

ACTION PLAN TO ESTABLISH POINT OF COMPLIANCE

DISTRICT SIX C6

Facility ID 286487

NENE Section 20, Township 5 North, Range 65 West



EXTRACTION OIL & GAS, INC.

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Preparation Date

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INTRODUCTION

Apex Companies, LLC (Apex) has been contracted by Extraction Oil & Gas Inc (Extraction) to prepare an action plan to establish point of compliance for a release at the District Six C6 well (API # 05-123-24211, Facility ID 286487) identified after the failure of a mechanical integrity test (MIT). The District Six C6 is location on the Greeley Directional pad (Facility ID 332837) in Greeley, Colorado, see **Attachment A**.

The groundwater, soil vapor, and water well sampling activities included herein are proposed to be completed following Form 27 (Site Investigation Workplan) approval by the Colorado Oil and Gas Conservation Commission (COGCC).

SAFETY

Site construction is currently being completed at the Greeley Directional Facility. All installation, development, and sampling activities related to this action plan may be halted, modified, or postponed if onsite crews determine it is unsafe to proceed as planned.

During the installation and development of MW01, atmospheric methane was detected inside the well casings. In order to mitigate the enhanced risk due to simultaneous operations and to minimize the risks associated with the presence of atmospheric methane gas, a site- and task-specific risk assessment will be generated. The risk assessment will summarize the task-specific physical hazards commonly associated with the activities associated with the drilling, development, and sampling processes and provide actions designed to reduce or remove these hazards. All personnel on-site, will be required to familiarize themselves with this risk assessment document as well as review and sign a daily job safety analyses (JSA) form.

GROUNDWATER MONITORING

Extraction is proposing the installation of four additional groundwater monitoring wells (MW02 through MW05) to investigate the extent of impacts to groundwater that may have originated from a breach in the District Six C6 well casing at approximately 60 to 75 feet below ground surface (bgs). This activity will characterize the potential up-, cross-, and down-gradient extents of impacted groundwater identified in the previously installed monitoring well MW01. The proposed monitoring wells will be located as close to District Six C6 as feasibly possible, with consideration to regional groundwater flow direction and both current and future land use. See **Appendix B** for a proposed location map.

Pre-Monitoring Field Procedures

Prior to advancing the soil borings described below, the following activities will be performed:

- All necessary workplan, permit, and form approvals will be obtained from the Department of Water Resources (DWR) and COGCC; and
- The drilling locations will be demarcated prior to contacting Colorado 811 and a private utility locator to clear the drilling area of underground utilities.

Monitoring Well Installation

Apex will oversee the advancement of four soil borings to approximately 85 feet bgs (bedrock depth as identified at MW01) using a hollow stem auger drilling rig, operated by a state-licensed drilling contractor and equipped with six-inch outside diameter augers. Prior to advancing the boring, each drilling location will be potholed using a hydro-vac rig to 6 feet bgs to verify utility clearance. Soil will be sampled at 10 foot intervals using a split-spoon sampler and used for lithologic logging and photoionization detector (PID) screening. A geologic boring log will be prepared for all monitoring wells, which will include a classification of soils using the Unified Soil Classification System (USCS), PID readings, and a description of the monitoring well construction. If soil impacts are suspected through field screening during boring activities, the boring location may be moved further from the District Six C6 well for determining the point of compliance extent of groundwater impacts.

Upon reaching total depth, the boring will be converted into a single-completion groundwater monitoring well installed in accordance with industry standards, with sand filter packed around the well casing up to 2 feet above the groundwater level, overlain with hydrated bentonite that will provide a plug to prevent a conduit from the ground surface into the well. The proposed monitoring wells will be completed using 2 inch diameter Schedule 40 PVC casing and 0.010-inch slotted well screen. The screened interval will be approximately 40 feet in length, extending from 45 feet bgs to 85 feet bgs. Due to current activity at the location, the monitoring wells will be completed with flush-mount trafficked steel well vaults with lockable j-plugs.

