FORM
27
Rev 6/99

Click here to reset form

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 (303)894-2100 Fax:(303)894-2109

FOR OGCC USE ONLY
Date 07/21/15
REM 9186
Doc 2495192

OGCC Employee:
☐ Spill ☐ Complaint
☐ Inspection ☐ NOAV
Tracking No:

SITE INVESTIGATION AND REMEDIATION WORKPLAN

This form shall be submitted to the Director for approval prior to the initiation of site investigation and remediation activities. Form 27 is intended to be used whenever possible. Additional documentation will be required when large volumes of soil and groundwater have been impacted or involve large facilities with multiple source areas. See Rule 910. Attach as many pages as needed to fully describe the proposed work.

CAUSE OF CONDITION BEING INVESTIGATED AND REMEDIATED

☐ Spill or Release ☐ Plug & Abandon ☐ Central Facility Closure ☐ Site/Facility Closure ☑ Other (describe): Spill DOC# 400767949

OGCC Operator Number: 100264
Name of Operator: XTO Energy Inc.
Address: PO Box 6501
City: Englewood State: CO Zip: 80155

Contact Name and Telephone:
Jessica Dooling
No: 970-675-4122
Fax: 970-675-4150

API Number: 05-103-08340
County: Rio Blanco
Facility Name: Piceance Creek Unit
Facility Number: 159569
Well Name: Piceance Creek Unit
Well Number: F23-18G
Location: (QtrQtr, Sec, Twp, Rng, Meridian): NESW, Sec. 18, T2S, R96W, 6th PM Latitude: 39.87636 Longitude: -108.21227

TECHNICAL CONDITIONS

Type of Waste Causing Impact (crude oil, condensate, produced water, etc): Produced Water

Site Conditions: Is location within a sensitive area (according to Rule 901e)? ☐ Y ☑ N If yes, attach evaluation.

Adjacent land use (cultivated, irrigated, dry land farming, industrial, residential, etc.): Non-Crop Land, Rangeland

Soil type, if not previously identified on Form 2A or Federal Surface Use Plan: Castner channery loam, 5 to 50% slopes

Potential receptors (water wells within 1/4 mi, surface waters, etc.): Nearest surface water is > 1/4 mile, nearest water well > 1/2 mile.

Description of Impact (if previously provided, refer to that form or document):

Impacted Media (check):	Extent of Impact:	How Determined:
☑ Soils	TPH, BTEX	laboratory analysis
☐ Vegetation		
☐ Groundwater		
☐ Surface Water		

REMEDIATION WORKPLAN

Describe initial action taken (if previously provided, refer to that form or document):

Initial spill was reported on January 9, 2015 via Form 19 Doc # 400767949. A line malfunction was isolated and the line removed from service. Initial samples were collected to assess level of impacts and to identify constituents of concern; please refer to Attachment I, Table 1, and Figures 1 - 4 (4 total).

Describe how source is to be removed:

Impacted soils above Table 910-1 concentration levels will be treated in-situ using a soil vapor extraction (SVE) system. At the completion of the project, appropriate confirmation sampling will be conduted to assure impacted soils are below Table 910-1 concentration levels.

Describe how remediation of existing impacts is to be accomplished, including removal and disposal at an injection well or licensed facility, land treatment on site, removal of impacted groundwater, insitu bioremediation, burning of oily vegetation, etc.:

Insitu bioremediation utilizing an SVE system.

Submit Page 2 with Page 1

FORM 27 Rev 6/99

Page 2

State of Colorado
Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801, Denver, Colorado 80203
(303)894-2100 Fax:(303)894-2109

Tracking Number: _____
Name of Operator: _____
OGCC Operator No: _____
Received Date: _____
Well Name & No: _____
Facility Name & No: _____

REMEDIATION WORKPLAN (Cont.)

OGCC Employee:

If groundwater has been impacted, describe proposed monitoring plan (# of wells or sample points, sampling schedule, analytical methods, etc.):

Available information indicates that the uppermost groundwater bearing zone is greater than 150 feet below the ground surface. The vertical extent of impacted soils is not known at this time. Soil samples will be collected during the proposed delineation and remediation activities from the beneath the spill area to confirm no groundwater impact potential exists (see Table 1 and Attachment I).

Describe reclamation plan. Discuss existing and new grade recontouring; method and testing of compaction alleviation; and reseeding program, including location of new seed, seed mix and noxious weed prevention. Attach diagram or drawing. Use additional sheet for description if required.

Please see Attachment I

Attach samples and analytical results taken to verify remediation of impacts. Show locations of samples on an onsite schematic or drawing.

