UNDERGROUND INJECTION CONTROL (UIC) PERMIT APPLICATION

WP-400
301 Old Fireline Road
API No. 47-109-02703

Prepared for:
Enervest Operating, LLC
300 Capital Street, Suite 200
Charleston, West Virginia 25301

Prepared by:
Envirocheck of Virginia, Inc.
375 Mountain Lane
Tazewell, Virginia 24651

e2C
Envirocheck of Virginia, Inc.
"Energy, Environmental Consulting"

CHECKLIST FOR FILING A UIC PERMIT APPLICATION

Please utilize this checklist to ensure you have prepared, completed, and enclosed all required documentation and payment to ensure a timely review of your submittal.

Operator	Enervest Operating, LLC		
Existing UIC Permit ID Number	2D1092703	UIC Well API Number	47-109-02703

Office of Oil and Gas Office Use Only	
Permit Reviewer	
Date Received	
Administratively Complete Date	
Approved Date	
Permit Issued	

Please check the fees and payment included.

Fees		Payment Type	
UIC Permit Fee: $500	☐	Check	☐
Groundwater Protection Plan (GPP) Fee: $50.00	☐	Electronic	☐
		Other	☐

Please check the items completed and enclosed.

- ☑ Checklist
- ☑ UIC-1
  - ☑ Section 1 – Facility Information
  - ☑ Section 2 – Operator Information
  - ☑ Section 3 – Application Information
  - ☑ Section 4 – Applicant/Activity Request and Type
  - ☑ Section 5 – Brief description of the Nature of the Business
  - ☑ CERTIFICATION
- ☑ Section 6 – Construction
  - ☑ Appendix A Injection Well Form
  - ☑ Appendix B Storage Tank Inventory
- ☑ Section 7 – Area of Review
  - ☑ Appendix C Wells Within the Area of Review

- [x] Appendix D Public Service District Affidavit
- [x] Appendix E Water Sources
- [x] Appendix F Area Permit Wells
- [x] Section 8 – Geological Data on Injection and Confining Zones
- [x] Section 9 – Operating Requirements / Data
  - [x] Appendix G Wells Serviced by Injection Well
- [x] Section 10 – Monitoring
- [x] Section 11 – Groundwater Protection Plan (GPP)
  - [x] Appendix H Groundwater Protection Plan (GPP)
- [x] Section 12 – Plugging and Abandonment
- [x] Section 13 – Additional Bonding
- [x] Section 14 – Financial Responsibility
  - [x] Appendix I Financial Responsibility
- [x] Section 15 – Site Security Plan
  - [x] Appendix J Site Security for Commercial Wells
- [x] Section 16 – Additional Information
  - [x] Appendix K Other Permit Approvals

NOTE: For all 2D wells an additional bond in the amount of $5,000 is required.

Reviewed by (Print Name): Chris Veazey

Reviewed by (Sign): Chris Veazey

Date Reviewed: 09/23/16

UIC-1
(4/25)

WEST VIRGINIA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
OFFICE OF OIL AND GAS
601 57th Street, SE
Charleston, WV 25304
(304) 926-0450
www.dep.wv.gov/oil-and-gas

UNDERGROUND INJECTION CONTROL (UIC) PERMIT APPLICATION

UIC PERMIT ID # UIC2D1092703 API # 47-109-20703 WELL # WP-400

Section I. Facility Information

Facility Name: WP-400

Address: 301 Fireline Road

City: Glen Rogers State: WV Zip: 25848

County: Wyoming

Location description:
On the waters of Lewis Fork of Laurel Fork of Clear Fork in Slab Fork District of Wyoming County.

Location of well(s) or approximate center of field/project in UTM NAD 83 (meters):
Northing: 4172929 Easting: 462937

Environmental Contact Information:
Name: Chris Veazey Title: HSE Manager
Phone: 304-343-5505 Email: cveazey@enervest.net

Section 2. Operator Information

Operator Name: EnerVest Operating, LLc
Operator ID: 309999

Address: 301 Fireline Road
City: Charleston State: WV Zip: 25301
County: Kanawha

Contact Name: Chris Veazey Contact Title: HSE Manager
Contact Phone: 304-343-5505 Contact Email: cveazey@enervest.net

Section 3. Applicant Information

Ownership Status: ■ PRIVATE ☐ PUBLIC ☐ FEDERAL ☐ STATE
☐ OTHER (explain):

SIC code: ■ 1311 (2D, 2H, 2R) ☐ 1479 (3S) ☐ OTHER (explain):

Section 4. Applicant / Activity Request and Type:

A. Apply for a new UIC Permit: ☐ 2D ☐ 2H ☐ 2R ☐ 3S
B. Reissue existing UIC Permit: ■ 2D ☐ 2H ☐ 2R ☐ 3S
C. Modify existing UIC Permit: ☐ 2D ☐ 2H ☐ 2R ☐ 3S
(Submit only documentation pertaining to the modification request)
2D COMMERCIAL FACILITY: ☐ YES ■ NO

Section 5. Briefly describe the nature of business and the activities to be conducted:

Enervest is an oil and gas facility that produces natural gas and coal bed methane from approximately 423 wells. The WP-400 has been a UIC well for the injection of Class II since 2006. Produced fluids are unloaded into a large filtration pond and gravity fed through two other ponds. From there, the fluids are pumped to the disposal well API 47-109-02703.

UIC-1
(4/25)

CERTIFICATION

All permit applications must be signed by a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, or by a principal executive or ranking elected official for a public agency, or a [1]duly authorized representative in accordance with 47CSR13-13.11.b.

A. Name and title of person applying for permit:

CV

Print Name: Barry Lay, Enervest Operating, LLC

Print Title: Vice President

B. Signature and Date.

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature: Barry Lay

CV

Date: 10/12/16

RECEIVED
Office of Oil and Gas
OCT 14 2016
WV Department of
Environmental Protection

[1] A person is a duly authorized representative if:

The authorization is made in writing by a person described in subdivision 47CSR13-13.11.a.

The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of the plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility.

The written authorization is submitted to the Director.

Section 6 – Construction

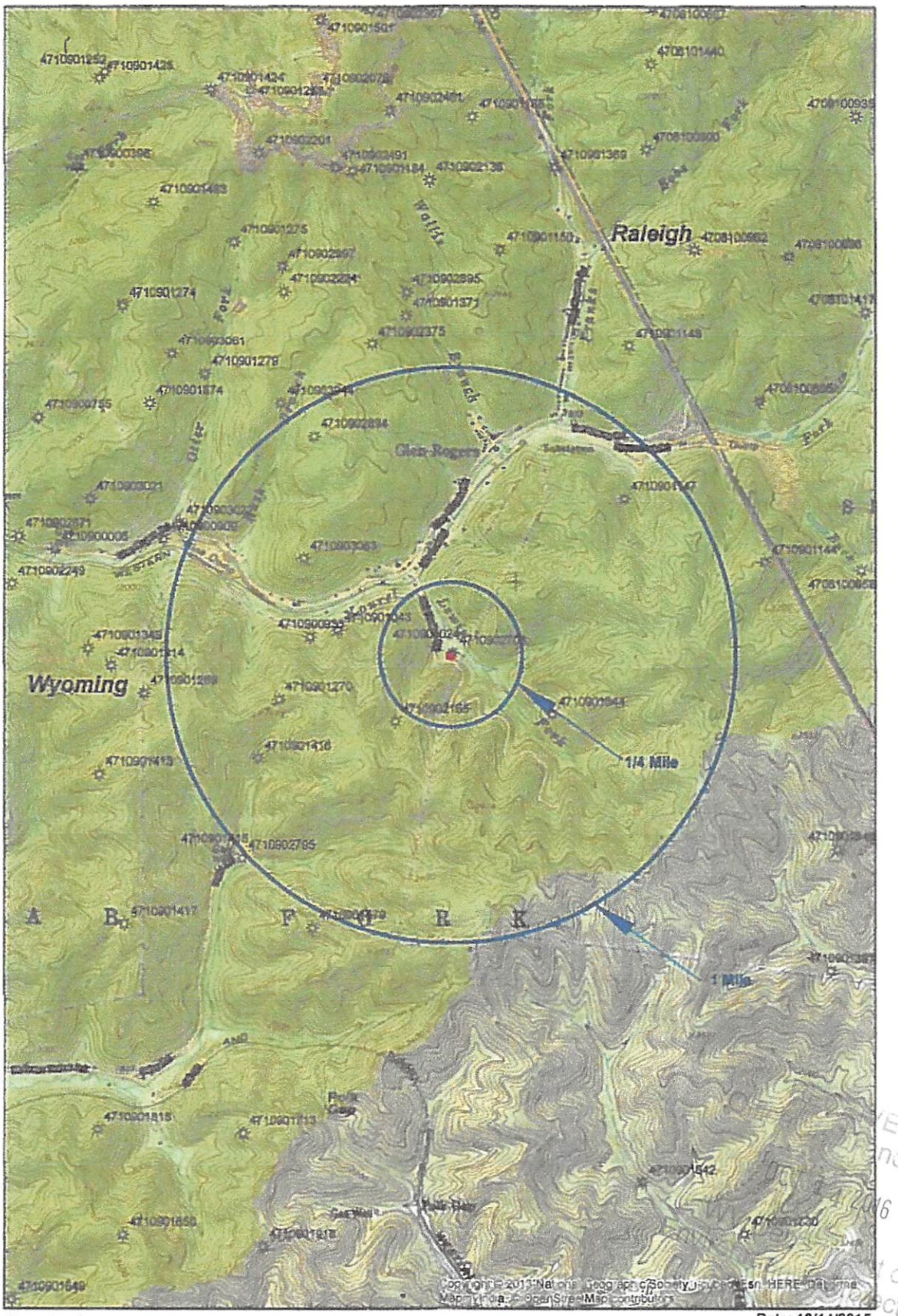
The WP-400 WIW is located at 301 Old Fireline Road, Glen Rogers, West Virginia. Access to the facility is only via Fireline Road. Access is restricted by a locked gate that allows vehicle access around the facility. The operating facility is located inside a six foot locked chain-link fence. The facility consists of a pump building, truck unloading bay, control building, transfer pump building and three HDPE lined ponds with a capacity of 24,000 bbls. An as-built drawing is provided as an attachment. Basically, product fluids are unloaded in a concrete unloading bay with an inverted pipe (for solids). Produced water then flows to the 12,000 bbl HDPE pond water then flows via inverted pipe to two 6,000 bbl HDPE ponds with a man hole. Produced water is then pumped from the manhole through canister filter, bag filter, and cartridge filters prior to being pumped to the injection well. Security cameras are employed for site security and the facility is only operated in manual mode.

Four single walled fiberglass 400 bbl ASTs are currently not active at this facility but are included in this permit. The four ASTs are located in single earthen berm with locked chain-link fencing. The earthen berm contains sufficient secondary containment capacity to support 128% of a 400 bbl tank in the event of a fracture. The four tanks are manifolded together with individual locked volumes. Thus, if one tank fails, the other three tanks cannot be emptied. Valves can only be opened.

Due to the current set up, tanks can only be loaded/unloaded manually. The produced water can only be trucked to this facility as it is not served by a pipeline. All filtration and pumping units have been removed but will be added if needed. The filtration unit will be identical to the current filtration used by the pond network of bag and cartridge filters. Any spills associated with the operation of these ASTs will be reported within 24 hours to the OOG. Additionally, Enervest maintains an approved Spill Prevention Response Plan (SPRP) for these ASTs.

Preventative maintenance of the ASTs, valves, and piping will be conducted as needed. Any sludge that accumulates in the ASTs will be cleaned out and properly disposed through Enervest's two year permit with Raleigh County landfill (same as the tank unloading bay sludge).

If any tank repairs are needed, those repairs will be made by the manufacturer and in accordance with applicable standards.



Date: 12/14/2015

Legend

- 400 WIW
- Wells
- County
- TWP
- EV

Enervest Operating

Exhibit #1
Topo Base
Disposal Well 400 WIW

0 1,250 2,500 5,000 7,500 10,000 Feet

ENERVEST

400 WIW
Wells
World Transportation
County
TWP
EV

Enervest Operating

Exhibit #1
Imagery Base
Disposal Well 400 WIW

Date: 12/14/2015

0 1,250 2,500 5,000 7,500 10,000 Feet

ENERVEST

EnviroCheck, Inc.

NO.	DATE	REVISION	APPROVED

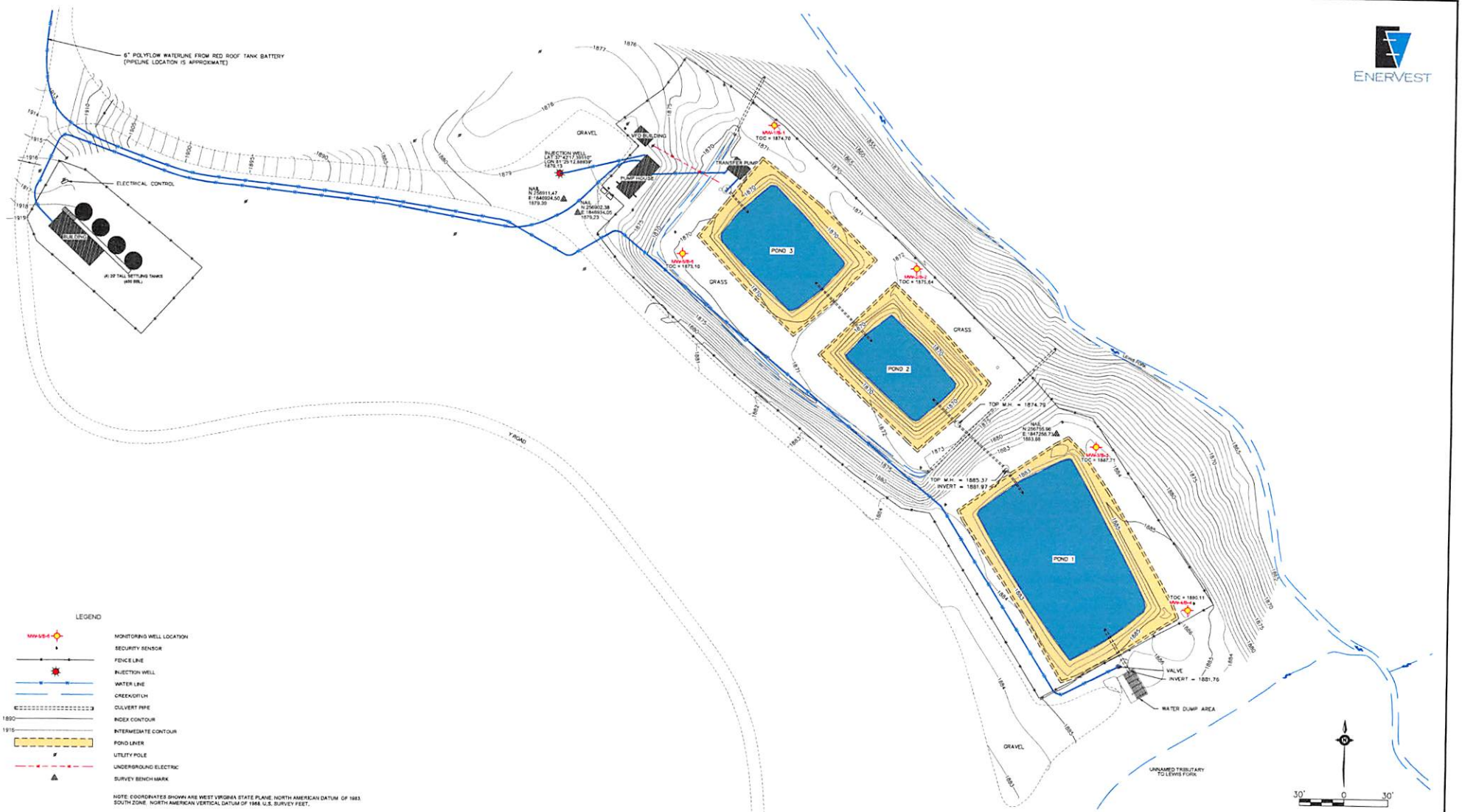
NO.	DATE	REVISION	APPROVED

DESIGNED:	JLR
DRAWN:	FL
CHECKED:	JLR
DATE:	09/07/2016
FILE NO.:	E2C1001
OFFICE LOC.:	BLUEFIELD, VA

ENERVEST OPERATING "AS-BUILT" UIC 10902703 "WP-400WIW" GLEN ROGERS, WYOMING COUNTY WEST VIRGINIA

PROJECT NO. E2C1001

SHEET 1 OF 1



e²C EnviroCheck, Inc.

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ENERVEST OPERATING "AS-BUILT" UIC 10902703 "WP-400WIW" GLEN ROGERS, WYOMING COUNTY WEST VIRGINIA

PROJECT NO. E2C1001

SHEET 1 OF 1

APPENDIX A
Injection Well Form

1) GEOLOGIC TARGET FORMATION: Weir

Depth: 3170 Feet (top) 3226 Feet (bottom)

2) Estimated Depth of Completed Well, (or actual depth of existing well): 3366 Feet

3) Approximate water strata depths: Fresh 35', 134', 230' Feet Salt _____ Feet

4) Approximate coal seam depths: Open Mine 668'-671', 978'-981', 1007'-1009', 1021'-1023'

5) Is coal being mined in the area? Yes ☐ No ☑

6) Virgin reservoir pressure in target formation 850 psig Source Data from wells in the field

7) Estimated reservoir fracture pressure 2300 psig (BHFP)

8) MAXIMUM PROPOSED INJECTION OPERATIONS:

Injection rate (bbl/hour) 425

Injection volume (bbl/day) 1200

Injection pressure (psig) 1034

Bottom hole pressure (psig) 2200

9) DETAILED IDENTIFICATION OF MATERIALS TO BE INJECTED, INCLUDING ADDITIVES:

Gas Field Brine. No additives anticipated

Temperature of injected fluid: (°F) Varies with season

10) FILTERS (IF ANY)

Use combination of two cartridges filtration units in series.

11) SPECIFICATIONS FOR CATHODIC PROTECTION AND OTHER CORROSION CONTROL

BJ Techni - HIB 606W GL Blk, Magnacide 575

APPENDIX A (cont.)

12. Casing and Tubing Program

TYPE	Size	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling	INTERVALS: Left in Well	CEMENT: Fill-up (Cu. Ft.)
Conductor	20"	New	LS	94	22'	22'	To Surface
Fresh Water	13 3/8"	New	H-40	48	694'	694'	To Surface
Coal							
Intermediate 1	9 5/8"	New	LS	29	1116'	1116'	To Surface
Intermediate 2							
Production	7"	New	J-55	23	3356'	3356'	3356' to 610'
Tubing	4 1/2"	New	M-65	9.5		3119'	
Liners							

TYPE	Wellbore Diameter	Casing Size	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./sk)	Cement to Surface ? (Y or N)
Conductor		20"	0.876"	?	Class A	1.18	Y
Fresh Water	17 1/2"	13 3/8"	0.66"	1,730 psi	Class A w/ 2% Salt	1.19	Y
Coal							
Intermediate 1	12 3/8"	9 5/8"	~0.562"	?	Class A w/ additives	1.35	Y
Intermediate 2							
Production	8 7/8"	7"	0.634"	4,360 psi	Class A w/ additives	1.82	N
Tubing		4 1/2"	0.41"	5180 psi			N
Liners							

PACKERS	Packer #1	Packer #2	Packer #3	Packer #4
Kind:	Production			
Sizes:	7" x 4.5"			
Depths Set:	3119'			

APPENDIX B
Storage Tank Inventory

API #	Tank ID	Tank Location (UTM NAD 83 Meters)		Installation Date	Tank Age (Months)	Construction Material (Steel, plastic, etc.)	Capacity (gallons)	Type of Fluid Stored	Volume of Fluid Stored (gallons)	Tank Type Single/Double Wall
		Northing	Easting							
41-109-02703	1548	4173158.01	462847.92	7/1/2006	113	Fiberglass	16,800	Produced Brine	0	Single
41-109-02703	1549	4173158.01	462847.92	7/1/2006	113	Fiberglass	16,800	Produced Brine	0	Single
41-109-02703	1550	4173158.01	462847.92	7/1/2006	113	Fiberglass	16,800	Produced Brine	0	Single
41-109-02703	1551	4173158.01	462847.92	7/1/2006	113	Fiberglass	16,800	Produced Brine	0	Single

ANALABS

Analabs, Inc.
PO Box 1235
Crab Orchard, WV 25827
Phone: (304) 255-4821
Fax: (304) 255-2410

September 13, 2016

J. L. Rhudy
Envirocheck of VA. Inc
375 Mountain Lane
Tazewell, VA 24651

RE: Workorder: 50297 Water Quality

Dear J. Rhudy:

Enclosed are the analytical results for sample(s) received by the laboratory on Friday, September 09, 2016. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

These results relate only to the items tested. All samples are analyzed on an "as received" basis, unless otherwise noted. Any deviation from the referenced method is noted on the report.

