

## WORK PLAN

**DATE** February 24, 2021

**Reference No.** 19125681-4-L-2

**TO** Adam Plonsky  
Wexpro Company

**CC** April Stegall - Wexpro Company

**FROM** Matt Somogyi, Jeremy Yeglin

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### SVE PILOT TESTING WORK PLAN – WEXPRO COMPANY

Golder Associates Inc. (Golder) has prepared this Soil Vapor Extraction (SVE) Work Plan for Wexpro Company (Wexpro) to outline the overall objectives of SVE pilot testing, the general procedures for the installation of an SVE pilot testing well network, and SVE pilot testing procedures, including analytical requirements. The objectives and procedures described in this document apply to three former exploration and production (E&P) pits in the Powder Wash Natural Gas Field in Moffat County, Colorado. Specifically:

- HW Stewart 1, Pit 2 (COGCC ID 100667)
- BW Musser 11 (COGCC ID 100382)
- BW Musser 16 (COGCC ID 100365)

These pits are located within a five-mile radius of 40.946683°, 108.301703° (the Sites) and are regulated by the Colorado Oil and Gas Conservation Commission (COGCC). A discussion of previous and proposed additional investigation and a remedial options evaluation for each of these sites is presented in the Remedial Action Plan for 18 Sites – Exploration and Production Pits (Golder 2020).

### SVE PILOT TESTING OBJECTIVES

SVE pilot testing program will be performed to accomplish the following primary objectives:

- Installation of a pilot-scale SVE well network that can be expanded upon for full-scale implementation of SVE.
- Obtain critical design parameters for the full-scale remedial system, including:
  - Vapor radius of influence (ROI) of the applied vacuum.
  - Optimal vapor extraction (i.e., flow) rates.
- Evaluate the performance of SVE on initial mass removal of total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) that will provide a preliminary indication of the effectiveness of the removal of these constituents with SVE under unenhanced conditions.
- Evaluate SVE's suitability to be used for full-scale implementation.

## SVE PILOT TESTING WELL NETWORK

It is proposed that three SVE pilot testing wells be installed at the BW Musser 11 (COGCC ID 100382) and BW Musser 16 (COGCC ID 100365) pits and that two SVE pilot testing wells be installed at the HW Stewart 1, Pit 2 (COGCC ID 100667). For the BW Musser 11 (COGCC ID 100382) and BW Musser 16 (COGCC ID 100365) pits, one SVE well would be installed near the center of impacts, understood to be near the center of the former pit(s) and based on the current understanding of area of impacts. Two pilot testing wells would be installed in-line and at distances of approximately 10 and 25 feet away from the central well. This spacing will allow for the evaluation of the radius of influence at 10-, 25-, and 35-foot distances from the point extraction.

For the HW Stewart 1, Pit 2 (COGCC ID 100667) pit, two SVE wells would be installed near the center of impacts and spaced approximately 10 feet apart. The area of impacts at this pit are well constrained and if suction is observed at 10 feet from the point of extraction, near-full coverage of the impacted area could potentially be achieved with just two SVE wells.

SVE pilot testing well locations are based on the results of the 2019 pit delineation investigations and not based on pit geometry interpreted from historical aerial imagery. The proposed SVE pilot test well locations for each of the three Sites are presented on figures in Attachment 1.

SVE pilot test wells will be installed in boreholes drilled with hollow stem auger and/or air coring methods using techniques that allow for the retrieval of continuous soil/bedrock samples. This sampling protocol will allow for the field geologist to assess the total depth interval of hydrocarbon-related impacts which will be the basis of design for the SVE well screen depths and intervals. Each well will be constructed of 4-inch-diameter polyvinyl chloride (PVC) well casing and screen and installed to screen the entire impacted depth. The well screen and surrounding filter pack material will be of appropriate size to maximize the induced suction and air transmission of the surrounding lithology to each SVE well; 0.020-inch and factory-slotted well screen and 2-12 fraction, or comparable, silica sand filter pack which will extend at least one-foot above the top of the well screen. A minimum of two feet of bentonite chips will be installed above the filter sand and will be hydrated after placement to form a seal. Depending on the length of the remaining annular space between the top of the bentonite seal and the ground surface, the remaining space will be filled with either high-solids bentonite slurry or bentonite chips hydrated after placement. Protective steel bollards may be installed around each SVE well at the request of Wexpro.

## GENERAL SVE PILOT TESTING PROCEDURES

Independent vapor extraction will be performed at each of the pilot test wells leaving the remaining well(s) as observation/monitoring locations for each test. This will result in three pilot tests performed at each of the BW Musser 11 and BW Musser 16 sites and two pilot tests performed at the HW Stewart 1, Pit 2 site. Pilot scale testing will be performed with a vacuum truck or other temporary (i.e., non-permanent) vacuum/suction equipment. Extraction piping and manifolds will be temporary and will be replaced and/or upgraded as appropriate if full-scale SVE is implemented.