Is further site investigation required? ☑ Y ☐ N If yes, describe:

Initial vertical and lateral soil assessment has been completed and impacts have been identified. Additional assessment activities are proposed to further delineate lateral and vertical impacts. Soil remediation activities will proceed following workplan approval. Impacted soils not meeting Table 910-1 concentration levels will be treated by insitu bioremediation using a soil vapor extraction (SVE) system. Confirmation sampling will be completed at the end of the project to assure Table 910-1 concentration levels have been met.

Final disposition of E&P waste (landtreated and disposed onsite, name of licensed disposal facility, recycling, reuse, etc.):

All impacted soils will be mix/blend process to below Table 910-1 concentrations, hauled to a permitted disposal/recycling facility or treated insitu.

IMPLEMENTATION SCHEDULE

Date Site Investigation Began: January 9th, 2015	Date Site Investigation Completed: TBD	Date Remediation Plan Submitted: TBD
Remediation Start Date: Pending Approval	Anticipated Completion Date: Pending Approval	Actual Completion Date: TBD

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct, and complete.

Print Name: Jessica Dooling Signed: _____

Title: Piceance EHS Supervisor Date: 7/20/2015

OGCC Approved: Stanley C. Spencer Digitally signed by Stanley C. Spencer DN: cn=Stanley C. Spencer, o=COGCC, ou=EPS Northwest, email=stan.spencer@state.co.us, c=US Date: 2015.07.21 14:00:13 -06'00' Title: EPS Northwest Date: 7/21/15

ATTACHMENT I

PCU F23-18G Tank Containment Area Site Investigation and Remediation Workplan, Form 27

A produced water spill was identified at the site on January 8, 2015 from within the tank battery containment area. This release was reported to the Colorado Oil and Gas Conservation Commission (COGCC) on January 9, 2015 (Spill/Release Doc# 400767949). The release occurred due to a failure in underground piping associated with the three Produced Water Tanks at the subject site (see Figures 1 and 2 for Site Location and Project Spill Area Maps). The subsurface release occurred beneath an unlined, soil berm containment area for the tank battery. The three Produced Water Tanks have since been placed out of service.

Describe initial action taken:

Initial attempts to delineate the impacts were restricted due to site conditions, specifically the presence of Produced Water Tanks and pipelines (aboveground and belowground). As requested by XTO Energy, KRW Consulting, Inc. (KRW) has prepared this workplan to perform the required delineation and remediation activities at the subject site. Due to site complexity XTO is requesting that assessment and remediation of impacts be conducted with limited or no excavation to allow ongoing field operations. All work will be performed per applicable rules and regulations.

Background

Initial soil sampling activities were completed at the site on January 14, 2015. Three discrete soil samples (samples #1, #2, and #3) and one composite soil sample (Source Composite #1 and #2) were collected and analyzed from the unconsolidated sediments in the release area. The Source Composite (#1 and #2) sample was analyzed for the full Table 910-1 analyte list; the discrete samples (#1, #2, and #3) were analyzed for an abbreviated analyte list of TPH and BTEX. Results exceeded Table 910-1 concentrations levels for TPH ranging from 7640 mg/kg (#3) to 15920 mg/kg (#1); Benzene ranging from 6.1 mg/kg (#3) to 18.1 mg/kg (#1); Toluene ranging from 109 mg/kg (#3) to 263 mg/kg (#1); and Xylenes ranging from 299 mg/kg (#3) to 603 mg/kg (#1). The Source Composite sample also had elevated EC (5.27 mg/kg), SAR (48.3 mg/kg) and Arsenic (5.9 mg/kg). (Refer to Figure 2 for locations and Table 1 for sample results).

Based on additional potholing by XTO within the tank containment area, the visual evidence of impacted soils appeared to extend from the release area to beneath the above ground storage tanks as well as along underground utility corridors in the immediate area.

Recommended Path Forward

XTO Energy will continue delineation and remediation of impacted soils above Table 910-1 concentration levels beneath and adjacent to the containment area. The following tasks have been identified to complete this work:

Task No. 1 – Full Delineation of Hydrocarbon Impacts

KRW will complete the vertical and lateral assessment of impacted soils using a CME- 50 track-mounted drill rig for easy access. This work will be subcontracted through HRL Compliance Solutions, Inc. out of Grand Junction, Colorado under KRW's direct supervision. Soil samples will be collected from the surface to total depth drilled using a 5-foot continuous sampler. Each boring will be logged noting geological characteristics and visual/olfactory evidence of hydrocarbon impacts. Samples from each 5-foot interval will be field screened using an FID/PID. Select soil samples will be properly containerized and submitted to a laboratory for an abbreviated Table 910-1 analyte list (TPH and BTEX analyses) following proper chain-of-custody protocol. Based on the initial full Table 910-1 laboratory results from the source area, the constituents of concern from the release have been identified as TPH and BTEX.