Referenced field methods may be different if not tested by Analabs' personnel.

All records are retained for 5 years.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Annissa J. Reiger

Annissa J. Reiger
Laboratory Director

Enclosures

Certifications:

WV DEP (NPDES) Crab Orchard 042; Charleston 359
WV DHHR (Drinking Water) Crab Orchard 00442 CM; Charleston 00202 M
VA DCLS (NELAC) Crab Orchard 460023

CERTIFICATE OF ANALYSIS

ANALABS

Analabs, Inc.
PO Box 1235
Crab Orchard, WV 25827
Phone: (304) 255-4821
Fax: (304) 255-2410

SAMPLE SUMMARY

Workorder: 50297 Water Quality

Lab ID	Sample ID	Matrix	Date Collected	Date Received
502970001	WP-400 Ponds Inj.	Water	9/9/2016 12:10	9/9/2016 14:20

CERTIFICATE OF ANALYSIS

ANALABS

Analabs, Inc.
PO Box 1235
Crab Orchard, WV 25827
Phone: (304) 255-4821
Fax: (304) 255-2410

ANALYTICAL RESULTS

Workorder: 50297 Water Quality

Lab ID: **502970001** Date Received: 9/9/2016 14:20 Matrix: Water
Sample ID: **WP-400 Ponds Inj.** Date Collected: 9/9/2016 12:10 Sampler: JLR
Client Project Name: PWS ID#: n/a
Permit:
Assoc. Permits:

Parameters	Flag	Results	Units	RegLmt	PQL	MDL	Prepared	By	Analyzed	By
Microbiology										
Analysis Desc: SM9223B-QT T.Coliforms/E.Coli		Analytical Method: SM9223B-QT T.Coliforms/E.Coli								
E. Coli	Z	3.00	/0.1L		1.00	1.00			9/9/2016 18:23	TM
Total Coliforms	Z	>2419.6	/0.1L		1.00	1.00			9/9/2016 18:23	TM

ANALABS

Analabs, Inc.
PO Box 1235
Crab Orchard, WV 25827
Phone: (304) 255-4821
Fax: (304) 255-2410

ANALYTICAL RESULTS QUALIFIERS

Workorder: 50297 Water Quality

MDL = Minimum Detection Limit

PQL = Practical Quantifying Limit

Z = non-NELAC

ANALABS

BACTERIOLOGICAL EXAMINATION OF WATER FROM PUBLIC WATER DISTRIBUTION SYST

Enervest WP-400 Ponds

ANALABS, INC.
P. O. Box 1235
Crab Orchard, WV 25827
ph.: 304-255-4821 fax: 304-255-2410
www.analabsinc.com

RED TYPE TO BE COMPLETED BY COLLECTOR

PWSID Number: NA County Name: WYOMING Compliance Date: NA Date Reported: NA

Public Water System Name: NA Contact Person: JL Ritchey III Phone: 276-261-3083 Fax: 276-322-1335

Report to Be Mailed To:
Client Name: Enervest of VA, DOL
Attn: JL Ritchey III
Address: 325 Moccasin Lane
City/State/Zip: Tazewell, VA 24651

Report to Be Billed To: (if different from report address)
Client Name:
Attn:
Address:
City/State/Zip:

Lab Performing Analysis: Analabs, Inc. Lab ID# 00442 CM Analyst(s) Name:

SAMPLE HISTORY										SAMPLE RESULTS						
COLLECTION DATA			RECEIVING DATA			ANALYSIS DATA				Chlorine Residual FREE or TOTAL (circle one)			COLIFORM (P/A)			
Date	Time	Initials	Date	Time	Initials	Date	Time	Initials	Sample Location		pH	Lab No.	Total	Fecal / E. coli	METHOD[1]	TYPE[2]
9/9/16	12:10	JL	9-9-16	2:20 PM	TA				WP-400 Ponds UNTREATED Total Bacteria (MPN)	MPN						4
Raw Sample:																

REMARKS (FOR LAB USE ONLY): (i.e. any samples not meeting "Transportation Condition" standards according to EPA regulations, etc.,) 10.4

RECEIVED Oil and Gas
OCT 14 2016
WV Department of Environmental Protection

SPECIAL REPORTING INSTRUCTIONS:

Drinking Water Records retained for 5 years ○ Report to EHS (State Health Dept.)

1. *Standard Methods for the Examination of Water and Wastewater, 18th or 19th Edition:* 1 - 9221A; 2 - 9221B; 3 - 9222A; 4 - 9222B; 59222C; 6 - 9221D; 7 - 9223. Note any other approved method.
2. Type of Samples: 1 - Compliance; 2 - Repeat; 3 - Replacement; 4 - Special Purpose

Analabs Sample Receipt Checklist

Client Name: Eisenbach Date/Initials: 9/12/16 JL

WO# 50297 Original WO#_____

Sample Receiving Temp: 10.4°C Sample Temp Requirement met? Y N On Ice? Y N

Sample received within hold time? Y N

- Collection Date/Time? Y N
- Received Date/Time? Y N
- Collector? Y N

Expedited TAT requested? Y N UpCharge? Y N Date/time lab notified_____

PO Required? Y N If yes on Work Order? Y N

Any samples cancelled? Y N If yes billable acodes deleted? Y N

Does sample ID match COC? Y N (If no record resolution below)

Does analysis match COC? Y N NA (If no record resolution below)

Verify PWSID #? Y N NA Sample Type verified for bacteria? Y N NA

SWM? Y N If yes schedule updated? Y N

Site(s):_____

Miscellaneous charges added? Y N

Charges triggered? Y N Date/time notification emailed_____

Client notification/Resolution:

Person Contacted:_____ Date/Time:_____

_____

_____

_____

Reviewed By: JL Date: 9/12/16

Sorting Personnel Only

Does the bar code label match the container label? Y N If no corrected from COC? Y N

Checked By: Lab Date:_____

ANALYTICAL REPORT

August 31, 2016

EnviroCheck of Va., Inc

Sample Delivery Group:	L854823
Samples Received:	08/20/2016
Project Number:	ENERVEST
Description:	Injectate Wastewater
Site:	WV
Report To:	Mr. J. L. Rhudy 375 Mountain Lane Tazewell, VA 24651

Entire Report Reviewed By:

Terrie Fudge

Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

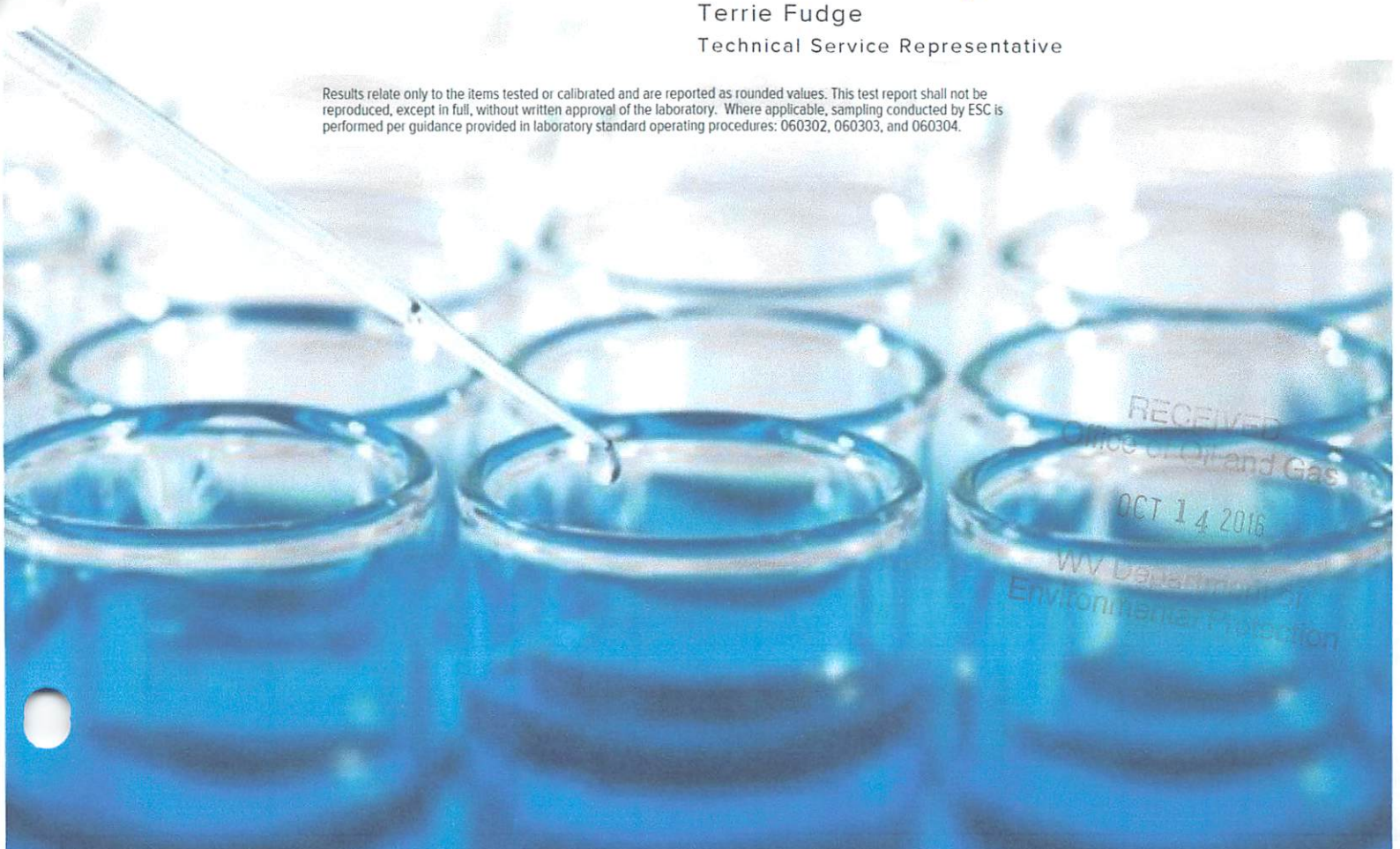


TABLE OF CONTENTS

ONE LAB. NATIONWIDE.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

INJECTATE L854823-01 WW

Collected by: James Price
Collected date/time: 08/18/16 08:40
Received date/time: 08/20/16 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Gravimetric Analysis by Method 2540 C-2011	WG901366	1	08/24/16 03:16	08/24/16 05:26	JM
Gravimetric Analysis by Method 2540 D-2011	WG901369	1	08/24/16 13:06	08/24/16 14:08	MMF
Metals (ICP) by Method 200.7	WG900866	1	08/23/16 07:10	08/23/16 10:21	CCE
Metals (ICP) by Method 200.7	WG900866	5	08/23/16 07:10	08/23/16 11:17	CCE
Semi-Volatile Organic Compounds (GC) by Method 8015	WG900726	1	08/20/16 20:49	08/23/16 20:22	TRF
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG900742	1	08/23/16 09:40	08/23/16 09:40	LRL
Volatile Organic Compounds (GC) by Method RSK175	WG902079	1	08/25/16 14:07	08/25/16 14:07	DWR
Volatile Organic Compounds (GC/MS) by Method 8260B	WG901637	1	08/25/16 05:46	08/25/16 05:46	BMB
Wet Chemistry by Method 2710 F-2011	WG900889	1	08/22/16 09:24	08/22/16 09:25	AMC
Wet Chemistry by Method 300.0	WG902541	50	08/26/16 08:57	08/26/16 08:57	SAM
Wet Chemistry by Method 300.0	WG902955	1	08/28/16 04:21	08/28/16 04:21	CM
Wet Chemistry by Method 4500H+ B-2011	WG900720	1	08/22/16 10:54	08/22/16 10:54	MHM
Wet Chemistry by Method 5310 B-2011	WG902294	1	08/29/16 23:20	08/29/16 23:20	AS
Wet Chemistry by Method 5540 C-2011	WG900713	1	08/20/16 12:31	08/20/16 16:14	KK

All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Terrie Fudge

Terrie Fudge
Technical Service Representative

Sample Handling and Receiving

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

ESC Sample ID	Project Sample ID	Method
L854823-01	INJECTATE	4500H+ B-2011, 5540 C-2011

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Dissolved Solids	5350000		10000	1	08/24/2016 05:26	WG901366

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Suspended Solids	19000		2500	1	08/24/2016 14:08	WG901369

Wet Chemistry by Method 2710 F-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	g/cm3			date / time	
Density	0.984		1	08/22/2016 09:25	WG900889

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Chloride	2790000		50000	50	08/26/2016 08:57	WG902541
Sulfate	21500		5000	1	08/28/2016 04:21	WG902955

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	7.37		1	08/22/2016 10:54	WG900720

mple Narrative:
4500H+ B-2011 L854823-01 WG900720: 7.37 at 10.1c

Wet Chemistry by Method 5310 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
TOC (Total Organic Carbon)	15700		1000	1	08/29/2016 23:20	WG902294

Wet Chemistry by Method 5540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
MBAS	145		100	1	08/20/2016 16:14	WG900713

Metals (ICP) by Method 200.7

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Aluminum	ND		200	1	08/23/2016 10:21	WG900866
Arsenic	11.7		10.0	1	08/23/2016 10:21	WG900866
Barium	20000		25.0	5	08/23/2016 11:17	WG900866
Calcium	233000		1000	1	08/23/2016 10:21	WG900866
Iron	956		100	1	08/23/2016 10:21	WG900866
Manganese	79.1		10.0	1	08/23/2016 10:21	WG900866
Sodium	1360000		5000	5	08/23/2016 11:17	WG900866

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
TPH (GC/FID) Low Fraction	ND		100	1	08/23/2016 09:40	WG900742
(S) a,a,a-Trifluorotoluene(FID)	*112*		*62.0-128*		*08/23/2016 09:40*	WG900742

Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result ug/l	Qualifier	RDL ug/l	Dilution	Analysis date / time	Batch
ethane	468		10.0	1	08/25/2016 14:07	WG902079
Ethane	ND		13.0	1	08/25/2016 14:07	WG902079
Ethene	ND		13.0	1	08/25/2016 14:07	WG902079

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result ug/l	Qualifier	RDL ug/l	Dilution	Analysis date / time	Batch
Benzene	ND		1.00	1	08/25/2016 05:46	WG901637
Toluene	ND		5.00	1	08/25/2016 05:46	WG901637
Ethylbenzene	ND		1.00	1	08/25/2016 05:46	WG901637
Total Xylenes	ND		3.00	1	08/25/2016 05:46	WG901637
(S) Toluene-d8	*107*		*90.0-115*		*08/25/2016 05:46*	WG901637
(S) Dibromofluoromethane	*103*		*79.0-121*		*08/25/2016 05:46*	WG901637
(S) a,a,a-Trifluorotoluene	*98.0*		*90.4-116*		*08/25/2016 05:46*	WG901637
(S) 4-Bromofluorobenzene	*97.5*		*80.1-120*		*08/25/2016 05:46*	WG901637

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result ug/l	Qualifier	RDL ug/l	Dilution	Analysis date / time	Batch
C10-C28 Diesel Range	596		100	1	08/23/2016 20:22	WG900726
C28-C40 Oil Range	458	B	100	1	08/23/2016 20:22	WG900726
(S) o-Terphenyl	*65.1*		*50.0-150*		*08/23/2016 20:22*	WG900726

Method Blank (MB)

(MB) R3159028-1 08/24/16 05:26

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dissolved Solids	U		2820	10000

L854689-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854689-01 08/24/16 05:26 • (DUP) R3159028-4 08/24/16 05:26

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	7230000	7110000	1	1.67		5

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159028-2 08/24/16 05:26 • (LCSD) R3159028-3 08/24/16 05:26

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Dissolved Solids	8800000	8280000	8540000	94.1	97.0	85.0-115			3.09	5

Method Blank (MB)

(MB) R3159071-1 08/24/16 14:08

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Suspended Solids	U		350	2500

L854595-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854595-01 08/24/16 14:08 • (DUP) R3159071-4 08/24/16 14:08

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	264000	268000	1	1.50		5

L854834-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854834-01 08/24/16 14:08 • (DUP) R3159071-5 08/24/16 14:08

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	256000	268000	1	4.58		5

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159071-2 08/24/16 14:08 • (LCSD) R3159071-3 08/24/16 14:08

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Suspended Solids	773000	768000	760000	99.4	98.3	85.0-115			1.05	5

L854823-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854823-01 08/22/16 09:25 • (DUP) WG900889-1 08/22/16 09:25

Analyte	Original Result g/cm3	DUP Result g/cm3	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Density	0.984	0.995	1	1.11		20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3159688-1 08/25/16 20:02

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Chloride	U		51.9	1000

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159688-2 08/25/16 20:16 • (LCSD) R3159688-3 08/25/16 20:31

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chloride	40000	39100	39100	98	98	90-110			0	20

Method Blank (MB)

(MB) R3159864-1 08/27/16 22:08

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Sulfate	U		77.4	5000

L854307-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854307-01 08/27/16 23:23 • (DUP) R3159864-4 08/27/16 23:38

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	ND	446	1	0		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159864-2 08/27/16 22:23 • (LCSD) R3159864-3 08/27/16 22:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Sulfate	40000	40000	40100	100	100	90-110			0	20

L854649-02 Original Sample (OS) • Duplicate (DUP)

(OS) L854649-02 08/22/16 10:54 • (DUP) WG900720-3 08/22/16 10:54

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.53	7.57	1	0.530		1

L854914-04 Original Sample (OS) • Duplicate (DUP)

(OS) L854914-04 08/22/16 10:54 • (DUP) WG900720-4 08/22/16 10:54

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	8.40	8.44	1	0.475		1

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) WG900720-1 08/22/16 10:54 • (LCSD) WG900720-2 08/22/16 10:54

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	su	su	su	%	%	%			%	%
pH	6.11	6.12	6.14	100	100	98.4-102			0.326	1

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3160251-3 08/29/16 14:55

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
TOC (Total Organic Carbon)	U		102	1000

L854653-02 Original Sample (OS) • Duplicate (DUP)

(OS) L854653-02 08/29/16 17:32 • (DUP) R3160251-6 08/29/16 17:50

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	913000	898000	10	2.00		20

L854844-08 Original Sample (OS) • Duplicate (DUP)

(OS) L854844-08 08/30/16 12:17 • (DUP) R3160251-9 08/30/16 12:35

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	1370000	1390000	20	1.00		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3160251-4 08/29/16 15:40 • (LCSD) R3160251-5 08/29/16 16:26

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	75000	75700	75200	101	100	85.0-115			1.00	20

Method Blank (MB)

(MB) R3158139-1 08/20/16 16:05

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
MBAS	U		19.0	100

L854812-07 Original Sample (OS) • Duplicate (DUP)

(OS) L854812-07 08/20/16 16:10 • (DUP) R3158139-4 08/20/16 16:11

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
MBAS	ND	ND	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158139-2 08/20/16 16:07 • (LCSD) R3158139-3 08/20/16 16:07

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
MBAS	1000	1060	1070	106	107	90.0-110			1.00	20

L854812-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854812-08 08/20/16 16:12 • (MS) R3158139-5 08/20/16 16:12 • (MSD) R3158139-6 08/20/16 16:13

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
MBAS	1000	ND	1100	1150	110	115	1	90.0-110		J5	5.00	20

Method Blank (MB)

(MB) R3158514-1 08/23/16 09:33

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aluminum	63.9	J	27.3	200
Arsenic	U		6.40	10.0
Barium	U		1.00	5.00
Calcium	153	J	100	1000
Iron	U		28.2	100
Manganese	U		2.00	10.0
Sodium	167	J	93.9	1000

