

State of Colorado Oil and Gas Conservation Commission

1120 Lincoln Street, Suite #01, Denver, Colorado 80203 (303)894-2100 Fax: (303)894-2109



RECEIVED
FOR OGCC USE ONLY
MAR 23 2011
COGCC

EARTHEN PIT REPORT/PERMIT

This form is to be used for both reporting and permitting pits. Rule 903 describes when a Permit with prior approval, or a Report within 30 days, is required for pits. Submit required attachments and forms.

Complete the
Attachment Checklist

FORM SUBMITTED FOR:

☐ Pit Report

☒ Pit Permit

Oper OGCC

Detailed Site Plan	x	
Topo Map w/ Pit Location	x	
Water Analysis (Form 25)		
Source Wells (Form 25)	x	
Pit Design & Construction	x	
Design Calculations	x	
Sensitive Area Determination	x	
Mud Program		
Form 2A	X	

OGCC Operator Number: 98850

Name of Operator: Williams Production RMT

Address: 1058 County Rd 215

City: Parachute State: CO Zip: 81635

Contact Name and Telephone:

Karoline Blaney

No: 970 683-2295

Fax: (970) 265-8573

API Number (if associated well):

OGCC Facility ID (if other associated facility):

Pit Location (Qtr, Sec, Twp, Rng, Meridian): SENW S19 T25 R98W 6th

Latitude: 39.51485801

Longitude: -108.26145334

County:

Pit Use: ☐ Production ☐ Drilling (Attach mud program) ☐ Special Purpose (Describe Use): Multi WellPit Type: ☒ Lined ☐ Unlined Surface Discharge Permit: ☐ Yes ☒ NoOffsite disposal of pit contents: ☐ Injection ☐ Commercial Pit/Facility Name: Mautz Ranch

Pit/Facility No:

Attach Form 26 to identify Source Wells and Form 25 to provide Produced Water Analysis results.

Existing Site Conditions

Is the location in a "Sensitive Area?" ☒ Yes ☐ No Attach data used for determination.

Distance (in feet) to nearest surface water: 843 ground water: 47 water wells: 14062

LAND USE (or attach copy of Form 2A if previously submitted for associated well) Select one which best describes land use:

Crop Land: ☐ Irrigated ☐ Dry Land ☐ Improved Pasture ☐ Hay Meadow ☐ CRPNon-Crop Land: ☒ Rangeland ☐ Timber ☐ Recreational ☐ Other (describe):Subdivided: ☐ Industrial ☐ Commercial ☐ Residential

SOILS (or attach copy of Form 2A if previously submitted for associated well)

Soil map units from USNRCS survey: Sheet No: Soil Complex/Series No: 6

Soils Series Name: Barcus

Horizon thickness (in inches): A: 0-6 ; B: 6-16 ; C: 16-60

Soils Series Name: Horizon thickness (in inches): A: ; B: ; C:

Attach detailed site plan and topo map with pit location.

Pit Design and Construction

Size of pit (feet): Length: 350 Width: 150 Depth: 15

Calculated pit volume (bbls): 93800 Daily inflow rate (bbls/day):

Daily disposal rates (attach calculations): Evaporation: NA bbls/day Percolation: NA bbls/day

Type of liner material: Synthetic Polyethylene and geosynthetic clay liner Thickness: 60 mil & 35 mil (see attachment)

Attach description of proposed design and construction (include sketches and calculations).

Method of treatment of produced water prior to discharge into pit (separator, heater treater, other):

Is pit fenced? ☒ Yes ☐ No Is pit netted? ☒ Yes ☐ No

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

Print Name: Karoline Blaney

Signed: Karoline Blaney

Title: Environmental Specialist

Date: 1/3/2011

OGCC Approved: David Kulpa Title: Location Assessment Specialist Date: 4-8-11

CONDITIONS OF APPROVAL, IF ANY:

FACILITY NUMBER:

See Attached

**Williams Production RMT, Mautz Ranch Multi Well Pit, SENW Sec 19 T2S R98W,
Rio Blanco County, Form 15 Pit Permit Conditions of Approval, Associated Form
2A #400132276**

COA 21 - Operator must comply with all provisions of the June 12, 2008 Notice to Operators (NTO) Drilling Wells Within $\frac{3}{4}$ Mile of the Rim of the Roan Plateau in Garfield County – Pit Design, Construction, and Monitoring Requirements.

COA 90 - Notify COGCC Oil and Gas Location Assessment (OGLA) Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us) and the COGCC Field Inspection Supervisor for Northwest Colorado (Shaun Kellerby; email shaun.kellerby@state.co.us) 48 hours prior to start of construction of the pad and pit.

COA 22 - After installation of the uppermost liner and prior to operating the pit, the synthetic liner(s) shall be tested by filling the pit with at least 4 feet of fresh water, measured from the base of the pit (not to exceed the 2-foot freeboard requirement). The operator shall monitor the pit for leaks for a period of 72 hours prior to draining the pit and commencing operations. Operator shall notify the COGCC Oil and Gas Location Assessment (OGLA) Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us) 48 hours prior to start of the hydrotest. Hydrotest monitoring results must be maintained by the operator for the life of the pit and provided to COGCC prior to using the pit.

COA 23 - Operator must ensure 110 percent secondary containment for any volume of fluids contained at the water handling facility site during natural gas development activities and operations; including, but not limited to, construction of a berm or diversion dike, diversion/collection trenches within and/or outside of berms/dikes, site grading, or other comparable measures (i.e., best management practices (BMPs) associated with stormwater management) sufficiently protective of nearby surface water. Any berm constructed at the well pad location will be stabilized, inspected at regular intervals (at least every 14 days), and maintained in good condition.

COA 5 - Operator must implement best management practices to contain any unintentional release of fluids, including any fluids conveyed via buried or temporary surface pipelines.

COA 39 - No portion of any pit that will be used to hold liquids shall be constructed on fill material, unless the pit and fill slope are designed and certified by a professional engineer, subject to review and approval by the director prior to construction of the pit. The construction and lining of the pit shall be supervised by a professional engineer or their agent. The entire base of the pit must be in cut.

COA 47 - The completion/flowback fluids multi-well pit must be double-lined. The pit will also require a leak detection system (Rule 904.e).

COA 48 - Operator must submit a professional engineer (PE) approved/stamped as-built drawing (plan view and cross-sections) of the completion/flowback pit within 14 calendar days of construction.

COA 41 - The nearby hillside and any fill-material bermed portions of the pit must be monitored for any day-lighting of fluids throughout pit operations.

COA 49 - The completion/flowback fluids multi-well pit must be fenced and netted. The operator must maintain the fencing and netting until the pit is closed in accordance with Rule 905. Closure of Pits, and Buried or Partially Buried Produced Water Vessels.

COA 25 - Flowback and stimulation fluids must be sent to tanks to allow the sand to settle out before the fluids can be placed into any pipeline or pit. The flowback and stimulation fluid tanks must be placed on the pad in an area with additional downgradient perimeter berming. The area where

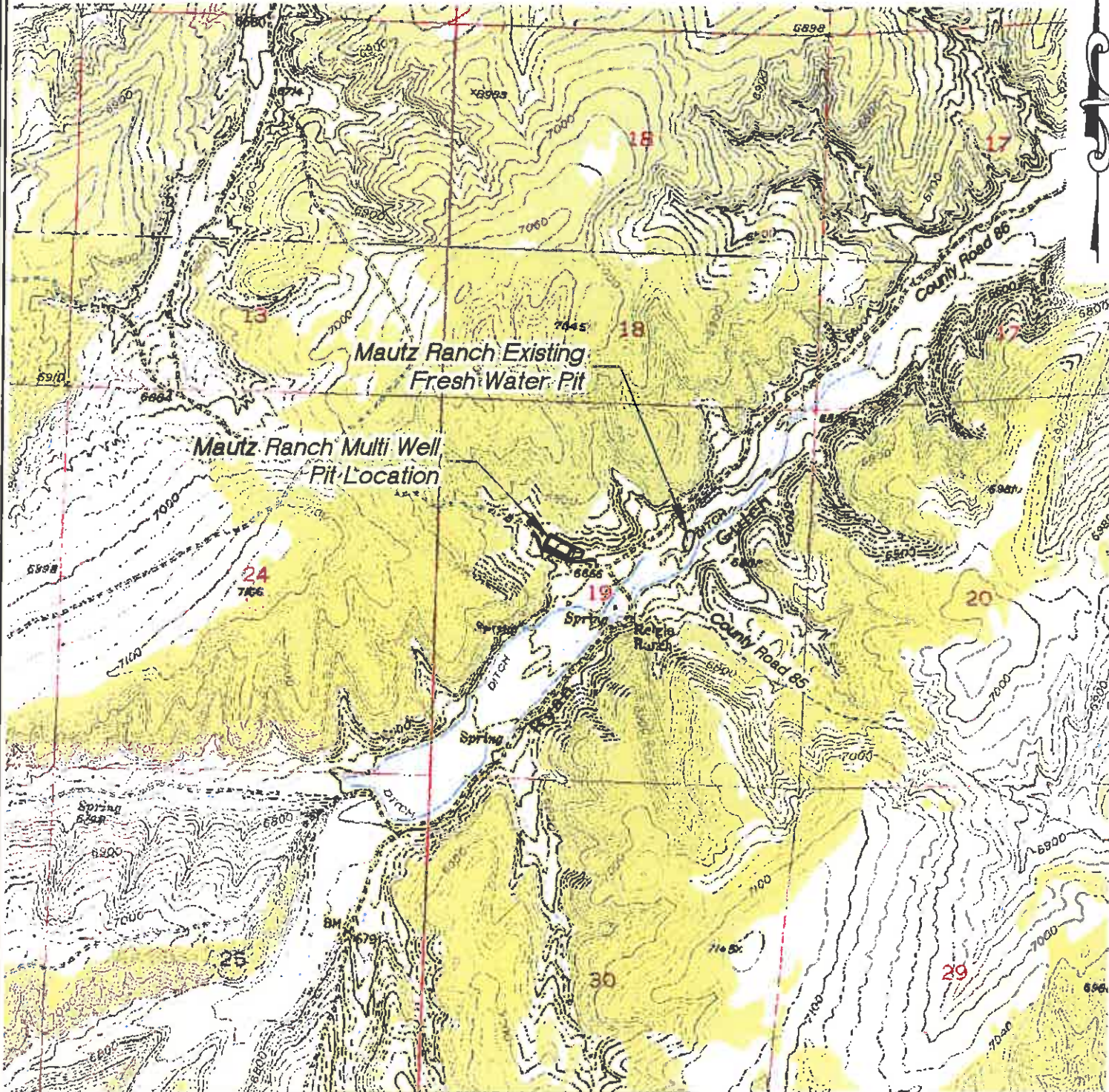
flowback fluids will be stored/reused must be constructed to be sufficiently impervious to contain any spilled or released material (per Rule 604.a.(4)).

COA 27 - Submit additional disposal facilities (wells, pits, etc.) for pit contents to COGCC via a Form 4 Sundry prior to disposal.

COA 20 - Surface water samples from the ditch and Ryan Gulch (both upgradient and downgradient of the proposed multi well pit) shall be collected prior to pit use and every 12 months to evaluate potential impacts from pit operations. At a minimum, the surface water samples will be analyzed for the following parameters: major cations/anions (chloride, fluoride, sulfate, sodium); total dissolved solids (TDS); and BTEX/DRO.

COA 91 - At the time of pit closure, operator must submit disposal information via a Form 4 Sundry Notice to the COGCC Location Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us). The disposal method will need to be approved prior to operator starting pit closure. In addition, operator will collect a pit water sample and, at a minimum, analyze for the following parameters: pH; alkalinity; specific conductance; major cations/anions (chloride, fluoride, sulfate, sodium); total dissolved solids (TDS); BTEX/DRO; TPH; PAH's (including benzo[a]pyrene); and metals (arsenic, barium, calcium, chromium, iron, magnesium, selenium). At the time of closure/disposal of pit water, COGCC may require additional analytes, as appropriate.

Section 19
T. 2 S., R 98 W
6th. P.M.



GRAPHIC SCALE IN FEET
1 INCH = 2000 FEET

ACCESS DESCRIPTION:

FROM THE INTERSECTION OF STATE HIGHWAY 64 AND RIO BLANCO COUNTY ROAD 5 PROCEED SOUTHERLY ALONG COUNTY ROAD 5 ± 14.5 MILES TO THE INTERSECTION WITH A DIRT/GRAVEL ROAD BEING COUNTY ROAD 24, PROCEED RIGHT IN A WESTERLY DIRECTION ALONG COUNTY ROAD 24 ± 5.9 MILES TO THE INTERSECTION WITH A DIRT/GRAVEL ROAD BEING COUNTY ROAD 86, PROCEED LEFT IN A SOUTHWESTERLY DIRECTION ± 3.3 MILES TO AN INTERSECTION WITH A DIRT/GRAVEL ROAD, PROCEED RIGHT IN A NORTHERLY DIRECTION ± 0.2 MILES TO THE PRODUCED WATER PIT LOCATION, AS SHOWN HEREON.

REVISED: 12/16/10

SCALE: 1" = 2000'
DATE: 11/8/10
Drawing: 3 of 4
PROJECT: Williams Highlands
DFT: cws

Construction Plan Prepared for:

Williams Williams Production, RMT

Mautz Ranch - Multi Well Pit
ACCESS & TOPO

136 East Third Street
Boulder, Colorado 80501
PH: (970) 825-1300
Fax: (970) 825-2773



BOOKCLIFF
Survey Services, Inc.

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

SOURCE OF PRODUCED WATER FOR DISPOSAL

This form must be completed for any new disposal site and for any change in sources of produced water for an existing disposal site.

Complete the
Attachment Checklist

OGCC Operator Number: <u>96850</u>	Contact Name and Telephone:
Name of Operator: <u>Williams Production RMT Company LLC</u>	<u>Karolina Blaney</u>
Address: <u>1058 County Rd 215</u>	No: <u>970 589 0743</u>
City: <u>Parachute</u> State: <u>CO</u> Zip: <u>81635</u>	Fax: <u>970 285 9573</u>

Chemical Analysis of fluid	Oper OGCC

OGCC Disposal Facility Number: _____
Operator's Disposal Facility Name: <u>Mautz Ranch Multi-Well Pit</u> Operator's Disposal Facility Number: _____
Location (QtrQtr, Sec, Twp, Rng, Meridian): <u>SE1/4 S19 T2S R9W 6th</u>
Address: _____
City: _____ State: _____ Zip: _____ County: <u>Rio Blanco</u>

If more space is required,
attach additional sheet.

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input checked="" type="checkbox"/>	Operator Name: <u>See Attachment B - List of Wells</u>		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input type="checkbox"/>	Operator Name: _____		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input type="checkbox"/>	Operator Name: _____		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input type="checkbox"/>	Operator Name: _____		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input type="checkbox"/>	Operator Name: _____		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

Add Source:	OGCC Lease No: _____	API No: _____	Well Name & No: _____
<input type="checkbox"/>	Operator Name: _____		Operator No: _____
Delete Source:	Location: QtrQtr: _____	Section: _____	Township: _____
<input type="checkbox"/>	Analysis Attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		Transported to disposal site via: <input type="checkbox"/> Pipeline <input type="checkbox"/> Truck TDS: _____

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

Print Name: Karolina Blaney Signed: Karolina Blaney
Title: Environmental Specialist Date: 1/3/2011

OGCC Approved: _____ Title: _____ Date: _____

CONDITIONS OF APPROVAL, IF ANY:

Attachment B

List of Source Wells

Attachment B - List of Wells

Well Name	API Number	Reservoir	Location sec.-town.-range	qtr/qtr-	Transport Method
RG 12-4-398	510310758	MESAVERDE	SWNW- 4-3S-98W-6 M		Trucking/Pipeline
RG 13-1-398	510310605	MESAVERDE	NWSW- 1-3S-98W-6 M		Trucking/Pipeline
RG 14-14-298	510311278	MESAVERDE	SWSW- 14-2S-98W-6 M		Trucking/Pipeline
RG 22-16-298	510310704	MESAVERDE	SEW- 16-2S-98W-6 M		Trucking/Pipeline
RG 24-13-398	510310702	MESAVERDE	SESW- 13-3S-98W-6 M		Trucking/Pipeline
RG 24-30-297	510311023	MESAVERDE	SESW- 31-2S-97W-6 M		Trucking/Pipeline
RG 31-8-398	510310622	MESAVERDE	NWNE- 8-3S-98W-6 M		Trucking/Pipeline
RG 41-18-297	510310906	MESAVERDE	NENE- 18-2S-97W-6 M		Trucking/Pipeline
RG 43-15-298	510310585	MESAVERDE	NESE- 15-2S-98W-6 M		Trucking/Pipeline
Government 397-8-4	510308528	MESAVERDE	NWNW- 8-3S-97W-6 M		Trucking/Pipeline
RGU 14-16-198	510310759	MESAVERDE	SWSW- 16-1S-98W-6 M		Trucking/Pipeline
RG 14-28-198	510310701	MESAVERDE	SWSW- 28-1S-98W-6 M		Trucking/Pipeline
RG 22-20-198	510310757	MESAVERDE	SEW- 20-1S-98W-6 M		Trucking/Pipeline
RG 22-28-298	510310448	FT UNION	SEW- 28-2S-98W-6 M		Trucking/Pipeline
RG 31-20-298	510310596	MESAVERDE	NWNE- 20-2S-98W-6 M		Trucking/Pipeline
RG 31-30-198	510310633	MESAVERDE	NWNE- 30-1S-98W-6 M		Trucking/Pipeline
RG 31-32-198	510310608	MESAVERDE	NWNE- 32-1S-98W-6 M		Trucking/Pipeline
RGU 33-7-298	510310610	MESAVERDE	NWSE- 7-2S-98W-6 M		Trucking/Pipeline
Federal 399-1-5	510310685	MESAVERDE	SEW- 1-3S-99W- 6 M		Trucking/Pipeline
Federal 399-1-2	510310686	MESAVERDE	NENW - 1-3S-99W - 6 M		Trucking/Pipeline
Federal 399-1-1	510310319	MESAVERDE	NWNE- 1 - 3S-99W- 6 M		Trucking/Pipeline
RG 11-7-397	510311060	MESAVERDE	NWNW- 7-3S-97W-6 M		Trucking/Pipeline
RG 11-11-298	510310936	MESAVERDE	NWNW- 11-2S-98W-6 M		Trucking/Pipeline
RG 13-1	510310605	MESAVERDE	SWNW- 1-3S-98W-6 M		Trucking/Pipeline
RGU 13-36-198	510310908	MESAVERDE	NWSW- 36-1S-98W-6 M		Trucking/Pipeline
RGU 14-25-198	510311080	MESAVERDE	SWSW- 25-1S-98W-6 M		Trucking/Pipeline
RGU 22-6 -297	510310603	MESAVERDE	SEW- 6-2S-98W-6 M		Trucking/Pipeline
RG 311-2-298	510311346	MESAVERDE	NWNW- 2-2S-98W-6 M		Trucking/Pipeline
Federal RGU 31-2-398	510310597	MESAVERDE	NWNE- 2-3S-98W-6 M		Trucking/Pipeline
Federal RG 31-3-298	510311354	MESAVERDE	SENE-3 2S-98W - 6 M		Trucking/Pipeline
RGU 322-35-198	510311490	MESAVERDE	SEW- 35-1S-98W-6 M		Trucking/Pipeline
RGU 32-27-198	510311381	MESAVERDE	SWNE- 27-1S-98W-6 M		Trucking/Pipeline
RG 32-3-298	510311348	MESAVERDE	SWNE- 3-2S-98W-6 M		Trucking/Pipeline
RGU 32-4-298	510310678	MESAVERDE	SWNE- 4-2S-98W-6 M		Trucking/Pipeline
RGU 324-33-198	510311173	MESAVERDE	SESW- 33-1S-98W-6 M		Trucking/Pipeline
RGU 33-24-198	510310937	MESAVERDE	NWSE- 24-1S-98W-6 M		Trucking/Pipeline
RGU 33-27-198	510311382	MESAVERDE	NWSE- 27-1S-98W-6 M		Trucking/Pipeline
RGU 33-32-198	510310707	MESAVERDE	NWSE- 32-1S-97W-6 M		Trucking/Pipeline
RGU 341-2-298	510311168	MESAVERDE	NENE- 2-2S-98W-6 M		Trucking/Pipeline
RG 341-24-298	510311504	MESAVERDE	NENE- 24-1S-98W-6 M		Trucking/Pipeline
RGU 341-3-298	510311353	MESAVERDE	NENE- 3-2S-98W-6 M		Trucking/Pipeline
RGU 34-24-198	510311463	MESAVERDE	SWSE- 24-1S-98W-6 M		Trucking/Pipeline
RGU 344-35-198	510311150	MESAVERDE	SESE- 36-1S-98W-6 M		Trucking/Pipeline