The borings will continue to a depth of approximately 5 feet beyond any field identified impacts (hydrocarbon staining, odor, elevated FID/PID readings) or drilling refusal, whichever comes first. Existing site knowledge indicates fairly competent sandstone bedrock will be encountered at approximately 10 feet below existing grade. Based on anticipated soil/bedrock findings and our field assessment experience in the XTO field, we have assumed that the lateral extent of hydrocarbon impacts has been limited to beneath the footprint of the containment area and that the vertical extent of impacts will be limited by the sandstone bedrock beneath.

For the purposes of this workplan we have estimated a total of 11 soil borings to a maximum depth of 15 feet; 7 borings outside of the soil berm containment area for lateral delineation and 4 soil borings within the soil berm area for both vertical and lateral delineation. We have also estimated a total of 15 BTEX/TPH (GRO & DRO) analyses; one BTEX/TPH analyses for each of the 7 borings outside of the containment area; and two BTEX/TPH analyses for each of the 4 borings inside of the containment area. As discussed further below, we will convert the 4 soil borings located within the soil berm area and the boring at the northwest corner to Soil Vapor Extraction (SVE) wells. Refer to Figure 3 for approximate boring locations. Final placement of these borings will be field adjusted based on above and below ground utilities, and the ongoing field assessment findings. If impacts are identified outside of the soil berm area, additional soil borings and sampling may be required to define the full lateral extent of impacts. If during the assessment activities, it becomes clear that the identified impacts we encounter may be from another potential source, XTO will be contacted immediately and plans will be modified accordingly.

Due to potential migration of hydrocarbons along underground utilities and associated backfill, underground utilities that cross near the immediate release area will be traced to the outside edge of the soil containment berm. Any suspect utility corridor will be exposed by hand at the outside edge of the soil containment berm. Soil samples will be collected from around the utility and field inspected for any evidence of hydrocarbon impacts. XTO will be contacted immediately if it appears that impacts extend beyond this point and plans will be modified accordingly

Task No. 2 – SVE System Installation

Based on our experience with similar sites, the underlying soil/bedrock conditions, and the hydrocarbon contaminants - KRW is proposing to install an active soil vapor extraction (SVE) system as the primary means to remediate impacted soils to below Table 910-1 concentration levels. Conceptually, the SVE system will consist of a series of vertical vapor extraction points

strategically placed to effect impacted soils/fractured bedrock beneath the site. The SVE wells are connected to a header piping system and an appropriately sized vacuum or blower. The SVE will be a process of introducing vacuum through the soils/fractured bedrock to remove and help break down hydrocarbons beneath the site. The SVE system promotes two significant removal mechanisms – biodegradation and volatilization. With TPH-DRO, approximately 20 to 30 percent of the removal will come from volatilization with the remaining 70 to 80 percent occurring through enhanced biodegradation (Kerr, 1992).

Due to the anticipated limited extent of hydrocarbon impacts (i.e., lateral extent limited to within the containment area; vertical extent confined to the top of competent bedrock), it is our assumption that the vertical SVE wells can be installed as a part of the assessment activities identified as a part of Task No. 1. A conservative radius of influence (ROI) of approximately 30 feet will be assumed for each SVE well. This assumed ROI is based on KRW's experience with similar geology and boundary conditions (i.e., sand and gravels underlain by shallow sandstone bedrock). A total of 5 SVE wells are proposed for installation at an assumed maximum depth of 10 to 15 feet BGS. Each SVE well will be constructed of 2-inch diameter Sch. 40 PVC; with the bottom 5 feet (for 10 foot wells) or 10 feet (for 15 foot wells) screened with 0.020 slot. A minimum 4 to 5 foot plug of hydrated bentonite and concrete grout will seal the top of each well to limit air intrusion from the surface. Each SVE well will be protected with an 8-inch flush-mounted well protector. The top of each well will have a quick connect secured thru a 2-inch slip cap to facilitate monitoring of vacuum pressures and VOCs being extracted at each well head. A 2-inch PVC Sch. 40 ball valve will be located within the vault along the sub-header line for control and adjustment of each SVE well independently. Refer to Figure 3 for the approximate location of these SVE wells with the estimated 30-foot ROI for each. The final location of each well will be field adjusted based on surface/sub-surface utilities. Refer to Figure 4 for a detail of the proposed SVE wells.