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158514-2 08/23/16 09:35 • (LCSD) R3158514-3 08/23/16 09:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aluminum	10000	10400	10400	104	104	85-115			1	20
Arsenic	1000	1020	1030	102	103	85-115			0	20
Barium	1000	1040	1040	104	104	85-115			0	20
Calcium	10000	10200	10100	102	101	85-115			1	20
Iron	10000	10100	10100	101	101	85-115			0	20
Manganese	1000	1010	1010	101	101	85-115			0	20
Sodium	10000	10100	10100	101	101	85-115			1	20

L854731-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854731-01 08/23/16 09:41 • (MS) R3158514-5 08/23/16 09:46 • (MSD) R3158514-6 08/23/16 09:49

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aluminum	10000	ND	10600	10600	106	106	1	70-130			0	20
Arsenic	1000	ND	1110	1110	110	111	1	70-130			1	20
Barium	1000	52.4	1060	1070	101	102	1	70-130			1	20
Calcium	10000	754000	752000	751000	0	0	1	70-130	V	V	0	20
Iron	10000	ND	9790	9920	98	99	1	70-130			1	20
Manganese	1000	14.9	999	1000	98	99	1	70-130			0	20
Sodium	10000	19100	29100	29300	100	103	1	70-130			1	20

Cp
Tc
Ss
Cn
Sr
Qc
Gl
Al
Sc

L854936-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854936-01 08/23/16 09:51 • (MS) R3158514-7 08/23/16 09:54 • (MSD) R3158514-8 08/23/16 09:56

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Aluminum	10000	3770	14000	14200	102	104	1	70-130			1	20
Arsenic	1000	ND	1060	1080	106	108	1	70-130			2	20
Barium	1000	71.0	1090	1110	102	104	1	70-130			2	20
Calcium	10000	57700	70700	71100	130	134	1	70-130		V	1	20
Iron	10000	476	10400	10500	99	100	1	70-130			1	20
Manganese	1000	20.6	1000	1020	98	100	1	70-130			2	20
Sodium	10000	214000	221000	222000	78	83	1	70-130			0	20

Method Blank (MB)

(MB) R3159550-3 08/22/16 14:56

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
TPH (GC/FID) Low Fraction	U		31.4	100
(S) a,a,a-Trifluorotoluene(FID)	*109*			*62.0-128*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159550-1 08/22/16 13:30 • (LCSD) R3159550-2 08/22/16 13:59

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
TPH (GC/FID) Low Fraction	5500	6490	6890	118	125	67.0-132			6.07	20
(S) a,a,a-Trifluorotoluene(FID)				*108*	*108*	*62.0-128*				

L854810-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854810-01 08/22/16 16:35 • (MS) R3159550-4 08/22/16 17:04 • (MSD) R3159550-5 08/22/16 17:33

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
TPH (GC/FID) Low Fraction	5500	ND	6340	6980	115	127	1	50.0-143			9.66	20
(S) a,a,a-Trifluorotoluene(FID)					*107*	*107*		*62.0-128*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3159218-1 08/25/16 13:51

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Methane	U		2.91	10.0
Ethane	U		4.07	13.0
Ethene	U		4.26	13.0

L854841-03 Original Sample (OS) • Duplicate (DUP)

(OS) L854841-03 08/25/16 14:18 • (DUP) R3159218-2 08/25/16 14:20

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	ug/l	ug/l		%		%
Methane	92.4	92.1	1	0.300		20
Ethane	ND	0.000	1	0.000		20
Ethene	ND	0.000	1	0.000		20

L854841-06 Original Sample (OS) • Duplicate (DUP)

(OS) L854841-06 08/25/16 14:27 • (DUP) R3159218-3 08/25/16 14:51

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	ug/l	ug/l		%		%
Methane	15.7	17.5	1	11.0		20
Ethane	ND	0.000	1	0.000		20
Ethene	ND	0.000	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159218-4 08/25/16 14:53 • (LCSD) R3159218-5 08/25/16 14:56

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Methane	67.8	69.1	69.3	102	102	85.0-115			0.300	20
Ethane	129	128	131	99.6	102	85.0-115			2.18	20
Ethene	127	128	130	101	102	85.0-115			1.64	20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3159747-3 08/25/16 00:50

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Benzene	U		0.331	1.00
Ethylbenzene	U		0.384	1.00
Toluene	U		0.780	5.00
Xylenes, Total	U		1.06	3.00
(S) Toluene-d8	*107*			*90.0-115*
(S) Dibromofluoromethane	*103*			*79.0-121*
(S) a,a,a-Trifluorotoluene	*97.5*			*90.4-116*
(S) 4-Bromofluorobenzene	*98.6*			*80.1-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159747-1 08/24/16 23:30 • (LCSD) R3159747-2 08/24/16 23:50

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	25.0	25.8	25.8	103	103	73.0-122			0.120	20
Ethylbenzene	25.0	23.7	23.9	94.7	95.6	80.9-121			0.900	20
Toluene	25.0	24.3	24.2	97.2	97.0	77.9-116			0.260	20
Xylenes, Total	75.0	69.8	70.2	93.1	93.6	79.2-122			0.580	20
(S) Toluene-d8				*106*	*106*	*90.0-115*				
(S) Dibromofluoromethane				*103*	*103*	*79.0-121*				
(S) a,a,a-Trifluorotoluene				*97.0*	*96.3*	*90.4-116*				
(S) 4-Bromofluorobenzene				*97.0*	*99.5*	*80.1-120*				

L854886-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854886-01 08/25/16 03:45 • (MS) R3159747-4 08/25/16 01:24 • (MSD) R3159747-5 08/25/16 01:44

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	25.0	U	26.5	25.8	106	103	1	58.6-133			2.41	20
Ethylbenzene	25.0	U	24.5	23.9	98.0	95.5	1	62.7-136			2.56	20
Toluene	25.0	U	25.1	24.5	100	98.1	1	67.8-124			2.24	20
Xylenes, Total	75.0	U	72.9	70.2	97.1	93.6	1	65.6-133			3.71	20
(S) Toluene-d8					*107*	*106*		*90.0-115*				
(S) Dibromofluoromethane					*104*	*104*		*79.0-121*				
(S) a,a,a-Trifluorotoluene					*97.0*	*96.3*		*90.4-116*				
(S) 4-Bromofluorobenzene					*98.6*	*96.7*		*80.1-120*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

L854739-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854739-07 08/25/16 03:24 • (MS) R3159747-6 08/25/16 02:04 • (MSD) R3159747-7 08/25/16 02:24

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	25.0	ND	26.2	26.4	105	106	1	58.6-133			0.860	20
Ethylbenzene	25.0	ND	23.7	24.1	95.0	96.5	1	62.7-136			1.56	20
Toluene	25.0	ND	23.7	25.4	94.7	101	1	67.8-124			6.89	20
Xylenes, Total	75.0	ND	70.6	71.6	94.1	95.5	1	65.6-133			1.44	20
(S) Toluene-d8					*100*	*107*		*90.0-115*				
(S) Dibromofluoromethane					*104*	*104*		*79.0-121*				
(S) a,a,a-Trifluorotoluene					*97.5*	*98.0*		*90.4-116*				
(S) 4-Bromofluorobenzene					*96.7*	*97.0*		*80.1-120*				

Semi-Volatile Organic Compounds (GC) by Method 8015

L854823-01

Method Blank (MB)

(MB) R3158640-1 08/23/16 12:23

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
C10-C28 Diesel Range	U		22.2	100
C28-C40 Oil Range	46.7	J	11.8	100
(S) o-Terphenyl	*93.5*			*50.0-150*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158640-2 08/23/16 12:43 • (LCSD) R3158640-3 08/23/16 13:02

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C10-C28 Diesel Range	1500	1460	1560	97.5	104	70.0-130			6.71	20
(S) o-Terphenyl				*97.6*	*104*	*50.0-150*				

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

ONE LAB. NATIONWIDE.

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE.**
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

[1] Cp
[2] Tc
[3] Ss
[4] Cn
[5] Sr
[6] Qc
[7] Gl
[8] Al
[9] Sc

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Conneticut	PH-0197	North Carolina [1]	DW21704
Florida	E87487	North Carolina [2]	41
Georgia	NELAP	North Dakota	R-140
Georgia [1]	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky [1]	90010	South Dakota	n/a
Kentucky [2]	16	Tennessee [14]	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

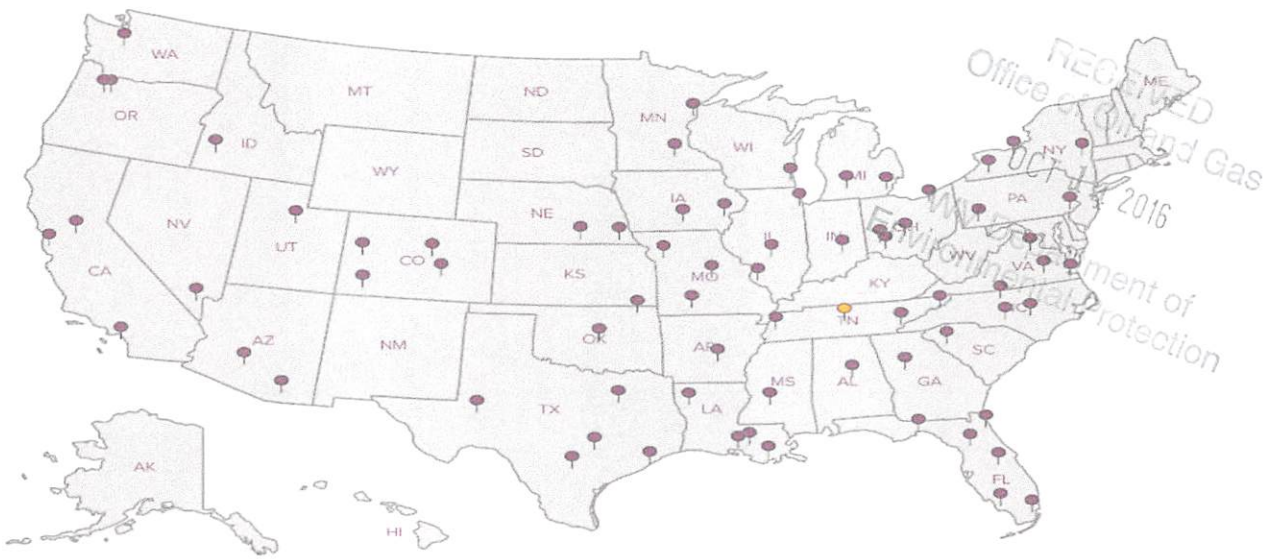
Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	S-67674
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [n/a] Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



EnviroCheck of Va., Inc

375 Mountain Lane
Tazewell, VA 24651

Billing Information:
Mr. J. L. Rhudy
375 Mountain Lane
Tazewell, VA 24651

Report to: Mr. J. L. Rhudy

Email To: jl@e2cofvirginia.com

Project Description: Injectate Wastewater

City/State Collected:

Phone: 276-322-1323
Fax: 276-472-2425

Client Project # ENERVEST

Lab Project # ENVCHTVA-INJECT

Collected by (print): JAMES Price

Site/Facility ID # WV

P.O. #

Collected by (signature): Jana Price

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%

Date Results Needed

Email? ___No X__Yes
FAX? ___No ___Yes

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Cl; pH; SO4; TDS 500mlHDPE-NoPres	DROOROLVI 40mlAmb-HCl-BT	Density 250mlHDPE-NoPres	GRO 40mlAmb HCl	MBAS 500mlHDPE-NoPres	Metals 250mlHDPE-HNO3	RSK-175 40mlAmb-HCl	Sub-Out - RAD 228 1L-HDPE-Add HNO3	Sub-Out- RAD 226 1L-HDPE-Add HNO3	TOC 250mlAmb-HCl	Rem./Contaminant	Sample # (lab only)
INJECTATE	Comp	WW		8/18/16	8:40	16	X	X	X	X	X	X	X	X	X	X		-01
		WW				16	X	X	X	X	X	X	X	X	X	X		

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Chain of Custody Page ___ of ___

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YOUR LAB OF CHOICE
12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L85-4823

A100

Acctnum: ENVCHTVA
Template: T114758
Prelogin: P564246
TSR: 064 - Terrie Fudge
PB: HS 8-9-16
Shipped Via: FedEX Ground

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Jana Price	8/18/16	11:30	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)
			Mary Dean

Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ _____

Temp: 3.1 °C Bottles Received: 16+T3

Date: 8-20-16 Time: 09a

A099 Subout

Hold #

Condition: CA 12 OK (lab use only)

COC Seal Intact: ___Y ___N ___NA

pH Checked: NCF:

RECEIVED
OCT 14 2016
Office of Oil and Gas
WV Department of Environmental Protection

ESC LAB SCIENCES

YOUR LAB OF CHOICE

Cooler Receipt Checklist

Client: ENVCHTVA SDG# L854823

Cooler Received/Opened On: 8-2016 By: Gregg Dearmen

Temperature Upon Receipt: 3.1 °c

(Signature)

Cooler Receipt Check List	Yes	No	N/A
Were custody seals on outside of cooler and intact?			/
Were custody papers properly filled out (ink, signed, etc.)?	/		
Did all bottles arrive in good condition?	/		
Were correct bottles used for the analyses requested?	/		
Was sufficient amount of sample sent in each bottle?	/		
Were correct preservatives used?	/		
Were all applicable sample containers checked for preservation? (Any samples not in accepted pH range noted on COC .)	/		
If applicable, was an observable VOA headspace present?		/	
Non Conformance Generated? (If yes see attached NCF)		/	

ESC
L·A·B S·C·I·E·N·C·E·S
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ACCREDITED IN ACCORDANCE WITH nelac
NJ OK001

Case Narrative

Lab No: 20160813

This report contains the analytical results for the 1 sample(s) received under chain of custody by ESC Lab Sciences on 8/23/2016 3:00:00 PM. These samples are associated with your Injectate Wastewater project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted below:

The test results in this report meet all NELAC requirements unless noted below:

All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client.

Results have been reviewed by the Director of Radiochemistry or their designees and is approved for release.

Observations / Nonconformances

OUTREACH LABORATORY, A Divsion of ESC Lab Sciences
Address: 311 North Aspen Avenue, Broken Arrow, OK, 74012 - EMail: outreach@esclabsciences.com - Tel: (918) 251-2515

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

Client	:	EnviroCheck of VA., Inc
Client Project	:	Injectate Wastewater
Lab Number	:	20160813
Date Reported	:	09/15/16
Date Received	:	08/23/16
Page Number	:	2 of 2

Analytical Report

	Method	Result	DL	Units	Qual	Prep Date	Analysis Date	Analyst
Lab ID :	**20160813-01**							
Client ID :	**INJECTATE**							
Date Sampled :	**8/18/2016 8:40:00 AM**							
Matrix :	**NPW**							
	Radiochemical Analyses							
Radium-226	SM 7500 Ra B M*	13.2 +/- 0.979	0.111	pCi/l		08/31/16	09/09/16	RE
Radium-228	EPA 904*/9320*	4.40 +/- 0.565	0.633	pCi/l		09/02/16	09/08/16	JR

QC Report

Parameter	Blank	LCS %REC	LCSD %REC	LCSD RPD	DUP RPD	RER, NAD or DER	MS %REC	MSD %REC	MSD RPD	Batch ID
Radium-226	0.009	99.1			NC	1.670	86.5	99.4	13.8	R1128
Radium-228	0.402	84.4			NC	0.580	84.3	87.6	3.8	R3851

Lab Approval:

Ron Eidson
Director of Radiochemistry

*NELAC Certified Parameter BDL = Below Detection Limit

OUTREACH LABORATORY, A Divsion of ESC Lab Sciences
Address: 311 North Aspen Avenue, Broken Arrow, OK, 74012 - EMail: outreach@esclabsciences.com - Tel: (918) 251-2515

EnviroCheck of Va., Inc
375 Mountain Lane
Tazewell, VA 24651

Billing Information:
Mr. J. L. Rhudy
375 Mountain Lane
Tazewell, VA 24651

Report to: Mr. J. L. Rhudy
Email To: jl@e2cofvirginia.com

Project Description: Injectate Wastewater
City/State Collected:

Phone: 276-322-1323
Fax: 276-472-2425
Client Project # ENERVEST
Lab Project # ENVCHTVA-INJECT

Collected by (print): JAMES Price
Site/Facility ID # WV
P.O. #

Collected by (signature): James Price
Immediately Packed on ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%

Date Results Needed

Email? ___No X__Yes
FAX? ___No ___Yes

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Cl; pH; SO4; TDS 500mlHDPE-NoPres	BROMO,VI 40mlAmb-HCl-BT	Density 250mlHDPE-NoPres	GRO 40mlAmb HCl	MBAS 500mlHDPE-NoPres	Metals 250mlHDPE-HNO3	RSK-175 40mlAmb-HCl	Sub-Out-RAD 228 1L-HDPE-Add HNO3	Sub-Out- RAD 226 1L-HDPE-Add HNO3	TOC 250mlAmb-HCl	Rem./Contaminant	Sample # (lab only)
INJECTATE	COMP	WW		8/18/16	8:40	16	X	X	X	X	X	X	X	X	X	X		-01
		WW				16	X	X	X	X	X	X	X	X	X	X		

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other ___

Remarks: 20600813

pH ___ Temp ___
Flow ___ Other ___

Chain of Custody Page ___ of ___

ESC LAB SCIENCE
YOUR LAB OF CHOICE
12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L854824
Table A100
Acctnum: ENVCHTVA
Template: T114758
Prelogin: P564246
TSR: 064 - Terrie Fudge
PB: 8-9-16
Shipped Via: FedEX Ground

Hold: A099 Subout

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
James Price	8/18/16	11:30	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	8/23/16	1500	Amber Taylor
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)
			Mary Dunn

Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ ___
Temp: 3.1 °C Bottles Received: 16+TB
Date: 8-20-16 Time: 0900

Condition: CA NP
(lab use only)
COC Seal Intact: ___ Y ___ N ___ NA
pH Checked: NCF:

SAMPLE LOGIN

Date Received: *8/23/2016 3:00:00* **Lab Number:** 20160813 **Due:** 9/20/2016

Sample Number	Client Sample ID	Matrix	Date Sampled	Container Type	Container Size	Preservation	Preserved Upon Receipt	Custody Seal	Seal Intact
20160813-01 B	INJECTATE	NPW	08/18/16	Plastic	1 L	HNO3, pH < 2	☑	No	No
20160813-01 A	INJECTATE	NPW	08/18/16	Plastic	1 L	HNO3, pH < 2	☑	No	No
Radium-226			SM 7500 Ra B M*						
Radium-228			EPA 904*/9320*						

CONTAINER INSPECTION

 # Coolers 1 **Custody Seals Broken** N/A **Temperature:** Amb **Ice** **Radiation Survey:** <300 cpm

SAMPLE INSPECTION

Sample Seal Broken N **Chain of Custody Record** ☑ **Labels in Tact** ☑ **Radiation Survey Complete** N/A

Anomalies

Inspected By: Amber Taylor **DATE** 8/23/16

QA or Designee Review: Raymond Thomas **DATE** 8/23/16

Sample Custodian Review: Eric M **DATE** 8/24/16

Project Notes:

Section 7 – Area of Review

The area of review for this well is a fixed ¼ mile radius around the well head (see attached maps). One producing gas well is located within a ¼ mile radius of this well. One drinking water spring is located within this ¼ mile radius. However, public water is available (if needed) and is provided to the Glen Rogers Community by the Wyoming County PSD. Lab results for this spring are provided as an attachment.

