

**Submitted via COGCC eForm by Alfred Ward & Son**

August 25, 2021

Mr. Rob Young  
Northeast Environmental Protection Specialist  
State of Colorado  
Oil and Gas Conservation Commission  
1120 Lincoln Street, Suite 801  
Denver, CO 80203

Re: Workplan for Subsurface Assessment  
Alfred Ward & Son – Former State 3 Well  
Section 16, T3S, R56W, Washington County, Colorado  
Paragon Project Number 1021020/COGCC Remediation Project 12068

Dear Mr. Young:

The purpose of this letter is to describe our proposed workplan for the above-referenced site. The purpose of this assessment is to obtain information regarding possible subsurface petroleum impacts at the former oil/gas facility located in the SW ¼ of the NW ¼ of Section 16, Township 3 South, Range 56 West in Washington County, Colorado. We understand that the former State 3 well has been plugged and abandoned by Alfred Ward & Son. The depth to groundwater is reported to be less than 20 feet below grade and the groundwater flow direction at the site is estimated to be to the east-northeast.

**PROPOSED WORKPLAN**

The tasks associated with our proposed workplan are generally described below. We understand that Alfred Ward & Son will use the tasks described herein to support submittal of the eForm 27 report required by the Colorado Oil and Gas Conservation Commission (COGCC).

1. We have notified the Colorado State Land Board (SLB) of the proposed assessment activities. If necessary, we will request a temporary access permit from the SLB.
2. We will coordinate the locating of known underground utilities in the proposed drilling area with the Utility Notification Center of Colorado.

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AND GEOHYDROLOGY

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3. A Notice of Intent to Construct Monitoring Hole(s) will be prepared and submitted to the State Engineer's Office.
4. Four to eight (8) soil borings are planned to be completed at the site at the approximate locations shown on the attached diagram. Boring locations may be modified based on field observations and site conditions. Four (4) borings are planned near the former well head. If obvious significant impacts are observed near the well head, three (3) additional borings are planned in the assumed downgradient direction, and one (1) boring is planned in the assumed upgradient direction. It is anticipated that the borings will be completed to depths ranging from approximately 20 to 25 feet below site grade. It is anticipated that soil samples will be collected at approximate five (5)-foot intervals in seven (7) of the borings while continuous hollow-stem sampling will be used in one (1) boring.
5. Soil samples that are collected from the borings will be screened on site with a photoionization detector (PID) using ambient temperature headspace analysis (ATHA) methods. Two (2) soil samples from the borings near the well head and one (1) soil sample from the other soil borings are planned to be submitted to our contract laboratory for laboratory analyses. The soil samples will be selected for chemical analyses based on the ATHA results, visual observations, olfactory observations and the presence of the groundwater table. The soil samples will be analyzed for benzene-toluene-ethylbenzene-xylenes (BTEX), naphthalene, total petroleum hydrocarbons – gasoline range organics (TPH-GRO), total petroleum hydrocarbons – diesel range organics (TPH-DRO), pH and electrical conductivity (EC). In addition, one (1) soil sample with the highest EC value will also be analyzed for sodium adsorption ratio (SAR).
6. One (1) monitoring well is planned to be installed near the former well head. If obvious significant impacts are observed near the well head, three (3) additional wells are planned to be installed in the assumed downgradient direction, and one (1) well is planned to be installed in the assumed upgradient direction. The monitoring wells will be developed, purged, and sampled for laboratory analyses of BTEX and chloride.
7. If three (3) or more wells are installed, the horizontal and vertical location of the wells will be surveyed in order to estimate a groundwater flow direction at the site.
8. We will prepare a letter report with figures, tables and boring logs based on the assessment data and we will submit them to Alfred Ward & Son along with the laboratory reports. We understand that information provided by us will be used by Alfred Ward & Son to support submittal of the eForm 27 report to the COGCC.

## **FIELD METHODS**

To perform the assessment services, we will provide a drill rig with associated equipment and experienced field personnel. One (1) of the crew members will be a field engineer or field geologist. Prior to arriving on site, the drill rig and sampling equipment will be cleaned using a high-pressure, hot-water, power washer. We will provide a portable high-pressure, hot-water, power washer for use on site and we will clean the drilling and sampling equipment between each use to limit the potential for cross contamination between borings. Excess soil from the borings, wash water from the equipment cleaning, and purge water from the wells will be containerized and left on site for future off-site disposal.

Soil samples will be screened on site for evidence of volatile organic contamination. Screening methods will include visual and olfactory observations as well as field ATHA. The ATHA method involves placing soil samples in Ziploc bags such that the bags are approximately one-third full. The sample is allowed to equilibrate with the container headspace for approximately 15 minutes. The PID probe is then used to pierce the bag and the maximum observed reading is recorded. PID readings are considered only a qualitative field measurement of contamination and should not be interpreted as quantitative analyses.