Each of the SVE wells will be connected to a subsurface header line that will be tied to a fully enclosed, intrinsically safe blower system. The blower unit we are proposing for this site is a 1.5 h.p. unit manufactured by Rotron (Model EN – 454). The proposed location of the subsurface header lines and the blower system are shown on Figure 3. These locations will be adjusted in the field based on surface/subsurface utilities and ongoing site operations. The final locations will be approved by XTO personnel prior to installation.

XTO acknowledges COGCC approval of the AS/SVE technology does not constitute permission for any contaminated air emissions and proper approval from APCD, as appropriate, will be required prior to system startup. XTO will submit an APEN or Construction Permit to CDPHE for emissions, as required.

Task No. 3 – SVE System Operations and Maintenance

Based on initial assessment activities at the site, we have assumed that hydrocarbon impacted soils extend beneath each of the tanks as well as beneath the full foot print of the soil containment area. Our experience has been that vacuum responses as low as 0.1 inches W.C. (water column) have been used to effectively stimulate biodegradation of hydrocarbons. During the start-up phase of the SVE system, we will independently monitor each of the SVE wells to assure that each well has a minimum of 0.1 inches W.C. In the unlikely event that we cannot maintain 0.1 inches W.C. across

the impacted site area, the system will be appropriately adjusted to create the necessary vacuum (i.e., 2 to 3 wells will be opened for full vacuum, while the remaining wells are closed).

Routine monitoring of the SVE system will include measuring the following:

- VOC measurements and Vacuum response at all SVE wells
- VOC measurements of the SVE system exhaust
- Vacuum and discharge pressure levels at the blower
- Water levels in the moisture knock-out pot

During initial start-up operations and the balancing of the SVE system - vacuum, VOC and pressure readings will be conducted three times per week for the first full week of operations, and then reduced to twice per week for three weeks. Subsequent monitoring and maintenance of the system will be conducted weekly.

Task No. 4 – Confirmation Soil Sampling

As identified during the initial sampling of the release area, the constituents of concern are hydrocarbon based, specifically TPH (GRO and DRO) and BTEX. The TPH analyses further identified the lighter Gasoline Range Organics (GRO) with carbon chains of C6 to C10 as the primary make-up of TPH (approx. 65%). SVE systems have historically proven to be most efficient on remediation of both TPH-GRO and BTEX constituents (6 to 12 months), with a longer remediation time (12 to 24 months) for the heavier Diesel Range Organics (DRO).

The effectiveness of the SVE system will be reviewed at the end of the first year of operations. A minimum of four soil samples will be collected from the areas of highest impact as identified during the assessment activities and analyzed for TPH (GRO & DRO) and BTEX. Based on the findings of these sample results relative to Table 910-1 concentration levels, decisions will be made regarding additional sampling requirements and/or additional system operations. Prior to initiating any confirmation soil sampling, XTO will partner with COGCC to determine the best path forward.

As discussed previously, final placement of assessment borings, SVE wells, header lines, and associated blower unit will be based on confirmed surface and subsurface utility location and XTO approval.

- Soil samples will be collected by KRW following proper sampling and shipping protocol and submitted to Accutest Laboratories in Wheat Ridge, Colorado. Appropriate QAQC of the laboratory results will be conducted. The laboratory test results will be summarized in tables. Complete laboratory reports will be available on request.

- Maximum allowable background Arsenic levels approved by COGCC were reviewed for three XTO sites within 0.75 to 1.25 miles of the PCU F23-18G site. The maximum allowable background Arsenic levels for these sites ranged from 6.9 mg/kg at PCU 78-12 (REM # 7466) to 17.6 mg/kg at PCU 296-7A (REM # 5076). The Arsenic level of 5.9

mg/kg detected in the Source Composite sample (#1 & #2) is considered within background Arsenic levels for the area. No additional Arsenic sampling is recommended at this time.

- Any remaining elevated levels of Electrical Conductivity, SAR and pH detected beneath the tank area as well as any backfill material will be covered with a minimum 3 feet of clean, native soils per COGCC guidance. No additional treatment of these soils will be required.

- Reclamation activities will be performed in accordance with applicable COGCC 900, 1000 Series rules and as specified in the Surface Use Plan and BLM Conditions of Approval.

