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	HG Energy LLC		
Existing UIC Permit ID Number	2D0871056	UIC Well API Number	47-087-01056

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

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WV Department of
Environmental Protection

dep

- [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): _____

Reviewed by (Sign): _____

Date Reviewed: _____

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 # 2D0871056 API # 47-087-01056 WELL # Kaufman W-19

Section I. Facility Information

Facility Name: Kaufman W-19 Disposal

Address: 5260 Dupont Rd

City: Spencer State: WV Zip: 25276

County: Roane

Location description:
On the waters of Millstone Run in Smithfield District of Roane County

Location of well(s) or approximate center of field/project in UTM NAD 83 (meters):
Northing: 4,289,969.6 Easting: 477,119.8

Environmental Contact Information:
Name: Matt McGuire Title: HSE Mgr
Phone: 304-483-3266 Email: mmcguire@hgenergyllc.com

Section 2. Operator Information

Operator Name: H G Energy LLC
Operator ID: 494497948

Address: 5260 Dupont Rd
City: Parkersburg State: WV Zip: 26101
County: Wood

Contact Name: Roger Heldman Contact Title: Operations Mgr
Contact Phone: 304-481-9061 Contact Email: rheldman@hgenergyllc.com

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:

Oil & natural gas production. Water produced from approximately 75 shallow wells is injected into the Big Injun Sand.

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:

Print Name: Eric Grayson

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: Eric Grayson

Date: 5/21/18

[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 No. 6

1. Water produced in conjunction with crude oil from the Wm Kaufman lease is separated from the oil and gathered in a 100 bbl storage tank near the location of Kaufman W – 17. This water along with water produced from nearby Clover Field Big Injun wells is filtered and in injected into Kaufman W- 19. A schematic of the production facility is show in the attached Fig No. 1.

2. The attached Fig No. 2 is a schematic of the as drilled injection well, Wm Kaufman W-19, with Big Injun (injection zone), Big Lime, and shale (confining zones) marked. Tubing and casing depths along with cement info is also shown on the schematic.

3. See Appendix A & B

4. This disposal well was drilled in 1964 and logged with GR/ Density/ Caliper logs. A copy of The United States Department of the Interior Report No 6992 (Reservoir Study of the William Kaufman Clove-Rush Run Oilfield, Roane County, WV by Karl-Heinz Frohne) is shown in Fig No. 3. This study provides a detailed study of the reservoir based on a core from Wm Kaufman No. 7 located approx. 2600' South West of Kaufman W- 19.

SECTION No. 7

1. A ¼ mile fixed radius from the injection well, Wm Kaufman W-19 was utilized for the AOR investigation.

2. Attached in Fig No. 4 is a map showing the wells within the AOR. The wells within the AOR are listed in APPENDIX C. The Well records available are also enclosed in Fig No. 5. The local PSD (Clover PSD) was contacted and the required Affidavit obtained. It is enclosed in APPENDIX D.

3. The USDWs in this area vary from approximately 20'-to 100'. Six potential sources of drinking water were identified within the AOR. TDS was measured as part of the analysis.

4. The wells within the AOR were located and shown on the attached map (Fig No. 5). All but one of the residences were determined to be utilizing the Clover PSD for their water source. The remaining well and one additional well, located outside the AOR were sampled for analysis. The results of this analysis is shown in APPENDIX E.

5. The samples were collected by a WVDEP certified laboratory as set forth in 40CFR Part 136.

6. No corrective action is deemed necessary buy the operator at this time.

7. This application if for a single disposal well and not an area permit.

SECTION No. 8

The Clover Field is located on the western flank of the Arches Fork Anticline. The reservoir boundary, as determined from early drilling, was controlled on the west and down dip by water and on the east and up dip by a decrease in permeability. The Big Injun Sandstone is the productive interval in this filed. The Keener is a very fine grained to coarse grained, tightly cemented with very low permeability, sandstone. The Keener grades into the oil productive Pocono Big Injun Sandstone. The Big Injun is light gray to light green, very fine to medium grained, moderate to well sorted, sub angular, calcite or dolomite cemented sandstone. The Big Lime overlays the Keener and the Pocono Shale underlies the Big Injun. Both are thick impermeable formations. The Big Injun on the Kaufman lease can be described as follows:

Gross sand thickness: 24'
Pay thickness: 12.5'
Permeability: .8 md
Porosity: 15%
Connate water saturation: 65%

The full core report from Wm Kaufman No. 7 is included in the United States Bureau of Mines Department of the Interior Report No 6992 (Reservoir Study of the William Kaufman Clover-Rush Run Oilfield, Roane County, WV by Karl-Heinz Frohne) is shown in Fig No. 3.

SECTION No. 9

The current operating conditions of this water disposal well are:

Average daily rate or volume- 10 bbls

Maximum Daily rate – 150 bbls

Average daily injection pressure- 500 psig

Maximum injection pressure – 686 psig

2. The attached Appendix G lists the wells served by this diposal well.
3. The injection fluid was sampled an analized for the required constituants. A copy of the analysis is attached in the enclosed Fig No 6.
4. The only additive to the injected fluid is a scale and corrosion inhibitor combination (Baker Hughes WCW219). This material is added to the injection water at a concentration of 50 PPM. A MSDS is enclosed in Fig No. 7.
5. The tubing / casing annulus of this injection well is filled with fresh water with a packer fluid (corrosion inhibitor).
6. In the event of a well failure the injection will be immediately shut in. The surface casing in this injection well is set at 466' and cemented to surface. The depth of the casing is below any know USDW in this area. If there was a failure of the injection string (tubing) there would still be three layers of protection between the injection fluid and the USDW's. Those three layers are the 4 ½" long string, 8 5/8" surface casing, and the cement outside of the 8 5/8" casing. The tubing casing annulus is left open during injection so any failure on the injection string will be noticed soon after any failure. In the event of a mechanical integrity failure that cannot be repaired immediately the water will either be disposed of in a commercial injection well or the producing wells shut in until the issues is resolved.

SECTION No. 10

1. Pressure and injection volumes are monitored daily for this injection well. Those volumes and pressure are recorded by the lease operator and reported weekly. That information is reported to the WVDEP monthly on form WR -40. This process has worked successfully for the 25 yrears this well has been utilized as a disposal well.

2. Currently the majority of the fluid injected at this well is transported by pipeline to the storage tank that services this injection well. A small portion of that fluid is transported by a small truck with a 500 gals tank from the producing well to the storage tank that serves this injection well. Those volumes are recorded at the producing well weekly. The only fluids injected are the fluids transported via pipeline and this small truck.

SECTION No. 11

Please see APPENDIX H for Ground Water Protection Plan for this facility.

SECTION No. 12

This injection well has surface casing set at 466' and cemented to surface. The 4 1/2" long sting is set at 2272' and cemented to approximately 2025'. The well will be plugged to the standards set by the WVDEP at the time it is plugged. If the well were to be plugged today the cement plugs would be set as follows:

Plug No 1 - 2200'-2100
Free point, cut and POH w/ 4 ½" casing – est 1975'
Plug No 2 – 2025'-1925'
Plug No 3 – 1100'-1000'
Plug No 4 – 515'-415' (base of surface casing)
Plug No 5 – 100'-0
6 % gel between cement plugs.

SECTION No. 13

Additional $5000 bond was posted at a prior renewal of this permit and we would ask that that bond remain in effect.

SECTION No. 14

See APPENDIX I

SECTION No. 15

This injection facility is remotely located and accessed via a roadway shared with a few residences. When unattended a locked gate blocks the access to this facility.