The total extraction period for each pilot test will be a maximum of 8-hours and will include various flow rates with the purpose of evaluating the pressure versus flow relationship between the extraction and observation well(s). The extraction flow rates will be measured with an in-line flow meter installed on the downstream side of the extraction well piping. Pressures induced at observation points will be monitored with a manometer, digital pressure gauge, pressure transducer, or comparable device. It is expected that pressure versus flow testing will

be performed for three different flow rates for a period of approximately one-hour per test. The remaining time will be used for a constant rate extraction test performed at the optimum rate as determined by the pressure versus flow tests. The total extraction period for each test may be increased or decreased from the proposed eight hours depending on the results of each test. Throughout the extraction period, the flow rate will be monitored at the extraction well and pressure/vacuum will be monitored at the two observation wells. The pressure versus flow test data will be useful for full-scale well field balancing and the longer-term constant rate extraction test will yield critical air permeability data that will be used for full-scale system design.

Prior to starting SVE, photoionization detector (PID) measurements will be taken from each well in the network and from the extraction well manifold throughout testing to get a preliminary indication of VOC removal. In addition to PID measurement throughout testing, one vapor sample will be collected from the extraction well prior to termination of each constant rate test. The vapor sample will be collected in either a Tedlar bag or SUMMA® canister and will be submitted to a certified analytical laboratory for analysis of TPH-gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylene (BTEX) by USEPA Method TO-3 or other applicable analytical method. Per the Colorado Department of Public Health and Environment – Air Quality Division, Regulation Number 3 (5 CCR 1001-5), Section II.D.1.i (ii and iii) an Air Pollutant Emission Notice and air emissions permit exemption applies to SVE pilot testing. Additional constituents may be analyzed for and by different methods to characterize emissions for permitting of full-scale remedial systems. Additional testing will be performed at the discretion of Wexpro.

## REPORTING

Upon completion of each SVE pilot test, a technical memorandum will be prepared that will summarize field activities including the drilling and installation of SVE wells, and pilot testing procedures and results. Borehole logs, SVE pilot test well as-built diagrams, pressure versus flow graphs, flow, vacuum, other operational data, and laboratory results will be included. Conclusions and recommendations will be provided regarding the feasibility of full-scale SVE implementation.

## CONCLUSION

SVE pilot testing will be performed at each of the three sites listed above to evaluate the pressure versus flow relationship and constant rate air permeability characteristics for each test. The data obtained by SVE pilot testing will be used to evaluate the feasibility of full-scale SVE implementation at each site. If full-scale SVE operation is a feasible remedial option, data gathered during pilot testing will be used to up-scale the pilot testing network for full-scale implementation.



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Senior Hydrogeologist

MKS/JLY/mb



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Associate

Attachments: Attachment 1: Proposed SVE Pilot Test Well Locations

[https://golderassociates.sharepoint.com/sites/111388/project files/6 deliverables/letters/4-l-sve\\_pilot\\_testing\\_work\\_plan/4-l-2/19125681-4-l-2-sve\\_pilot\\_testing\\_work\\_plan\\_24feb21.docx](https://golderassociates.sharepoint.com/sites/111388/project%20files/6%20deliverables/letters/4-l-sve_pilot_testing_work_plan/4-l-2/19125681-4-l-2-sve_pilot_testing_work_plan_24feb21.docx)

**ATTACHMENT 1**

# Proposed SVE Pilot Test Well Locations



#### LEGEND

● PROPOSED SVE PILOT TEST WELL LOCATION

#### HISTORICAL ANALYTICAL SAMPLE

- EXCEEDANCE OF COGCC  
TABLE 910-1 CONCENTRATION LEVEL (2019)
- NO EXCEEDANCE OF COGCC  
TABLE 910-1 CONCENTRATION LEVEL (2019)

#### NOTE(S)

1. ACTUAL SVE PILOT TEST WELL LOCATIONS MAY VARY FROM THE LOCATIONS SHOWN AND WILL BE BASED ON ACCESS, LOCATIONS OF UTILITIES, AND OTHER APPLICABLE FIELD CONSIDERATIONS.

#### REFERENCE(S)

1. GPS POINT DATA COLLECTED BY GAI IN OCTOBER AND NOVEMBER OF 2019.
2. AERIAL IMAGERY: ESRI BASEMAP SERVICE, DIGITAL GLOBE, VIVID IMAGERY CAPTURED ON 5/26/2013.