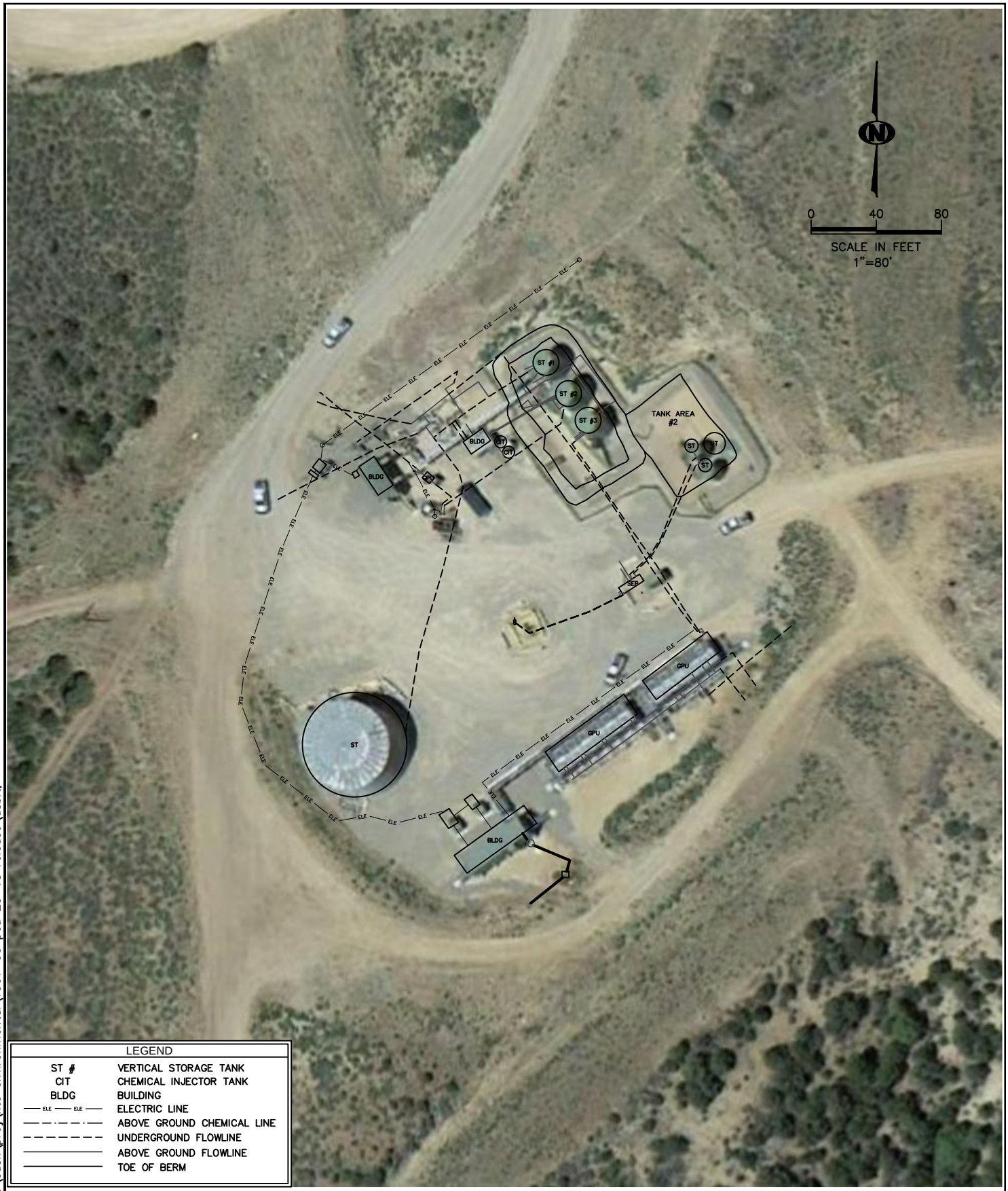
Table 1
Location: PCU F23-18G
Lab Summary