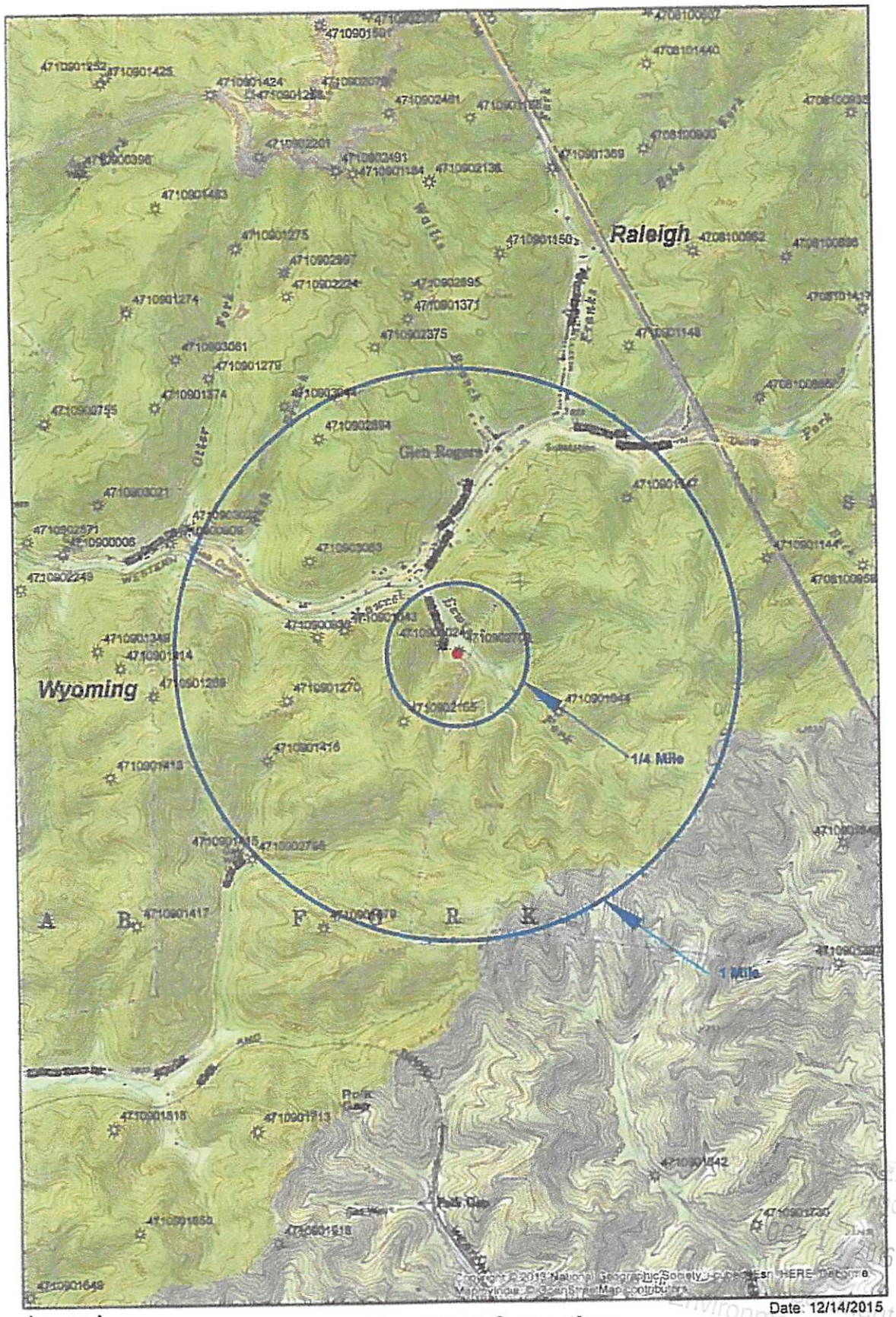
Well logs that penetrate the injection zone have been reviewed and are provided as an attachment.

APPENDIX C

Wells within the Area of Review

API #	Well Type	Well Status (Active, Abandoned, Shut-in, Plugged)	Northing (UTM NAD 83 Meters)	Easting (UTM NAD 83 Meters)	Penetrate Injection Zone (Y or N)	Penetrate Confining Zone (Y or N)	Total Vertical Depth	Surface Elevation
4710901024	Gas	Active	4173193.2	462868.1	Y	Y	3920	1892
4710902165	Gas	Active	4172776	462640.5	N	N	2055	2283
4710902894	Gas	Active	4174374.6	462180.6	Y	Y	4500	2374
4710902795	Observatory	Active	4171994.8	461752.9	Y	Y	3426	1925

Make as many copies as necessary and include page numbers as appropriate.



Legend

- 400 WIW
- Wells
- County
- TWP
- EV

Enervest Operating

Exhibit #1

Topo Base

Disposal Well 400 WIW

Date: 12/14/2015

0 1,250 2,500 5,000 7,500 10,000 Feet

ENERVEST

(4/25)

APPENDIX D

Public Service District Affidavit

Underground Injection Control Permit applicants must identify all publically recorded drinking water sources within a one (1) mile radius of the proposed injection well facility. If no drinking water sources are present within this radius a written affidavit shall be supplied by the local Public Service District (PSD) as ample verification.

"I certify under penalty of law that (state name of business)

EnerVest Operating

has verified with the public service district (state name of PSD)

Glen Rogers

that there are no such publically recorded sources.

Barry K Young

(Signature of Authorized Representative)

Sworn and subscribed to before me this 22nd day of September, 2016.

Alison E. Winter, my commission expires June 5, 2016

(Notary Signature)

Alison E. Winter

ALISON E. WINTER
Notary Public Official Seal
State of West Virginia
My Comm. Expires Jun 5, 2021
1845 Roundhill Rd. Charleston WV 25314

APPENDIX E
Water Sources

Operator: Enervest Operating Year 2015 UIC Permit # UIC2D1092703

		Source # 1	Source #	Source #	Source #
Water Source Name		Ivan Bailey Spring			
Northing		4173536			
Easting		462741			
Parameter	Units				
TPH - GRO	mg/L	U			
TPH - DRO	mg/L	U			
TPH - ORO	mg/L	U			
BTEX	mg/L	U			
Chloride	mg/L	1.04			
Sodium	mg/L	18.0			
Total Dissolved Solids (TDS)	mg/L	NA			
Aluminum	mg/L	0.0516			
Arsenic	mg/L	0.00757			
Barium	mg/L	0.0622			
Iron	mg/L	1.23			
Manganese	mg/L	0.0688			
pH	SU	Not Reported			
Calcium	mg/L	20.6			
Sulfate	mg/L	41.8			
MBAS	mg/L	U			
Dissolved Methane	mg/L	U			
Dissolved Ethane	mg/L	U			
Dissolved Butane	mg/L	U			
Dissolved Propane	mg/L	U			
Bacteria (Total Coliform)	c/100mL	U			

Section 8 – Data on Injection Zone and Confining Zone

8.1 Geology

8.1.1 Geologic Setting

The AOR is situated within the central Alleghany Plateau of the Appalachian Basin Province, along Lewis Fork in the northern portion of Wyoming County in southern West Virginia (see Exhibit 1 General Location Map). The injection zone is stratigraphically located within the Lower Mississippian clastic sedimentary system, lying approximately 3540 feet below Crane Fork. Refer to General Location Map in the Appendix.

8.1.1 Structural Geology

The principal geologic structures of the central Appalachian Basin are broad, gently folded, southwest-northeast trending anticlines and synclines. The injection area is located on the western limb of the Pineville Anticline where strata is westerly dipping at less than five degrees. Minor undulations and flexures are typical, but faulting and tectonic features are generally absent west of the Allegheny Front, the east-facing escarpment of the Allegheny Mountains which forms the Appalachian Structural Front and the eastern extent of the Allegheny Plateau. There are no documented major fault systems in the AOR or evidence of subsurface faulting or fracturing within or in proximity to the injection or confining zones.

8.1.2 Stratigraphy

8.1.2.1 Injection Zone

The Weir sandstone is characterized as a prodelta to fluvial deposit of the lower-Mississippian clastic sequence, occurring within the Rockwell and Price Formations from Pennsylvania to southwestern Virginia and southern West Virginia. The term Weir is typically used to identify sandstones occurring in the lower part of the Mississippian section, generally within 100 to 200 feet of the base. Although the Weir can be observed at thicknesses up to 200 feet, occurring as multiple sandstone units, the thickness locally ranges from 32 to 41 feet, occurring as a single sandstone unit and demonstrating relative homogeneity. General Stratigraphic Chart in the Appendix shows the general stratigraphy of southern West Virginia and highlights the location of the Weir within the stratigraphic section.

Although the depositional environment of Lower Mississippian sandstones is not clearly defined in all areas of southern West Virginia, available information suggests that the Weir sandstone is

laterally extensive across southern and eastern West Virginia, and extending into southern Virginia. The Weir sandstone demonstrated relatively consistent thickness on all geophysical logs reviewed within a one-mile radius of the injection site. Lower Mississippian sandstones have been a significant source of hydrocarbons in southern West Virginia, exhibiting favorable characteristics (porosity and permeability) for accumulation and economic development of hydrocarbons. The porosity of these units is primary in nature, meaning porosity is related to depositional processes and not post-depositional modification. Porosity of the Weir generally averages approximately 10 percent.

8.1.2.2 Confining Zone

The confining zone overlying the Weir sandstone is identified very generally on available lithologic logs as shale or shale and sand, however geophysical log records indicate that the dominant strata is shale and interbedded sandy shale, with sand content increasing upward in the section near the base of the Big Lime limestone. The confining zone, as identified in geophysical logs, ranges in thickness between 114 and 148 feet. The top of the confining zone is identified on geophysical logs below the Big Lime limestone, near the base of a fining downward sequence where and sandy zone grades to predominately shale. The base of the confining zone is defined by the top of the Weir sandstone. There is an easily identifiable high-gamma response shale present near the middle of the confining zone.

The confining zone is laterally continuous across the AOR and adjacent area where geophysical data was reviewed. Shale, by nature and in the absence of post depositional deformation, is impervious, preventing upward fluid mobility. There is no evidence from available data that suggests the presence of subsurface faulting or fracturing within the confining zone. The depth to the top of the confining layer is generally more than 3500 feet below the surface and nearly 3000 feet below the fresh water sources documented in drilling and permit records.

8.2 Groundwater Use

A groundwater inventory was conducted that showed one drinking water spring within a one mile radius from the injection well. A sample was obtained and analyzed November 2015 (results are attached). This spring has been periodically sampled since issuance of the UIC permit. No public water wells were found within a one mile radius of the injection well. Further, baseline surface water samples were obtained from five immediate surface waters within a ¼ mile radius in the last year. Lab data for surface water samples is included in the Attachments. Please note Enervest operates another disposal well LC-19 in which the same injectable fluids would be injected in this well. Please note that the chlorides (due to the CBM water) are relatively low for produced fluids.

The baseline water sample results are provided as an Attachment to this document. The analysis were conducted by a WV Certified Laboratory (WV0233), Environmental Lab Sciences

Corporation of Mt. Juliet, Tennessee. No anomalies were identified in the surface water samples. A schedule for additional sampling will be coordinated with the WVDEP.

8.3 Chemical Compatibility

Water analyses (provided as an Attachment) show the chemical composition of the injection water for the year 2016. Based on current chemical composition and injection history, there are no anticipated compatibility issues between injection fluid and formation fluid. The produced water was tested and has a specific gravity of 1.0 mg/L (water).

8.4 Seismic

The AOR is designated as a relatively low seismic risk zone (http://earthquake.usgs.gov/earthquakes/states/westvirginia/hazards.php) with no history of major seismic activity. There are no seismically active features proximal to the AOR and the likelihood of a future seismic event of sufficient magnitude to cause future migration of injection fluid is low. For seismic history and risk mapping relevant to the AOR, see Earthquake Epicenters of West Virginia published by West Virginia Geological and Economic Survey and Seismic Hazard Map of West Virginia published by the United States Geological Survey in the Appendix.

8.4 Lithologic and Geophysical Logs

Geologic data for wells drilled within a one-mile radius of the injection site were reviewed. Lithologic logs are available for a limited number of wells reviewed. These logs are general in nature, including only general lithology and thickness observed by the driller from rotary cuttings. These logs also appear to include formation names as determined by the driller and do not include revisions and correlations based on observations and/or interpretations from geophysical logs. There are three geophysical logs available which penetrate the confining and injections zones. Additional geophysical logs were reviewed but were determined to be not deep enough to penetrate the injection or confining zones. If a geophysical log was available, the geophysical log was used for purposes of this review. If only a general lithologic log was available, the information is reported herein, but has a lower level of geologic assurance. Copies of all geologic well data used for the review are included in the Appendix.

8.5 Fluid Migration Model

The following is an estimation of the fluid migration given the information available for the study of the Weir formation within the AOR. The calculation utilizes the volumetric method of prediction of reservoir migration of the injection operation. This calculation uses reservoir height, porosity percent and saturation displacement percent to calculate fluid migration from the

well over a given amount of fluid injected. Below is the formula used for this calculation~ along with the fluid migration distance from the well and the respective values used.

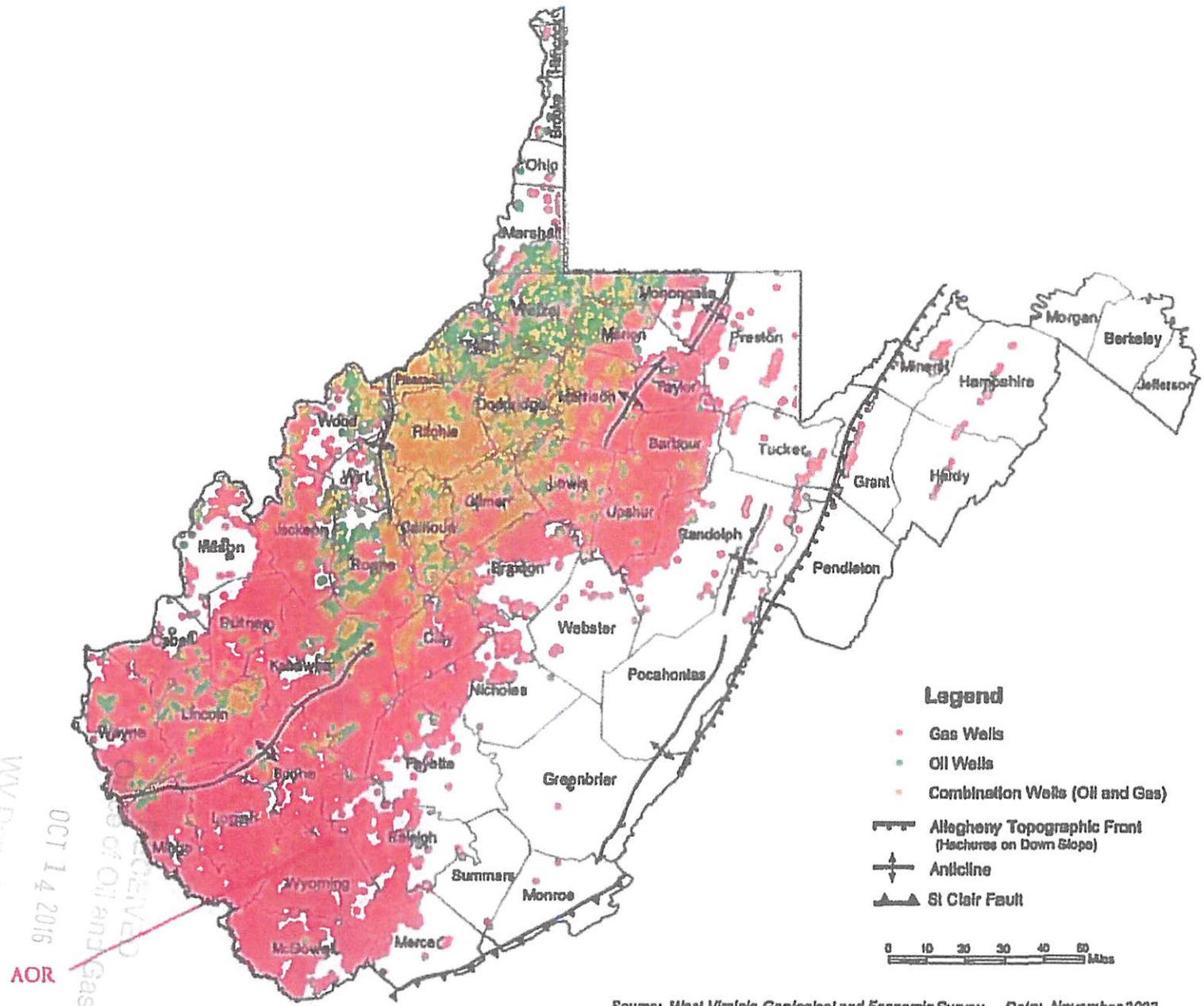
The following equation gives the constants throughout cumulative volume calculation gathered from information available for the study of the Weir formation within the AOR:

$$R = \sqrt{Q * 5.615 \left(\frac{ft^3}{bbl}\right) / 3.14 * 0.10 * 38 * 0.25}$$

Q = Cumulative Volume	R = Lateral Distance of Fluid Bank From Well Bore	
100,000	433.8586431	ft
250,000	685.9907473	ft
500,000	970.1374185	ft
1,000,000	1371.981495	ft
1,500,000	1680.327299	ft
2,000,000	1940.274837	ft

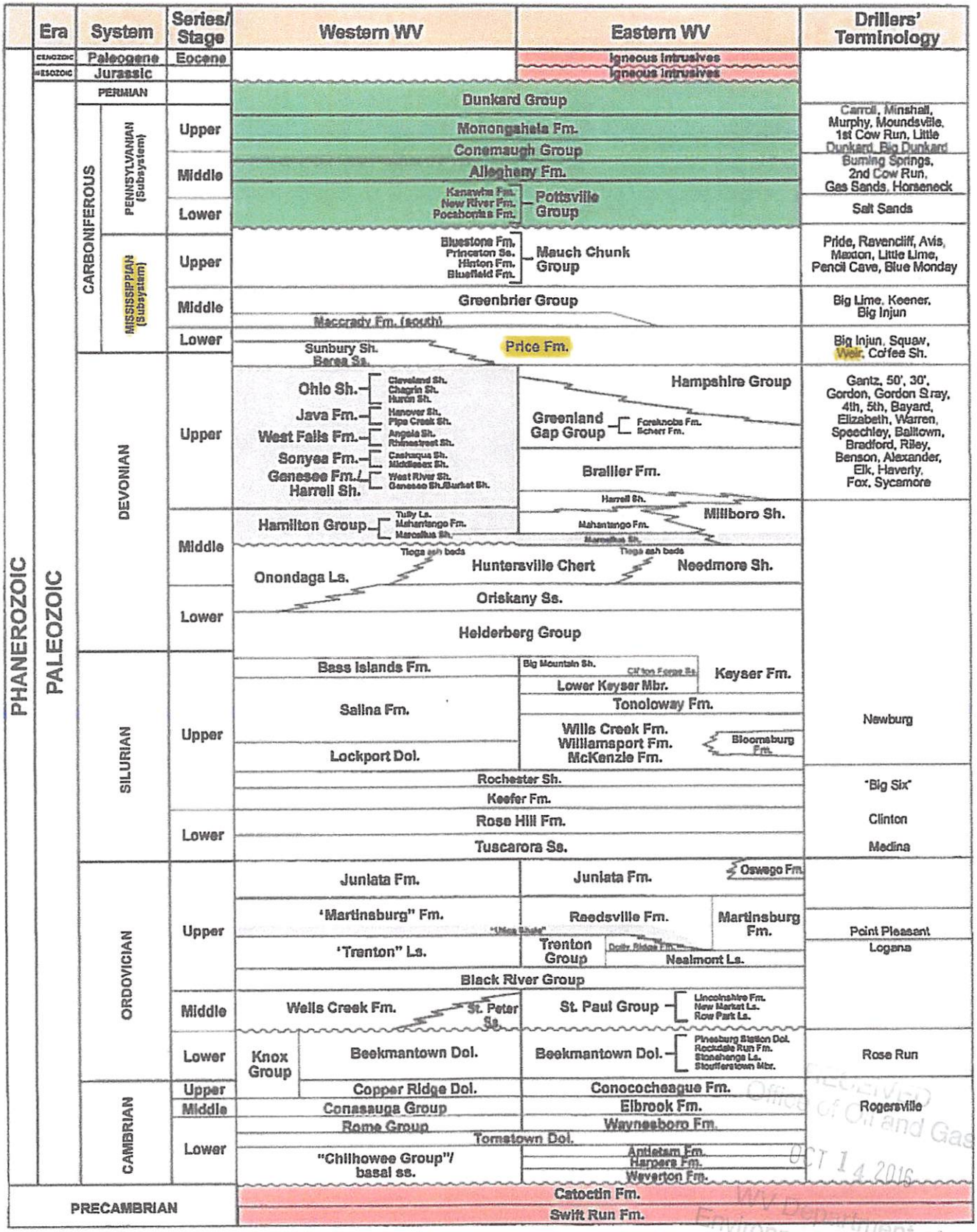
Note: Volume range based on max. approved injection rate