#### CLIENT

DOMINION ENERGY WEXPRO

#### PROJECT

EXPLORATION AND PRODUCTION  
PIT DELINEATION PROJECT  
CRAIG, CO

#### TITLE

**SVE PILOT TEST WELL LOCATIONS FOR:  
PAD NAME: HW STEWART 1  
PIT NUMBER: 2  
COGCC ID: 100667**

#### CONSULTANT



**GOLDER**

YYYY-MM-DD 2021-01-06

DESIGNED RHG

PREPARED RHG

REVIEWED TLH

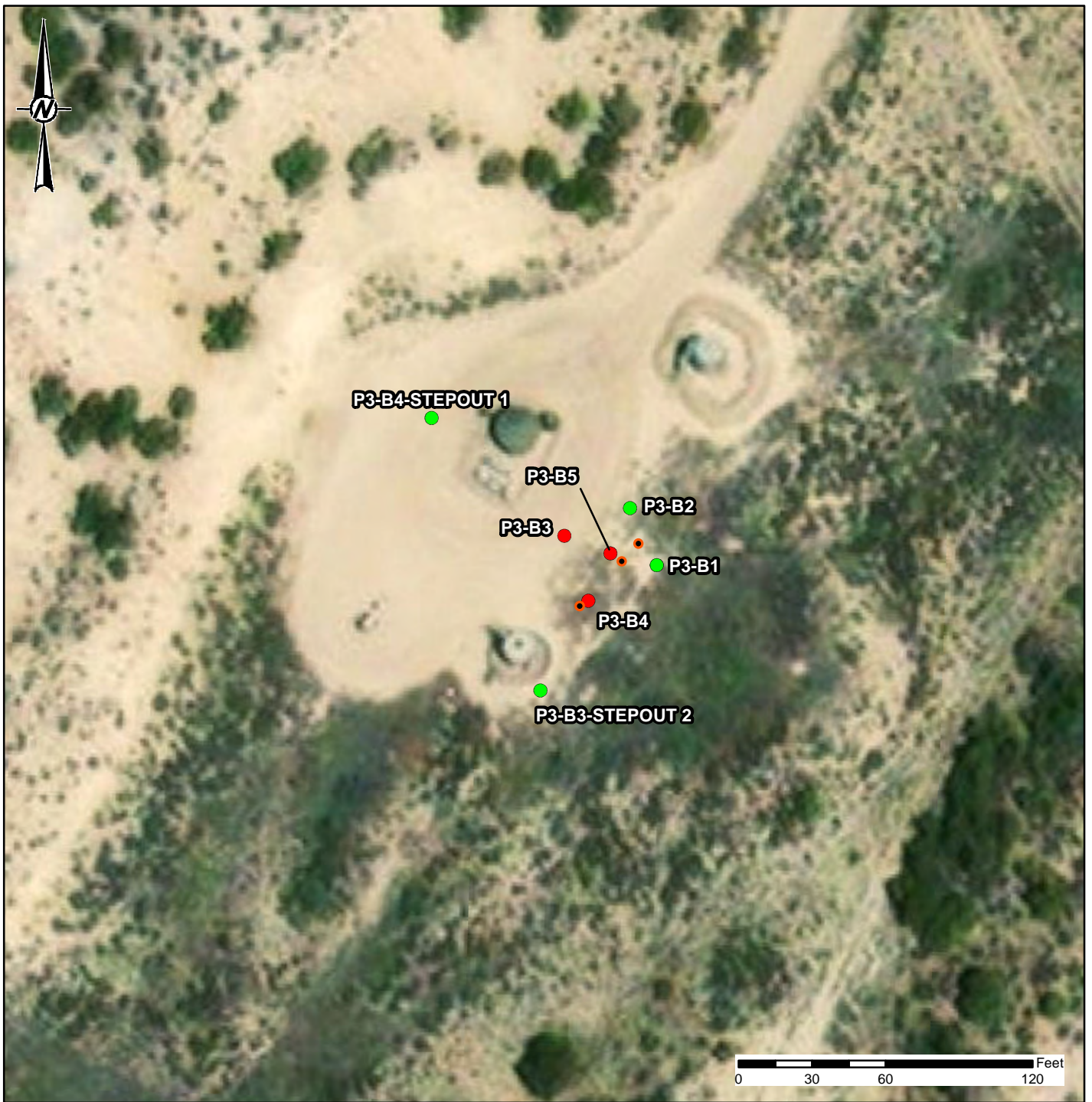
APPROVED MKS

#### PROJECT NO.

19125681

#### FIGURE

1



#### LEGEND

● PROPOSED SVE PILOT TEST WELL LOCATION

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DOMINION ENERGY WEXPRO

#### PROJECT

EXPLORATION AND PRODUCTION  
PIT DELINEATION PROJECT  
CRAIG, CO

#### TITLE

**SVE PILOT TEST WELL LOCATIONS FOR:**  
**PAD NAME: BW MUSSER 11**  
**PIT NUMBER: 3**  
**COGCC ID: 100382**

#### CONSULTANT



**GOLDER**

YYYY-MM-DD 2021-01-06