Well Name	API Number	Reservoir	Location sec.-town.-range qtr/qtr.	Transport Method
Federal 399-2-1	510310620	MESAVERDE	SESE 2-3S-99W -6M	Trucking/Pipeline
RGU 412-35-198	510311491	MESAVERDE	SWNW- 35-1S-98W-6 M	Trucking/Pipeline
RGU 42-2-298	510311171	MESAVERDE	SENE- 2-2S-98W-6 M	Trucking/Pipeline
RGU 42-3-298	510310938	MESAVERDE	SENE- 32-2S-98W-6 M	Trucking/Pipeline
RGU 432-27-198	510311380	MESAVERDE	SWNE- 27-1S-98W-6 M	Trucking/Pipeline
RGU 433-24-198	510311461	MESAVERDE	NWSE- 24-1S-98W-6 M	Trucking/Pipeline
RGU 43-35-198	510311147	MESAVERDE	NESE- 36-1S-98W-6 M	Trucking/Pipeline
NRG 434-13-298	510311503	MESAVERDE	SWSE- 13-2S-98W-6 M	Trucking/Pipeline
RGU 441-2-298	510311169	MESAVERDE	NENE- 2-2S-98W-6 M	Trucking/Pipeline
RGU 442-3-298	510311351	MESAVERDE	SENE- 32-1S-98W-6 M	Trucking/Pipeline
RGU 44-35-198	510311148	MESAVERDE	SESE- 36-1S-98W-6 M	Trucking/Pipeline
RGU 511-2-298	510311347	MESAVERDE	NWNW- 2-2S-98W-6 M	Trucking/Pipeline
RG 522-35-198	510311492	MESAVERDE	SENW- 35-1S-98W-6 M	Trucking/Pipeline
RGU 523-33-198	510311175	MESAVERDE	NESW- 33-1S-98W-6 M	Trucking/Pipeline
RG 531-24-198	510311506	MESAVERDE	NWNE- 24-1S-98W-6 M	Trucking/Pipeline
RGU 532-24-198	510311462	MESAVERDE	SWNE- 24-1S-98W-6 M	Trucking/Pipeline
RGU 532-35-198	510311493	MESAVERDE	SWNE- 35-1S-98W-6 M	Trucking/Pipeline
RG 541-24-198	510311506	MESAVERDE	NENE- 24-1S-98W-6 M	Trucking/Pipeline

Form 26
Source of Produced Water



Results for Williams Production, Western Slope, CO

DATE	ANALYZE DATE	LOCATION (WELL)	pH	TDS mg/l	Total Hardness mg/l	Potassium mg/l	Sodium mg/l	Calcium mg/l	Magnesium mg/l	Iron mg/l	Zinc mg/l	Boron mg/l	Barium mg/l	Strontium mg/l	Total mg/l	Sulfate mg/l	Chloride mg/l	Carbonate mg/l	I
06/25/10	06/29/10	TR 344-27	7.7	16066.64	320.4761	50.411737	5564.602	111.7246	10.02793217	14.40671	1.953699	21.79898	37.14746	20.10421753	5788.321	100	9500	0	
06/25/10	06/29/10	TR 441-34	6.94	177891.6	986.6543	262.66571	5483.512	209.7127	112.7738113	57.50673	4.111893	2.359207	12.10296	5.612705231	6136.274	710	176400	0	
11/10/10	11/16/10	AP 522-9				119.38559	45.36.746	90.94054	9.713909149	110.9567	4.266605	18.99163	40.75811	15.46736526					
10/29/10	11/16/10	RG 12-4				147.05983	3748.407	78.94136	7.18311739	10.4159	0.554249	14.14105	26.91955	13.96279076					
10/29/10	11/16/10	RG 13-1				159.742111	5198.46	149.8649	13.07498932	62.44817	2.39046	13.00567	38.42319	18.9392759					
10/29/10	11/16/10	RG 14-14				36.4691277	3469.237	56.97246	6.580787182	48.91982	0.358401	11.97034	21.37789	10.20052242					
10/29/10	11/16/10	RG 22-16				153.223175	3897.938	64.27667	6.408272743	14.73732	5.56715	9.996466	28.9552	11.27095108					
10/29/10	11/16/10	RG 24-13				98.9560089	2865.823	27.68516	2.195913553	45.86309	3.104936	15.40655	17.63269	6.25138855					
10/29/10	11/16/10	RG 24-30				158.785527	5102.122	112.8103	11.93872643	28.36238	6.824281	11.85561	42.21546	20.99261665					
10/29/10	11/16/10	RG 31-8				84.8893814	3094.768	58.44674	6.003409386	156.1831	4.361172	6.039009	27.65182	6.728110313					
10/29/10	11/16/10	RG 41-18				154.526474	2899.502	24.2262	2.614798546	9.109577	3.5889	14.18016	8.193215	4.011240005					
10/29/10	11/16/10	RG 43-15				104.874329	3718.489	64.15099	5.513809581	15.11087	8.517579	10.73369	22.976	10.19399548					
10/28/10	11/16/10	RG 11-8				122.80661	4248.952	32.59195	3.289475918	29.7998	1.83891	19.50535	13.65042	8.51745157					
10/28/10	11/16/10	RG 14-16				91.4296722	3031.768	22.1891	2.481566933	40.54746	1.814282	12.98034	13.20169	4.15226078					
10/28/10	11/16/10	RG 14-28				88.9061737	3175.884	32.5354	3.242389441	94.40227	7.813219	21.44044	18.30439	8.77091217					
10/28/10	11/16/10	RG 22-20				41.6699181	5056.201	110.832	11.24539661	38.598	-0.09471	12.71144	45.07938	20.25964737					
10/28/10	11/16/10	RG 22-28				38.4110413	1865.578	129.6956	41.28212738	274.6561	13.01477	1.316966	14.14942	7.519317627					
10/28/10	11/16/10	RG 31-20				124.249542	4056.622	56.38387	7.408823967	18.18963	4.511699	5.567109	24.44658	8.368109703					
10/28/10	11/16/10	RG 31-30				52.112915	2569.671	29.52649	2.913118124	14.94944	8.287415	7.705211	7.39081	3.197018862					
10/28/10	11/16/10	RG 31-32				105.338074	3771.831	37.21938	3.682562351	91.96896	2.431203	15.53927	17.93929	6.967058182					
10/28/10	11/16/10	RG 33-7				99.7815781	3221.104	48.89565	5.216806889	10.89188	5.493112	7.653886	16.07689	9.074629378					
10/28/10	11/16/10	RG 399-1				67.0321274	2660.965	18.48667	3.415485859	241.0016	6.154711	13.15666	4.976792	3.63971133					
10/28/10	11/16/10	RG 399-1-2																	
10/27/10	11/16/10	RG 11-7				87.7134476	4824.882	6.611115	6.841566563	23.57898	5.013025	20.39697	32.38058	15.60981464					
10/26/10	11/16/10	RG 11-11				95.1958389	3987.796	68.52274	10.7260313	85.20312	5.070748	9.070326	47.91946	20.27833752					
10/26/10	11/16/10	RG 12-1				150.160217	3496.698	71.84349	8.782364845	24.22414	6.402609	10.84471	37.45923	19.26265256					
10/26/10	11/16/10	RG 13-36				157.924606	4586.92	144.5072	11.81309032	32.39038	1.09233	9.096914	49.23654	25.73618889					
10/26/10	11/16/10	RG 14-25				105.162132	3016.957	47.35009	3.500679016	61.9429	2.310549	8.72699	14.25119	6.535132855					
10/26/10	11/16/10	RG 22-6				153.815872	4597.995	112.9488	10.78206539	20.91198	5.037014	13.81316	52.28124	23.21132278					
10/26/10	11/16/10	RG 31-12				47.6701126	2050.146	20.80952	2.228750163	20.7733	10.96884	5.532927	6.413176	2.475487232					
10/26/10	11/16/10	RG 31-2				44.5742111	5217.147	135.1879	13.24446392	48.32326	2.6419	12.04413	54.56883	26.28862762					
10/26/10	11/16/10	RG 31-2				112.3703	4309.682	134.4	13.20032597	61.043	6.867861	10.93037	59.84902	24.7540226					
10/26/10	11/16/10	RG 31-3				56.4889274	5336.939	102.8151	8.660423279	81.81996	1.90192	17.27795	43.5163	23.49120903					
10/26/10	11/16/10	RG 32-25				35.3792381	4668.911	121.3831	11.10056591	310.8194	0.80924	17.03761	44.44893	19.61118507					
10/26/10	11/16/10	RG 32-3				26.6605263	3739.585	45.43647	3.79893196	129.824	6.381678	17.50867	12.98073	7.622300675					
10/26/10	11/16/10	RG 32-4				208.513184	7914.218	230.7236	14.42366219	279.483	4.961689	28.4583	52.16207	31.11753645					
10/26/10	11/16/10	RG 32-33				129.191788	3178.747	27.65057	2.839261537	12.54644	4.21246	14.92909	10.08617	5.452718533					
10/26/10	11/16/10	RG 33-24				130.787155	3123.932	36.01971	3.163991451	59.10648	-4.58121	11.79937	15.87819	6.830068588					
10/26/10	11/16/10	RG 33-27				139.693649	4388.894	117.164	11.28446579	31.16432	2.050189	8.329972	32.79093	20.31847422					
10/26/10	11/16/10	RG 33-32				27.0860405	3547.134	49.40992	3.834775448	111.2346	-2.59501	13.96488	12.8316	8.915958405					
10/26/10	11/16/10	RG 341-2				141.964386	3554.765	23.84697	3.007608061	17.42351	4.770009	10.95305	15.80564	6.327449322					
10/26/10	11/16/10	RG 341-24				140.566605	4829.551	142.2554	14.3370924	20.32022	2.47222	9.800785	58.23888	29.61545372					
10/26/10	11/16/10	RG 34-1				51.2478828	5898.163	105.0413	9.82135587	160.0021	-3.12769	20.89602	35.79094	23.24158478					
10/26/10	11/16/10	RG 34-3				37.7912979	4267.896	93.7192	10.63006592	45.1747	0.77731	11.74766	23.09732	19.02134323					
10/26/10	11/16/10	RG 34-24				199.519485	7980.02	117.244	17.34843826	66.62497	0.469089	27.7537	54.098	28.73791695					
10/26/10	11/16/10	RG 344-35				117.35791	4881.874	136.1568	12.73073673	25.89141	3.463288	13.62714	61.21631	26.76899719					
10/26/10	11/16/10	RG 399-1-5				94.0607376	4039.788	46.35756	10.08504677	65.3874	1.946804	7.064343	10.41601	6.231199741					
10/26/10	11/16/10	RG 399-2-1				78.2967834	3464.638	16.76275	2.0249331	79.16132	2.821206	11.76516	7.723957	3.575741339					
10/26/10	11/16/10	RG 412-85				38.5857925	4697.617	117.3879	11.17044735	84.41715	-1.25031	11.08888	43.07384	19.53251839					
10/26/10	11/16/10	RG 42-2				178.462891	5814.308	205.8289	20.14176941	182.235	5.568643	11.31413	89.56143	38.7937938					
10/26/10	11/16/10	RG 42-3				198.085739	5779.205	115.6767	11.47171021	22.04951	4.264901	18.44443	56.68826	29.3311035					
10/26/10	11/16/10	RG 432-27				70.9568939	8165.777	175.3476	16.23214531	406.3225	4.7115	26.25472	69.67454	30.60934258					
10/26/10	11/16/10	RG 433-24				36.6143227	4476.787	79.08247	7.437927246	31.37216	1.187984	13.30496	25.30862	14.78782177					
10/26/10	11/16/10	RG 43-35				148.702301	5336.069	117.8051	12.77437019	12.20074	0.857307	14.79875	49.18926	24.40280151					
10/26/10	11/16/10	RG 434-13				43.5630188	5244.905	96.81282	8.608384132	102.4332	-0.0865	17.52197	28.68813	21.86863899					
10/26/10	11/16/10	RG 441-2				150.740097	4853.307	167.3701	15.31261349	69.81728	4.115266	8.477145	68.97884	32.3609848					
10/26/10	11/16/10	RG 442-3				170.500092	8804.9	154.8851	15.01330853	84.24178	3.651189	31.22835	54.2291	37.04128265					
10/26/10	11/16/10	RG 44-35				99.7991867	3701.021	95.77982	9.275133133	32.35128	2.081124	13.1495	43.04956	19.57792854					
10/26/10	11/16/10	RG 511-2				44.8757248	5394.472	162.6916	17.02225876	59.17593	0.399909	9.65766	59.40356	31.10580826					
10/26/10	11/16/10	RG 522-35				40.4890377	4995.976	138.991	12.60699461	210.1359	-4.11518	12.42366	50.57754	22.48257256					
10/26/10	11/16/10	RG 523-33				138.844391	3192.567	32.03485	2.701210022	245.1463	4.388199	17.02711	17.35737	7.328037738					

Mautz Ranch Multi-Well Pit Pit Volume Calculator*

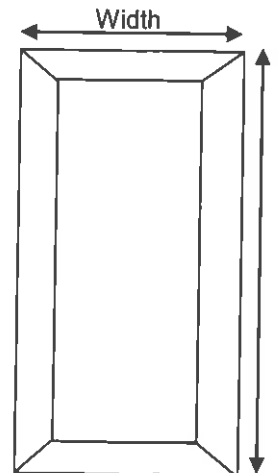
Fox Engineering Solutions, LLC



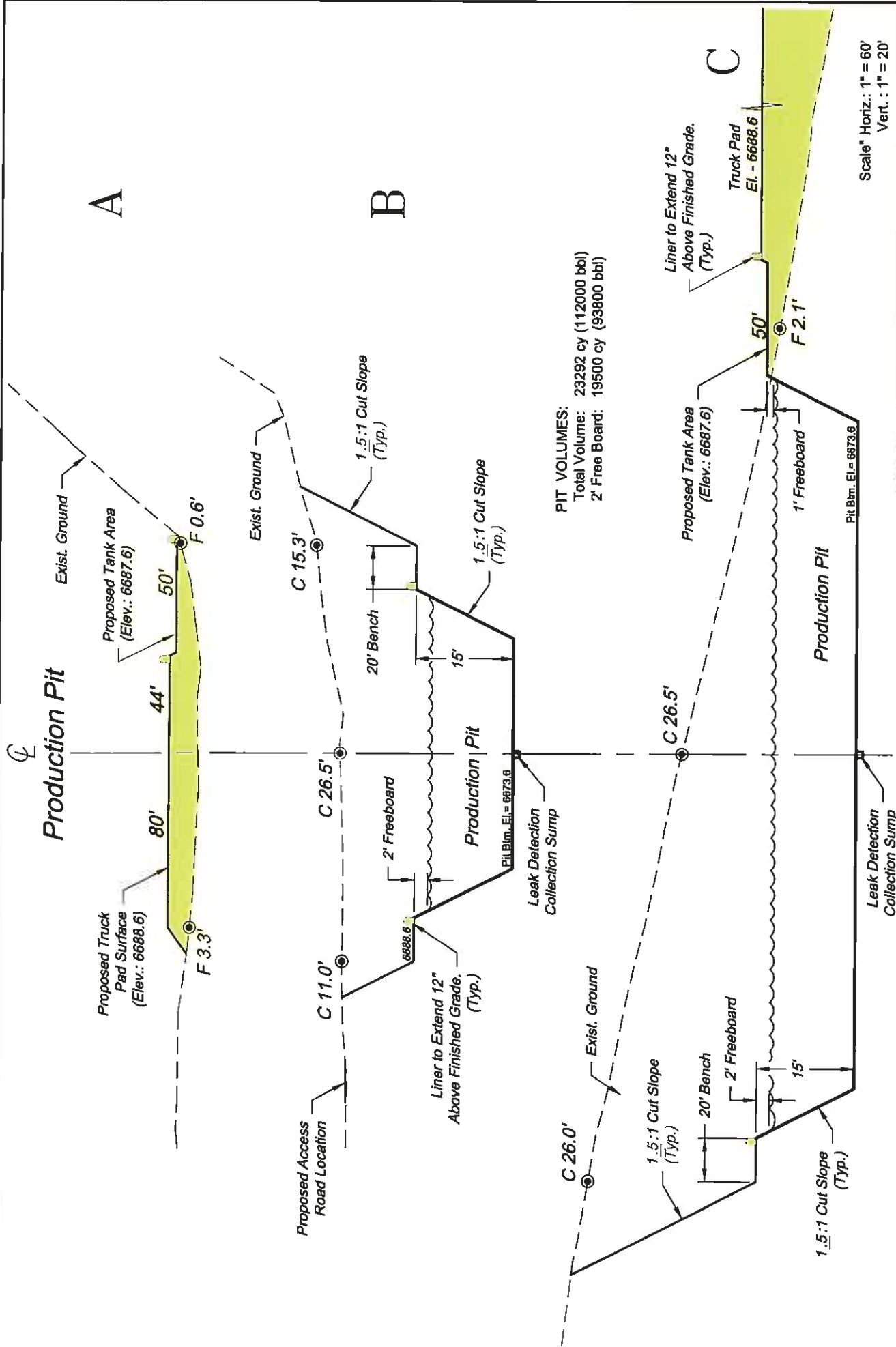
Input					Compute					
Length ft.	Width ft.	Total Depth ft.	Side Slopes		Total Pit Volume ⁽¹⁾		Free Board		Usable Volume	
			Run ft.	Rise ft.	yds. ³	bbls	Required ft.	Volume yds. ³	yds. ³	bbls
350	150	15	1.5	1	23291.67	112000	2	3778.67	19513.00	93830

(1) Volume Formula= $\frac{((D14 \cdot C14) \cdot (A14 - 2 \cdot (D14 \cdot C14)) \cdot C14) + ((D14 \cdot C14) \cdot (B14 - 2 \cdot (D14 \cdot C14)) \cdot C14) + ((B14 - 2 \cdot (D14 \cdot C14)) \cdot (A14 - 2 \cdot (D14 \cdot C14))) \cdot C14 + \frac{1}{3} \cdot (2 \cdot D14 \cdot C14)^2 \cdot C14)}{27}$

* Not valid if the Width < 2 (Depth x Run).