General Location Map



Source: West Virginia Geological and Economic Survey Date: November 2003

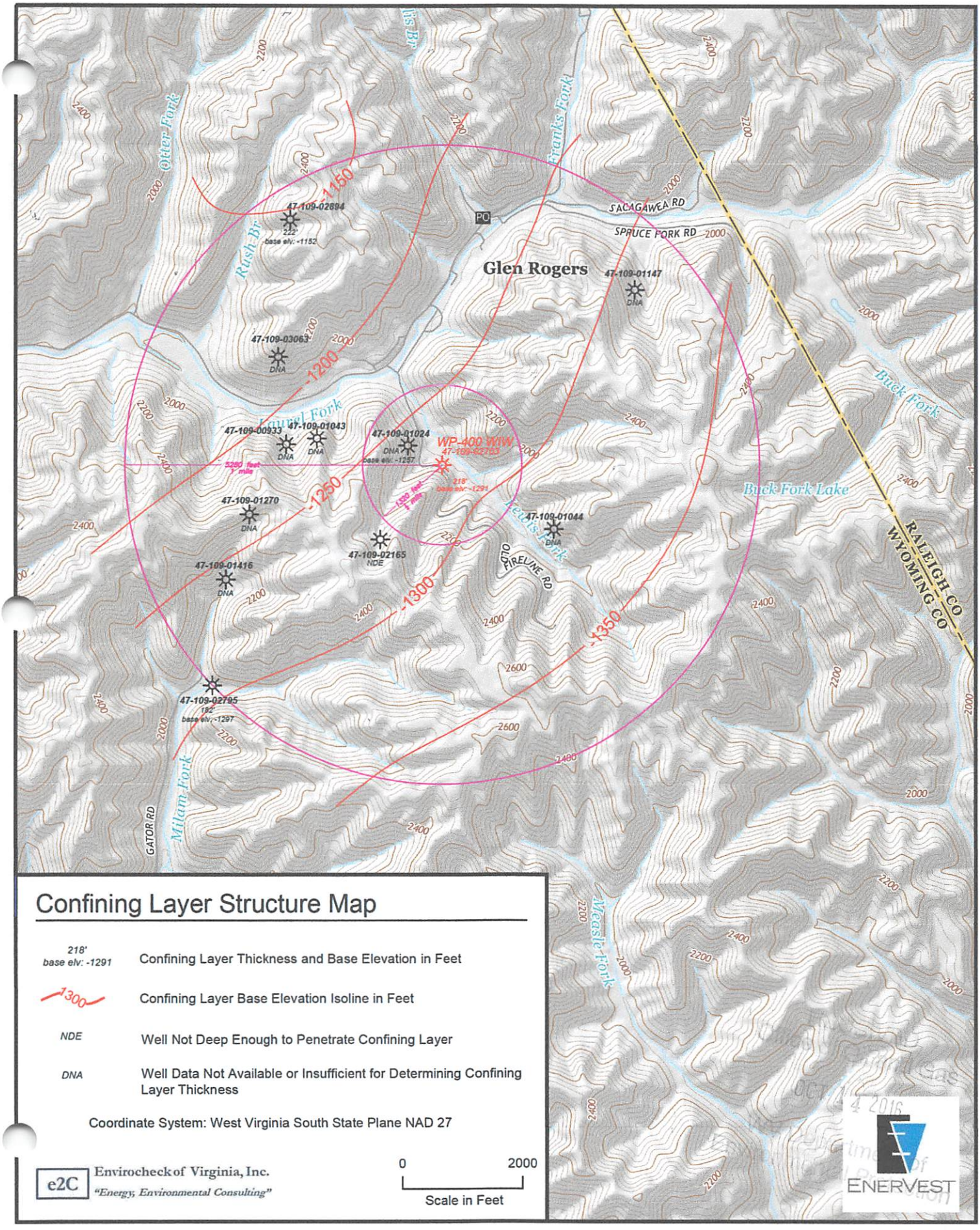
Generalized Stratigraphic Chart for West Virginia



(This chart uses current WVGES terminology and supercedes stratigraphic unit names used in older publications.)

Map-29A 2014

WVGES



Confining Layer Structure Map

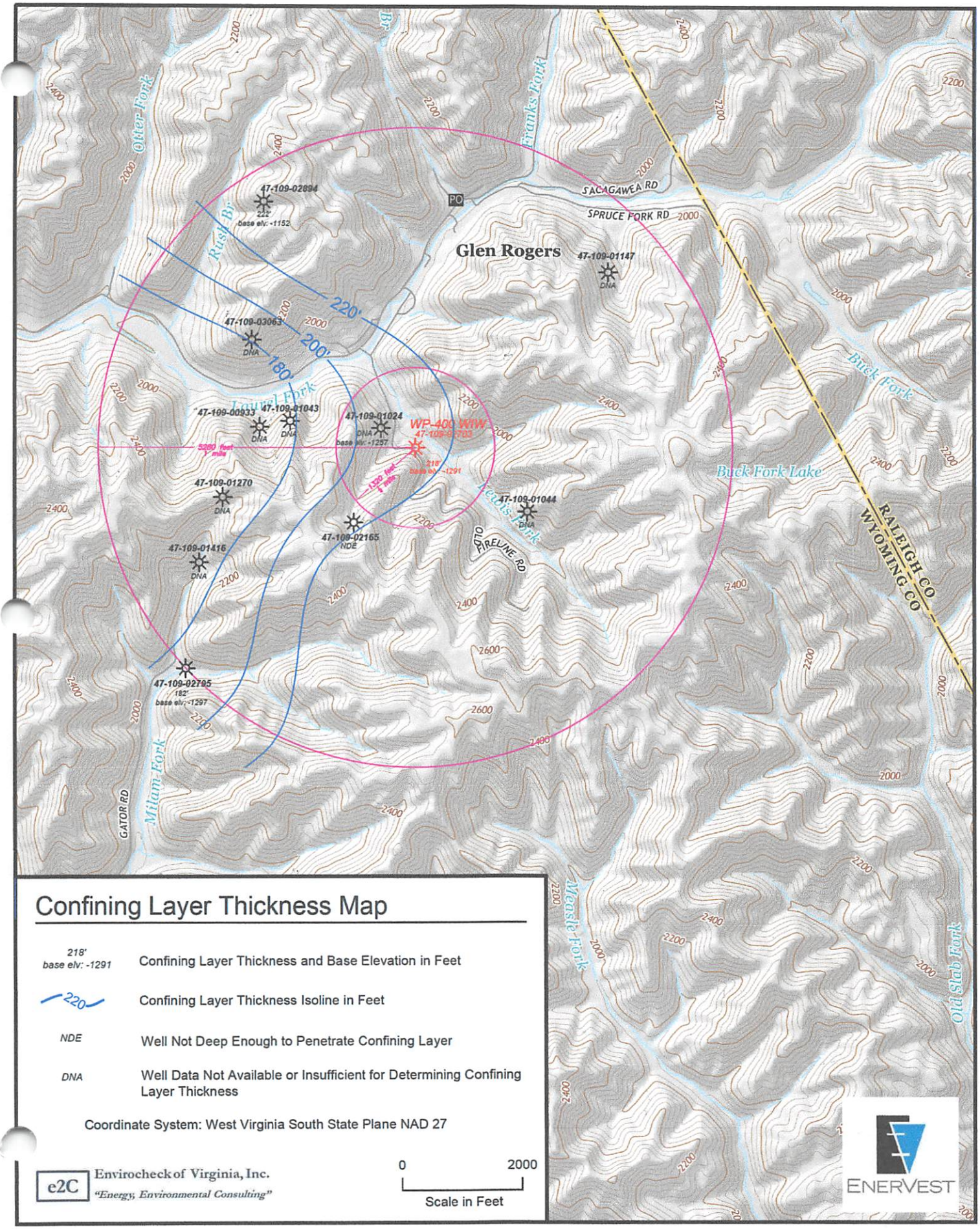
218' base elv: -1291	Confining Layer Thickness and Base Elevation in Feet
1300	Confining Layer Base Elevation Isoline in Feet
NDE	Well Not Deep Enough to Penetrate Confining Layer
DNA	Well Data Not Available or Insufficient for Determining Confining Layer Thickness

Coordinate System: West Virginia South State Plane NAD 27

e2C Envirocheck of Virginia, Inc.
"Energy, Environmental Consulting"

0 2000
Scale in Feet

ENERVEST



Confining Layer Thickness Map

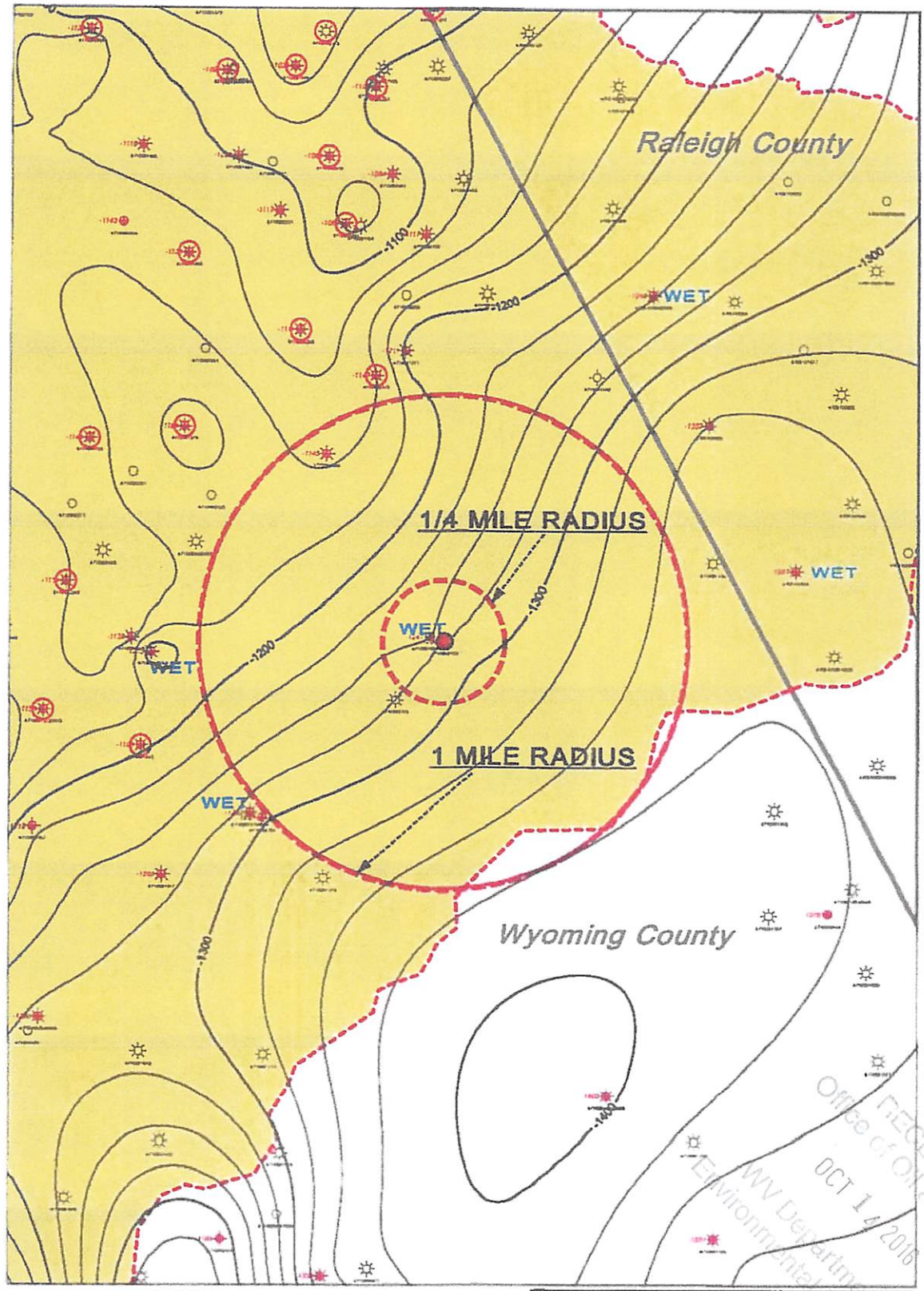
218' base elv: -1291	Confining Layer Thickness and Base Elevation in Feet
220	Confining Layer Thickness Isoline in Feet
NDE	Well Not Deep Enough to Penetrate Confining Layer
DNA	Well Data Not Available or Insufficient for Determining Confining Layer Thickness

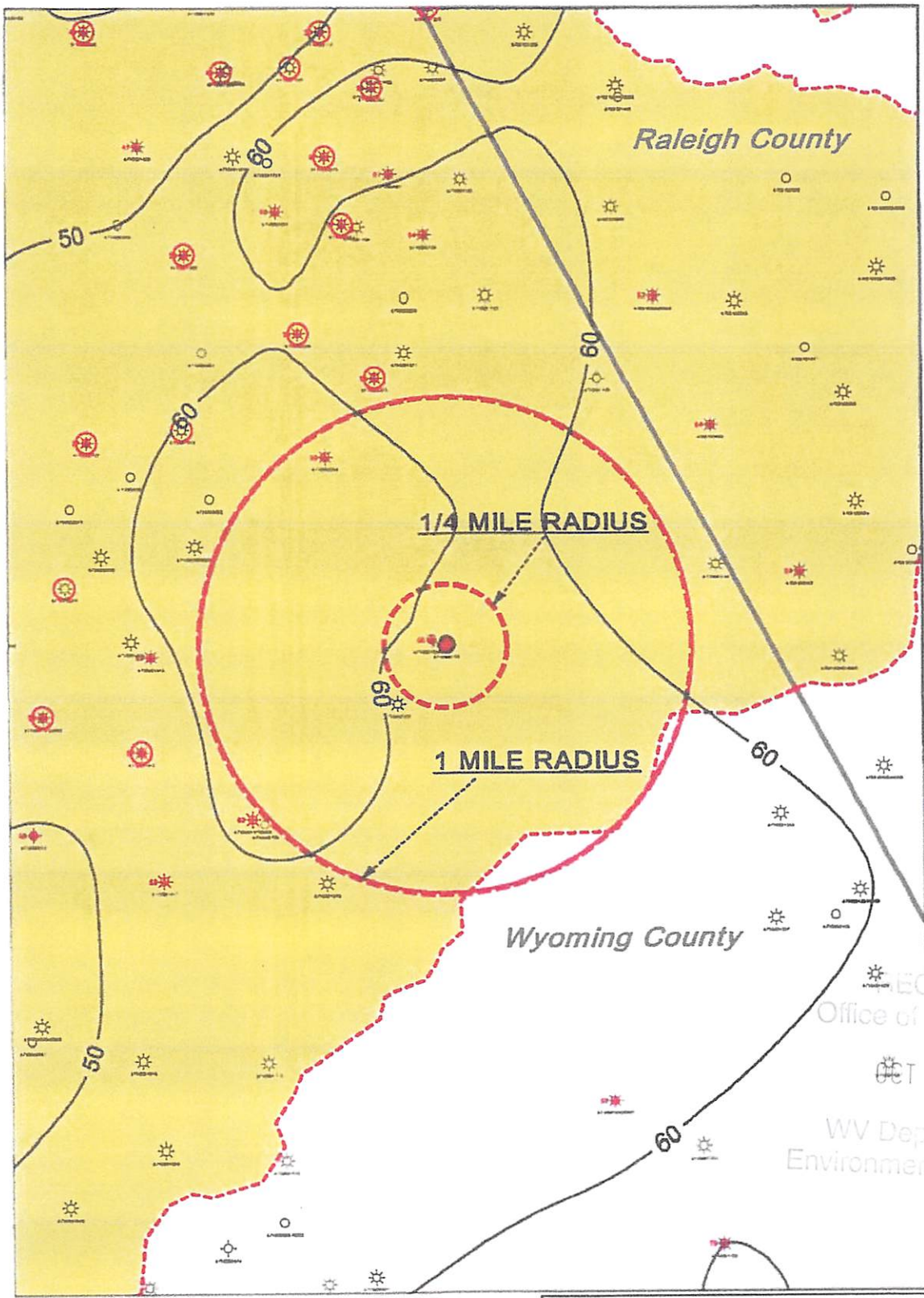
Coordinate System: West Virginia South State Plane NAD 27

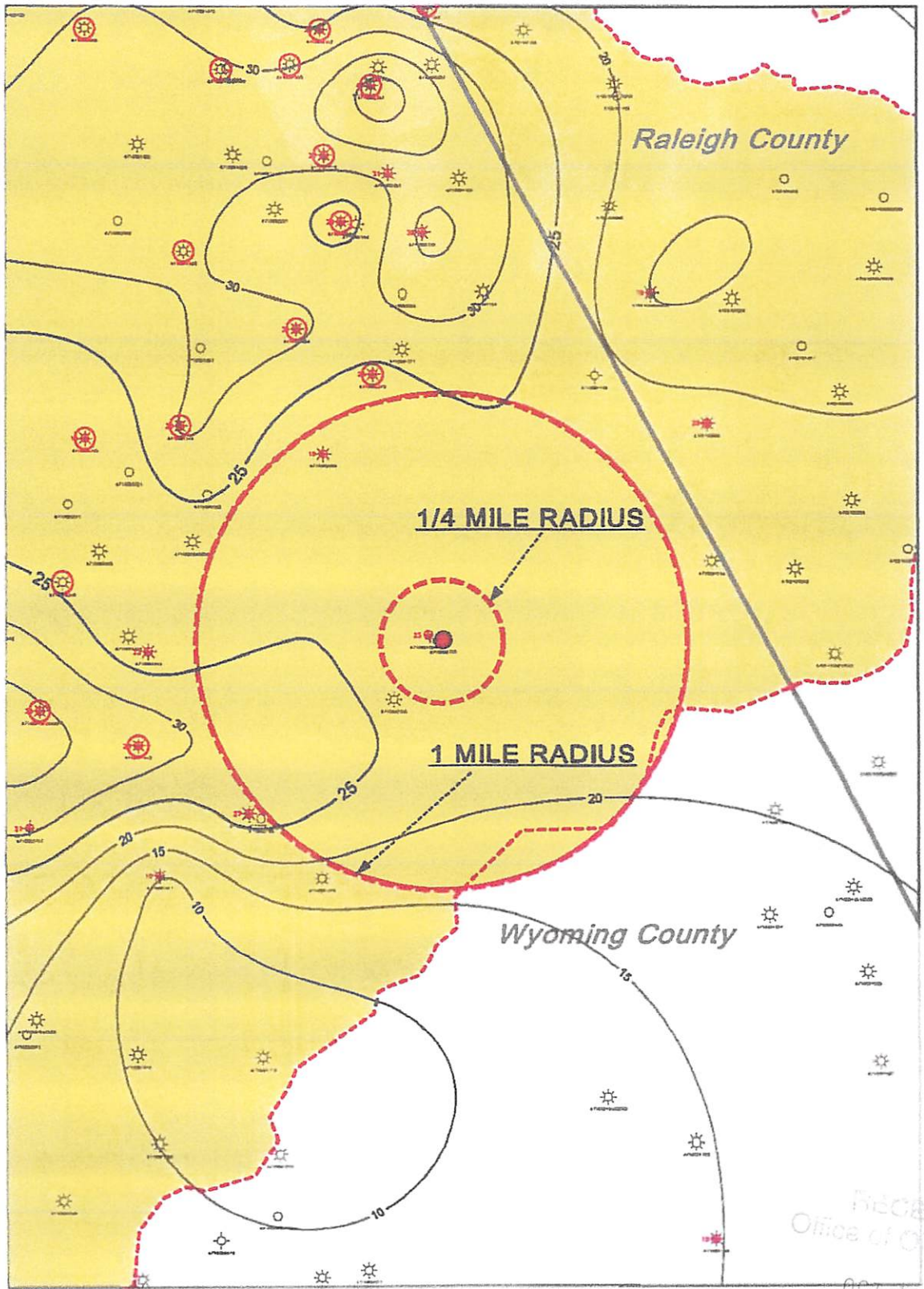
e2C Envirocheck of Virginia, Inc.
"Energy, Environmental Consulting"