See APPENDIX J

SECTION No. 16

SEE APPENDIX K

APPENDIX A
Injection Well Form

1) GEOLOGIC TARGET FORMATION: Big Injun

Depth: 2202 Feet (top) 2235 Feet (bottom)

2) Estimated Depth of Completed Well, (or actual depth of existing well): 2277 Feet

3) Approximate water strata depths: Fresh 200-400 Feet Salt 1245 Feet

4) Approximate coal seam depths: None

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

6) Virgin reservoir pressure in target formation 960 psig Source Estimated

7) Estimated reservoir fracture pressure 2455 psig (BHFP)

8) MAXIMUM PROPOSED INJECTION OPERATIONS:

Injection rate (bbl/hour)	12
Injection volume (bbl/day)	50
Injection pressure (psig)	686
Bottom hole pressure (psig)	2400

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

Produced water, bactericides, and other chemicals as may be necessary to maintain water quality.

Temperature of injected fluid: (°F) 60

10) FILTERS (IF ANY)

Cartridge filters at injection pump and well head.

11) SPECIFICATIONS FOR CATHODIC PROTECTION AND OTHER CORROSION CONTROL

No cathodic protection is utilized at this time. Internal corrosion protection through chemical corrosion inhibitors.

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	10 3/4	NA	NA	NA	9	9	NA
Fresh Water	8 5/8	N	H-40	28	466	466	CTS
Coal							
Intermediate 1							
Intermediate 2							
Production	4 1/2	N	J-55	9.5	2272	2272	53
Tubing	2 3/8	N	J-55	4.6	2103	2103	
Liners							

TYPE	Wellbore Diameter	Casing Size	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./sk)	Cement to Surface ? (Y or N)
Conductor	drive	10 3/4	NA	NA	NA	NA	N
Fresh Water	10	8 5/8	.264	2950	Reg Neat	1.18	Y
Coal							
Intermediate 1							
Intermediate 2							
Production	7 7/8	4 1/2	.205	4380	50/50 Poz	1.26	N
Tubing		2 3/8	.167	6770	NA	NA	N
Liners							

PACKERS	Packer #1	Packer #2	Packer #3	Packer #4
Kind:	tension			
Sizes:	4" x 2"			
Depths Set:	2103			

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							
	321	4,289,962.851	477,149.523	2008	120	steel	8820	crude oil	7000	single
	322	4,289,963.617	477,153.348	2013	60	steel	8820	crude oil	7000	single
	324	4,289,305.826	476,875.744	2013	60	steel	4200	crude oil	3500	single
	325	4,289,308.386	476,873.231	2013	60	steel	4200	crude oil	3500	single
	326	4,289,310.501	476,870.978	2006	144	steel	4200	prod water	3500	single
	323	4,289,964.380	477,157.955	2003	180	steel	4200	prod water	3500	single

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
087-01068	O/G	A	4,290,470.861	477,304.589	Y	Y	2255	1022
087-01079	O/G	A	4,290,255.635	477,520.749	Y	Y	2260	1045.56
087-00995	O/G	A	4,290,388.426	477,106.089	Y	Y	2313	1096.46
087-01056	WIW	A	4,290,105.192	477,198.935	Y	Y	2277	1060.85
087-01055	O/G	A	4,289,919.828	477,488.230	Y	Y	2097	875.44
087-01053	O/G	A	4,289,888.778	477,092.399	Y	Y	2190	971.38
087-01032	O/G	A	4,289,685.688	477,409.657	Y	Y	2371	1162.93
087-00988	O/G	A	4,289,673.220	477,190.137	Y	Y	2430	1224.93
087-00985	WIW	I	4,289,706.988	476,757.003	Y	Y	2219	1003.40
087-00894	O/G	A	4,289,969.500	476,883.929	Y	Y		
087-91145			4,289,758.063	476,520.205				
087-00984	O/G	A	4,289,499.926	476,642.048	Y	Y	2270	1040.47
087-00987	O/G	A	4,289,588.208	476,357.739	Y	Y	2335	1132.36
087-30190			4,289,635.662	476,521.234				
087-00994	O/G	A	4,290,143.637	476,912.239	Y	Y	2380	1152.09

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

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)

HG Energy LLC

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

Clover PSD

that there are no such publically recorded sources.

(Signature of Authorized Representative)

Sworn and subscribed to before me this 14th day of June, 2017.