Fox Engineering Solutions
12/21/2010



PIT VOLUMES:
Total Volume: 23292 cy (112000 bbl)
2' Free Board: 19500 cy (93800 bbl)

Scale: Horiz.: 1" = 60'
Vert.: 1" = 20'

REVISED: 12/17/10

As Noted
DATE: 11/18/10
SHEET: 2 of 4
PROJECT: Williams
DFT: CUS

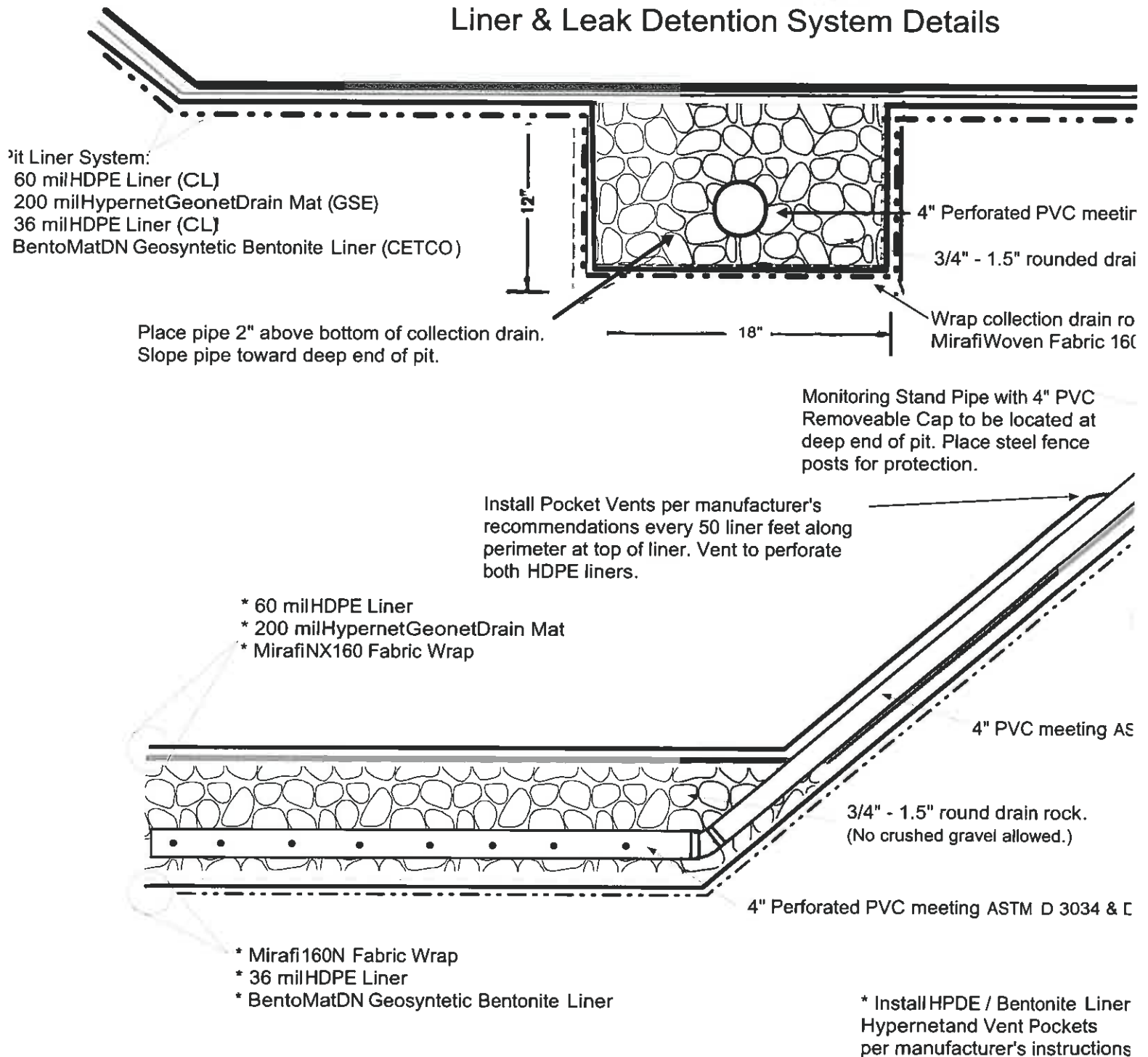
Construction Plan Prepared for:
Williams Williams Production, RMT

Mautz Ranch - Multi Well Pit
CROSS SECTIONS



128 East Third Street
Suite 100
P.O. Box 128
P.O. Box 128

Mautz Ranch Multi-Well Pit Liner & Leak Detention System Details



Section 19
T. 2 S., R. 98 W
6th. P.M.

GRAPHIC SCALE IN FEET
1" = 100 FEET

BLM
Williams Production
RMT

Excess Soil
Stockpile Area

Edge of
Proposed Bench

Daylight
Line

Liner to Extend 12' Above
Finished Pad Grade
(Typ.)

Proposed Multi Well Pit
Bench/Elev. = 6688.6
150'x350'x15' Depth
(See Cross Sections)

Top Soil
Stockpile Area

Tank Area
(50'x50')

12" to 18" High Perimeter
Berm. Transition
into Cut Slopes

Existing Overhead Util.
(to be relocated)

Exist. Pipeline & Road
(To be relocated)

MULTI WELL PIT:

	NORTHING	EASTING
Pit Center	1752752.4	2175544.7
Exist. Ground Elevation:		6700.1
Proposed Bench Elevation:		6688.6

EARTHWORKS VOLUMES:

Cut:	42854 cy
Fill:	6830 cy
Top Soil:	4900 cy
*No Volume Adjustment Applied	

MULTI WELL PIT VOLUMES:

Total:	23292 cy
2' Freeboard:	93800 bbl

*Note:
No Well or Meter House on Pad.

REVISED: 1/24/11

Construction Plan Prepared for:

Williams. Williams Production, RMT

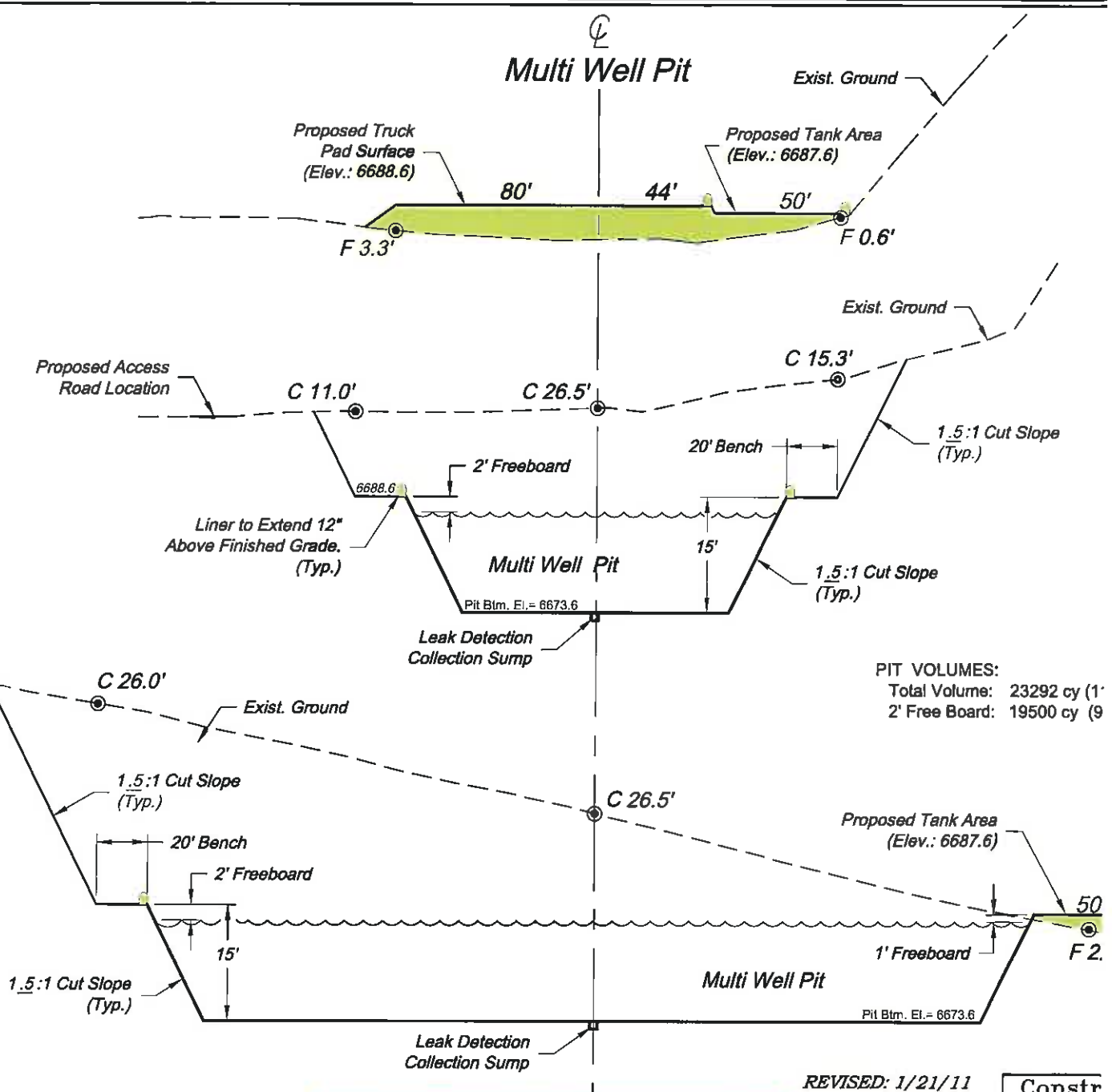
SCALE: 1" = 100'
DATE: 11/18/10
PLAT: 1 of 4
PROJECT: Williams Highlands
DFT: CWS

Mautz Ranch - Multi Well Pit
CONSTRUCTION LAYOUT

100 East Third Street
P.O. Box 11420
PA. (717) 625-1300
Fax (717) 625-3772

BOOKCLIFF
Survey Services, Inc.

K:\2010 HIGHLANDS CENTRAL\Manufz Ranch\PRODUCTION PIT.dwg, J/21/2011 11:35:58 AM



PIT VOLUMES:
Total Volume: 23292 cy (1'
2' Free Board: 19500 cy (9

136 East Third Street
Rifle, Colorado 81630
Ph. (970) 625 1330
Fax (970) 625 2773

BOOKCLIFF
Survey Services, Inc.

REVISED: 1/21/11
SCALE: As Noted
DATE: 11/18/10
SHEET: 2 of 4
PROJECT: Williams
DFT: cws

Constr
Williams
M

Sensitive Area Determination Checklist

Williams Production RMT Company		
Person(s) Conducting Field Inspection	Ashlee Lane	12/3/10
	Biologist	
Site Information		
Location:	Mautz Ranch	Time: 1200
Type of Facility:	Proposed Multi-Well Pit	
Environmental Conditions	Clear and breezy; snow patches in the area; soils saturated.	
Temperature (°F)	50s	

Has the proposed, new or existing location been designated as a sensitive area?

☒ Yes ☐ No

SURFACE WATER

1. Are there any surface water features or SWSAs adjacent to or within ¼ mile of the proposed/new or existing facility?

☒ Yes ☐ No

If yes, list type of surface water feature(s), i.e. rivers, creeks, streams, seeps, springs, wetlands: Ryan Gulch, a spring fed intermittent stream tributary to Piceance Creek and two unnamed irrigation ditches. In addition two springs were identified within the quarter mile buffer zone and are addressed in the additional comments section of this sensitive area determination checklist.

If yes, describe location relative to facility: Ryan Gulch is located 1,061 feet from the center of the proposed facility. The northern most irrigation ditch is located 843 feet from the proposed facility and the southernmost irrigation ditch is located approximately 1,200 feet from the proposed facility.

2. Could a potential release from the facility reach surface water features?

☒ Yes ☐ No

If yes, describe the pathway a release from the facility would likely follow to determine if the potential to impact surface water is high or low. A potential release if it were to migrate off the proposed facility would tend to flow to the southeast following the natural topographic contours of the area.

GROUNDWATER

1. Will the proposed/new or existing facility have any pits which will contain hydrocarbons and chlorides or other E&P wastes?
☒ Yes ☐ No
 If yes, List the pit type(s): Multi-Well Pit

2. Is the site of the proposed facility underlain by an unconfined aquifer or recharge zone?
☒ Yes ☐ No

3. Is the hydraulic conductivity of the underlying soil or geologic material $\leq 1.0 \times 10^{-7}$ cm/sec?
☐ Yes ☒ No

4. Is the proposed facility located within 1/8 mile of a domestic water well or 1/4 mile of a public water supply well which would use the same aquifer?
☐ Yes ☒ No

5. Is the proposed facility located within a 100 year floodplain?
☐ Yes (*Sensitive Area*) ☒ No (*If no, proceed to question #6.*)

6. Is the depth to groundwater known?
☐ Yes (*If yes, follow instructions provided in 6(a) of this section.*)
☒ No (*If no, follow instructions provided in 6(b) of this section.*)
 - (a) If yes, could a potential release from the proposed facility reach groundwater?
☐ Yes ☐ No
 If yes, explain:

 - (b) If no:
 - (i) Evaluate surrounding soils, topography, and vegetation which may suggest the presence of shallow groundwater.
 - (ii) Gather information from surrounding well data in order to determine a depth to groundwater, i.e. State Engineers Office.

7. Is the potential to impact ground water from the facility in the event of a release high or low?
☒ High ☐ Low

Additional Comments:

As stated in the surface water section of this sensitive area determination the northern most irrigation ditch is located 843 feet to the south of the proposed facility; there is no surface hydraulic connectivity to Ryan Gulch. Ryan Gulch, in the immediate vicinity south of the proposed facility, is identified as an intermittent stream based on the fairly well defined channel, providing evidence to support that the stream flows during certain times of the year. The southernmost irrigation ditch is located south of Ryan Gulch and flows parallel to Ryan Gulch for some distance. The facility as it is currently proposed, limits flow directions of a potential release to the southwestern and southeastern edges. If a potential release were to migrate off the facility on the southwestern or southeastern edges it would flow down the gently sloping hillside towards the northern most unnamed irrigation ditch. The greatest potential for impact would be if the irrigation ditch was flowing water. Impacts from a release could then potentially impact the irrigated fields in the immediate vicinity of the proposed facility. Therefore, the potential to impact Ryan Gulch is fairly low since any potential release would be diverted by the above mentioned irrigation ditch. Ryan Gulch could be potentially impacted by a very large release which would allow the irrigation ditch to overflow and allow fluids to migrate towards Ryan Gulch. It is not anticipated that the unnamed irrigation ditch south of Ryan Gulch would be impacted since any potential release would be captured by the irrigation ditch to the north and Ryan Gulch. It would be highly recommended that Best Management Practices (BMPs) be installed in the form of a perimeter berm on the northwestern, southwestern, and southeastern edges of the proposed facility and a diversion ditch along any fill slopes, especially on the southwestern and southeastern sides. It would also be recommended that BMPs be installed along the road as well where the access road to the facility intersects Ryan Gulch. These BMPs should be closely monitored and maintained to ensure site containment in the event of a release.

The State Engineer's Office and USGS records were reviewed and revealed that one application was submitted to the State Engineer's Office for a monitoring well approximately 1,250 feet to the northeast of the proposed facility. The records indicate that the well was never drilled. The vegetative cover in the immediate vicinity of the facility (service berry, oak brush, and sage brush) does not suggest the presence of shallow groundwater. However, the vegetative cover in the alluvial valley (Ryan Gulch) south of the facility does suggest the presence of shallow groundwater. It is not anticipated that the two springs identified on the USGS map and confirmed during the site visit would be impacted by a potential release from the proposed facility. The first spring is located approximately 1,247 feet to the southwest and is upgradient of the proposed facility. The second spring is located approximately 1,153 feet to the southeast of the proposed facility. Based on the topographical location of this spring, it appears that the water source for this spring is originating from the south and would not be impacted by a release from the proposed facility.

The proposed facility will be constructed in the Uintah formation. The Uintah in the immediate vicinity appears to be in a shaley section of the formation based on observations from the site

visit. Shaley sections of the Uintah Formation, like the Green River Formation, tend to be fractured both vertically and horizontally which allows fluids to migrate in the subsurface over large distances. Based on the topographical setting of the proposed facility, a portion of the facility may intersect this shaley section. In addition, portions of the facility may reside in the alluvial fan sediments of the small valley which could potentially be hydraulically connected to the alluvial fill associated with the Ryan Gulch alluvium (floodplain). Therefore it is possible that an overland release could impact shallow groundwater which may be present south of the proposed facility due to the high to very high infiltration rates of the underlying soil. There is also the potential for impact to shallow groundwater from a release that occurred over a longer period of time such as a leaking pit. In either case it would be highly recommended that the pit be lined in accordance to COGCC criteria and tested prior to placement of any materials into it.

Based on the information collected during the site investigation and desktop review, the potential to impact actual surface water or surface waters has been deemed low mainly due to the very high infiltration rates of the underlying soil and the diversionary structures. The greatest potential for impacts from the facility is to shallow groundwater due to the geologic conditions in the area. With the potential to impact shallow groundwater, the facility should be designated as being in a sensitive area.

Inspector Signature(s): Mark E. Mumby Date: 12/8/2010

Mark E. Mumby, *Project Manager/RPG*
HRL Compliance Solutions, Inc.

Ashlee Lane Date: 12/7/2010

Ashlee Lane, *Biologist*
HRL Compliance Solutions, Inc.

COGCC FORM 15 EARTHEN PIT PERMIT - SUPPLEMENTAL INFORMATION

Pit Name –Williams Mautz Ranch Multi Well Pit

Williams Production RMT Company (Operator Number 96850)

February, 2011

This supplement to the COGCC Form 15 for Williams Production RMT Company's Williams) proposed Mautz Ranch Multi Well Pit provides additional information required by COGCC Rules 902, 903, and 904. This information is identified in the following sections by reference to the applicable section of these rules.

This pit is a component of Williams' water management and reuse system. This pit is not used for the disposal of water. This pit will be used to store water that is produced from drilling, water handling and production operations associated with natural gas wells. Water is transported to the pit via pipelines from producing well sites. The water is stored in the pit and then transported to other well sites for natural gas development activities via pipeline.