Field logs of each boring will be prepared by a Paragon field geologist or engineer. The field logs contain visual and tactual classifications of the materials encountered during drilling, as well as the driller's interpretation of subsurface conditions based on drilling resistance and difficulty. Paragon's standard field logging form will be utilized to record this information. A copy of a typical Paragon field log is attached to this document. In addition, a copy of the soil classification system utilized in the field by Paragon personnel to document soil observations on these forms is attached to this document. A final boring log for the project file will be prepared based on the field log. The boring logs represent an interpretation of the field logs. The stratification boundaries shown on the boring logs represent the approximate locations of changes in soil types; in-situ, the transition of materials may be gradual.

Soil borings that are not instrumented with monitoring wells will be closed using powdered bentonite and/or bentonite chips mixed with apparently non-impacted auger cuttings or imported material at a ratio of approximately one (1) part bentonite to eight (8) parts soil. The mixture will be placed in the boreholes and drill stem may be used to field compact the added mixture.

Boreholes in which monitoring wells will be installed will be advanced, sampled and logged in a manner similar to that used to complete other soil borings. As needed, hollow-stem augers will be used to maintain an open borehole for the installation of the monitoring wells. Copies

of final boring logs for monitoring wells and construction data will be provided to the Division of Water Resources.

The monitoring wells will be constructed of 2-inch nominal diameter, flush-threaded PVC casing materials; 0.010-inch factory slotted, flush-threaded, schedule 40, PVC well screen material matching the diameter of the solid casing; and flush-threaded, schedule 40, PVC bottom sumps with threaded caps to reduce the inflow of sediment into the bottoms of the wells. The well filter pack will be chemically inert 10/20 graded, washed silica sand placed to approximately six (6) inches to one (1) foot above the top of the well screen interval. A minimum two (2) foot thick bentonite layer will be placed in the well annular space immediately above the gravel pack. This layer is intended to act as a seal and is typically constructed by placing 1/4-inch or 3/8-inch bentonite pellets in the borehole and adding potable water. The bentonite is allowed to swell for approximately 20 minutes before further completion of the well. A bentonite-cement grout mixture is added to the remainder of the annular space above the bentonite layer. Concrete is placed above the frost line and a sloped apron is constructed to drain surface runoff away from the well head. The PVC well casings will be protected with a lockable above-ground cover.

Monitoring well development will be performed by surging the well to remove sediment from the well prior to sampling. The water level in each well is measured before and after development. Dissolved oxygen (DO) will be measured prior to development and pH, electrical conductivity, oxygen-reduction potential (ORP), and temperature will be measured during well development. Paragon's standard well development procedure involves removing five (5) or more well volumes until the water geochemical data are within ten (10) percent of the previous readings. The water levels may be monitored after development in attempts to confirm that the water levels in the wells have stabilized. After the wells are developed, groundwater samples will be collected with single-use, pre-cleaned bailers. The groundwater samples will be placed in appropriate glass or plastic containers, which are supplied by our contract laboratory, for transportation to the laboratory.

We anticipate that the field services for this project will be performed under safety level D personal protective procedures. Paragon personnel utilized for this project are involved in our in-house medical monitoring program and we will provide site monitoring during our field services by utilizing a PID. Should this monitoring indicate that an upgrade in the level of personal protective equipment is required, our field services will be terminated until the necessary protection is available for our field personnel.

## SCHEDULE

The drilling and well installation is scheduled for September 27 through September 29, 2021. It is anticipated that development and sampling of the groundwater monitoring well(s) will be performed on October 1, 2021. Laboratory results for soil samples should be received by October 14, 2021 and laboratory results for groundwater sample(s) should be received by October 18, 2021. It is anticipated that the figures, tables, boring logs, and laboratory reports will be transmitted to Alfred Ward & Son by October 29, 2021 for incorporation into a supplemental Form 27, which will be submitted to the COGCC by Alfred Ward & Son.

If you have any questions or changes concerning the proposed workplan, please contact us prior to September 22, 2021.

Sincerely,  
PARAGON CONSULTING GROUP, INC.



Scott A. Rutherford, P.E.  
Senior Project Engineer

SAR/DMR:sar2



David M. Rau, P.E., BCEE  
Principal Engineer

enc: Figure 1 – Proposed Assessment Location Diagram

cc: Mr. Randy Ward/Alfred Ward & Son (via email)  
Mr. Steve Freese/State Land Board (via email)

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