Last Update 5/29/2015

Analytical Parameter	PCU F23-18G Release				COGCC
(with units)	#1	#2	#3	Source Composite #1 & #2	Table 910-1 Concentration Levels
Accutest Job #	D66660 (1/14/15)			D66661 (1/14/15)	-
Sample type (**C**omposite/**D**iscrete)	D	D	D	C	-
TPH (GRO) (mg/Kg)	9,160	10,100	5,210	8,270	-
TPH (DRO) (mg/Kg)	6,760	4,940	2,430	6,900	-
TPH (GRO + DRO) (mg/Kg)	15920	15040	7640	15170	500
Benzene (mg/Kg)	18.1	11.9	6.1	8.58	0.170
Toluene (mg/Kg)	263	195	109	175	85
Ethylbenzene (mg/Kg)	30.8	26.2	15.5	27.5	100
Xylenes (total) (mg/Kg)	603	506	299	535	175
Acenaphthene (mg/Kg)	-	-	-	0.840	1000
Anthracene (mg/Kg)	-	-	-	0.0588	1000
Benzo(A)anthracene (mg/Kg)	-	-	-	0.0231	0.22
Benzo(B)fluoranthene (mg/Kg)	-	-	-	0.0130	0.22
Benzo(K)fluoranthene (mg/Kg)	-	-	-	0.0064	2.2
Benzo(A)pyrene (mg/Kg)	-	-	-	0.0177	0.022
Chrysene (mg/Kg)	-	-	-	0.0729	22
Dibenzo(A,H)anthracene (mg/Kg)	-	-	-	0.0019	0.022
Fluoranthene (mg/Kg)	-	-	-	0.0417	1000
Fluorene (mg/Kg)	-	-	-	3.61	1000
Indeno(1,2,3,C,D)pyrene (mg/Kg)	-	-	-	0.0019	0.22
Naphthalene (mg/Kg)	-	-	-	8.6	23
Pyrene (mg/Kg)	-	-	-	0.156	1000
Electrical Conductivity (mmhos/cm)	-	-	-	5.27	4
Sodium Adsorption Ratio (SAR)	-	-	-	48.3	12
pH	-	-	-	8.84	6-9
Arsenic (mg/kg)	-	-	-	5.9	0.39
Barium (mg/kg)	-	-	-	366	15000
Cadmium (mg/kg)	-	-	-	<1.2	70
Chromium (III) (mg/Kg)	-	-	-	35.6	120000
Chromium (VI) (mg/Kg)	-	-	-	<1.0	23
Copper (mg/kg)	-	-	-	10.1	3100
Lead (inorganic) (mg/kg)	-	-	-	16.3	400
Mercury (mg/kg)	-	-	-	0.88	23
Nickel (mg/kg)	-	-	-	16.6	1600
Selenium (mg/kg)	-	-	-	<6.2	390
Silver (mg/kg)	-	-	-	<3.7	390
Zinc (mg/kg)	-	-	-	40.4	23000
% Solids	76.2	78.4	79.1	77.0	-

Notes:

1) ND = not detectible to the laboratory detection limit.
2) Results highlighted in yellow exceed Table 910-1 concentration levels.
3) "-" indicates no analysis.



LEGEND	
ST #	VERTICAL STORAGE TANK
CIT	CHEMICAL INJECTOR TANK
BLDG	BUILDING
ELE — ELE	ELECTRIC LINE
— · — · —	ABOVE GROUND CHEMICAL LINE
- - - - -	UNDERGROUND FLOWLINE
	ABOVE GROUND FLOWLINE
	TOE OF BERM

DESIGNED: MJ	CHECKED: TH	FIGURE 1	NOTES: AERIAL PHOTO FROM GOOGLE EARTH, DATED JUNE 20, 2013.
DATE: 6/18/15	DRAWN: MJ		
FILE NAME: asblt.dwg		SHEET NO. 1 of 4	DATE / REVISIONS
PROJECT NO. 1501-05		SCALE: 1" = 80'	

KRW CONSULTING, INC.
8000 W. 14TH AVENUE, SUITE 200
LAKEWOOD, COLORADO
(303) 239-9011

FIGURE 1
PICEANCE CREEK
PCU F23-18G
SITE LOCATION MAP

PREPARED FOR XTO ENERGY

\\hyper-v03\lkwd-co\sdsk\proj\xto environmental\1501-05 pcu 23-18 release\asblt,

\\hyper-v03\lkwd-co\sdsk\proj\xto environmental\1501-05 pcu 23-18 release\pcu f23-18g,

DESIGNED:	MJ
CHECKED:	TH
DATE:	6/18/15
DRAWN:	MJ
FILE NAME:	pcu f23-18g.dwg
PROJECT NO.	1501-05
SCALE:	1" = 30'
SHEET NO.	2 of 4
	FIGURE 2