902.a.

The pit has been designed with features to prevent spills or leaks from impacting the environment. The implementation of Williams' Stormwater Management Plan and the operational policies and procedures described in this supplement are designed to minimize the risk to the environment and accommodate rapid response in the event of an accidental spill or release of fluids. All transfers of water into and out of the pit will be monitored by personnel during the entire transfer operation to ensure that adequate freeboard (minimum of 2 feet) is maintained in the pit at all times. The leak detection system in the pit will be checked at least once per week and, in the event that a leak is detected, the pit will be drained as quickly as possible so that the source of the leak can be determined.

902.b.

Williams' pits have been designed to provide for a minimum of two (2) feet of freeboard at all times. Pit design and cross section details, calculation details, and a copy of the source well(s) (Form 26), are included. Monitoring and maintaining free board is addressed as part of Williams' regular operations. Spills and releases will be reported in accordance with Rule 906.

902.c.

Any accumulation of oil or condensate in a pit shall be removed within twenty-four (24) hours of discovery.

902.d.

The pit has been designed with a fence to prevent wildlife from entering.

902.e.

Williams is permitting this pit as a multi-well pit, which will be used for a period of no more than three years.

902.h.

Williams has instituted a treatment process that is in accordance with Rule 907.

902.i.

The water facility will be treated with biocide as necessary to control bacterial growth and related odors.

903.a.(4)

This supplemental information is being prepared for a multi-well pit in correlation with the COGCC Form 15 that is being submitted to the Director for prior approval.

903.d.

Instructions located in the COGCC Appendix I were used as a guide in the Water Handling of the Earthen Pit Report/Permit, Form 15.

904.a.(5)

The multi-well pit will be lined in accordance with Rule 904.

904.b.(1)

A polysynthetic material that is impervious, has high puncture and tear strength, has adequate elongation, and is resistant to deterioration by ultraviolet light, weathering, hydrocarbons, aqueous acids, alkali, fungi or other substances in the produced water will be used.

904.b.(2)

The pit liners will be constructed, installed, and maintained in accordance with the manufacturers' specification. The pits have also been designed with good engineering practices.

904.b.(3)

Field seams will be installed and tested in accordance with manufacturer specifications and good engineering practices. Test results will be maintained at the Parachute office and will be provided to the Director upon request.

904.c

The water handling pit will utilize a double liner system consisting of 1-30 mil liner and 1-45 mil liner that shall cover the bottom and interior sides of the pit and will be anchored in at least a twelve (12) inch deep anchor trench. The pit will be built in accordance with the regulations set forth in Rule 904.c

904.e.

Since the facility is within close proximity to surface water it is considered to be in a sensitive area. The pit has been designed with features that significantly reduce the potential for the facility to impact nearby surface and ground water. The pit will be double lined in the manner described above and include a leak detection system. All material used in the sensitive area determination are included.

Polyethylene Geomembrane Product Specifications



Colorado Lining International, Inc.
Parker, CO 80138
(800) 524-8672/(303) 841-2022
Fax: (303) 841-5780
www.coloradolining.com

TABLE OF CONTENTS

PART I PURPOSE	2
1.1.0 Scope of Quality Assurance	2
1.2.0 Units	2
1.3.0 References	2
PART II DELIVERY	2
2.2.1 Transportation and Handling.....	3
2.2.0 Storage	3
2.2.1 Special Consideration for Welding Rod or GCL	3
PART III SITE PREPARATION & INSPECTION	3
3.1.0 Anchor Trench Systems	3
3.2.0 Site Inspection	3
PART IV PANEL DEPLOYMENT AND TRACKING	3
4.1.0 Weather and Site Conditions	3
4.2.0 Panel Identification	4
4.3.0 Panel Placement	4
4.4.0 Precautions During Panel Placement.....	4
4.5.0 Damaged Material	5
PART V SEAMING	5
5.1.0 Required Weather Conditions for Seaming.....	5
5.2.0 Seaming and Related Equipment	5
5.2.1 Equipment Preparation	6
5.2.2 Trial Seams	6
5.3.0 Seam Layout	6
5.4.0 Panel Overlap for Seaming	7
5.5.0 Seam Preparation	7
5.6.0 Wedge Welder Seaming Procedure	7
5.6.0 Extrusion Welder Seaming Procedure	8
PART VI NON-DESTRUCTIVE SEAM CONTINUITY TESTING.....	8
6.1.0 Vacuum Box Testing	9
6.2.0 Air Channel Pressure Testing (for Double Fusion Seam Only)	9
6.2.1 Pressure Test Failure.....	9
PART VII DESTRUCTIVE SEAM TESTING	10
7.1.0 Sample and Coupon Size and Extraction.....	11
7.2.0 Coupon Field Testing.....	11
7.3.0 Procedures for Destructive Test Failure.....	12
PART VIII DEFECTS AND REPAIRS.....	13
8.1.0 Identification	13
8.2.0 Repair Procedures	13
8.2.1 Verification of Repairs.....	13
PART IX ANCILARY ITEMS AND FINAL ACCEPTANCE.....	13
9.1.0 Pipe Penetrations.....	13
9.2.0 Backfilling of Anchor Trenches.....	14
9.3.0 Lining System Acceptance.....	14

PART I PURPOSE

This manual addresses the quality assurance and quality control of the installation of High Density Polyethylene (HDPE) geomembrane liners used by Colorado Lining Construction (CLC) in hazardous waste disposal landfills, surface impoundments or other installations as specified by the owner and/or engineer. This manual delineates the quality procedures and standards for installation.

1.1.0 Scope of Quality Assurance

The scope of this manual includes the quality assurance applicable to shipment, handling, and installation of High Density Polyethylene (HDPE) geomembrane liners also referred to Flexible Membrane Liners (FML's).

1.2.0 Units

In this manual, all properties and dimensions are expressed in English units, with "equivalent" Système International (SI)/metric units in parentheses. It should be noted that the conversion is typically only accurate within ten percent. In cases of conflict or clarifications, the U.S. units shall be deemed to govern. Since most field geomembrane testing equipment manufactured in the United States are equipped to measure in English units, required test result data are tabulated herein with such units.

1.3.0 References

The manual includes references to test procedures of the American Society for Testing and Materials (ASTM), the Federal Test Method Standards (FTMS) and the "Standards for Flexible Membrane Liners" of the National Sanitation Foundation (NSF).

PART II DELIVERY

2.1.0 Transportation and Handling

CLC through its own transportation or an independent trucking firm or other party as agreed upon by the Owner will perform transportation of the geomembrane. If the geomembrane arrives on site prior to CLC project personnel, the Owner is responsible for off-loading roll goods and any ancillary items shipped. The material received shall be matched against the freight bill of lading. Any discrepancies shall be immediately reported to CLC before the shipment is signed for. When off-loaded, geomembrane and any ancillary items should be placed on a smooth, well drained surface, free of rocks or any other protrusions which may damage the material. No special covering is necessary for geomembrane.

The following should be verified prior to and during off-loading geomembrane:

Handling equipment used on the site is adequate and does not pose any risk or damage to the geomembrane and that personnel handle the geomembrane with care. If slings are provided, the material should be lifted with such. In any event, materials shall be offloaded in a safe manner whereby the rolls are properly balanced and no personnel or property are at risk of being injured/damaged should loss of control of any roll(s) of material occur.

Upon arrival at the site, CLC shall conduct a surface observation of all rolls for

defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. CLC shall indicate any damage to the Owner's Representative. The Owner shall immediately report to CLC any damage known to exist prior to delivery or that may have occurred during off-loading/handling.

2.2.0 Storage

The Owner shall provide storage in location (or several locations) such that on-site transportation and handling are minimized. Storage space should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined.

2.2.1 Special Consideration for Welding Rod or GCL Liner

Should any welding rod or geoclay (GCL) liner be delivered to the site prior to CLC arrival, such materials shall be immediately secured in a sheltered/dry condition and maintained in such condition until deployed by CLC personnel.

PART III SITE PREPARATION & INSPECTION

3.1.0 Anchor Trench Systems

All Anchor Trench Systems shall be excavated by others (unless otherwise specified) to the lines and widths shown on the design drawings, prior to geomembrane placement.

3.2.0 Site Inspection

Immediately prior to installation, the subgrade shall be jointly inspection walked by the Owner's Representative and CLC personnel to determine it's worthiness to accept the specified lining system. The decision to repair cracks, if any, should be made only by the Owner's Representative. Once properly prepared, CLC will sign acceptance of the surface condition of the subgrade. The integrity of the underlying soil shall remain the responsibility of the owner/earthwork contractor.

Subgrade Preparation Recommendations:

No liner shall be placed on surfaces not previously found acceptable by the CLC supervisor or his agent.

Surfaces to be lined shall be compacted, smooth, and free of all rocks greater than 3/8" in diameter, sharp angular stones, sticks, vegetation, roots, sharp objects, gravel, or debris of any kind. The surface shall provide a firm, unyielding foundation for the lining system with no sudden, sharp or abrupt changes or breaks in grade or geometry.

Part IV PANEL DEPOLYMENT AND TRACKING

4.1.0 Weather and Site Conditions

Panel placement shall not take place during precipitation, or in the presence of excessive winds (unless wind barriers are provided). In addition, deployment shall not take place in any areas of ponded water.

4.2.0 Panel Identification

Panels are portions of roll stock membrane that are field cut to size as required for

fitment and overlapped/welded in situ. In larger projects, a panel may consist of an entire uncut roll.

At the time of installation, the CLC Field Supervisor shall give each field panel an "identification code" (Number or letter-number). This field panel identification code shall be as simple and logical as possible.

4.3.0 Panel Placement

Panels are located by the CLC Field Supervisor in a manner consistent with the specification and best suited to existing site conditions. Field Panels shall be placed one at a time and each shall be seamed immediately after its placement for protection against wind action or rainwater infiltration.

CLC shall record the identification code, location, and date of installation of each geomembrane field panel.

4.4.0 Precautions During Panel Placement

CLC shall ensure that:

Any equipment used will not damage the geomembrane by handling, trafficking, excessive heat, leakage of fluids, or other means.

The prepared surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to liner placement.

Any geosynthetic elements immediately underlying the geomembrane are clean and free of debris.

All personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

Methods used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil.

Methods used to place the panels minimize wrinkles (especially differential wrinkles between adjacent panels).

Adequate temporary ballast is placed over deployed lining panel edges to prevent wind uplift and is not likely to damage the geomembrane. In the event of high winds, continuous loading such as sandbags shall be placed end to end along edges of panels to minimize risk of wind effects.

Direct contact with the geomembrane is minimized. Geotextiles, extra liner or other suitable materials shall be used as protective buffers in areas where excessive traffic may be expected.

4.5.0 Damaged Material

CLC shall inspect the geomembrane after placement and prior to seaming for damage. Any damaged membrane that cannot be reasonably repaired shall be removed and replaced. Repairs to geomembrane shall be made according to procedures described in section 8.2.0.

PART IV SEAMING

5.1.0 Required Weather Conditions for Seaming

No seaming shall be conducted during periods of excessive moisture, blowing dust, or in the presence of excessive winds (unless wind barriers are provided). Seaming shall not take place in an areas of ponded water.

High temperature limits for welding are dependent upon crew safety and membrane material limits. Elevated temperatures can create conditions whereby seam strength may be compromised and an inferior installation may result. When elevated temperature conditions exist over 95° F/35° C, weld quality shall be closely monitored during seaming operations.

No seaming shall be conducted during rain or snow, unless the seam is covered with an enclosure permitting favorable seaming conditions.

No seaming shall be attempted at ambient temperatures below 5° F without proper pre-heating of material promoting favorable seaming conditions.

In all cases, geomembrane shall be dry and protected from wind.

CLC shall verify that favorable weather conditions exist and advise the Owner's Representative if they are not favorable.

5.2.0 Seaming and Related Equipment

Unless otherwise specified, all field seaming procedures shall be limited to two methods: extrusion welding and fusion (via hot wedge/"wedge welding"). The bulk of all panel to panel seaming shall be performed using the wedge weld technique. Extrusion welding shall limited to areas where wedge welders cannot practically be deployed such as patching and pipe penetration sealing. These machines typically require gas or diesel fueled generators as power sources.

Each extrusion welding apparatus shall be equipped with gauges giving the temperature of the apparatus at the nozzle and extruder barrel.

Each wedge welding apparatus shall be equipped with gauges giving the applicable temperatures.

Although welding over a frozen, wet or muddy subgrade is generally not encouraged, fusion welding may be possible under such conditions by deployment of a movable plastic slip-sheet placed directly below the overlapped membranes being seamed. Properly designed and deployed slip-sheets serve to prevent moisture buildup between the sheets being welded while providing conditions whereby wedge welding machines may be propelled at an uninterrupted rate of speed.

5.2.1 Equipment Preparation

Generator(s) shall be fueled outside the extents of the lining system and be inspected for fluid leakage and mechanical damage that may result in damage to the lining system. Should it be necessary to place the generator over the lining system a suitable buffer strip shall be placed between the tires and the membrane. Generators without inflated rubber tires shall not be introduced over the lining system. Tires shall be pre-inspected to be free of foreign matter that may damage the membrane. Generators shall be positioned within close proximity of the seaming region and have adequate extension cords to complete an entire seam without the necessity to move the machine.

Wedge welders shall be calibrated for ambient conditions and the material type/thickness to be welded. The front part of the seaming device should be inspected for sharp corners and irregular details, which may damage the liner. The major point for inspection is that no sharp edges should exist where FML sheet surfaces must pass over the heated wedge element. If a dual, or split, hot wedge seam is being made, the recessed space for the air track should be examined. Knurled pressure rollers shall be inspected for sharp surfaces. All wedge welder adjustments shall be checked daily. Cleaning of machine should be done at least daily.

Extrusion welders shall have an initial inspection before warm up to confirm that the insulation and covers are in good condition and that the welding nozzles (or Teflon shoes) are correct for the FML to be seamed. Teflon shoes should be checked for proper weld bead geometry and excessive wear and replaced if necessary. They shall then be heated to the correct welding temperature for thickness of the material to be welded and then purged of all heat-degraded resin from within the barrel. During the purge process temperature controllers shall be monitored for proper function and that the welding rod feed systems and rotating tips are operating properly.

5.2.2 Trial Seams

Before any welding is performed by either method on the actual membrane lining system, trial seam welds must first be performed yielding passing results.

CLC shall prepare trial seams made with test strips of the actual membrane being installed to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period (start of the day and midday) for each seaming apparatus used. Trial seams shall be made under the same conditions as actual seams.

The trial seam sample shall be approximately 3 feet/1.0 m long by 1 foot/0.3 m wide (after seaming) with the seam centered lengthwise. Seam overlap shall be nominally 4 inches/10.2 cm, 3 inches/7.6 cm minimum.

Unless otherwise specified, five (5) seam sample coupons each measuring 1"/25mm wide x 6"/150mm long shall be cut from the trial seam sample in increments to span its length. The specimens shall be tested in peel (3 ea.) and shear (2 ea.) modes using a field tensiometer. No seaming apparatus shall be used for seaming until deficiencies are corrected and two consecutive trial welds are successfully achieved.

5.3.0 Seam Layout

In general, seams should be oriented parallel to the line of maximum slope, in the direction of slope, not across the slope (horizontal to slopes). Horizontal to slope seams should be no less than 5 feet (1.5 m) from the toe of the slope or areas of potential

stress concentrations unless otherwise approved by The Owner's Representative. When full roll lengths do not extend past the toe of the slope, panel ends may be seamed provided the panel end is cut at an angle greater than 45° to minimize seam stress. In corners and areas of irregular geometry, the number of seams should be minimized.

A seam numbering system compatible with a panel numbering system shall be employed.

5.4.0 Panel Overlap for Seaming

Controlled overlapping of adjacent sheets shall produce approximately 3 inches of overlap for extrusion welds and 4 inches of overlap between sheets for wedge welded seams.

5.5.0 Seam Preparation

CLC shall verify that:

Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material, and seams are aligned with the fewest possible number of wrinkles or "fishmouths".

All areas to receive extrusion welds shall first be lightly/evenly ground with a hand held grinder with a 60 or 80 grit disc to roughen the surface while removing all surface shine. The grinding is performed parallel to the seam and controlled such that grinding marks do not extend more than 0.25 inches outside the area of the weld bead area. Sixty mil or thicker liners should have the edge of the top sheet beveled by grinding to approximately a 45° angle. This grinding preparation shall be completed no more than one (1) hour prior to extrusion welding. Grinding preparation does not apply to wedge welding.

5.6.0 Wedge Welder Seaming Procedure

A smooth insulating plate or fabric is shall be placed beneath the hot welding apparatus both before and after usage.

Unless otherwise specified, the general seaming procedure used by CLC shall be as follows:

The rolls of geomembrane shall be overlapped by approximately four inches (100 mm) for fusion welding and three inches for extrusion welding.

Welding can occur once the panels to be joined have been brought into their exact plan position for final installation.

"Fishmouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut "fishmouths" or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.

Power to the drive motor shall remain switched-off off when positioning the machine to make a seam.

When starting a new weld, the machine shall be manually placed into the overlapped sheet of material. The sheets shall then be guided between the idlers and the wedge element, and into the drive/nip rollers.

When starting a weld in the middle of two sheets, the material must be loaded from the sides. The machine is to be picked up a few inches, loading the bottom sheet first and top sheet second.

As soon as the wedge is in position and the nip rollers are engaged, the drive motor should be energized and the hot wedge moved into position and locked.

Welder alignment and temperature shall be monitored during the seaming process and any adjustments be made as necessary.

Should the machine tend to bulldoze the subgrade due to soil conditions, the operator shall take some of the weight off the front of the machine by lifting it slightly. Alternatively, a base for the machine to travel on could be provided consisting of strips of geotextile or geomembrane.

To avoid damaging membrane material, once the end of a seam is reached the drive and/or pressure rollers shall be immediately disengaged before the material runs completely out of the machine. The machine shall be withdrawn as quickly as possible to avoid damaging the membrane.

Seaming shall span the full panel length extend well into the anchor trench.

All cross seams or "T" intersections are to be extrusion welded where they intersect. The top flap of geomembrane shall be removed in the area to be extrusion welded and the weld area is ground prior to welding.

5.7.0 Extrusion Welder Seaming Procedure

A smooth insulating plate or fabric is shall be placed beneath the hot welding apparatus both before and after usage.

Using a hot air welders or hand held heat guns with seam rollers the overlapping materials to be welded must first be pre-bonded to hold the materials in place before actual extruding.

Welding operations should be observed to assure that the machines are properly aligned resulting in weld beads that are centered over the edges of the top FML sheets and that weld bead appearances are smooth and uniform.

PART VI

Non-Destructive Seam Continuity Testing

CLC shall non-destructively test all field seams over their full length using a vacuum test unit, air pressure testing, or other approved method. The purpose of non-destructive tests is to check the continuity of seams. It does not provide information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

6.1.0 Vacuum Box Testing

This test method is almost exclusively used for evaluating extrusion weld bead quality. In areas where vacuum boxes cannot practically be deployed, the welds shall be visually inspected and manually probed over their full length to check adhesion.