0 2000
Scale in Feet

ENERVEST



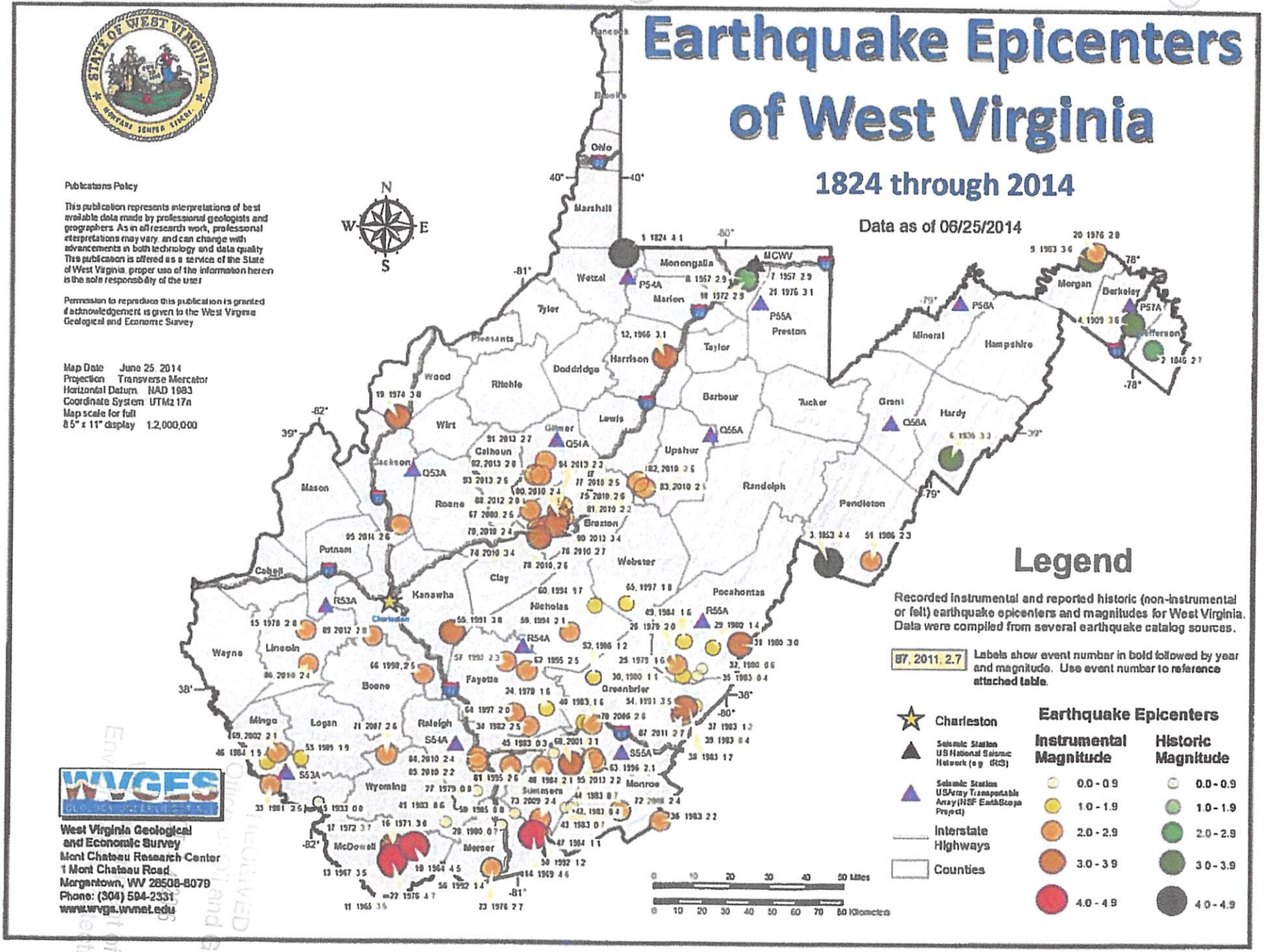




Earthquake Epicenters of West Virginia

1824 through 2014

Data as of 06/25/2014



Event Num	WVGID	County	UTC Year	UTC Month	UTC Day	UTC HH	UTC MM	UTC SS	Latitude (N)	Longitude (W)	Magnitude	Recorded	MMI	Magnitude Type	Source 1	Source 2	USGS Link
1	18240715160	Wood	1824	7	15	16	20	0.00	39.70000	-80.50000	4.1	Historic	4.0	Mb	VTSO	NCEER	
2	18461019020	Jefferson	1846	10	19	2	0	0.00	39.30000	-77.90000	2.7	Historic	3.0	<NULL>	VTSO	<NULL>	
3	18530502140	Pendleton	1853	5	2	14	20	0.00	38.50000	-79.50000	4.4	Historic	5.5	<NULL>	NCEER	Wheeler I-2737	
4	19090402070	Berkeley	1909	4	2	7	25	0.00	39.40000	-78.00000	3.6	Historic	5.0	Mb	VTSO	Wheeler I-2737	
5	19330615010	Mingo	1933	6	15	1	14	36.80	37.56800	-81.97300	0.0	Historic	0.0	<NULL>	VTSO	<NULL>	
6	19351101080	Hardy	1935	11	1	8	30	0.00	38.90000	-78.90000	3.3	Historic	4.0	<NULL>	VTSO	NCEER	
7	19570307210	Monongalia	1957	3	7	21	5	9.00	39.60000	-79.90000	2.9	Historic	3.0	Mb	VTSO	<NULL>	
8	19570313210	Monongalia	1957	3	13	21	0	41.00	39.60000	-79.90000	2.9	Historic	3.0	Mb	VTSO	<NULL>	
9	19631010000	Morgan	1963	10	10	0	0	0.00	39.65500	-78.19700	3.6	Historic	0.0	<NULL>	Wheeler I-2737	<NULL>	
10	19641125020	McDowell	1964	11	25	2	50	5.00	37.40000	-81.50000	4.5	Instrumental	0.0	Mb	ANSS	<NULL>	
11	19650426150	McDowell	1965	4	26	15	26	19.70	37.32500	-81.60200	3.5	Instrumental	0.0	MbLg	VTSO	NCEER	
12	19660928000	Harrison	1966	9	28	0	0	0.00	39.30000	-80.30000	3.1	Instrumental	4.0	<NULL>	NCEER	<NULL>	
13	19671216120	McDowell	1967	12	16	12	23	33.40	37.36000	-81.60400	3.5	Instrumental	0.0	Mb	VTSO	NCEER	
14	19691120010	Mercer	1969	11	20	1	0	9.30	37.44900	-80.93200	4.6	Instrumental	6.0	MbLg	VTSO	NCEER	
15	19700811060	Lincoln	1970	8	11	6	14	25.50	38.23000	-82.05000	2.8	Instrumental	4.0	MbLg	VTSO	NCEER	
16	19710401050	McDowell	1971	4	1	5	5	11.00	37.40000	-81.60000	3.0	Instrumental	0.0	Mb	NCEER	ANSS	
17	19720109230	McDowell	1972	1	9	23	24	29.00	37.40000	-81.60000	3.7	Instrumental	0.0	MbLg	NCEER	ANSS	
18	19720912150	Monongalia	1972	9	12	15	17	13.70	39.60000	-79.90000	2.9	Historic	3.0	Mb	VTSO	NCEER	
19	19741020150	Wood	1974	10	20	15	13	55.60	39.06000	-81.60900	3.8	Instrumental	5.0	Mb	VTSO	NCEER	Further Info
20	19760130180	Morgan	1976	1	30	18	58	49.80	39.68300	-78.17000	2.8	Instrumental	0.0	Lg	USGS	ANSS	Further Info
21	19760506180	Monongalia	1976	5	6	18	46	8.10	39.60000	-79.90000	3.1	Historic	4.0	Mb	VTSO	NCEER	
22	19760619050	McDowell	1976	6	19	5	54	13.40	37.34400	-81.60200	4.7	Instrumental	5.0	Mb	VTSO	NCEER	Further Info
23	19760703200	Mercer	1976	7	3	20	53	45.80	37.32000	-81.13000	2.7	Instrumental	0.0	MbLg	VTSO	<NULL>	
24	19780814040	Fayette	1978	8	14	4	50	5.40	37.93900	-80.87400	1.6	Instrumental	0.0	Mc	VTSO	ANSS	
25	19790916090	Pocahontas	1979	9	16	9	39	22.60	38.09900	-80.24000	1.6	Instrumental	0.0	Mc	ANSS	<NULL>	
26	19790919000	Pocahontas	1979	9	19	0	45	57.40	38.11000	-80.24300	2.0	Instrumental	0.0	Mc	ANSS	<NULL>	
27	19791031080	Raleigh	1979	10	31	8	32	47.30	37.61700	-81.20700	0.8	Instrumental	0.0	Mc	ANSS	<NULL>	
28	19800410220	Mercer	1980	4	10	22	33	15.70	37.48700	-81.08600	0.7	Instrumental	0.0	Mc	VTSO	ANSS	
29	19800921100	Pocahontas	1980	9	21	10	2	46.30	38.17500	-80.07000	1.4	Instrumental	0.0	Mc	VTSO	ANSS	
30	19801016030	Pocahontas	1980	10	16	3	48	7.60	38.06600	-80.21500	1.1	Instrumental	0.0	Mc	VTSO	ANSS	
31	19801105210	Pocahontas	1980	11	5	21	48	14.20	38.18800	-79.93600	3.0	Instrumental	0.0	ML	ANSS	<NULL>	
32	19801125070	Pocahontas	1980	11	25	7	44	4.00	38.09500	-80.12300	0.6	Instrumental	0.0	Md	VTSO	ANSS	
33	19811130170	Mingo	1981	11	30	17	33	11.00	37.63000	-82.20000	2.5	Instrumental	0.0	Mc	VTSO	ANSS	
34	19820623160	Fayette	1982	6	23	16	17	34.10	37.87000	-80.95700	2.5	Instrumental	0.0	Md	VTSO	ANSS	
35	19830121050	Pocahontas	1983	1	21	5	33	20.40	38.06700	-80.14400	0.4	Instrumental	0.0	Md	VTSO	ANSS	
36	19830526010	Monroe	1983	5	26	1	4	44.80	37.50600	-80.31600	2.2	Instrumental	0.0	Md	VTSO	ANSS	
37	19830610000	Greenbrier	1983	6	10	0	18	40.40	37.94800	-80.16300	1.2	Instrumental	0.0	Md	VTSO	ANSS	
38	19830610001	Greenbrier	1983	6	10	0	24	57.00	37.95100	-80.18900	1.2	Instrumental	0.0	Md	VTSO	ANSS	
39	19830610002	Greenbrier	1983	6	10	0	31	8.30	37.93800	-80.16800	0.4	Instrumental	0.0	Md	VTSO	ANSS	
40	19830720040	Greenbrier	1983	7	20	4	41	40.90	37.88500	-80.69100	1.6	Instrumental	0.0	Md	VTSO	ANSS	
41	19830725030	Wyoming	1983	7	25	3	27	0.20	37.49600	-81.35200	0.6	Instrumental	0.0	Md	VTSO	ANSS	
42	19831113160	Summers	1983	11	13	16	51	6.70	37.55600	-80.77500	0.4	Instrumental	0.0	Md	VTSO	ANSS	
43	19831113170	Monroe	1983	11	13	17	50	50.10	37.55900	-80.75300	0.7	Instrumental	0.0	Md	VTSO	ANSS	
44	19831125160	Monroe	1983	11	25	16	27	47.80	37.56800	-80.74500	0.7	Instrumental	0.0	Md	VTSO	<NULL>	
45	19831223100	Summers	1983	12	23	10	51	21.90	37.76600	-80.83700	0.3	Instrumental	0.0	Md	VTSO	ANSS	
46	19840202050	Mingo	1984	2	2	5	10	19.70	37.71700	-82.21800	1.9	Instrumental	0.0	Md	VTSO	ANSS	
47	19840311040	Summers	1984	3	11	4	1	38.90	37.47400	-80.90000	1.1	Instrumental	0.0	Md	VTSO	ANSS	
48	19841009050	Summers	1984	10	9	5	33	31.50	37.71300	-80.89100	2.1	Instrumental	0.0	Md	VTSO	ANSS	
49	19841221130	Pocahontas	1984	12	21	13	12	21.90	38.19800	-80.20800	1.6	Instrumental	0.0	Md	VTSO	ANSS	
50	19850614070	Mercer	1985	6	14	7	57	10.20	37.53400	-81.02000	0.8	Instrumental	0.0	Md	VTSO	ANSS	
51	19860226210	Pendleton	1986	2	26	21	53	20.80	38.50700	-79.29200	2.3	Instrumental	0.0	Md	VTSO	ANSS	
52	19861220080	Greenbrier	1986	12	20	8	13	12.80	38.05800	-80.64300	1.2	Instrumental	0.0	Md	VTSO	ANSS	
53	19890319100	Logan	1989	3	19	10	7	55.80	37.73500	-82.06400	1.9	Instrumental	0.0	Md	VTSO	ANSS	
54	19910422010	Greenbrier	1991	4	22	1	1	20.20	37.94200	-80.20500	3.5	Instrumental	0.0	Md	VTSO	ANSS	Further Info

Event Num	WVGID	County	UTC Year	UTC Month	UTC Day	UTC HH	UTC MM	UTC SS	Latitude (N)	Longitude (W)	Magnitude	Recorded	RMS	Magnitude Type	Source 1	Source 2	USGS Link
55	19910628180	Kanawha	1991	6	28	18	34	55.50	38.23100	-81.33500	3.0	Instrumental	0.0	Mb	VTSO	ANSS	
56	19920329200	Mercer	1992	3	29	20	16	48.20	37.31400	-81.14900	1.4	Instrumental	0.0	Md	VTSO	ANSS	
57	19920506210	Fayette	1992	5	6	21	20	23.90	38.11800	-81.06900	2.3	Instrumental	0.0	Md	VTSO	ANSS	
58	19921124020	Summers	1992	11	24	2	26	50.70	37.45700	-80.88400	1.2	Instrumental	0.0	Md	VTSO	ANSS	
59	19940204070	Nicholas	1994	2	4	7	40	32.40	38.23600	-80.75900	2.1	Instrumental	0.0	Md	VTSO	ANSS	
60	19940619080	Nicholas	1994	6	19	8	36	41.30	38.33900	-80.64000	1.7	Instrumental	0.0	Md	VTSO	ANSS	
61	19951115100	Raleigh	1995	11	15	10	29	24.80	37.71700	-81.04300	2.6	Instrumental	0.0	Md	VTSO	ANSS	
62	19951228230	Fayette	1995	12	28	23	48	30.40	38.08400	-80.96800	2.5	Instrumental	0.0	Md	VTSO	ANSS	
63	19960811090	Greenbrier	1996	8	11	9	11	21.30	37.73100	-80.62800	2.1	Instrumental	<NULL>	Mc	ANSS	<NULL>	
64	19970222140	Fayette	1997	2	22	14	32	33.10	37.92100	-81.02700	2.0	Instrumental	<NULL>	Mc	ANSS	<NULL>	
65	19970315050	Webster	1997	3	15	5	56	36.40	38.34700	-80.48400	1.8	Instrumental	0.0	Md	VTSO	ANSS	
66	19970315050	Kanawha	1998	10	2	10	1	6.90	38.06800	-81.46600	2.5	Instrumental	0.0	Md	VTSO	ANSS	
67	20001016170	Braxton	2000	10	16	17	56	13.80	38.63600	-80.92000	2.5	Instrumental	0.0	Md	VTSO	ANSS	
68	20011204210	Summers	2001	12	4	21	15	13.90	37.72600	-80.75200	3.1	Instrumental	0.0	Mb	VTSO	ANSS	
69	20020327080	Mingo	2002	3	27	8	25	3.30	37.75300	-82.17100	2.1	Instrumental	0.0	Md	VTSO	ANSS	
70	20060711120	Greenbrier	2006	7	11	12	1	43.10	37.87800	-80.64900	2.6	Instrumental	0.0	Mb	CERI	VTSO	
71	20070830120	Wyoming	2007	8	30	12	52	9.34	37.75300	-81.63600	2.6	Instrumental	0.0	Lg GS	CERI	USGS ENS	Further Info
72	20080129010	Monroe	2008	1	29	1	4	20.70	37.54480	-80.50980	2.4	Instrumental	<NULL>	Md	CERI	ANSS	
73	20090411180	Summers	2009	4	11	18	11	9.07	37.51330	-80.89570	2.4	Instrumental	<NULL>	Md	CERI	ANSS	
74	20100404090	Braxton	2010	4	4	9	19	14.01	38.59900	-80.91617	3.4	Instrumental	0.0	MbLg	CERI	USGS ENS	Further Info
75	20100129010	Braxton	2010	4	29	1	36	22.59	38.68567	-80.81483	2.6	Instrumental	0.0	MbLg	CERI	USGS ENS	Further Info
76	20100429120	Braxton	2010	4	29	12	38	53.43	38.64700	-80.87200	2.7	Instrumental	0.0	MbLg	USGS ENS	CERI	Further Info
77	20100429130	Braxton	2010	4	29	23	26	39.47	38.72200	-80.80300	2.5	Instrumental	0.0	Lg GS	CERI	USGS ENS	Further Info
78	20100507100	Braxton	2010	5	7	10	26	3.47	38.60650	-80.91317	2.6	Instrumental	0.0	MbLg	CERI	USGS ENS	Further Info
79	20100508030	Braxton	2010	5	8	3	3	0.62	38.62300	-80.91133	2.4	Instrumental	0.0	Md	CERI	USGS ENS	Further Info
80	20100724090	Braxton	2010	7	24	9	15	44.13	38.67533	-80.82017	2.4	Instrumental	0.0	Md	CERI	USGS ENS	Further Info
81	20100725030	Braxton	2010	7	25	3	48	70.00	38.67900	-80.79700	2.2	Instrumental	0.0	Md	USGS ENS	LDEO	
82	20100815040	Lewis	2010	8	15	4	38	47.38	38.81833	-80.42983	2.5	Instrumental	0.0	Md	CERI	USGS	Further Info
83	20100821030	Upshur	2010	8	21	3	16	21.99	38.79250	-80.39767	2.5	Instrumental	0.0	Md	USGS ENS	LDEO	Further Info
84	20100826040	Raleigh	2010	8	26	4	22	15.19	37.74833	-81.20467	2.4	Instrumental	0.0	Md	CERI	USGS	
85	20100826041	Raleigh	2010	8	26	4	24	55.39	37.72733	-81.20433	2.2	Instrumental	0.0	Md	CERI	USGS ENS	
86	20100913150	Lincoln	2010	9	13	15	8	46.47	38.10000	-82.03400	2.4	Instrumental	0.0	Md	CERI	ANSS	
87	20110825050	Greenbrier	2011	8	25	5	59	13.76	37.91600	-80.21533	2.7	Instrumental	4.0	Md	CERI	USGS	Further Info
88	20120111190	Braxton	2012	1	10	19	38	58.66	38.70400	-80.95900	2.8	Instrumental	4.0	unk	CERI	USGS	Further Info
89	20120316150	Boone	2012	3	16	15	5	55.00	38.21200	-81.71400	2.8	Instrumental	2.0	MbLg	CERI	USGS NEIC	Further Info
90	20130331140	Braxton	2013	3	31	14	1	24.03	38.64500	-80.83317	3.4	Instrumental	5.0	Mw	CERI	USGS NEIC	Further Info
91	20130720110	Gilmer	2013	7	20	11	38	46.18	38.89567	-80.88700	2.7	Instrumental	<NULL>	MbLg	CERI	USGS ENS	Further Info
92	20130730060	Gilmer	2013	7	30	6	9	4.85	38.83933	-80.90867	2.8	Instrumental	<NULL>	Md	CERI	USGS ENS	Further Info
93	20130816110	Gilmer	2013	8	16	11	2	21.04	38.84150	-80.93867	2.6	Instrumental	3.0	MbLg	CERI	USGS ENS	Further Info
94	20131013090	Braxton	2013	10	13	9	20	58.55	38.70117	-80.82417	2.2	Instrumental	<NULL>	Md	CERI	USGS ENS	Further Info
95	20131019080	Greenbrier	2013	10	19	8	41	57.43	37.74767	-80.64333	2.2	Instrumental	<NULL>	Md	CERI	USGS ENS	Further Info
96	20140606220	Jackson	2014	6	6	22	15	40.79	38.64383	-81.58550	2.6	Instrumental	<NULL>	Md	CERI	USGS ENS	Further Info

Data as of June 25, 2014. For a more detailed listing, please download the West Virginia Earthquake spreadsheet from WVGES at http://www.wvgs.wvnet.edu/www/earthquakes/seismic.html

If you view this map and data as a PDF, you can click any of the blue hyperlinked text to view further information on a web site.