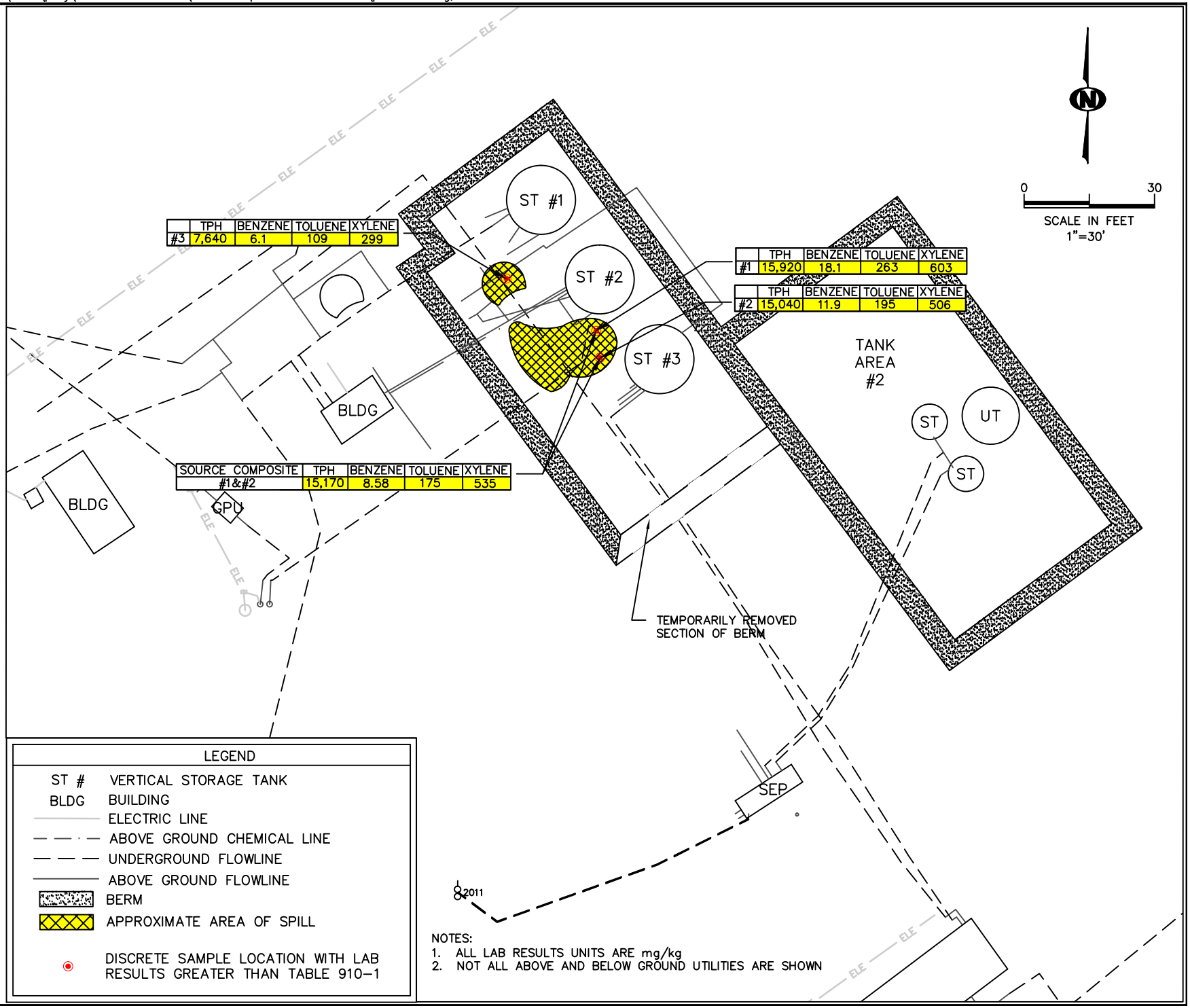
NOTES:

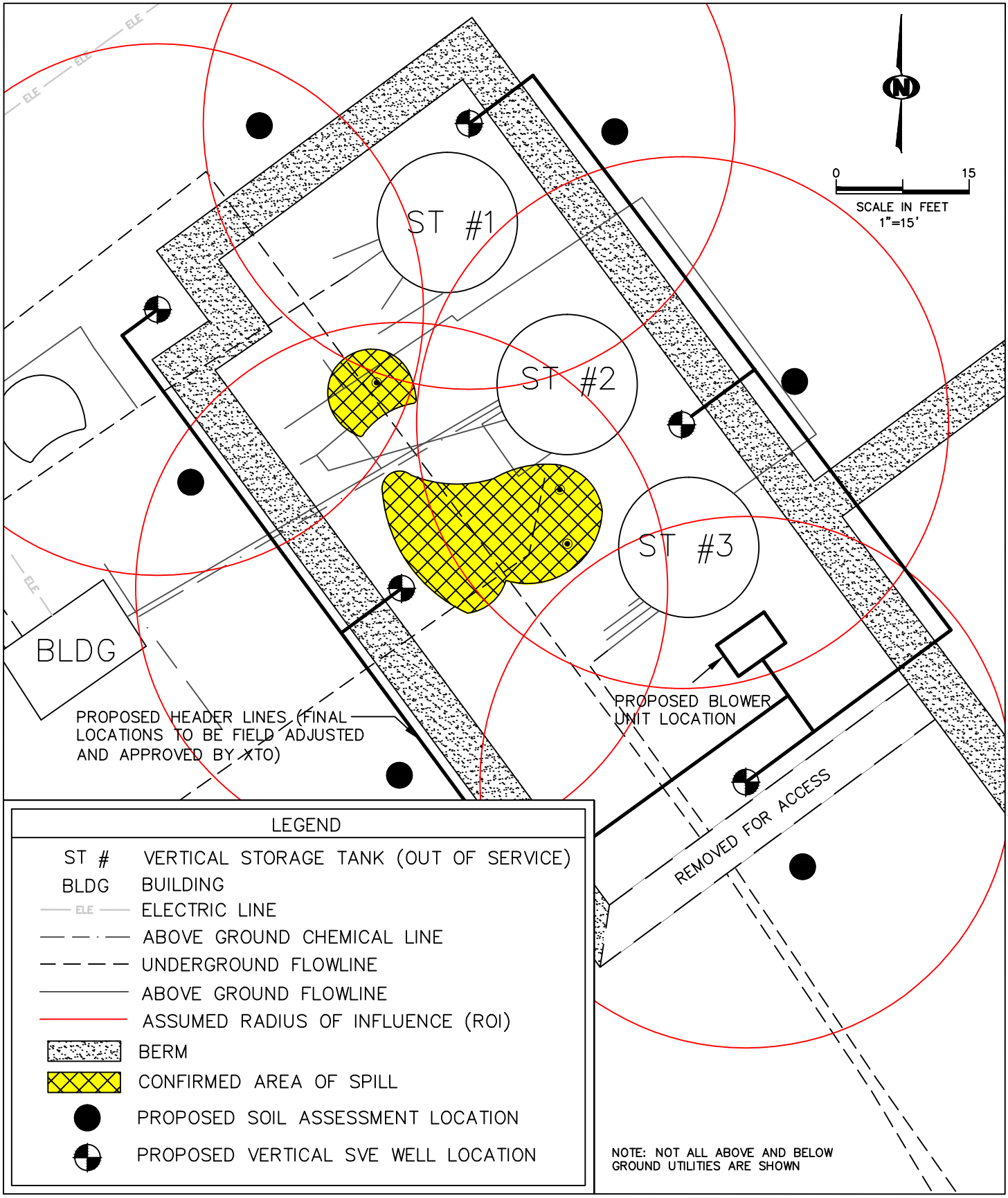
DATE	REVISIONS

KRW CONSULTING, INC.
8000 W. 14TH AVENUE, SUITE 200
LAKEWOOD, COLORADO
(303) 239-9011

PREPARED FOR XTO ENERGY

FIGURE 2
PICEANCE CREEK
PCU F23-18G
SPILL AREA





DESIGNED: MJ	CHECKED: TH	FIGURE 3	NOTES:
DATE: 6/18/15	DRAWN: MJ		
FILE NAME: pcu f23-18g.dwg		SHEET NO. 3 of 4	DATE / REVISIONS
PROJECT NO. 1501-05		SCALE: 1" = 15'	

KRW CONSULTING, INC.
8000 W. 14TH AVENUE, SUITE 200
LAKEWOOD, COLORADO
(303) 239-9011

FIGURE 3
PICEANCE CREEK
PCU F23-18G
PROPOSED SVE WELL LOCATIONS
PREPARED FOR XTO ENERGY

\\hyper-v03\lkwd-co\sdsk\proj\xto environmental\1501-05 pcu 23-18 release\pcu f23-18g.

\\hyper-v03\lkwd-co\sdsk\proj\xto environmental\1501-05 pcu 23-18 release\pcu f23-18g,

DESIGNED:	MJ
CHECKED:	TH
DRAWN:	MJ
DATE:	6/18/15
FILE NAME:	pcu f23-18g.dwg
PROJECT NO.	1501-05
SCALE:	NOT AVAILABLE
SHEET NO.	4 of 4
FIGURE	4

NOTES:

DATE	REVISIONS

KRW CONSULTING, INC.
8000 W. 14TH AVENUE, SUITE 200
LAKEWOOD, COLORADO
(303) 239-9011

FIGURE 4
PICEANCE CREEK
PCU F23-18G
SVE WELL CROSS-SECTION

PREPARED FOR XTO ENERGY