The equipment shall be comprised of the following:

A vacuum box assembly constructed from clear transparent plastic with a soft neoprene gasket attached to the bottom and a gauge to indicate vacuum chamber pressure.

A vacuum motor capable of creating a vacuum of 2.5 to 3 psi.

A bucket and wide brush, mop or spray assembly.

A soapy solution.

Procedure:

Wet a strip of geomembrane approximately 12 inches by 48 inches (0.3 m by 1.2 m) with the soapy solution;

Place the box over the wetted area.

Energize the vacuum apparatus; confirm 2.5 to 3psi.

Ensure that a leak tight seal is created.

For a period of approximately 5 to 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

All areas where soap bubbles appear shall be marked and repaired in accordance with Section 3.4.

If no bubbles appear, the vacuum shall be disengaged and the box indexed to the next test area with a minimum 6" overlap between indexes, and the process repeated.

Vacuum tested seams are recorded on Daily Progress Reports.

6.2.0 Air Channel Pressure Testing

This method is only applicable to seam continuity testing of air channels produced using dual track hot wedge welding equipment.

Testing equipment shall be comprised of the following:

An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa).

A air hose with fittings and connections.

A sharp hollow needle or other approved pressure feed device.

Procedure:

Seal both ends of the seam to be tested by tack welding and clamping with Vise Grips;

Insert needle into the air test channel created by the fusion weld.

Inflate the channel as applicable to pressure between 25 and 30 psi (160 and 200 kPa), close pressurized air source valve and monitor air pressure drop for five (5) minutes.

Remove needle or other approved pressure feed device and seal.

If pressure drop exceeds values tabulated herein or does not stabilize, locate faulty area and repair and re-test until defects are corrected and test values are passing.

Pressure tested seams are recorded on Daily Progress Reports.

**TABLE 6.2
SEAM PRESSURE TEST ALLOWANCE**

Material Thickness	Minimum psi Test Pressure	Maximum psi Test Pressure	Maximum psi Drop Allowed After 5 Minutes
30 mil	24	30	3 PSI
40 mil	24	30	3 PSI
60 mil	27	30	3 PSI
80 mil	27	30	3 PSI
100 mil & Thicker	30	32	3 PSI

6.2.1 Pressure Test Failure

Should excessive pressure drop occur, both ends of seam shall be checked to insure proper seal and be re-tested. Should failure reoccur, the top fusion seam shall be checked by applying a constant air pressure to the air channel and applying a soapy water solution over the weld length. Any failure or leak will be indicated by continuous bubbles appearing.

If no failure appears in the top fusion seam area the seam shall then be systematically isolated into in one hundred and fifty linear foot sections of seam which shall each be re-tested by pressure testing until the leak is located. Failed seam areas shall be repaired by extrusion welding the outside edge of the top fusion weld between areas of failure. The extruded edge shall be vacuum tested in accordance with this manual.

PART VII

Destructive Seam Testing

Destructive seam tests (if required by the project specification) shall be performed at random selected locations at a frequency of one sample per every 500 lineal feet of seam or as otherwise specified. Seam testing shall be conducted concurrent to the seaming work progress. The Owner's Representative if required, may select locations where seam samples are to be cut. If destructive seam tests are not required, representative seam samples may be substituted at a similar frequency using material samples of the actual material being installed so that no "damage" is done to the actual lining system requiring patching and testing, etc.

Procedure

Samples shall be cut by CLC as the seaming progresses. CLC shall:

Cut samples.

Assign a number to each sample, which is to be based upon seam and sample number and mark it accordingly.

Record sample location on daily report.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in Section 8.2.0.

7.1.0 Sample and Coupon Size and Extraction

Unless otherwise specified, the following sample preparation guidelines shall govern:

Trial, representative or destructive seam samples cut from the installed liner shall measure 12"/30cm in width x 3'/1m in length with the width of the seam centered in the long axis of the sample. Coupons shall measure 1"/25mm wide by 6"/150mm long with the seam centered perpendicular to the length.

Coupon extractions shall occur in three paired locations along the length of the seam sample:

2 coupons at the beginning, 2 coupons in the center and 2 coupons at the end of the sample for a total of six (6) extractions. Coupons may be extracted and evaluated incrementally.

Sample Distribution

Remnant 12"/30 cm square samples shall be cut into parts, labeled as specified and distributed as applicable:

One portion for independent geosynthetic laboratory testing if previously specified

and

One portion to the Owner for archive storage

7.2.0 Coupon Field Testing

Coupons shall be tested with a tensiometer and evaluated for bonded seam strength (shear) and peel using methods ASTM D4437. Tensiometer jaw separation rate for bonded seam strength/shear and peel test shall be 2"/minute (5cm/min.)

All shear strength samples shall yield Film Tearing Bond (FTB) as defined in NSF 54 Annex A,

If the initial sample coupon test passes shear analysis yielding a FTB, the sample qualifies for further testing to obtain quantitative results until three (3) each peel samples and three (3) each shear samples are evaluated from the beginning middle and end of each sample.

If more than one (1) of six coupons per sample fails, the seam should be repaired in accordance with Section 7.3.0.

TABLE 7.2
REQUIRED FUSION AND EXTRUSION SEAM TEST RESULTS
 Per NSF 54 1993 Standards

Material Thickness	Minimum Values Required (In Units of Pounds per inch of Width)			
	Peel Extrusion	Peel Fusion	Shear Extrusion	Shear Fusion
30 mil HDPE	35	49	63	63
40 mil HDPE	48	86	86	86
60 mil HDPE	70	98	126	126
80 mil HDPE	92	115	166	166
100 mil HDPE	115	143	207	207
Textured 30 mil HDPE	31	44	56	56
Textured 40 mil HDPE	42	60	76	76
Textured 60 mil HDPE	63	88	113	113
Textured 80 mil HDPE	84	115	151	151
Textured 100 mil HDPE	105	143	189	189

Notes: Textured values are applicable to membranes textured on one side of the sheet only.
 Only the inner weld track is peeled apart in this destructive test. The outer track (directly at sheet edge) is for the purpose of air pressure testing capabilities.

7.3.0 Procedures for Test Failure

Should a sample fail a destructive test, the defect may be remedied by:

Capping the respective seam in its entirety as described in this section,

or

If a defect is suspected to be local to a certain area it may be further investigated to isolate the defective are by:

Taking small coupon test samples located 10' on either side of the defective sample seam void area. If these additional samples pass tensiometer testing, then full samples are to be taken. If these samples pass the tests, then the seam is capped between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed. All acceptable seam areas must be bounded by two locations from which samples passing destructive tests have been taken.

Cap stripping of defective seams or isolated areas shall be performed using either wedge or extrusion welding techniques or combination thereof and re-testing the repaired area with applicable methods as described herein. Cap strips shall cover the defective seam by no less than 6"/15cm On either side of the original weld. Wider patches will be required to cover seam sample void areas.

CLC shall document all actions taken in conjunction with destructive test failures; e.g., capping of failed seam area.

PART VIII

Defects and Repairs

8.1.0 Identification

All seams and non-seam areas of the geomembrane shall be examined by CLC for identification of defects, holes, blisters, un-dispersed raw materials and any sign of contamination by foreign matter.

Defective/damaged materials shall be identified via a deficiency report, either separately or on the Daily Report. Actions taken to resolve or correct the problem will also be recorded on the similar form.

Defects, holes, blisters, un-dispersed raw materials, signs of contamination by foreign matter, unacceptable welds in geomembranes and other unsatisfactory conditions will be identified on the Daily Report form. The repair/corrective action to "fix" the problem will also be recorded on a similar form.

8.2.0 Repair Procedures

Available methods include:

Patching - used to repair large holes, tears, and contamination by foreign matter.

Grinding and re-welding - used to repair small sections of extruded seams.

Spot welding or seaming - used to repair pinholes or other minor localized flaws;

Capping - used to repair large lengths of failed seams;

Methods for patching lining system defects shall consist of welding patches or caps over such areas using the same membrane lining material as used on the specific project. Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.

Seaming, preparation and welding equipment deployment procedures previously addressed in this manual shall be adhered to during patching operations.

8.2.1 Verification of Repairs

Each repair shall be non-destructively tested using the methods described in Section 6 as appropriate. Repairs which pass the non-destructive test, shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be redone and re-tested until a passing test result is obtained.

Part IX

Ancillary Items and Final Acceptance

9.1.0 Pipe Penetrations

Pipes penetrating through the lined area shall be sealed using pipe boot details that are welded to the lining system via extrusion weld method and sealed the pipe with double stainless steel banding clamps and butyl sealant tape. Pipe boots shall be fabricated from the membrane material being installed and shall fit snugly over the pipe and pipe to grade interface without undue slack or bridging. In instances where piping is

manufactured from HDPE, the pipe boot sleeve may be extrusion welded directly to the pipe foregoing the need for banding clamps.

9.2.0 Backfilling of Anchor Trenches

Anchor trenches, if any, shall be adequately drained by others to prevent ponding or otherwise softening the adjacent soils while the trench is open. The anchor trench shall be back-filled by others or as outlined in the specifications and bid documents.

Since back-filling the anchor trench can affect material bridging at toe of slope, consideration should be given to backfill the liner at its most contracted state; preferably during the cool of the morning or extended period of overcast skies. Care shall be taken when back-filling the trenches to prevent any damage to the lining system.

9.3.0 Lining System Acceptance

Once the lining system is installed and all quality assurance testing has been completed with satisfactory results, and the system is approved by Owner's Representative, the Representative shall sign an acceptance form provided by CLC prior to demobilization.



Promoting Industry Growth • Providing Better Quality Workmanship

Approved Installation Contractor

This Certificate Recognizes That

Colorado Lining International, Inc.

Has achieved Approved Installation Contractor status through
the International Association of Geosynthetic Installers.

Valid through July 8, 2010



Carl Apicella

Laurie Honnigford
Managing Director, IAGI

**BENTOMAT® CL****GEOSYNTHETIC CLAY LINER SPECIFICATION GUIDELINES**

This specification is intended for use as a GENERAL GUIDELINE for developing a specification for a specific project. It is NOT intended as a substitute for a detailed specification, which must be written to address site-specific conditions.

1.0 GENERAL

1.1 Scope

This specification covers the technical requirements for the furnishing and installation of the geosynthetic clay liner described herein. All materials used shall meet the requirements of this specification, and all work shall be performed in accordance with the procedures provided herein and the contract drawings.

1.2 Definitions

For the purposes of this specification guideline, the following terms are defined below:

Geosynthetic Clay Liner (GCL). A manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetics.

Geomembrane. An essentially impermeable geosynthetic composed of one or more geosynthetic sheets.

Geotextile. Any permeable geosynthetic comprised solely of textiles.

Minimum Average Roll Value. For geosynthetics, the value calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.

Overlap. Where two adjacent GCL panels contact, the distance measuring perpendicular from the overlying edge of one panel to the underlying edge of the other.

1.3 Unit Prices

Measurement will be made of the total surface area in square feet covered by the GCL as shown on the contract drawings. Final quantities will be based on as-built conditions. Allowance will be made for GCL in anchor and drainage trenches but no allowance will be made for waste, overlap, or materials used for the convenience of the Contractor. GCL installed and accepted will be paid for at the respective contract unit price in the bidding schedule.

1.4 Submittals

A. With the bid, the Contractor shall furnish the following information:

1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.
2. GCL manufacturer's MQC Plan for documenting compliance to Sections 2.1 and 2.2 of these specifications.
3. GCL manufacturer's historical data for multi-axial tension testing of the laminated GCL per Section 2.1E.

4. A copy of GCL manufacturer's ISO quality Certificate of Registration.
- B. At the Engineer's or Owner's request the Contractor shall furnish:
1. A representative sample of the GCLs.
 2. A project reference list for the GCL(s) consisting of the principal details of at least ten projects totaling at least 10 million square feet (100,000 square meters) in size.
- C. Upon shipment, the Contractor shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.
- D. As installation proceeds, the Contractor shall submit certificates of subgrade acceptance, signed by the Contractor and CQA Inspector (see Sections 1.6 and 3.3) for each area that is covered by the GCL.

1.5 Qualifications

- A. GCL Manufacturer must have produced at least 300 million square feet (30 million square meters) of GCL within the past three years, including at least 30 million square feet (3 million square meters) with 3.5 lb/in (610 N/m) peel strength.
- B. The GCL Installer must either have installed at least 1 million square feet (100,000 square meters) of GCL, or must provide to the Engineer satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner.

1.6 Construction Quality Assurance (CQA)

- A. The Owner and Engineer shall provide a third-party inspector for CQA of the GCL installation. The inspector shall be an individual or company who is independent from the manufacturer and installer, who shall be responsible for monitoring and documenting activities related to the CQA of the GCL, throughout installation. The inspector shall have provided CQA services for the installation of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet (100,000 square meters).
- B. Testing of the GCL, as necessary to support the CQA effort, shall be performed by a third party laboratory retained by the Contractor and independent from the GCL manufacturer and installer. The laboratory shall have provided GCL CQA testing of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet (100,000 square meters).
- C. CQA shall be provided in accordance with the *GCL CQA Manual* provided by the engineer.

2.0 PRODUCTS

- A. The GCL shall consist of a layer of granular sodium bentonite clay needlepunched between two geotextiles and laminated to a thin flexible membrane liner (Bentomat CL). The GCL shall comply with all of the criteria listed in this Section.
- B. Bentonite shall be a high-swelling sodium bentonite, with a minimum swell index of 24 mL/2g and a maximum fluid loss of 18 mL. Bentonite shall be CG-50 granular bentonite, mined and processed by American Colloid Company.
- C. Bentonite shall have a granular consistency (1 percent max. passing a No. 200 sieve [75 µm]), to ensure uniform distribution throughout the GCL and minimal edge loss during handling and installation.
- D. Prior to using an alternate GCL, the Contractor must furnish independent test results demonstrating that the proposed alternate material meets all requirements of this specification. Contractor must also provide evidence of successful use of the proposed alternate material on past similar projects. This evidence can include past direct shear results against similar materials under similar site conditions, and/or past permeability/compatibility test results with a similar leachate or waste stream. The Contractor also must obtain prior approval of the alternative GCL by the Project Engineer.

2.1 Materials

- A. Acceptable GCL product is Bentomat CL, as manufactured by CETCO, 2870 Forbs Avenue, Hoffman Estates, Illinois 60192 USA (800-527-9948), or an engineer-approved equal.
- B. The GCL and its components shall have the properties shown in the Bentomat CL Certified Properties table.
- C. The moisture content of the bentonite in the finished GCL shall be between 20 and 40 percent, to ensure uniform bentonite distribution, consistent needlepunch density, and adequate electrical conductivity to maximize leak location survey sensitivity.
- D. GCL shall be needlepunch-reinforced, with a minimum peel strength of 3.5 lb/inch (610 N/m). To maximize large-displacement shear strength, GCL reinforcement shall be achieved solely through needlepunching, without any supplemental heat treatment.
- E. The Bentomat CL GCL shall have multi-axial tension testing data per ASTM D5617. The GCL shall achieve a minimum multi-axial strain of 9.49%.
- F. For projects in cold-weather climates, the GCL shall have passing test results for both Brittleness (ASTM D1790) and Low-temperature flexibility (ASTM D1970) tests, at temperatures as low as -40 degrees C.

- G. The minimum acceptable dimensions of full-size GCL panels shall be 150 feet (45.7 m) in length. Short rolls [(those manufactured to a length greater than 70 feet (21 m) but less than a full-length roll)] may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square feet (3,500 square meters) of GCL, whichever is less.
- H. A 12-inch (300 mm) overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink.

2.2 Product Quality Documentation

The GCL manufacturer shall provide the Contractor or other designated party with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

- A. Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the swell index and fluid loss values shown in the Bentomat CL Certified Properties table.
- B. Manufacturer's test data for finished GCL product(s) demonstrating compliance with the values shown in the Bentomat CL Certified Properties table.
- C. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

2.3 Product Labeling

- A. Prior to shipment, the GCL manufacturer shall label each roll, identifying:
 - 1. Product identification information (Manufacturer's name and address, brand product code).
 - 2. Lot number and roll number.
 - 3. Roll length, width and weight.

2.4 Packaging

- A. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.
- B. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light.



LINING TECHNOLOGIES

Certified Properties

BENTOMAT® CL CERTIFIED PROPERTIES

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY ft ² (m ²)	REQUIRED VALUES
Bentonite Swell Index ¹	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss ¹	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area ²	ASTM D 5993	40,000 ft ² (4,000 m ²)	0.75 lb/ft ² (3.6 kg/m ²) min
GCL Tensile Strength ³	ASTM D 6768	200,000 ft ² (20,000 m ²)	45 lbs/in (78 N/cm) MARV
GCL Peel Strength ³	ASTM D 6496	40,000 ft ² (4,000 m ²)	3.5 lbs/in (4.4 N/cm) min
GCL Index Flux ⁴	ASTM D 5887	Periodic	1 x 10 ⁻⁹ m ³ /m ² /sec max
GCL Hydraulic Conductivity ⁴	ASTM D 5887	Periodic	5 x 10 ⁻¹⁰ cm/sec max
GCL Hydrated Internal Shear Strength ⁵	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typical

Bentomat CL is a reinforced GCL consisting of a layer of granular sodium bentonite between two geotextiles, which are needlepunched together and laminated to a thin flexible membrane liner.

Notes

¹ Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

² Bentonite mass/area reported at 0 percent moisture content.

³ All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

⁴ ASTM D5887 Index flux and hydraulic conductivity testing with deaired distilled/deionized water at 80 psi (551 kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 92 gal/acre/day. This flux value is equivalent to a permeability of 5x10⁻¹⁰ cm/sec for typical GCL thickness. ASTM D 5887 testing is performed only on a periodic basis because the membrane is essentially impermeable.

⁵ Peak value measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

2.5 Accessory Bentonite

- A. The granular bentonite sealing clay used for overlap seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer. Seaming of GCLs shall be conducted in accordance with the manufacturer's specifications for each particular GCL. Please refer to the installation guidelines for Bentomat/Claymax GCLs.

3.0 EXECUTION

3.1 Shipping and Handling

- A. The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor, Installer or other designated party.
- B. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.
- C. The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

3.2 Storage

- A. Storage of the GCL rolls shall be the responsibility of the installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well drained.
- B. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).
- C. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.
- D. The integrity and legibility of the labels shall be preserved during storage.