DESIGNED RHG

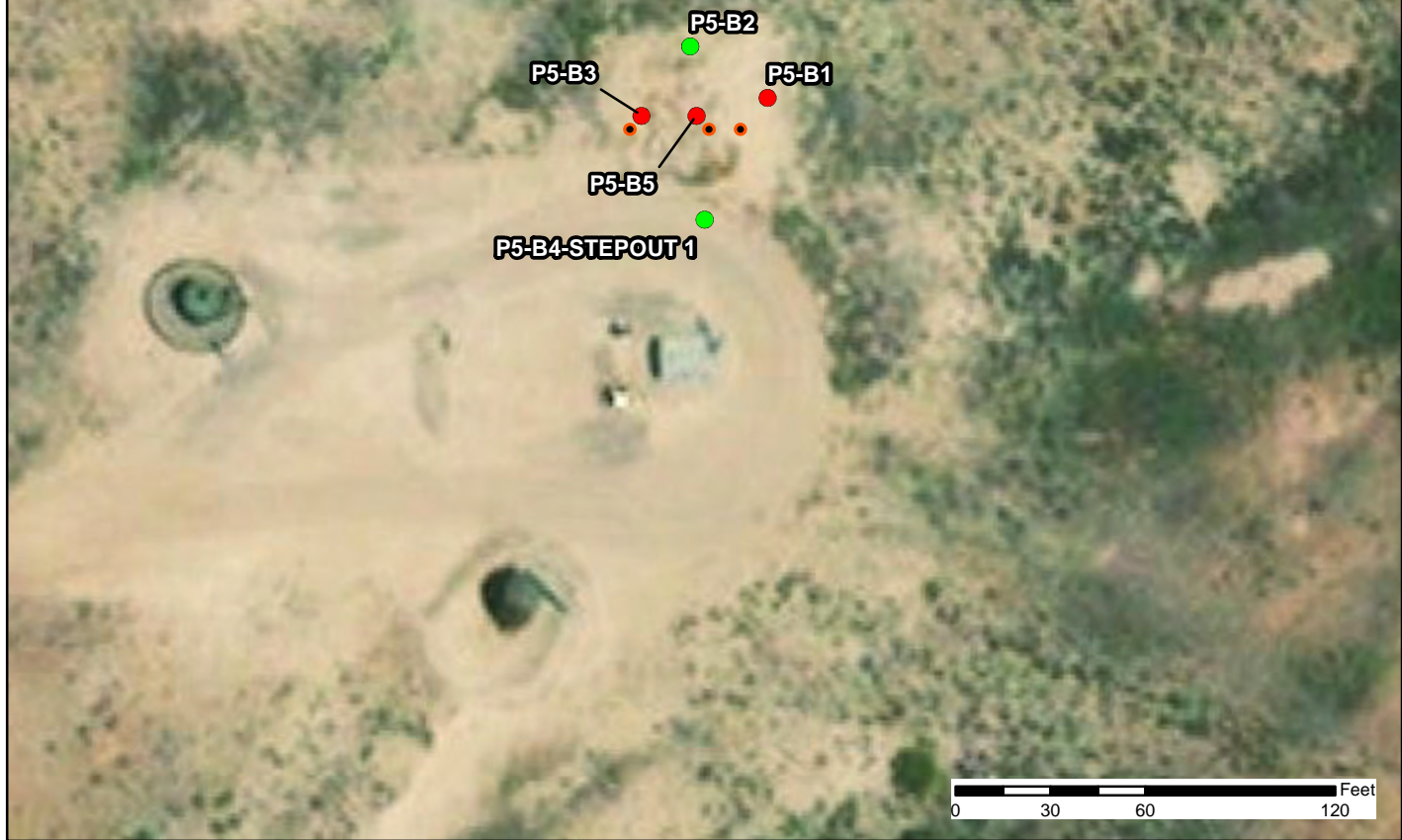
PREPARED RHG

REVIEWED TLH

APPROVED MKS

PROJECT NO.  
19125681

FIGURE  
2



**LEGEND**

● PROPOSED SVE PILOT TEST WELL LOCATION

**HISTORICAL ANALYTICAL SAMPLE**

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**CLIENT**

WEXPRO COMPANY

**PROJECT**

EXPLORATION AND PRODUCTION  
PIT DELINEATION PROJECT  
CRAIG, CO

**TITLE**

**SVE PILOT TEST WELL LOCATIONS FOR:  
PAD NAME: BW MUSSER 16  
PIT NUMBER: 5  
COGCC ID: 100365**

**CONSULTANT**



YYYY-MM-DD 2020-12-16

DESIGNED RHG

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REVIEWED TLH

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**FIGURE**

3