Please note that USGS Links, above, are considered "beta" at the time of this publication and USGS may change destinations, pages, etc. afterward.

Definition of terms on next page.

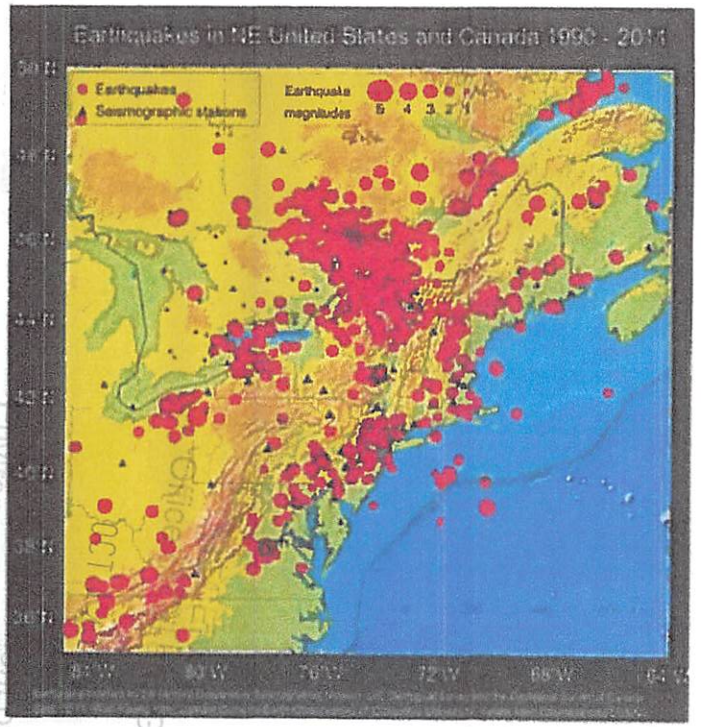
Definitions and Explanations:

- **County:** the name of the county where the epicenter was located, derived from spatial selection.
- Dates and times are in Coordinated Universal Time (UTC) for Year, Month, Day, Hours (HH), Minutes (MM) and Seconds (SS). (For Eastern Standard Time, the offset is - 5 hours).
- **Magnitude (Mag):** Magnitude numbers indicative of an earthquake's relative size and is the measured maximum motion as recorded by a seismograph. The numbers are pulled from various sources; the primary source whenever possible.
- **Recorded:** refers to the means by which magnitudes were recorded: if they were reported as "felt" (Historical) or recorded via scientific instrumentation (Instrumental) as retrieved from Source1 or Source2.
- **Latitude (Lat_N)** and **Longitude (Lon_W)** values are expressed in decimal degrees for the northern (_N) and western (_W) hemispheres, respectively.
- **MMI:** The Modified Mercalli Intensity scale for epicenter intensity, usually designated with Roman numerals. Visit USGS at http://earthquake.usgs.gov/learn/topics/mercalli.php for further information.
- **Mag_Type:** Magnitude type code; the method used in measuring magnitudes (e.g., *Mb* for "body-wave", *Mc* for "coda amplitude", *Md* for "coda duration").
- **Depth_KM:** The reported depth of the earthquake hypocenter or focus (below the epicenter on the surface) in kilometers.

For other or more detailed earthquake and seismological definitions, please visit the USGS (http://earthquake.usgs.gov/learn/glossary/) and Rapid Earthquake Viewer (http://rev.seis.sc.edu/definition.html).

Sources (Source1 and Source2):

- VTSO – Virginia Tech Seismological Observatory (Primary Source)
- ANSS – Advanced National Seismic System
- CERI – Center for Earthquake Research and Information
- LDEO – Lamont-Doherty Earth Observatory
- NCEER – National Center for Earthquake Engineering Research
- USGS ENS – United States Geological Survey, Earthquake Notification Service
- Wheeler I-2737 – Wheeler, Russell L., *Earthquakes In and Near the Northeastern United States, 1638-1998* (Used only as reference here)

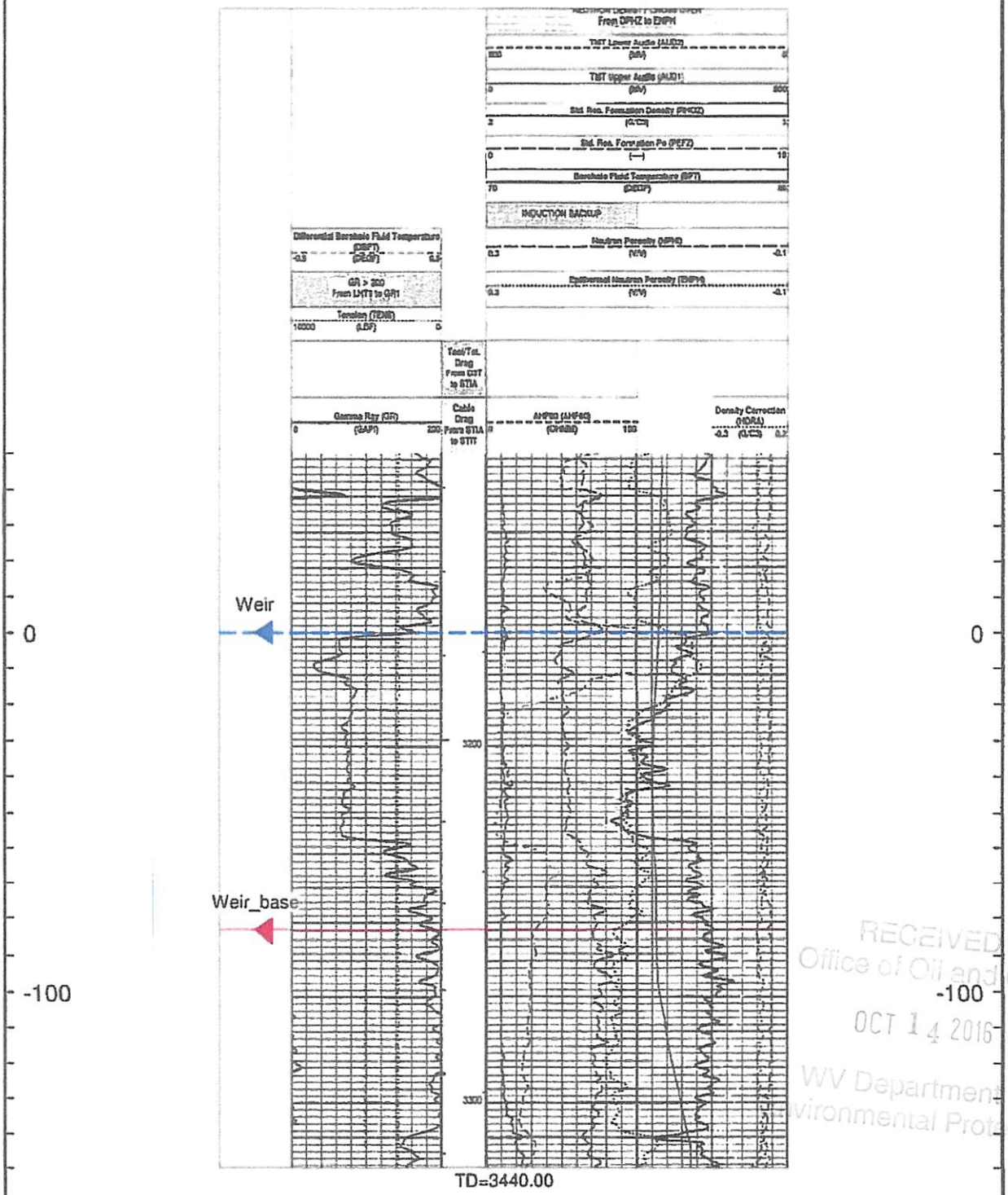


Northeastern United States and southeastern Canadian earthquakes from 1990 to 2011.
Image courtesy of the Lamont-Doherty Earth Observatory (Won-Young Kim)
of Columbia University, New York. Used by permission.

West Virginia Geological and
Economic Survey
http://www.wvgs.wvnet.edu/

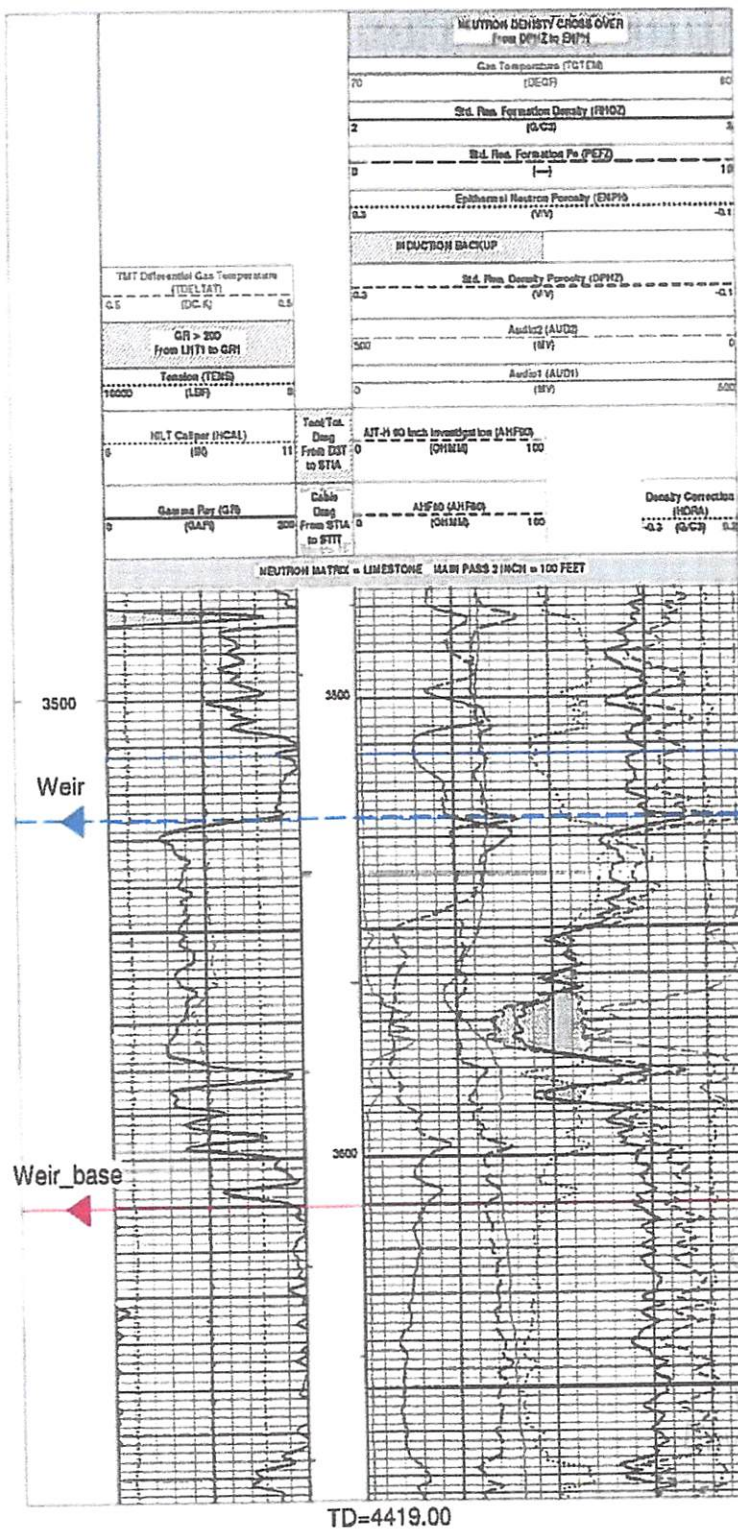
4710902703

Penn Virginia Oil & Gas Corp.
HEARTWOOD FOREST LAND 400WIW



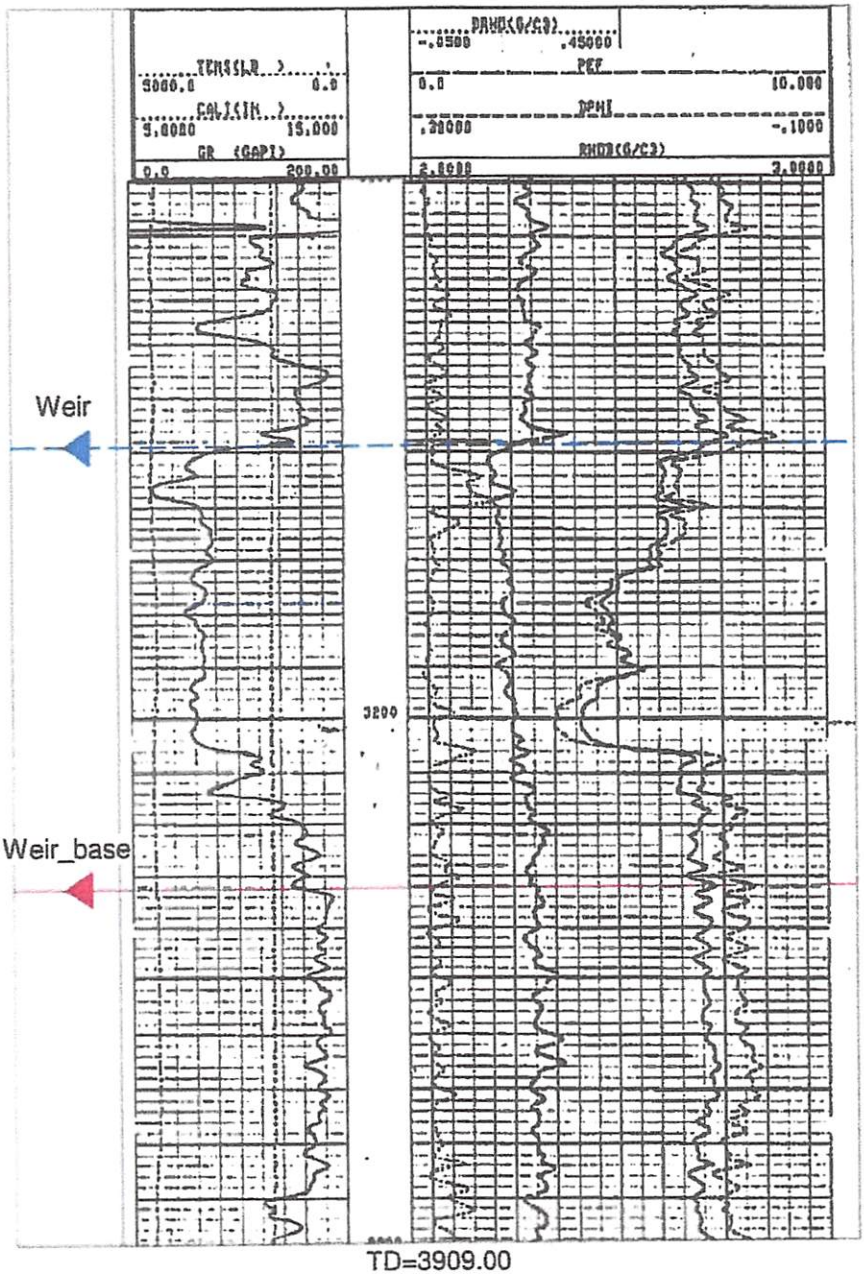
4710902894

Penn Virginia Oil & Gas Corp.
#385 WP 385



47109010240000

Penn Virginia Oil & Gas Corp.
#099 Y&O COAL 99



Section 9-Operating Requirements/Data

The WP-400 WIW has previously been permitted as a UIC Class 2D injection facility. Production casing of 7" 23# was run to a total depth of 3,356' with 4-1/2" 9.5# tubing and compression packer set at 3,119'. Virgin reservoir pressures obtained from previous reports indicated the Weir's pressure of 850 psig with a maximum injection pressure of 1,034 psig and 2,300 psig bottom hole pressure. Historically, approximately 425 barrels per hour were injected at this location. Projected use is estimated to be the same. The facility utilizes three contained surface ponds as filtration. If needed, 4-400bbl tanks are available for use. Injection fluids run though these tanks would use four types of filtration:

1. A 200 micron bag filter for removing heavy particulate matter.
2. A 50 micron bag type filter unit
3. A 20 micron cartridge type filter unit
4. A 5 micron cartridge type filter unit.

MIT inspections shall be performed a minimum of every five years or anytime service work is performed to the well or anytime routine daily/monthly inspections show the possibility of an integrity problem. Routine daily/monthly inspections shall consist of casing and tubing pressures monitoring, equipment and manifold, well head, tanks, containments and equipment inspections for corrosion and potential leaks. Monthly manifold and pipeline integrity step tests to 10% over the maximum permitted injection pressure. All daily/monthly inspections and test shall be recorded, logged and filed in the plant office. In the event of any suspected well, manifold or pipeline integrity problem the well will be immediately shut in and injection activities shall cease with proper notifications being made. In the event of any well integrity problem the well will be made "static" and evaluation of data shall be performed and remedial work will begin once a plan of action has been put into place. Any injection fluids shall be transported and disposed of in an alternated state approved disposal facility or permitted UIC Class 2D well.

Please find enclosed **Appendix G.**

APPENDIX G

Wells Serviced by Injection Wells

API #	Operator	Producing Formation
	See following sheets	

Make as many copies as necessary and include page numbers as appropriate.

EnerVest Operating- Wells in West Virginia 2014

API #	Well #
4710900652T	Y&O COAL #29-T
4710900652	Y&O COAL #29-A
4710901095	Y&O COAL # 110
4710901137	Y&O COAL # 124
4710901151	Y&O COAL#125
4710901138	Y&O Coal #126
4710901139	Y&O Coal #127
4710901152	Y&O Coal #128
4710901140	Y&O Coal #138
4710901254	Y&O Coal #143
4710901255	Y&O Coal #144
4710901256	Y&O Coal #145
4710901319	WP-242
4710901357	WP-252
4710901446	WP-276
4710901565	WP-279
4710901502	WP-293
4710901572	WP-311
4710901573	WP-316
4710901595	WP-318
4710901599	WP-320
4710901694	WP-328
4710901968	WP-339
4710901969	WP-340
4710902112	WP-352
4710902233	WP-357R
4710902368	WP-369
4710902345	WP-370
4710901351	LC-13
4710901733	LC-197
4710902020	LC-208
4710902120	LC-220
4710902124	LC221
4710902113	LC-222
4710900046	LC-8871
4710900195	LC-9120
4710900199	LC-9141
4710900255D	LC-9174
4710900022D	LC-9176
4710900260	LC-9217
4710901513	LC-81
4710901592	LC-153

4710901634	LC-174
4710901994	LC209
4710902489	LC-245
4710902025	LC-180R
4710900245	Y&O COAL # 23
4710900415	Y&O COAL # 39
4710900508	Y&O COAL # 45
4710900787	Y&O COAL # 78
4710901134	Y&O COAL # 121
4710901135	Y&O COAL # 122
4710901136	Y&O COAL # 123
4710901206	Y&O Coal #137
4710901308A	WP 224 Annulus
4710901308	WP 224 Tubing
4710901326	WP-237
4710901344	WP-238
4710901328	WP-239
4710901327	WP-240 Annulus
4710901329	WP-241
4710901371	WP-259
4710901451T	WP-265 Tubing
4710901451	WP-265 Annulus
4710901418	WP-277
4710901459	WP-281
4710901566	WP-283
4710901548	WP-284
4710901489	WP-285R
4710901500	WP-291R
4710901671	WP-292
4710901597	WP-295
4710901598	WP-296
4710901628	WP-310
4710901629	WP-313
4710901559F	WP-315
4710902066	WP-342
4710902067	WP-343
4710902126	WP-350
4710902127	WP-355
4710902228	WP-364
4710902436	WP-375
4710902520	WP-377R
4710902521T	WP-382 Tubing
4710902521	WP-382 Annulus
4710902695	WP-386
4710902498C	WP-HC-206B
4710902900C	WP-HC-214BR
4710901350R	LC-6