Monitoring Well Development

Following installation, the wells will be developed per *U.S EPA Environmental Response Standard Operating Procedures for Monitoring Well Development* (2001) guidelines. A groundwater elevation survey will be completed using depth to groundwater measurements and the relative elevations of the top of the well casings in order to determine the measured groundwater gradient and flow direction to ensure the gradient extents have been captured by the well locations.

Monitoring Well Sampling

Prior to sample collection, a stabilization purge method will be completed per *ASTM D4448-01 (Reapproved 2019) Standard Guide for Sampling Ground-Water Monitoring Wells* to ensure a representative groundwater sample will be obtained. Purge water will be containerized onsite and properly disposed of at an Extraction designated disposal facility.

Groundwater samples will be submitted to an accredited laboratory, for analysis of Table 7-1 of the COGCC Model Sampling and Analysis Plan (SAP) with the exception of biological activity reaction tests (BART). Stable isotope analysis shall be performed on samples from the monitoring wells on an annual basis, stable isotope analysis shall include: gas composition, stable isotope analysis of hydrocarbon gases C1 through C5, and carbon dioxide (if present), carbon isotope ratio of dissolved inorganic carbon (DIC), and stable isotopes of water (SIW).

Groundwater samples will be collected from each monitoring well (MW01-MW05) quarterly beginning upon installation and development of the additional monitoring wells. Sample frequency will continue for a minimum of four events, before the plan is re-evaluated.

SOIL VAPOR

Extraction will utilize a leak detection camera to determine if fugitive vapors are visible from the previously installed soil vapor monitoring points SVP-1 through SVP-4. If no visible vapors are identified, no additional soil vapor monitoring points will be installed at this time. Monitoring will continue at the following previously installed points:

- SVP-1-5
- SVP-1-30
- SVP-2-5
- SVP-2-30
- SVP-3-5
- SVP-3-30
- SVP-4-5
- SVP-4-30

In the event further monitoring points are required, the following action plan will be completed to characterize the extent of stray gas that may have traveled from the breach to ground surface through conduits in the subsurface.

Soil Vapor Monitoring Well Installation

Apex will oversee the installation of nested vapor points at pre-approved locations around the District Six C6 well. A diagram of the proposed locations of the soil vapor points will be provided if/as necessary. Two nested sample points will be installed in each borehole at 5 and 30 feet bgs and boring will be potholed to 6 feet bgs using a hydro-vac rig, and advanced to total depth using a hollow-stem auger equipped with six-inch augers.

Each soil vapor point will be constructed with a soil vapor probe tip connected to one-quarter-inch diameter Nylaflow® tubing (or equivalent). Annular fill around the vapor probes will consist of a sand pack extending from the base of the probe to approximately 6 inches above the probe. At least one-foot of dry granular bentonite will be placed above the sand followed by hydrated bentonite chips to seal the annular space between the vapor probes. Upon reaching the next desired vapor probe depth, the process will be repeated. The five-foot vapor probe will be sealed with hydrated bentonite chips to just below surface grade. The tubing at the top of each probe will be fitted with a valve assembly to facilitate soil vapor sampling. A section of 2 inch diameter PVC pipe approximately 1 foot in length with a threaded cap will be set into the bentonite 2 to 3 inches below ground surface to protect the probe tubing and provide easy access for sampling.

Soil Vapor Monitoring

To allow for sufficient equilibration, the vapor points will not be sampled or field screened for at least 24 hours following probe installation. Apex will conduct soil vapor screening in the field using a calibrated Landtec GEM 5000 landfill meter (or equivalent) equipped with methane (CH₄), hydrogen sulfide (H₂S), carbon monoxide (CO), and oxygen (O₂) sensors.

If methane is detected within a vapor points above background concentrations, a sample will be collected for laboratory analysis of methane via EPA method 3C.

DIVISION OF WATER RESOURCES WATER WELLS

All Colorado Division of Water Resources (DWR) water wells within a quarter mile radius were identified and evaluated for inclusion in a sampling event as part of the action plan. All of the DWR permitted water sources within the radius were eliminated based on an abandoned, incomplete, or expired permit status or after completion of field verification. See **Attachment C** for an evaluation of the DWR water sources.