3.3 Earthwork

- A. Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project specifications and drawings. The surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation.
 2. Construction Debris.
 3. Sticks.
 4. Sharp rocks.
 5. Void spaces.
 6. Ice.
 7. Abrupt elevation changes.
 8. Standing water.
 9. Cracks larger than one-quarter inch (6 mm) in width.
 10. Any other foreign matter that could contact the GCL.
- B. Subgrade surfaces consisting of granular soils or gravels may not be acceptable due to their large void fraction and puncture potential. Subgrade soils should range between fines and 1 inch (25 mm). In high-head applications (greater than 1 foot or 30.48 cm), CETCO recommends a membrane-laminated GCL.
- C. Immediately prior to GCL deployment, the subgrade shall be final-graded to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints or other irregularities shall exist in the subgrade. Furthermore, all protrusions extending more than one-half inch (12 mm) from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor.
- D. On a continuing basis, the project CQA inspector shall certify acceptance of the subgrade before GCL placement.
- E. It shall be the installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.
- F. At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated or an equivalent runout shall be utilized in accordance with the project plans and specifications and as approved by the CQA Inspector. When utilizing an anchor trench design, the trench shall be excavated and approved by the CQA Inspector prior to GCL placement. No loose soil shall be allowed at the bottom of the trench and no sharp corners or protrusions shall exist anywhere within the trench.

3.4 GCL Placement

- A. The areas to be lined with GCL shall be agreed upon by the Installer and the Engineer prior to installation.
- B. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's recommendations.

- C. Equipment, which could damage the GCL, shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.
- D. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.
- E. The GCL panels shall be placed parallel to the direction of the slope.
- F. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.
- G. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project Engineer, CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

3.5 Anchorage

- A. As directed by the project drawings and specifications, the end of the GCL roll shall be placed in an anchor trench at the top of the slope or an equivalent runout design shall be utilized. When utilizing an anchor trench design, the front edge of the trench should be rounded so as to eliminate any sharp corners. Loose soil should be removed from the floor of the trench. The GCL should cover the entire trench floor but does not extend up the rear trench wall.

3.6 Seaming

- A. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. Bentonite-enhanced seams are required for installation of membrane-laminated GCLs.
- B. The minimum dimension of the longitudinal overlap for Bentomat CL should be 12 inches (300 mm). End-of-roll overlapped seams should be similarly constructed, but the minimum overlap should measure 24 inches (600 mm).
- C. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.
- D. Bentonite-enhanced seams are constructed between the overlapping adjacent panels described above. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied within the zone defined by the edge of the underlying panel and the 12-inch (300 mm) line. A similar bead of granular

sodium bentonite is applied at the end-of-roll overlap. The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot (0.4 kg/m).

3.7 Detail Work

- A. The GCL shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the GCL Manufacturer.
- B. Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

3.8 Damage Repair

- A. If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches (300 mm) is achieved around all of the damaged area. Granular bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch. It may be desirable to use an adhesive to affix the patch in place so that it is not displaced during cover placement.

3.9 Cover Placement

- A. Cover soils shall be free of angular stones or other foreign matter that could damage the GCL. Cover soils should be approved the project Engineer with respect to particle size, uniformity and chemical compatibility. Cover soils with high concentrations of calcium (e.g., limestone, dolomite) are not acceptable.
- B. Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot (300 mm) of cover should be maintained between the equipment tires/tracks and the GCL at all times during the covering process. This thickness recommendation does not apply to frequently trafficked areas or roadways, for which a minimum thickness of 2 feet (600 mm) is required.
- C. Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. Cover soil shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.
- D. Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of any geosynthetic material placed over the GCL. The GCL supplier or CQA engineer should be contacted with specific recommendations on the appropriate procedures in this situation.



GSE STANDARD PRODUCTS

Product Data Sheet

GSE HyperNet, HF, HS and UF Geonet

GSE HyperNet geonets are synthetic drainage materials manufactured from a premium grade high density polyethylene (HDPE) resin. The structure of the HyperNet geonet is formed specifically to transmit fluids uniformly under a variety of field conditions. HDPE resins are inert to chemicals encountered in most of the civil and environmental applications where these materials are used. GSE geonets are formulated to be resistant to ultraviolet light for time periods necessary to complete installation. GSE HyperNet geonets are available in standard, HF, HS, and UF varieties.

The table below provides index physical, mechanical and hydraulic characteristics of GSE geonets. Contact GSE for information regarding performance of these products under site-specific load, gradient, and boundary conditions.

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE ^(b)			
			HyperNet	HyperNet HF	HyperNet HS	HyperNet UF
Product Code			XL4000N004	XL5000N004	XL7000N004	XL8000N004
Transmissivity ^(a) , gal/min/ft (m ² /sec)	ASTM D 4716	1/540,000 ft ²	9.66 (2 x 10 ⁻³)	14.49 (3 x 10 ⁻³)	28.98 (6 x 10 ⁻³)	38.64 (8 x 10 ⁻³)
Thickness, mil (mm)	ASTM D 5199	1/50,000 ft ²	200 (5)	250 (6.3)	275 (7)	300 (7.6)
Density, g/cm ³	ASTM D 1505	1/50,000 ft ²	0.94	0.94	0.94	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D 5035	1/50,000 ft ²	45 (7.9)	55 (9.6)	65 (11.5)	75 (13.3)
Carbon Black Content, %	ASTM D 1603, modified	1/50,000 ft ²	2.0	2.0	2.0	2.0
Roll Width ^(c) , ft (m)			15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)
Roll Length ^(c) , ft (m)			300 (91)	250 (76)	220 (67)	200 (60)
Roll Area, ft ² (m ²)			4,500 (418)	3,750 (348)	3,300 (305)	3,000 (278)

NOTES:

- ^(a) Gradient of 0.1, normal load of 10,000 psf, water at 70° F (20° C), between steel plates for 15 minutes.
- ^(b) These are MARV values that are based on the cumulative results of specimens tested by GSE.
- ^(c) Roll widths and lengths have a tolerance of ±1%.

DS017 HyperNet R01/13/06

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Please check with GSE for current, standard minimum quality assurance procedures and specifications.

GSE and other trademarks in this document are registered trademarks of GSE Lining Technology, Inc. in the United States and certain foreign countries.

North America	GSE Lining Technology, Inc.	Houston, Texas	800 435 2008	281 443 8564	Fax: 281 230 8650
South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hamburg, Germany		49 40 767 420	Fax: 49 40 767 4234
Middle East	GSE Lining Technology-Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889

www.gseworld.com

State of Colorado Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80205 Phone: (303) 894-2100 Fax: (303) 894-2109



Document Number:

400132276

Date Received:

02/22/2011

Oil and Gas Location Assessment

☒ New Location ☐ Amend Existing Location Location#: _____

Submit original plus one copy. This form is to be submitted to the COGCC prior to any ground disturbance activity associated with oil and gas development operations. This Assessment may be approved as a standalone application or submitted as an informational report accompanying an Application for Permit-To-Drill, Form 2. Approval of this Assessment will allow for the construction of the below specified location; however, it does not supersede any land use rules applied by the local land use authority. This form may serve as notice to land owners and other interested parties, please see the COGCC web site at <http://colorado.gov/cogcc/> for all accompanying information pertinent to this Oil and Gas Location Assessment.

Location ID:

422672

Expiration Date:

04/16/2014
☐ This location assessment is included as part of a permit application.

1. CONSULTATION

- ☐ This location is included in a Comprehensive Drilling Plan. CDP # _____
- ☒ This location is in a sensitive wildlife habitat area.
- ☐ This location is in a wildlife restricted surface occupancy area.
- ☐ This location includes a Rule 306.d.(1)A.ii. variance request.

2. Operator

Operator Number: 96850

Name: WILLIAMS PRODUCTION RMT COMPANY LLC

Address: 1001 17TH STREET - SUITE #1200

City: DENVER State: CO Zip: 80202

3. Contact Information

Name: Howard Harris

Phone: (303) 606-4086

Fax: (303) 629-8268

email: howard.harris@williams.com

4. Location Identification:

Name: Mautz Ranch Multi Well Pit Number: _____

County: RIO BLANCO

QuarterQuarter: SENW Section: 19 Township: 2S Range: 98W Meridian: 6 Ground Elevation: 6700

Define a single point as a location reference for the facility location. This point should be used as the point of measurement in the drawings to be submitted with this application. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 2011 feet FNL, from North or South section line, and 1721 feet FWL, from East or West section line.

Latitude: 39.863494 Longitude: -108.437370 PDOP Reading: 1.8 Date of Measurement: 09/29/2010

Instrument Operator's Name: J. Kirkpatrick

5. Facilities (Indicate the number of each type of oil and gas facility planned on location):

Special Purpose Pits: <input type="text"/>	Drilling Pits: <input type="text"/>	Wells: <input type="text"/>	Production Pits: <input type="text"/>	Dehydrator Units: <input type="text"/>
Condensate Tanks: <input type="text"/>	Water Tanks: <input type="text" value="10"/>	Separators: <input type="text"/>	Electric Motors: <input type="text"/>	Multi-Well Pits: <input type="text" value="1"/>
Gas or Diesel Motors: <input type="text"/>	Cavity Pumps: <input type="text"/>	LACT Unit: <input type="text"/>	Pump Jacks: <input type="text"/>	Pigging Station: <input type="text"/>
Electric Generators: <input type="text"/>	Gas Pipeline: <input type="text"/>	Oil Pipeline: <input type="text"/>	Water Pipeline: <input type="text"/>	Flare: <input type="text"/>
Gas Compressors: <input type="text"/>	VOC Combustor: <input type="text"/>	Oil Tanks: <input type="text"/>	Fuel Tanks: <input type="text"/>	

Other: Note: The facility proposed is a multi well pit

6. Construction:

Date planned to commence construction: 06/01/2011 Size of disturbed area during construction in acres: 4.22
Estimated date that interim reclamation will begin: 06/01/2014 Size of location after interim reclamation in acres: 0.00
Estimated post-construction ground elevation: 6700 Will a closed loop system be used for drilling fluids: Yes ☐
Will salt sections be encountered during drilling: Yes ☐ No ☒ Is H2S anticipated? Yes ☐ No ☒
Will salt (>15,000 ppm TDS Cl) or oil based muds be used: Yes ☐ No ☐
Mud disposal: Offsite ☐ Onsite ☐ Method: Land Farming ☐ Land Spreading ☐ Disposal Facility ☐
Other: NA

7. Surface Owner:

Name: Williams PProduction RMT L Phone: 970-263-9377
Address: 1058 County Road 215 Fax: 970-285-9573
Address: _____ Email: _____
City: Parachute State: CO Zip: 81635 Date of Rule 306 surface owner consultation: _____
Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian
Mineral Owner: ☐ Fee ☐ State ☐ Federal ☐ Indian
The surface owner is: ☐ the mineral owner ☐ committed to an oil and gas lease
☐ is the executer of the oil and gas lease ☒ the applicant
The right to construct the location is granted by: ☐ oil and gas lease ☐ Surface Use Agreement ☐ Right of Way
☒ applicant is owner
Surface damage assurance if no agreement is in place: ☐ \$2000 ☐ \$5000 ☐ Blanket Surety ID _____

8. Reclamation Financial Assurance:

☐ Well Surety ID: _____ ☐ Gas Facility Surety ID: _____ ☐ Waste Mgmt. Surety ID: _____

9. Cultural:

Is the location in a high density area (Rule 603.b.): Yes ☐ No ☒
Distance, in feet, to nearest building: 1071 , public road: 16 , above ground utilit: 114
, railroad: 184000 , property line: 402

10. Current Land Use (Check all that apply):

Crop Land: ☐ Irrigated ☐ Dry land ☐ Improved Pasture ☐ Hay Meadow ☐ CRP
Non-Crop Land: ☒ Rangeland ☐ Timber ☐ Recreational ☐ Other (describe): _____
Subdivided: ☐ Industrial ☐ Commercial ☐ Residential

11. Future Land Use (Check all that apply):

Crop Land: ☐ Irrigated ☐ Dry land ☐ Improved Pasture ☐ Hay Meadow ☐ CRP
Non-Crop Land: ☒ Rangeland ☐ Timber ☐ Recreational ☐ Other (describe): _____
Subdivided: ☐ Industrial ☐ Commercial ☐ Residential

12. Soils:

List all soil map units that occur within the proposed location. Attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at <http://soildatamart.nrcs.usda.gov/> or from the COGCC web site GIS Online map page found at <http://colorado.gov/cogcc>. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: 6 Barcus Channery Loam Sand, 2 to 8 percent slopes

NRCS Map Unit Name:

NRCS Map Unit Name:

13. Plant Community:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☐ NRCS or, ☒ field observation Date of observation: 05/01/2010

List individual species: Cheatgrass, Wheat Grass, Sage

Check all plant communities that exist in the disturbed area.

- ☒ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
☒ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
☒ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
☐ Alpine (above timberline)
☐ Other (describe):

14. Water Resources:

Rule 901.e. may require a sensitive area determination be performed. If this determination is performed the data is to be submitted with the Form 2A.

Is this a sensitive area: ☐ No ☒ Yes Was a Rule 901.e. Sensitive Areas Determination performed: ☐ No ☒ Yes

Distance (in feet) to nearest surface water: 843, water well: 14062, depth to ground water: 47

Is the location in a riparian area: ☒ No ☐ Yes Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes

Is the location within a Rule 317B Surface Water Supply Area buffer zone:

☒ No ☐ 0-300 ft. zone ☐ 301-500 ft. zone ☐ 501-2640 ft. zone

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified: ☐ No ☐ Yes

15. Comments:

This Location Assessment is to construct a multi well pit which will be used for temporary storage of produced water that will be recycled for fracture stimulation in the Ryan Gulch Fields. The surface owner for the pit is Williams. Find attached form 15 pit Pit permit and Form 26 Source of Produced Water which are also being submitted along with this FORM 2A for approval. Reference photos will be submitted at a later date.

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

Signed: Date: 02/22/2011 Email: howard.harris@williams.com

Print Name: Howard Harris Title: Sr. Regulatory Specialist

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: David S. Nashin Director of COGCC Date: 4/17/2011

**CONDITIONS OF
APPROVAL, IF ANY:**

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

GENERAL SITE AND ROAN RIM COAs:

Operator must comply with all provisions of the June 12, 2008 Notice to Operators (NTO) Drilling Wells Within $\frac{3}{4}$ Mile of the Rim of the Roan Plateau in Garfield County – Pit Design, Construction, and Monitoring Requirements.

After installation of the uppermost liner and prior to operating the pit, the synthetic liner(s) shall be tested by filling the pit with at least 4 feet of fresh water, measured from the base of the pit (not to exceed the 2-foot freeboard requirement). The operator shall monitor the pit for leaks for a period of 72 hours prior to draining the pit and commencing operations. Operator shall notify the COGCC Oil and Gas Location Assessment (OGLA) Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us) 48 hours prior to start of the hydrotest. Hydrotest monitoring results must be maintained by the operator for the life of the pit and provided to COGCC prior to using the pit.

Operator must ensure 110 percent secondary containment for any volume of fluids contained at the water handling facility site during natural gas development activities and operations; including, but not limited to, construction of a berm or diversion dike, diversion/collection trenches within and/or outside of berms/dikes, site grading, or other comparable measures (i.e., best management practices (BMPs) associated with stormwater management) sufficiently protective of nearby surface water. Any berm constructed at the well pad location will be stabilized, inspected at regular intervals (at least every 14 days), and maintained in good condition.

Operator must implement best management practices to contain any unintentional release of fluids, including any fluids conveyed via buried or temporary surface pipelines.

Notify COGCC Oil and Gas Location Assessment (OGLA) Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us) and the COGCC Field Inspection Supervisor for Northwest Colorado (Shaun Kellerby; email shaun.kellerby@state.co.us) 48 hours prior to start of construction of the pit.

No portion of any pit that will be used to hold liquids shall be constructed on fill material, unless the pit and fill slope are designed and certified by a professional engineer, subject to review and approval by the director prior to construction of the pit. The construction and lining of the pit shall be supervised by a professional engineer or their agent. The entire base of the pit must be in cut.

The completion/flowback fluids multi-well pit must be double-lined. The pit will also require a leak detection system (Rule 904.e).

Operator must submit a professional engineer (PE) approved/stamped as-built drawing (plan view and cross-sections) of the completion/flowback pit within 14 calendar days of construction.

The nearby hillside and fill-material bermed portions of the pit must be monitored for any day-lighting of fluids throughout pit operations.

The completion/flowback fluids multi-well pit must be fenced and netted. The operator must maintain the fencing and netting until the pit is closed in accordance with Rule 905. Closure of Pits, and Buried or Partially Buried Produced Water Vessels.

Flowback and stimulation fluids must be sent to tanks to allow the sand to settle out before the fluids can be placed into any pipeline or pit. The flowback and stimulation fluid tanks must be placed on the pad in an area with additional downgradient perimeter berming. The area where flowback fluids will be stored/reused must be constructed to be sufficiently impervious to contain any spilled or released material (per Rule 604.a.(4)).

Submit additional disposal facilities (wells, pits, etc.) for pit contents to COGCC via a Form 4 Sundry prior to disposal.

Surface water samples from the ditch and Ryan Gulch (both upgradient and downgradient of the proposed multi well pit) shall be collected prior to pit use and every 12 months to evaluate potential impacts from pit operations. At a minimum, the surface water samples will be analyzed for the following parameters: major cations/anions (chloride, fluoride, sulfate, sodium); total dissolved solids (TDS); and BTEX/DRO.

At the time of pit closure, operator must submit disposal information via a Form 4 Sundry Notice to the COGCC Location Specialist for Western Colorado (Dave Kubeczko; email dave.kubeczko@state.co.us). The disposal method will need to be approved prior to operator starting pit closure. In addition, operator will collect a pit water sample and, at a minimum, analyze for the following parameters: pH; alkalinity; specific conductance; major cations/anions (chloride, fluoride, sulfate, sodium); total dissolved solids (TDS); BTEX/DRO; TPH; PAH's (including benzo[a]pyrene); and metals (arsenic, barium, calcium, chromium, iron, magnesium, selenium). At the time of closure/disposal of pit water, COGCC may require additional analytes, as appropriate.

