be given to background levels in native soils and ground water.
3	Pursuant to Rule 910.b.(3).(C) and consistent with its prior practice, the COGCC typically will not require operators to sample for Hot Water Soluble Boron in soils. The current reference to Hot Water Soluble Boron in Table 910-1 is an artifact from the previous version of the Table. The Commission amended the threshold concentrations for metals in soils in December 2008 to conform them to the CDPHE-HMWMD's Table 1 Colorado Soil Evaluation Values (December 2007) (http://www.cdphe.state.co.us/hm/csev.pdf) (CSEV).

*Samples have not been validated

Appendix IV

Preliminary Soil TPH Data

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TPH Sampling Location Map

Sample ID	Description	Date Collected	PID Screening (PPM)	Analytical Sample Results (GRO, mg/kg)	Analytical Sample Results (DRO, mg/kg)	Total TPH (mg/kg)
RC4-CLU-7	Centerline Div. 2	3/10/2017	2317	7800	20000	27,800
RC4-CLU-9	Centerline Div. 2	3/11/2017	654	5000	24000	29,000
RC4-CLU-11	Centerline Div. 2	3/11/2017	1217	280	7100	7,380
RC4-EX-15	Excavation Samples	3/18/2017	NM	860	19000	19,860
RC4-EX-16	Excavation Samples	3/18/2017	NM	270	7800	8,070
RC4-EX-17	Excavation Samples	3/19/2017	NM	400	11000	11,400
RC4-SC-18	Screening Samples Div. 3	3/20/2017	122	170	15000	15,170
RC4-SC-19	Screening samples Div. 3	3/20/2017	165	590	50000	50,590
RC4-SC-20	Screening samples Div. 3	3/20/2017	125	91	2800	2,891
RC4-SC-21	Screening samples Div. 3	3/20/2017	53	7.9	670	678
RC4-SC-22	Screening samples Div. 3	3/20/2017	46	22	940	962
RC4-SC-23	Screening samples Div. 3	3/20/2017	11	0.53 J	160	160
RC4-SC-24	Screening samples Div. 3	3/20/2017	1	ND (1.5)	5.3	5
RC4-SC-25	Screening samples Div. 3	3/20/2017	--	19	770	789
RC4-SC-26	Screening samples Div. 3	3/20/2017	1	ND (1.4)	7	7
RC4-SC-27	Screening samples Div. 3	3/20/2017	56	ND (1.5)	18	18
RC4-SC-28	Screening samples Div. 3	3/20/2017	192	57	2500	2,557
RC4-SC-29	Screening samples Div. 3	3/20/2017	27	38	600	638
RC4-SC-30	Screening samples Div. 3	3/21/2017	2	ND (1.5)	6.6	7
RC4-SC-31	Screening samples Div. 3	3/21/2017	2	4.4	44	48
RC4-SC-32	Screening samples Div. 3	3/21/2017	270	1300	23000	24,300
RC4-SC-33	Screening samples Div. 3	3/21/2017	26	5.9	260	266
RC4-SC-34	Screening samples Div. 3	3/21/2017	36	11	400	411
RC4-SC-35	Screening samples Div. 3	3/21/2017	4	2.6	160	163
RC4-SC-36	Homogenized screening samples 12"	3/22/2017	NM	4.3	170	174
RC4-SC-37	Homogenized screening samples 12"	3/22/2017	NM	27	220	247

*Data from 3/20 to 3/22/17 is preliminary and laboratory final data will be presented as part of the May 17, 2017 response phase sampling and analysis report. Data presented above were used to guide response phase excavations.

Rangely C-4 Incident
Total Petroleum Hydrocarbons Sampling Locations Map
4/12/2017

Chevron

The Response Group
Emergency Response | Pre-Planning & Support
281-880-5000

Scale: 1:10,700