A further review of the Colorado Environmental (COENV) database indicates a potentially viable water source, Doty 160051, Facility ID 754055, located 0.33 miles from the District Six C6 well. Upon well owner permission, a water well sample will be collected for laboratory analysis of Table 7-1 of the COGCC Model SAP.

REPORTING

Laboratory results will be uploaded into the COENV database via Form 43. Apex will provide the laboratory and field-testing results in a summary report attached to a supplemental Form 27 following work completion each quarter. The summary report will include a narrative description of the work performed, boring logs, and well construction logs for all additional monitoring wells installed, as well as waste disposal information, tabulated data summaries, and figures showing the assessment locations.

LIST OF APPENDICES

- A. Topographic Site Map
- B. Proposed Additional Monitoring Well Locations
- C. Quarter Mile DWR Identified Water Source Documentation

ATTACHMENT A
Topographic Site Map



**District Six C6
Proposed Additional
Monitoring Wells**



ATTACHMENT B

Proposed Additional Monitoring Well Locations



**District Six C6 Well
(Location ID: 473512)
Proposed Monitoring Well
Locations**



MW05

MW04

MW01

MW02

MW03



ATTACHMENT C

Quarter Mile DWR Identified Water Source Documentation

Extraction Oil & Gas
DWR Water Sources
District Six C6 286487

Status	Receipt	Permit	Permit Status	Contact Name	Twn	Rng	Sec	Q40	Q160	Q10	Latitude	Longitude	Use(s)	TD
Eliminated -- Field verification on 3/18/20 identified a non-functioning, non-accessible casing. No sample will be collected.	9060228	9989	Well Constructed	1st Avenue Partners, LLC Mailing: PO Box 69 Windsor, CO 80550-0069 Phone: (970) 458-7196 (1st Ave. Storage) Note: 1st Ave. Storage on lot owned by 1st Ave Properties, LLC	5N	65W	21	NW	NW		40.391123	-104.677276	Domestic	120
Eliminated -- Field verification on 3/18/20 identified a non-functioning, non-accessible casing. No sample will be collected.	203120	70254--A	Well Constructed	All-Well, LLC Mailing: C/O Scott Realty Co 1212 8th Ave. Greeley, CO 80631-4012 Physical: 2829 1st Ave. Greeley, CO 80631 Phone: (970) 352-1209 Scott Realty Co	5N	65W	20	NE	NE		40.390988	-104.679073	Household use only	120
Eliminated -- Field verification on 3/18/20 identified well is no longer present. Field has been graded and owner only uses City water, no well in are.	9059157	4253	Well Constructed	BMC West Corporation Mailing: PO BOX 25178 Lehigh Valley, PA 18002-5178 Physical: 500 27th ST. Greeley, CO 80631 Phone: (970) 356-9000 Mike Floggette MGR Phone: Anna Mehue: (919) 431-1840	5N	65W	17	SW	SE		40.393658	-104.685014	Domestic	69
Eliminated -- desktop review indicates well is under highway	9059052	3553-F	Well Constructed	State Dept of Highway	5N	65W	17	SE	SE		40.393645	-104.680225	Commercial	79
Eliminated -- Permit review indicates Diversion of water prohibited, power disconnected	9059484	5999-R	Well Constructed	Rush Truck Centers of Colorado Mailing: 555 S Interstate 35 STE 500 New Braunfels, TX 78130-4889 Physical: 625 31st ST Evans, CO 80620 Phone: (970) 534-3900	5N	65W	20	NW	NE		40.390014	-104.684991	Irrigation	118
Eliminated -- Permit Status	0000337C	1995197-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388915	-104.682008	Other	
Eliminated -- Permit Status	0000337D	1995198-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388037	-104.681962	Other	
Eliminated -- Permit Status	0000337E	1995199-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387947	-104.681962	Other	
Eliminated -- Permit Status	0000337F	1995200-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387955	-104.681846	Other	
Eliminated -- Permit Status	0000337G	1995201-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388005	-104.681857	Other	
Eliminated -- Permit Status	0000337H	1995202-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388027	-104.681718	Other	
Eliminated -- Permit Status	0000337I	1995203-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387906	-104.681785	Other	
Eliminated -- Permit Status	0000337J	1995204-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387906	-104.681897	Other	
Eliminated -- Permit Status	0000337K	1995205-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387965	-104.682004	Other	
Eliminated -- Permit Status	0000337L	1995206-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388023	-104.682004	Other	
Eliminated -- Permit Status	0000337M	1995207-AB	Well Abandoned	RR DONNELLEY NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387955	-104.68181	Other	
Eliminated -- Permit Status	16991	16991-MH	Permit Issued	NORWEST, PUBLISHING	5N	65W	20		NE		40.388192	-104.682601	Monitoring/Sampling	
Eliminated -- Permit Status	20007	20007-MH	Permit Issued	NORWEST RR DONNELLEY	5N	65W	20		NE		40.388192	-104.682601	Monitoring/Sampling	
Eliminated -- Permit Status	25549	25549-MH	Permit Issued	R R DONNELLY NORWEST INC	5N	65W	20		NE		40.390005	-104.680211	Monitoring/Sampling	
Eliminated -- Permit Status	25574	25574-MH	Permit Issued	R R DONNELLEY NORWEST INC	5N	65W	20		NE		40.388192	-104.682601	Monitoring/Sampling	
Eliminated -- Permit Status	240889		Application Information Requested	Rush Truck Centers of Colorado Mailing: 555 S Interstate 35 STE 500 New Braunfels, TX 78130-4889 Physical: 625 31st ST Evans, CO Phone: (970) 534-3900	5N	65W	20	SW	SE		40.391945	-104.685089	Domestic	