Attachment Check List

Att Doc Num	Name
2033685	OTHER
2033702	CORRESPONDENCE
2089417	ACCESS ROAD MAP
2089419	TOPO MAP
400132276	FORM 2A APPROVED
400136065	PROPOSED BMPs
400136066	CONST. LAYOUT DRAWINGS
400136069	HYDROLOGY MAP
400136070	LOCATION DRAWING
400136071	LOCATION PICTURES
400136072	NRCS MAP UNIT DESC
400136073	OTHER
400136074	REFERENCE AREA MAP
400136075	SENSITIVE AREA DATA
400138916	LOCATION PICTURES
400154349	FORM 2A SUBMITTED

Total Attach: 16 Files

General Comments

<u>User Group</u>	<u>Comment</u>	<u>Comment Date</u>
OGLA	Initiated/Completed OGLA Form 2A review on 04-08-11 by Dave Kubeczko; requested acknowledgement of fluid containment, spill/release BMPs, lined pits/closed loop, no pit in fill, flowback to tanks, tank berming, surface water sampling, pit contents disposal options, fencing/netting of pit, berm/hillside monitoring, as-builts, hydrotesting, and Roan Rim COAs from operator on 04-08-11; received acknowledgement of COAs from operator on 04-14-11; passed Form 15 Permit on 04-08-11 by Dave Kubeczko; fluid containment, spill/release BMPs, lined pits/closed loop, no pit in fill, flowback to tanks, tank berming, surface water sampling, pit contents disposal options, fencing/netting of pit, berm/hillside monitoring, as-builts, hydrotesting, and Roan Rim COAs; passed by CDOW on 03-09-11 with BMPs submitted by operator (with permit application) acceptable; passed OGLA Form 2A review on 04-14-11 by Dave Kubeczko; fluid containment, spill/release BMPs, lined pits/closed loop, no pit in fill, flowback to tanks, tank berming, surface water sampling, pit contents disposal options, fencing/netting of pit, berm/hillside monitoring, as-builts, hydrotesting, and Roan Rim COAs.	4/8/2011 12:56:17 PM
Permit	Rio Blanco County map clearly shows that CR 70 ends at the intersection with CR 68. The road to be relocated is not a public road and will require no further action.	3/22/2011 2:00:14 PM
Permit	Contacted operator about public road that is to be relocated	3/17/2011 3:42:08 PM
DOW	CDOW has reviewed this multi well pit plan and permit. CDOW affirms that the operator submitted BMP's for fencing and netting of all fluid pits as well as the COGCC rule 902.d to be conditions of approval for this permit. Submitted by: Ed Winters, Land Use Specialist 9 March 2011 @ 10:38	3/9/2011 10:45:25 AM
Permit	Deleted plugging bond	3/4/2011 3:21:01 PM
Permit	Back to draft for location photos and possibly remove fors 15 and 26. sf	2/24/2011 9:29:29 AM
Permit	Back to draft. None of the attachments will open. sf	2/22/2011 11:14:02 AM

Total: 7 comment(s)

BMP

<u>Type</u>	<u>Comment</u>

Total: 0 comment(s)

In addition to compliance with General Operating Requirements required under COGCC rule 1203 to be applied in Sensitive Wildlife Habitat and Restricted Surface Occupancy areas or COGCC 1204 to be applied statewide or in areas noted in the Rule, Williams will employ the following BMPs either field wide or at the specific location for which this Form 2A is being submitted.

Field Wide BMPs:

General

- Prepare plans and studies to support wildlife conservation and protection
- Contribute to and participate in wildlife studies and research efforts related to oil and gas activity's relationship to wildlife
- Treat/control noxious weeds/plants including Tamarisk
- Assist CDOW in obtaining access to private lands for wildlife research and conservation
- Focus BMPs on critical wildlife seclusion and "crucial habitats"
- Contribute to organizations that acquire/manage habitat
- Continue to Support Operation Game Thief
- Continue to support CDOW sportsman's programs
- Participate in wildlife seminars and conferences (e.g. AFWA)
- Focus Ranch and Property Management (Williams' owned/managed properties) on wildlife resources
- Identify conservation easement opportunities on Williams-owned/managed properties
- Acquire water rights and irrigate key habitat areas
- Restrict and/or manage grazing to benefit wildlife
- Fence and restrict activities in locations that provide high value habitat
- Construct habitat improvement projects as practical
- Enforce policies to protect wildlife (e.g., no poaching, no firearms, no dogs on location, no feeding of wildlife, etc.).
- Inventory, monitor and remove obsolete, degraded, or hazardous fencing on Williams owned property
- Support research to test the effectiveness of specific Best Management Practices

Planning

- Conduct wildlife surveys to determine presence of game/non-game species/habitat
- Identify and Protect "crucial habitats"
- Site access roads, pads and facilities in locations that minimize habitat impacts
- Identify private and Federal land seclusion areas where drilling will be voluntarily deferred in critical seasonal habitats
- Identify and protect migration corridors
- Minimize well pad density to the extent possible
- Minimize the number, size and distribution of well pads and locate pads along existing roads where possible.

- Cluster well pads in the least environmentally sensitive areas.
- Plan pipelines routes ahead of time to avoid field fitting and reduce excessive ROW widths and reclamation.
- Adequately size infrastructure and facilities to accommodate both current and future gas production.

Construction

- Schedule necessary construction in stream courses to avoid critical spawning times.
- Surface roads to ensure that the anticipated volume of traffic and the weight and speed of vehicles using the road do not cause environmental damage, including generation of fugitive dust and contribution of sediment to downstream areas.
- Protect culvert inlets from erosion and sedimentation and install energy dissipation structures at outfalls
- Use the minimum right-of-way width and vegetation mats where pipelines cross riparian areas and streams wherever possible
- Construct fluid pit fences and nets that are capable of withstanding animal pressure and environmental conditions and that are appropriately sized for the wildlife encountered.
- Install impermeable barriers beneath fluid pits to protect groundwater, riparian areas and wetlands.
- Salvage topsoil from all road construction and other rights-of-way and re-apply during interim and final reclamation.
- Strip and segregate topsoil prior to construction. Appropriately configure topsoil piles and immediately seed to control erosion, prevent weed establishment and maintain soil microbial activity

Drilling/Completions

- Continue application of BMPs to prevent wildlife from entering pits including fencing and netting where appropriate
- Limit days/hours operations where practical to minimize disturbance and traffic
- Promptly report spills that affect wildlife to the CDOW.
- Store and stage emergency spill response equipment at strategic locations so that it is available to expedite effective spill response.
- Limit parking to already disturbed areas that have not yet been reclaimed
- Screen water suction hoses to exclude fish.
- Reduce noise by using effective sound dampening devices or techniques (e.g., hospital-grade mufflers, equipment housing, insulation, installation of sound barriers, earthen berms, vegetative buffers, etc.).

Production/Reclamation

- Gate access roads where necessary to minimize/control access to “crucial habitats”

- Install automated emergency response systems (e.g., high tank alarms, emergency shut-down systems, etc.).
- Implement fugitive dust control program
- Avoid direct discharge of pipeline hydrostatic test water to any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.
- Locate above-ground facilities to minimize the visual effect (e.g., low profile equipment, appropriate paint color, vegetation screening in wooded areas, etc.).
- Skim and eliminate oil from produced water ponds and fluid pits at a rate sufficient to prevent oiling of birds or other wildlife that could gain access to the pit.
- Apply an aggressive, integrated, noxious and invasive weed management plan. Utilize an adaptive management strategy that permits effective responses to monitored findings and reflects local site and geologic conditions
- Map the occurrence of existing weed infestations prior to development to effectively monitor and target areas that will likely become issues after development.
- Evaluate the utility of soil amendment application or consider importing topsoil to achieve effective reclamation.
- Use locally adapted seed whenever available and approved by landowner.
- Use appropriately diverse reclamation seed mixes that mirror an appropriate reference area for the site being reclaimed where approved by landowner.
- Conduct seeding in a manner that ensures that seedbed preparation and planting techniques are targeted toward the varied needs of grasses, forbs and shrubs (e.g., seed forbs and shrubs separately from grasses, broadcast big sagebrush but drill grasses, etc.)
- Emphasize bunchgrass over sod-forming grasses in seed mixes in order to provide more effective wildlife cover and to facilitate forb and shrub establishment.
- Seed during appropriate season to increase likelihood of reclamation success
- Do not include aggressive, non-native grasses in reclamation seed mixes
- Choose reference areas as goals for reclamation that have high wildlife value, with attributes such as a diverse and productive understory of vegetation, productive and palatable shrubs, and a high prevalence of native species.
- Establish vegetation with total perennial non-invasive plant cover of at least eighty (80) percent of pre-disturbance or reference area levels.
- Establish vegetation with plant diversity of non-invasive species which is at least half that of pre-disturbance or reference area levels. Quantify diversity of vegetation using a metric that considers only species with at least 3 percent relative plant cover.
- Establish permanent and monumented photo points and vegetation measurement plots or transects; monitor at least annually until plant cover, composition, and diversity standards have been met.
- Observe and maintain a performance standard for reclamation success characterized by the establishment of a self-sustaining, vigorous, diverse, locally appropriate plant community on the site, with a density sufficient to control erosion and non-native plant invasion and diversity sufficient to allow for normal plant community development.

- Use early and effective reclamation techniques, including interim reclamation to accelerate return of disturbed areas for use by wildlife
- Remove all unnecessary infrastructure during the production phase.
- Reclaim reserve pits as quickly as practical after drilling and ensure that pit contents do not contaminate soil.
- Remediate hydrocarbon spills on disturbed areas prior to reclamation.
- Complete final reclamation activities so that seeding occurs during the first optimal season following plugging and abandonment of oil and gas wells.
- Perform interim reclamation to final reclamation species composition and establishment standards.
- Perform interim reclamation on all disturbed areas not needed for active support of production operations
- Remove and properly dispose of degraded silt fencing and erosion control materials after their utility has expired
- Remove and properly dispose of pit contents where contamination of surface water, groundwater, or soil by pit contents cannot be effectively prevented
- Apply certified weed free mulch and crimp or tacyfy to remain in place to reclaim areas for seed preservation and moisture retention
- Control weeds in areas surrounding reclamation areas in order to reduce weed competition
- Educate employees and contractors about weed issues
- Where possible, fence livestock and/or wildlife out of newly reclaimed areas until reclamation standards have been met and plants are capable of sustaining herbivory
- Conduct necessary reclamation and invasive plant monitoring.
- Census and assess the utilization of the reclaimed areas by the target species
- Maintain pre and post development site inspection records and monitor operations for compliance
- Utilize GIS technologies to assess the extent of disturbance and document the reclamation progression and the footprint of disturbances
- Identify native species for which commercial seed sources are not available. Provide support to contractors for developing cultivation and seed production techniques for needed species
- Conduct reclamation field trials to match seed mixes, soil preparation techniques, and planting methods to local conditions.

Site Specific BMPs:

Planning

- Minimize newly planned activities and operations within 300 feet of the ordinary high water mark of any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.
- Locate roads outside of drainages where possible and outside of riparian habitat.

- Avoid constructing any road segment in the channel of an intermittent or perennial stream.
- Minimize the number, length, and footprint of oil and gas development roads;
- Combine and share roads to minimize habitat fragmentation
- Maximize use of long-term centralized production facilities to minimize traffic

Drilling/Completions

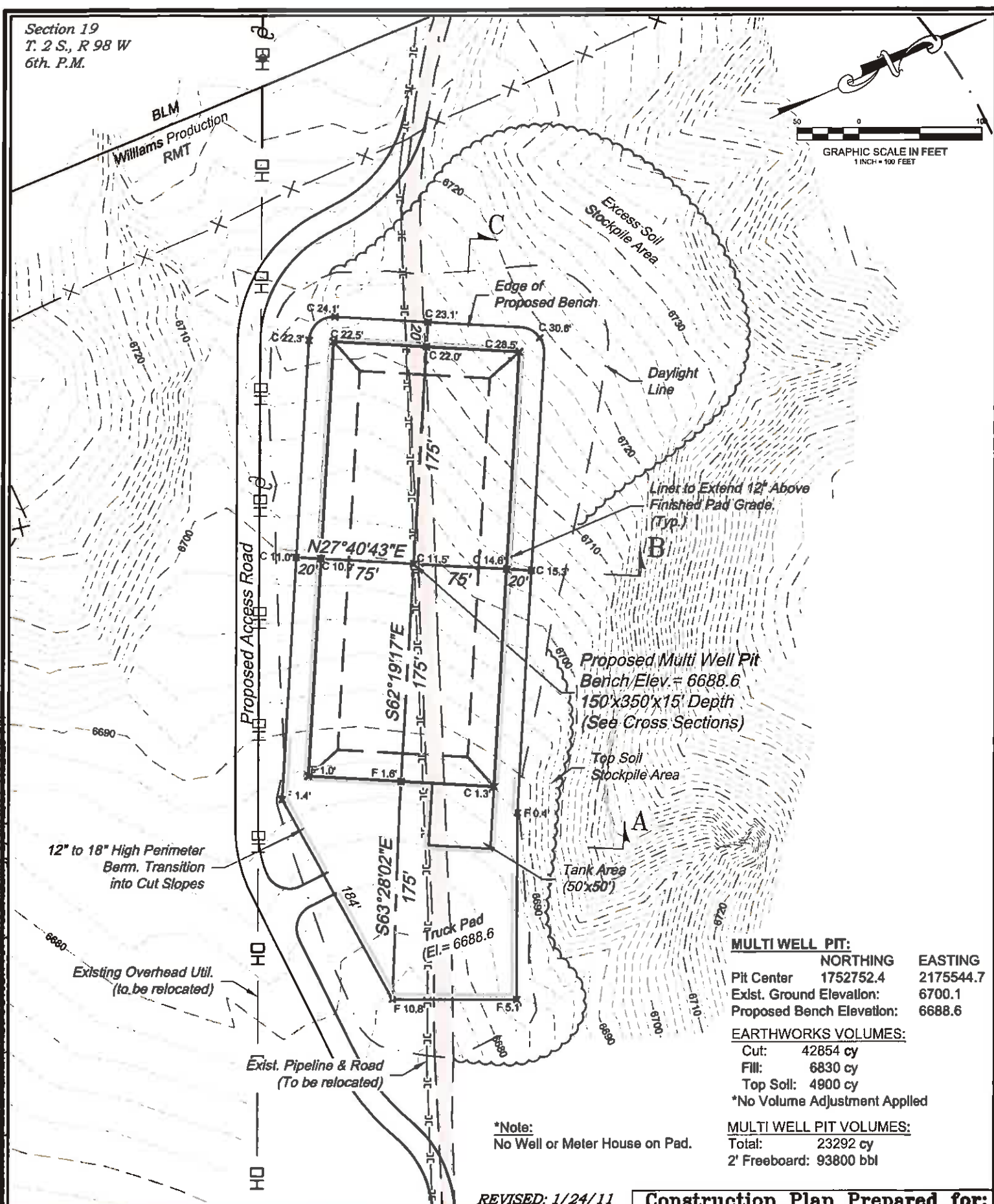
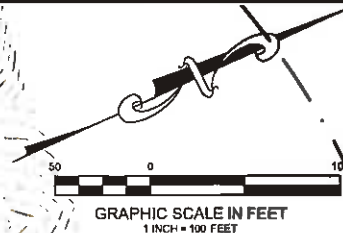
- Install and maintain adequate measures to exclude all types of wildlife (e.g., big game, birds, and small rodents) from all fluid pits (e.g., fencing, netting, and other appropriate exclusion measures).

Production/Reclamation

- Utilize staked soil retention blankets for erosion control and reclamation of large surface areas with 3:1 or steeper slopes. Avoid use of plastic blanket materials.
- Install exclusionary devices to prevent bird and other wildlife access to equipment stacks, vents and openings.
- Reduce visits to well-sites through remote monitoring (i.e. SCADA) and the use of multi-function contractors.
- Install and use locked gates or other means to prevent unauthorized vehicular travel on roads and facility rights-of-way.



Section 19
T. 2 S., R 98 W
6th. P.M.



MULTI WELL PIT:

	NORTHING	EASTING
Pit Center	1752752.4	2175544.7
Exst. Ground Elevation:		6700.1
Proposed Bench Elevation:		6688.6

EARTHWORKS VOLUMES:

Cut:	42854 cy
Fill:	6830 cy
Top Soil:	4900 cy
*No Volume Adjustment Applied	

MULTI WELL PIT VOLUMES:

Total:	23292 cy
2' Freeboard:	93800 bbl

*Note:
No Well or Meter House on Pad.

REVISED: 1/24/11

Construction Plan Prepared for:

Williams Williams Production, RMT

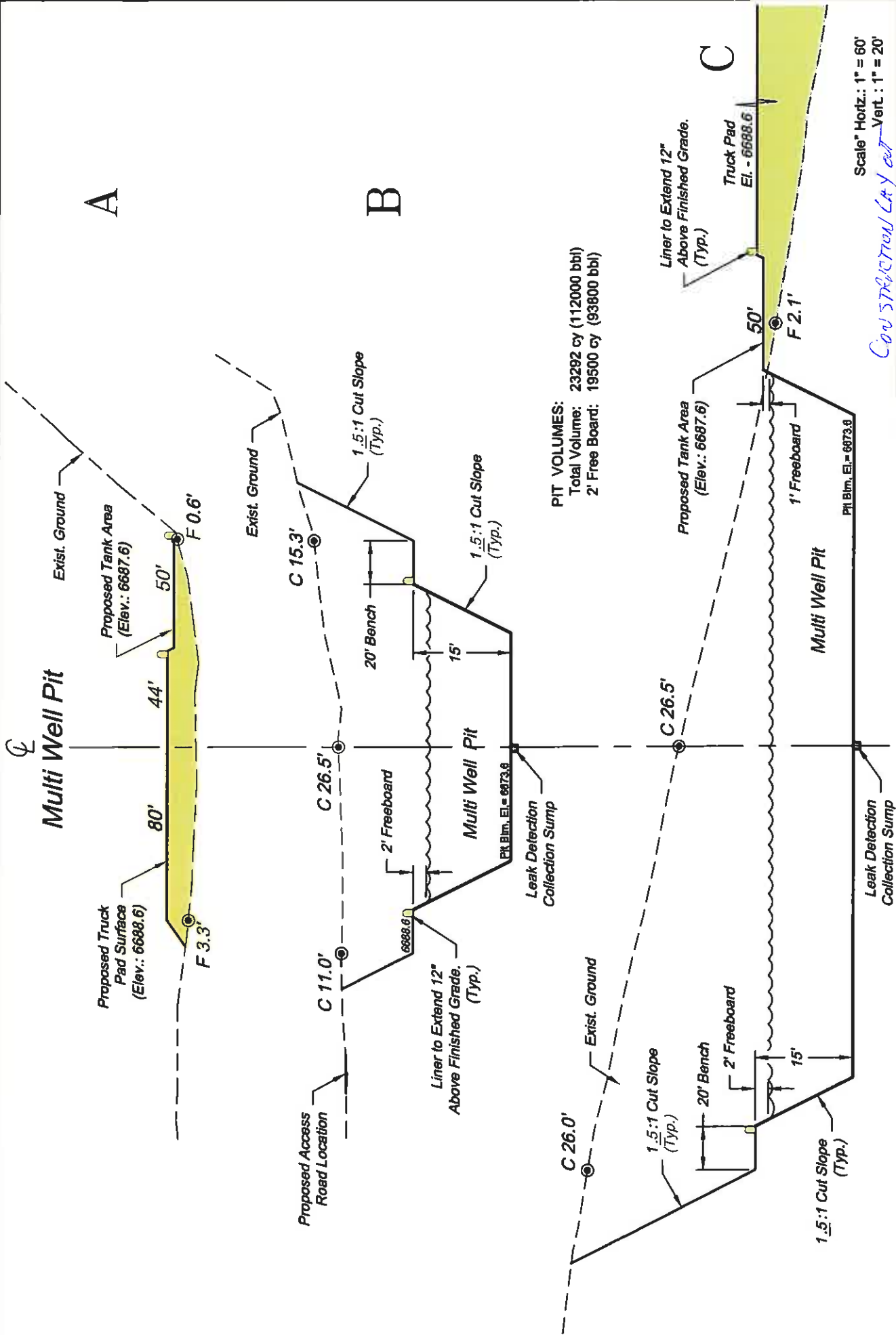
Mautz Ranch - Multi Well Pit
CONSTRUCTION LAYOUT

SCALE: 1" = 100'
DATE: 11/18/10
PLAT: 1 of 4
PROJECT: Williams Highlands
DFT: CWS

130 East Third Street
Nixa, Missouri 64550
Ph: (937) 625-1330
Fax: (937) 625-2773

BOOKCLIFF
Survey Services, Inc.