4710901495	LC-71
4710901771	LC-121
4710902137	LC-148
4710902115	LC-224
4710902226	LC-231
4710902250	LC-235
4710902285	LC-236
4710902492	LC-246
4710902486	LC-247
4710902690	LC-254
4710901355	LC-7
4710901440W	LC-26
4710901441	LC-27
4710901675	LC-63
4710901543	LC-70R
4710901794	LC-98
4710901866	LC-102
4710901633	LC-108
4710901796	LC-115
4710901574	LC-117
4710901544	LC-118
4710902007	LC-162
4710901578	LC-169
4710901687	LC-185
4710901689	LC-190
4710901690	LC-193
4710902347	LC-230
4710902348	LC-238
4710900163	LC-9058
4710902403	LC-241
4710902979	LC-251H
4710901667C	LC-16C-117
4710901669C	LC-25C-108
4710901673C	LC-27C-87R2
4710901694C	LC-31C-194
4710902030C	LC-35C-27
4710901742C	LC-38C
4710901755C	LC-39C
4710901743C	LC-40C
4710901758C	LC-42C
4710901744C	LC-43C
4710901745C	LC-44C
4710901925C	LC-45C
4710901746C	LC-46C
4710901763C	LC-54C-63
4710901812C	55C
4710901813C	LC-57C

4710901937C	58C
4710901906C	60CR
4710901903C	61C-102
4710901878C	62C-121
4710901993C	LC-72C
4710902068C	LC-79C
4710902033C	LC-80C
4710902049C	LC-81C
4710901985C	LC-82C-147
4710902094C	SLC-4
4710902095C	SLC-5
4710901518	LC-82
4710901606	LC-89
4710901591	LC-92
4710901630	LC-93
4710901593	LC-154
4710901680	LC-181
4710900271D	LC-9237
4710901517	LC-68
4710900239	LC-9193
4710901793	LC-86
4710901550	LC-90
4710902197	LC-133
4710902199	LC-173
4710901610	LC-167
4710901882	LC-91R2
4710902490	LC-94R2
4710902518	LC-95R
4710902196	LC-99
4710900044	LC-8869
4710900348	LC-9446
4710900124	LC-9023
4700501578	LC-9
4700501579	LC-11
4700501580	LC-12
4700501751	LC-140R
4700501738	LC-211
4700501755	*LC-215
4700501757	LC-217
4700501777	LC-219
4700500666	LC-8912
4700500777	LC-9122
4700501610	LC-15
4700501626	LC-75
4700501642	LC-144
4700501665	LC-145R
4700501666	LC-177

4700501673	LC-182
4700501674	LC-183
4700501690	LC-201
4704501361	LC-112
4704501354	LC-139
4704501296	LC-189
4710901353	LC-4
4710901354	LC-5
4710901356	LC-10
4710901432F	LC-17
4710901454	LC-18
4710901434	LC-20
4710901435	LC-21
4710901436	LC-22
4710901437	LC-23
4710901438W	LC-24
4710901439	LC-25
4710901442	LC-35
4710901443	LC-36
4710901984	LC-72
4710902841	LC-255
4710901497	LC-76
4710901865	LC-77R
4710901511	LC-78
4710901852	LC-116
4710901786	LC-120
4710901867	LC-122
4710901545	LC-125
4710901874	LC-128
4710901584	LC-129
4710901609	LC-130
4710901798	LC-132
4710901648	LC-176
4710901702	LC-192
4710901986	LC-203
4710901936	LC-206
4710901987	LC-207
4710902005	LC-213
4710902200	LC-214
4710902114	LC-223
4710902227	LC-232R
4710902435	LC-242
4710902448	LC-243
4710902842	LC-256
4710900185	LC-9121
4700502176	ESTRS #1
4700502211	ESTRS #4

4708100962	WP-257
4710901372	WP-260
4710901373	WP-261
4710901374	WP-262
4710901411	WP-267
4710901413	WP-269
4710902859T	WP-383 Tubing
470902859A	WP-383 Casing
4710901414	WP-271
4710901424	WP-272
4710901415	WP-273
4710902004	WP274R
4710901417	WP-275
4710901695	WP-329
4710901699	WP-330
4710902091	WP-341
4710902076	WP-344
4710902375	WP-367
4710902367	WP-368
4710902474	WP-371R
4710902371	WP-372
4710902461	WP-374R
4710902894	WP-385
4710902491	WP-379
4710900742	Wyoming Land #75
4710900810	Y&O #2
4710900002	Y&O #8
4710900005	Y&O #9
4710900009	Y&O #12
4708100126	Y&O #24
4710900376	Y&O #33
4710900478	Y&O #43
4710900498	Y&O #44
4710900541D	Y&O #47
4710900558	Y&O #48
4710900583	Y&O #50
4710900605	Y&O #51
4710900591	Y&O #52
4710900611	Y&O #53
4710900623	Y&O #54
4710900696	Y&O #69
4710900700	Y&O #71
4710900708	Y&O #72
4710900755	Y&O #76
4710900757F	Y&O #77
4710900909	Y&O #95
4708100607	Y&O #96

4710902406C	LC-HC-107C
4708101385C	Kanawha S.# 1B
4708101386C	Kanawha S. #1C
4708101388C	Saddler # 1-B
4708101389C	Saddler # 1-C
4708101391C	Tygrett # 1B
4708101392C	Tygrett #1 C
4708101458C	SL #3
4708101409C	Henderson 1B
4708101502C	MM # 12 C
4710901425	WP-278 ANNULUS
4710901425T	WP-278 TUBING
4710901868	WP-282
4710901479	WP-286
4710901539	WP-287
4710901483	WP-288
4710901484	WP-289
4710901904	WP-299
4710902125	WP-300R
4710901819	WP-301
4710902000	"WP-309
4710901555A	WP-312 ANNULUS
4710901555	WP-312 TUBING
4710901579	WP-314
4710901801	WP-319
4710901649	WP-321R
4710901650	WP-322
4710901918	WP-324
4710901713	WP-325
4710901818	WP-326
4708101253	WP351
4710902136	WP-353
4710902165	WP-354
4710902201	WP-356
4710902223	WP-358
4710902214	WP-359
4710902210	WP-361
4710902249	WP-365
4710902224	WP-366
4710901325	WL-229
4710901324	WL-230
4710901321	WP-235
4710901332	WL-244
4710901333	WL-245
4708100958	WP-248
4710901349	WP-249
4710901375	WP-254

4710901024	Y&O #99
4710901094	Y&O #108
4708100865	Y&O #111
4710901096	Y&O #112
4708100894	Y&O #113
4708100900	Y&O #119
4710901150	Y&O #120
4708100901	Y&O #133
4710901184	Y&O #134
4710901185	Y&O #135
4710901186	Y&O #136
4708100936	Y&O #158
4708100932	Y&O #159
4708100937	Y&O #184
4708100934	Y&O #223
4710903020	WP-HC-217B
4710900043	LC-8868
4710900169	LC-9090
4710901504	LC-66
4710902366	LC-240
4710901632	LC-107R
4710901554	LC-109
4710900134	LC-9041
4710900224	LC-9160
4710901547	LC-110
4710900062	LC-8911
4710901803	LC-97
4710901795	LC-103
4710901696	LC-105
4710901784	LC-106
4710901663	LC-179
4710901697	LC-186
4710901698	LC-187
4710901688	LC-188
4710901747	LC-198R
4710901776	LC-200R
4710901875	LC-204
4710902060	LC-210
4710902274	LC-233
4710902496	LC-244
4710900129	LC-8982
4710901300	LC-2
4710901524	LC-84
4710901938	LC-85
4710902848	LC-111
4710902051	LC136
4710901700	LC-156

4710902326C	WP HC-207B
4710902327C	WP HC-207C
4710902312C	WP HC-208B
4710902313C	WP HC-208C
4710902329C	WP HC-209B
4710902330C	WP HC-209C
4710902537C	WP HC- 210B
4710902538C	WP HC-210C
4710902544C	WP-HC-211B
4710902570C	WP-HC-212B
4710902571C	WP-HC-212C
4710903002C	WP-HC-216B
4710902839C	PC-HC-1309B
4710902840C	PC-HC-1309C
4710902027C	WP-73C
4710902028C	WP-74C
4710902029C	WP-78C
4710902364C	LC HC-104B
4710902365C	LC HC-104C
4710902494C	LC HC-108B
4710902391C	WP HC-202B
4710902392C	WP HC-202C
4710902350C	WP HC-203B
4710902351C	WP HC-203C
4710902466C	WP HC-204B
4710902456C	WP HC-204C
4710902401C	WP HC-205B
4710902402C	WP HC-205C
4710902805	WPP-005B
4710902806C	WPP-005C
4710902901C	WP-HC-214CR
4708101419C	BCC-002B
4710901992C	LC-71C
4710901877C	LC-63C
4710901883C	LC-64C
4710902057C	LC-69CR
4704501433C	LC-83C
4700501672C	LC-85C-184
4710902062C	LC-126C
4710902061C	LC-202C
4710902280C	LC-HC-101B
4710902281C	LC-HC-101C
4710902217C	LC-HC-102
4710902248C	LC-HC-103
4710902395C	LC-HC-106B
4710902396C	LC-HC-106C
4710902404C	LC-HC-107B

4710901594	LC-161
4710901584	LC-165R
4710901885	LC-170
4710902140	LC-225
4710902132	LC-226
4710902370	LC-239
4710902516	LC-248
4710900612	LC-10339
4710901288	LC-1
4710901294	LC-3
4710901348	LC-8
4710901515	LC-61
4710901491	LC-64
4710901492	LC-65
4710901520	LC-83
4710901499	LC-88
4710901556	LC-96
4710901551	LC-101
4710902203	LC-104R
4710901585	LC-166
4710901662	LC-171
4710901608	LC-172
4710902017	LC-212
4710900537	LC-10236
4710900567	LC-10237
4710900732F	LC-11515
4710901510	LC-62R
4710902198	LC-156
4710901703	LC-164
4710902682	LC-253
4710902519	LC-249
4710900772	LC-12329
4710901612	LC-157
4710900804	POCAHONTAS LAND #1
4710900797	POCAHONTAS LAND #2
4710900798	POCAHONTAS LAND #3
4710900799	POCAHONTAS LAND #4
4710900807	POCAHONTAS LAND #6
4710900828	POCAHONTAS LAND #7
4710900636	Y&O COAL #56
4710900659	Y&O COAL #57
4710900662	Y&O COAL #58
4710900678	Y&O COAL #61
4710900682	Y&O COAL #63
4710900686	Y&O COAL #66
4710900687	Y&O COAL #67
4710900862	Y&O COAL #84

4710900863	Y&O COAL #85
4710900868	Y&O COAL #87
4710900897	Y&O#92 (Cook)
4710900906	Y&O COAL #93
4710900984F	Y&O COAL #102
4710901097	Y&O COAL #109
4710901207	Y&O COAL #129
4710901208	Y&O COAL #139
4710901209	Y&O COAL #140
4710901259	Y & O -160
4710901347	WP-251
4710901312	WP-228
4710901314	WP-233
4710901315	WP-234
4710901334	WP-236
4710901320	WP-243
4710901358	WP-253
4710901423	WP-268
4710901445	WP-270
4710901480	WP-290
4710901943	WP-333
4710902211	WP-362
4710902234	WP-363
4710902346	WP-373
4710902437	WP-376
4710902495	WP-381
4710901823C	WP-5C-234
4710900001	Y&O COAL #6
4710900028	WYOMING LAND #17
4710900683	Y&O COAL #64
4710900735F	Y&O COAL #74
4710900834	Y&O COAL #80
4710900835	Y&O COAL #81
4710900860	Y&O COAL #82
4710900864	Y&O COAL #86
4710900892	Y&O COAL #88
4710900890	Y&O COAL #89
4710900896	Y&O COAL #90
4710900905	Y&O COAL #91
4710900910	Y&O COAL #97
4710900911	Y&O COAL #98
4710900986	Y&O COAL #106
4710901093	Y & O Coal #107
4710901182	Y&O COAL #131
4710901183	Y&O COAL #132
4710901187	Y&O COAL #141
4710901190	Y&O COAL #142

4710901330	WP-225
4710901310	WP-226
4710901311	WP-227 (CASING)
4710901345	WP-246
4710901412	WP-255
4710901368	WP-256
4710901825	WP-317
4710901640	WP-323
4710901981	WP-327
4710901760	WP-332R
4710901939	WP-334
4710901944	WP-335
4710901982	WP-336
4710901983	WP-337
4710902012	WP-338
4710902129	WP-345
4710902130	WP-348
4710902111	WP-347
4710902116	WP-348
4710902526	WP-380
	North Wyoming Compressor
	Clarks Gap Compressor
	Rollins Branch Compressor
	Huff Creek Comp.
	Kopperston Compressor
	Clear Fork Compressor
	North Itmann Compressor
	Kanawha Shoals Compressor
	SL #3 Compressor
	Saddler Compressor
	WPP-005 Compressor
	Tygrett Compressor
	Drybranch Compressor
	BCC-002 Compressor
	PC-HC-1309 Compressor
	Pax Compressor
	LC-HC 101 Compressor
	LC-HC-102 Compressor
	LC-HC-104 Compressor
	LC-HC-106 Compressor
	LC-HC-107 Compressor
	WP-HC-202 Compressor
	WP-HC-204 Compressor
	WP-HC-205 Compressor
	WP-HC-206 Compressor
	WP-HC-207 Compressor
	WP-HC-208 Compressor

	WP-HC-209 Compressor
	WP-HC-210 Compressor
	WP-HC-212 Compressor
	WP-HC-214 Compressor
	WP-HC-216 Compressor

Section 10-Monitoring

Monitoring of all injection parameters shall be reported and logged daily consisting of startup/shutdown pressures, total injection volumes, injection rates, average injection pressures and annulus pressure along with the integrity of all tanks, containments, equipment and manifolds/lines. WR-40's shall be completed and filed in accordance with state regulations and kept on file at the facility office and be made available upon request. Fluids manifests shall be completed documenting every load of fluid delivered to the facility for disposal. These manifests shall report the following:

- Operator
- Well Name, Number, and API number
- Amount of fluid
- Type of fluid
- Contractor Hauling Fluid
- Name of Driver/Truck number
- Fluid Sampling/Testing, if required

Records of this information shall be kept at the facilities office and shall be made available upon request.

Attached is a map of the well site with numbered/marked monitoring locations.

APPENDIX H

GROUNDWATER PROTECTION PLAN

Facility Name: WP-400 WIW

County: Wyoming

Facility Location:

Postal Service Address:	300 Capitol Street, Suite 200		
Charleston, WV 25301			
Latitude :	37.704905	Longitude:	-81.421473

Contact Information:

Person:	Chris Veazey
Phone Number:	304-343-5505
E-mail Address:	cveazey@enervest.net

Date: 12/01/2015

1. A list of all operations that may contaminate the groundwater.

- Water trucks unloading produced fluids (oil, glycols, road salt, diesel fuel)
- Produced fluids (chlorides, metals, and petroleum)

2. A description of procedures and facilities used to protect groundwater quality from the list of potential contaminant sources above.

- Lined filtration ponds
- Secondary containment for all tanks.
- Use of concrete unloading bays with cameras.
- All bag filters located in secondary containment unit.
- Proper disposal of all solid waste (filtered/bag filters)

3. List procedures to be used when designing and adding new equipment or operations.

-Provide site security to prevent unauthorized entry.
-Use of real time security cameras and alarms.
-Design for secondary containment for all pipelines and storage tanks.
-Consult with WVDEP.

4. Summarize all activities at your facility that are already regulated for groundwater protection.

-AST Act
-This permit

5. Discuss any existing groundwater quality data for your facility or an adjacent property.

See Section 7 of this report, creeks sampled monthly, no groundwater monitoring wells within a mile of the site.

6. Provide a statement that no waste material will be used for deicing or fill material on the property unless allowed by another rule.

It is Enervest operating policy that any and all wastes generated at this facility will be properly managed Enervest currently maintains a 2 year blanket permit with the Raleigh County Solid Waste Authority.

7. Describe the groundwater protection instruction and training to be provided to the employees. Job procedures shall provide direction on how to prevent groundwater contamination.

- Enervest provides and conducts monthly environmental meetings for all employees.

- UIC well is inspected two - three times while in operations.

- All waste generated will be placed in containers to prevent surface water or precipitation to affect surficial soils.

- Tank battery has overfill and spill alarms that prohibit overfills.

- All contract drivers and employees have understood and agreed to Enervest's operational environmental policies.

8. Include provisions for inspections of all GPP elements and equipment. Inspections must be made quarterly at a minimum.

- Enervest employees are on-site daily. Any leaks are repaired immediately. Tank battery has overfill and spill alarms that prohibit unauthorized delivery. - Pipeline is inspected monthly and injection pressure is monitored in real time.

Signature: Barry K Long

Date: 9/22/16

Section 12 -Plugging and Abandonment

After completion of injection fluids or in the event the well inspection data concludes that a well integrity issue may occur, the injection well will be plugged and abandoned in accordance with all applicable WVDEP regulations. Prior to abandonment, the small building on-top of the well ahead will be inspected for asbestos containing materials (ACM) and will be properly demolished per applicable regulations. The plan is to have the well in static condition, remove the 4-1/2", 9.5# tubing and packer. Run a CBL to determine the top of cement and a production backoff point. Tubing will then be ran back into the hole with cement plugs balanced over all perforated intervals in the well spacing from 50 feet below the perforations to 50 feet above the perforations. The cement plugs will then be displaced with freshwater and the tubing removed from the well. The 7" production casing shall then be backed off at free point and a 100 foot balanced cement plug shall be set at the backoff point and a 50 foot cement plug set at the surface. Upon completion of the well abandonment, the well head will be removed, cemented to surface and permanent abandonment monument will be erected. Finally. a completed WR-38 form will be submitted to the OOG within 30 days of well abandonment.

Section 13 – Additional Bonding

Proper performance bonding is in place for WP-400 well as previously provided by Enervest Operating. The OOG has that information on file.

(4/25)

APPENDIX I

Requirement for Financial Responsibility to Plug/Abandon an Injection Well

To: WV Department of Environmental Protection
Office of Oil and Gas
601 57th Street, SE
Charleston, West Virginia 25304-2345
ATTN: Underground Injection Control Program

From: _____

_____

_____

_____

Date: _____

Subject: Underground Injection Control (UIC) Permit Application
UIC2D1092703
Requirement for Financial Responsibility

I, Barry Lay, verify in accordance with 47CSR13-13.7.g., that I will maintain financial responsibility and resources to close, plug, and abandon underground injection wells(s) in a manner prescribed by the Chief of the Office of Oil and Gas.

Name: Barry Lay

Signature: Barry K Lay

Date: 9/22/16

APPENDIX J

Site Security for Commercial Facilities

Provide a detailed description of the method(s) utilized at the facility to restrict or prohibit illegal dumping of unauthorized waste or vandalism at the facility.

1. Complete enclosure of all wells, holding tank/pits and manifold assemblies within a chain link or other suitable fencing; and

2. Require that all gates and other entry points be locked when the facility is unattended; or

3. Providing tamper-proof seals for the master valve on each well (a "lock-out" or chain & padlock system would be more secure; however, these devices could create a potential safety hazard if the well needed to be quickly shut in due to an emergency); and

4. Installing locking caps on all valves and connections on holding tanks, unloading racks, and headers.

Due to site construction, the only vehicle access is through a locked gate. Security cameras monitor the truck unloading bays, tank battery, ponds, and unloading controls. Fluid levels in the ponds are monitored continuously by Enervest personnel through telemetry. All valves are locked and only authorized representatives have access to the tank battery.

The injection well pump building is locked at all times. Upon departure from deliveries, gate is locked by the driver.

APPENDIX K

Identify permit or construction approvals received or applied for under the following programs:

Permit/approvals	ID Number
Hazardous Waste Management Program under RCRA	NA
NPDES Program	NA
Prevention of Significant Deterioration (PSD)	NA
Nonattainment Program	NA
Dredge or Fill	NA
NPDES/NPDES – Stormwater	NA
WVDEP – Office of Waste Management (OWM) – Solid Waste Facility	Blanket permit with Raleigh County Landfill
WVDEP – OWM – RCRA (Hazardous Waste TSD or Transporter)	NA
WVDEP – OWM – UST	NA
CERCLA – Superfund	NA
WV Voluntary Remediation – Brownfields	NA
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act	NA
Well Head Protection Program (WHPP)	NA
Underground Injection Control (UIC)	UIC 2D1092703
Toxic Substances Control Act (TSCA)	NA
Best Management Plans	NA
Management of Used Oil	Recycled as needed
Other Relevant Permits (Specify):	
AST Act	Tanks registered with DWWM
	055-00001730-733