Extraction Oil & Gas
DWR Water Sources
District Six C6 286487

Status	Receipt	Permit	Permit Status	Contact Name	Twn	Rng	Sec	Q40	Q160	Q10	Latitude	Longitude	Use(s)	TD
Eliminated -- Permit Status	0330311A	40122-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387982	-104.681797	Other	
Eliminated -- Permit Status	0330311C	40124-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387981	-104.681448	Other	
Eliminated -- Permit Status	0330311D	40125-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387752	-104.681449	Other	
Eliminated -- Permit Status	0330311E	40126-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388037	-104.681962	Other	
Eliminated -- Permit Status	0330311F	40127-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387947	-104.681962	Other	
Eliminated -- Permit Status	0330311G	40128-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387955	-104.681848	Other	
Eliminated -- Permit Status	0330311H	40129-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388027	-104.681718	Other	
Eliminated -- Permit Status	0330311I	40130-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387906	-104.681787	Other	
Eliminated -- Permit Status	0330311J	40131-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387906	-104.681897	Other	
Eliminated -- Permit Status	0330311K	40132-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.387965	-104.682005	Other	
Eliminated -- Permit Status	0330311L	40133-F	Permit Expired	NORWEST PUBLISHING CO	5N	65W	20	SE	NE		40.388005	-104.681858	Other	
Eliminated -- Permit Status	397190	194053	Permit Issued	RR DONNELLEY NORWEST INC	5N	65W	20	SE	NE		40.387752	-104.681431	Monitoring/Sampling	
Eliminated -- Permit Status	397191	194054	Permit Issued	RR DONNELLEY NORWEST INC	5N	65W	20	SE	NE		40.387981	-104.68143	Monitoring/Sampling	
Eliminated -- Permit Status	9065216	70254	Well Replaced	FRANKLIN, FRED	5N	65W	20	NE	NE		40.390498	-104.679165	Household use only	
Eliminated -- Permit Status	30532	30532-MH	Permit Issued	MID AMERICA HOLDING CO	5N	65W	17	SE	SE		40.393645	-104.680225	Monitoring/Sampling	
Eliminated -- Permit Status	30693	30693-MH	Permit Issued	MID AMERICAN HOLDING	5N	65W	17	SE	SE		40.393645	-104.680225	Monitoring/Sampling	
Sampled 10/17/19	59993	59993-MH	Well Constructed	Richmark Real Estate Partners, LLC Mailing: PO Box 328 Greely, CO 80632-0328 Physical: None Phone: (970) 352-9446	5N	65W	20	NE	NE		40.391327	-104.681902	Monitoring/Sampling	85