K:\2010\HIGHLANDS CENTRAL\Mautz Ranch\PRODUCTION\DWG\DWG 1/24/2011 1:42:35 PM



PIT VOLUMES:
Total Volume: 23292 cy (112000 bbl)
2' Free Board: 19500 cy (93800 bbl)

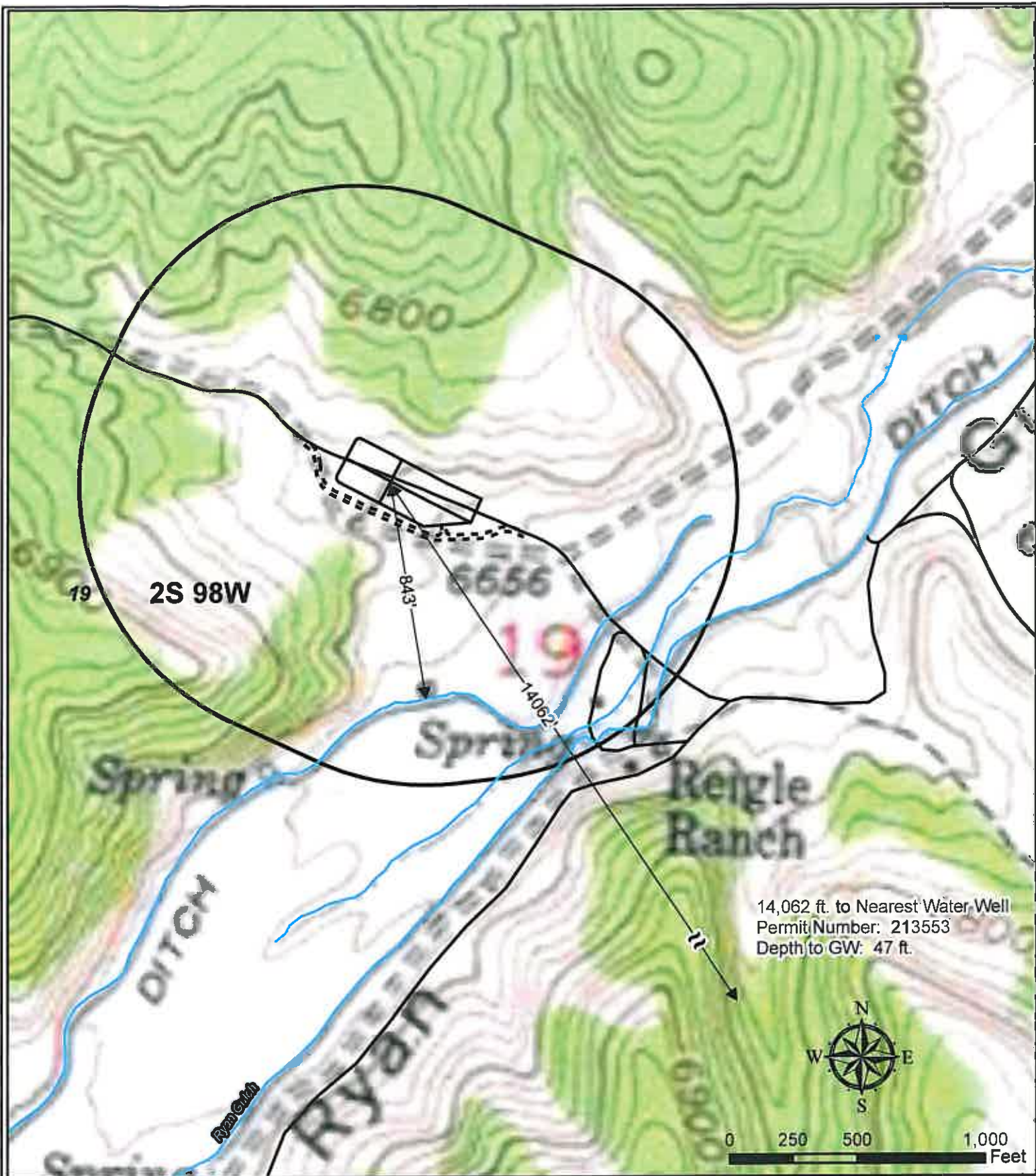
Scale: Horiz.: 1" = 60'
Vert.: 1" = 20'

Construction Plan Prepared for:
Williams
Williams Production, RMT
Mautz Ranch - Multi Well Pit
CROSS SECTIONS

REVISED: 1/21/11

SCALE:	As Noted
DATE:	11/18/10
SHEET:	2 of 4
PROJECT:	Williams
DFT:	cus





Legend

- Water Well
- Pad
- - - Proposed Road
- Stream
- 1000' Buffer

Williams Production RMT

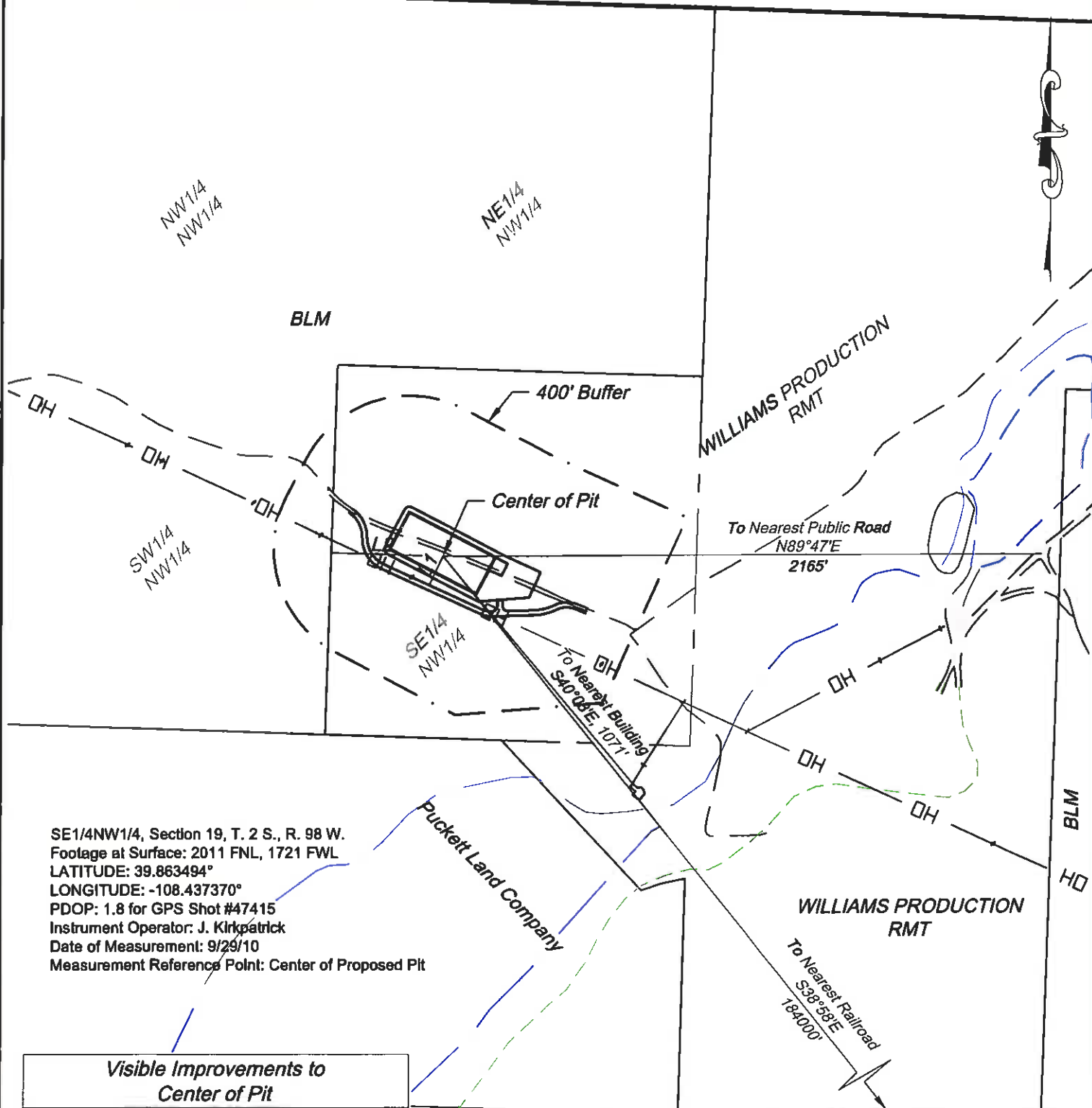
Plat 5C

Mautz Ranch Multi Well Pit Hydrology Map
T2S R98W, Section 19



Section 19
T. 2 S., R. 98 W
6th. P.M.

250 0 500
GRAPHIC SCALE IN FEET
1 INCH = 500 FEET



SE1/4NW1/4, Section 19, T. 2 S., R. 98 W.
Footage at Surface: 2011 FNL, 1721 FWL
LATITUDE: 39.863494°
LONGITUDE: -108.437370°
PDOP: 1.8 for GPS Shot #47415
Instrument Operator: J. Kirkpatrick
Date of Measurement: 9/29/10
Measurement Reference Point: Center of Proposed Pit

**Visible Improvements to
Center of Pit**

Desc.	Bearing	Distance (ft)
Building	S40°03'E	1071
Public Road	N89°47'E	2165
L1 Above Gnd Util.	S24°39'W	114
Railroad	S38°58'E	184000
L2 Property Line	N88°14'W	402

CURRENT LAND USE		
<input type="checkbox"/> CROP LAND	<input checked="" type="checkbox"/> NON-CROP LAND	<input type="checkbox"/> SUBDIVIDED
<input type="checkbox"/> IRRIGATED	<input checked="" type="checkbox"/> RANGELAND	<input type="checkbox"/> INDUSTRIAL
<input type="checkbox"/> DRY LAND	<input type="checkbox"/> TIMBER	<input type="checkbox"/> COMMERCIAL
<input type="checkbox"/> IMPROVED PASTURE	<input type="checkbox"/> RECREATIONAL	<input type="checkbox"/> RESIDENTIAL
<input type="checkbox"/> HAY MEADOW	<input type="checkbox"/> OTHER (describe):	
<input type="checkbox"/> CRP		

REVISED: 1/24/11

SCALE: 1" = 500'
DATE: 11/8/10
Drawing: 4 of 4
PROJECT: Williams Highlands
DFT: CWS

Construction Plan Prepared for:
Williams. Williams Production, RMT

Mautz Ranch - Multi Well Pit
PLAT #6 LOCATION DRAWING

106 East Third Street
Boulder, Colorado 80501
Ph. (970) 425-1330
Fax (970) 425-3772



BOOKCLIFF
Survey Services, Inc.

2010 WILLIAMS HIGHLANDS RANGELAND PRODUCTION RMT.dwg, 1/24/2011 1:32:47 PM

Map Unit Description

Rio Blanco County Area, Colorado

6 Barcus channery loamy sand, 2 to 8 percent slopes

Setting

Elevation: 5800 to 6800 feet
Mean annual precipitation: 14 to 16 Inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 80 to 105 days

Composition

Barcus and similar soils: 85 percent

Description of Barcus

Setting

Landform: Valleys, alluvial fans
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Calcareous alluvium derived from sandstone and shale

Properties and Qualities

Slope: 2 to 8 percent
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High or very high (6.00 to 20.00 in/hr)
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate maximum: 10 percent
Gypsum maximum: 0 percent
Available water capacity: Low (about 3.6 inches)

Interpretive Groups

Land capability classification (irrigated): 6e
Land capability (non irrigated): 6e
Ecological site: Foothill Swale (R048AY285CO)

Typical Profile

0 to 6 inches: channery loamy sand
6 to 16 inches: channery sand
16 to 60 inches: sr to very channery sand to very channery loamy fine sand

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW FROM PAD

CAMERA ANGLE: South



PHOTO: VIEW FROM PAD

CAMERA ANGLE: North


126 East Third Street
Bldg. Colorado 81680
P.O. Box 625-1200
Fax (970) 625-2773



BOOKCLIFF
Survey Services, Inc.

REVISED: 2/28/11
photo lath

PHOTO DATE:	1/19/11
TAKEN BY:	WKK
DRAWN BY:	WKK
SHEET:	1 of 3
PROJECT:	Williams

LOCATION PHOTOS Prepared for:
 Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW FROM PAD

CAMERA ANGLE: West



PHOTO: VIEW FROM PAD

CAMERA ANGLE: East

REVISED: 2/28/11
photo lath

PHOTO DATE: 1/19/11
TAKEN BY: WKK
DRAWN BY: WKK
SHEET: 2 of 3
PROJECT: Williams

LOCATION PHOTOS Prepared for:
Williams Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO

120 East Third Street
P.O. Box 1000
P.O. Box 1000
P.O. Box 1000



BOOKCLIFF
Survey Services, Inc.

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW OVERALL

CAMERA ANGLE: *northwest*



PHOTO: VIEW of ACCESS

CAMERA ANGLE: *East*

REVISED: 2/28/11
photo lath

PHOTO DATE: 1/19/11
TAKEN BY: WKK
DRAWN BY: WKK
SHEET: 3 of 3
PROJECT: Williams

LOCATION PHOTOS Prepared for:
Williams Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO

100 East Third Street
Bldg. Colorado 81650
PH. (970) 625-1330
Fax (970) 625-3773



BOOKCLIFF
Survey Services, Inc.

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW FROM PAD CENTER

CAMERA ANGLE: South



PHOTO: VIEW FROM PAD CENTER

CAMERA ANGLE: North

LOCATION PHOTOS Prepared for:
Williams. Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO

PHOTO DATE: 1/19/11
TAKEN BY: WKK
DRAWN BY: WKK
SHEET: 1 of 3
PROJECT: Williams

104 East Third Street
Boulder, Colorado 80501
Tel. (970) 625-1330
Fax (970) 625-2779



BOOKCLIFF
Survey Services, Inc.

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW OVERALL

CAMERA ANGLE: West



PHOTO: VIEW of ACCESS

CAMERA ANGLE: East

234 East 10th Street
P.O. Box 1000
P.O. Box 1000
P.O. Box 1000



PHOTO DATE: 1/19/11
TAKEN BY: WKK
DRAWN BY: WKK
SHEET: 3 of 3
PROJECT: Williams

LOCATION PHOTOS Prepared for:
Williams Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO

Williams Production, RMT

Multi Well Pit



PHOTO: VIEW FROM PAD CENTER

CAMERA ANGLE: West



PHOTO: VIEW FROM PAD CENTER

CAMERA ANGLE: East

136 East Third Street
P.O. Box 11650
Phoenix, AZ 85066
Tel: (602) 625-1330
Fax: (602) 625-2772

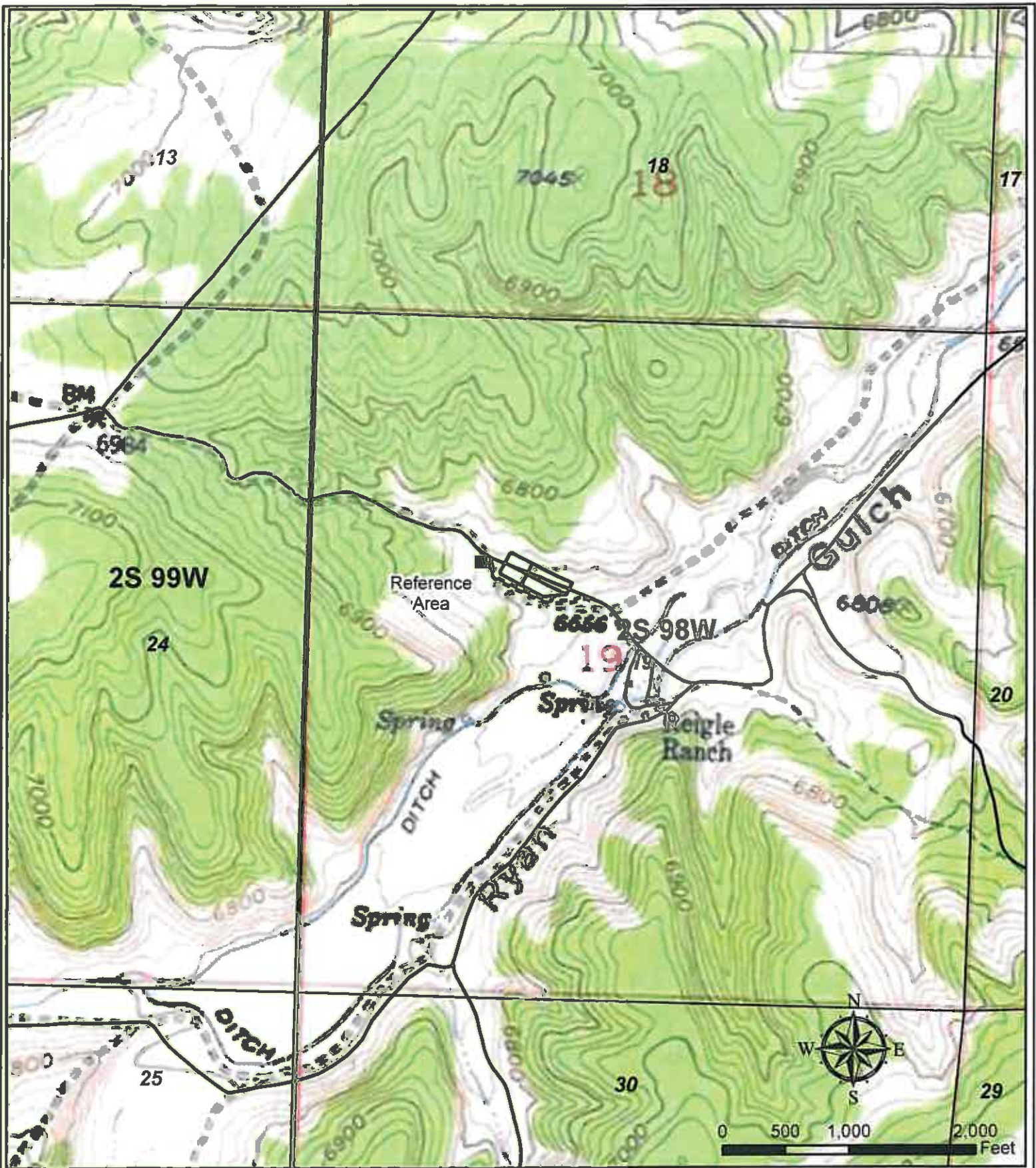


BOOKCLIFF
Survey Services, Inc.

PHOTO DATE: 1/19/11
TAKEN BY: WKK
DRAWN BY: WKK
SHEET: 2 of 3
PROJECT: Williams

LOCATION PHOTOS Prepared for:
Williams Williams Production, RMT

SE1/4 NW1/4, SECTION 19
T. 2 S., R. 98 W. of the 6th. P.M.
Rio Blanco COUNTY, COLORADO



Legend

- Pad
- Proposed Road

Williams Production RMT

Plat 5D

Mautz Ranch Multi Well Pit Reference Area Map
T2S R98W, Section 19