_____, my commission expires March 8, 2021

(Notary Signature) Richard E Nash

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
RICHARD E. NASH
973 CLOVER ROAD
SPENCER, WV 25276
My commission expires March 8, 2021

APPENDIX E
Water Sources

Operator: H G Energy LLC Year 2018 UIC Permit # 2D0871056

		Source # 1	Source # 2	Source #	Source #
Water Source Name		Joe Lung	Richard Smith		
Northing		4,289,922.116	4,290,238.230		
Easting		477,868.117	477,263.225		
Parameter	Units				
TPH - GRO	mg/L	ND	ND		
TPH - DRO	mg/L	ND	ND		
TPH - ORO	mg/L	ND	ND		
BTEX	mg/L	ND	ND		
Chloride	mg/L	3.77	6.29		
Sodium	mg/L				
Total Dissolved Solids (TDS)	mg/L	199	211		
Aluminum	mg/L	ND	ND		
Arsenic	mg/L	ND	ND		
Barium	mg/L	.277	.0070		
Iron	mg/L	.705	.212		
Manganese	mg/L	.0655	ND		
pH	SU	7.1	7.01		
Calcium	mg/L	37.9	.191		
Sulfate	mg/L	5.75	6.54		
MBAS	mg/L	ND	ND		
Dissolved Methane	mg/L	ND	ND		
Dissolved Ethane	mg/L	ND	ND		
Dissolved Butane	mg/L	ND	ND		
Dissolved Propane	mg/L	ND	ND		
Bacteria (Total Coliform)	c/100mL	11	33		

Lung

REI Consultants, Inc. - Analytical Report

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 2:20:00 PM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-02A	**Matrix:**	Drinking Water
Client Sample ID:	KJL	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
METALS BY ICP-Low Level			**Method: EPA 200.7 Rev. 4.4 (1994)**					**Analyst: EP**
Aluminum	ND	0.0030	0.0050	NA		mg/L	12/26/2017 3:33 PM	
Arsenic	ND	0.0080	0.0200	NA		mg/L	12/26/2017 3:33 PM	
Barium	0.277	0.0030	0.0050	NA		mg/L	12/26/2017 3:33 PM	
Calcium	37.9	0.0500	0.500	NA		mg/L	12/26/2017 3:33 PM	
Iron	0.705	0.0100	0.0500	NA		mg/L	12/26/2017 3:33 PM	
Manganese	0.0655	0.0030	0.0050	NA		mg/L	12/26/2017 3:33 PM	
SEMI-VOLATILE RANGE ORGANICS			**Method: SW8015C**					**Analyst: YT**
TPH (Diesel Range: C10 - C28)	ND	0.12	0.25	NA		mg/L	12/27/2017 7:03 AM	
TPH (Oil Range: C22 - C36)	ND	0.12	0.25	NA		mg/L	12/27/2017 7:03 AM	
Surr: o-Terphenyl	69.9	NA	17.6-135	NA		%Rec	12/27/2017 7:03 AM	
VOLATILE RANGE ORGANICS			**Method: SW8015C**					**Analyst: TKC**
TPH (Gasoline Range: C6 - C10)	ND	0.250	0.500	NA		mg/L	1/2/2018 8:38 PM	
Surr: 2,5-Dibromotoluene	68.0	NA	53.5-143	NA		%Rec	1/2/2018 8:38 PM	
VOLATILE ORGANIC COMPOUNDS			**Method: SW8021B**					**Analyst: TKC**
Benzene	ND	0.500	1.00	NA		µg/L	1/2/2018 8:38 PM	
Toluene	ND	0.500	1.00	NA		µg/L	1/2/2018 8:38 PM	
Ethylbenzene	ND	0.500	1.00	NA		µg/L	1/2/2018 8:38 PM	
m,p-Xylene	ND	1.00	2.00	NA		µg/L	1/2/2018 8:38 PM	
o-Xylene	ND	0.500	1.00	NA		µg/L	1/2/2018 8:38 PM	
Surr: 1,1,1-Trifluorotoluene	76.1	NA	57.1-139	NA		%Rec	1/2/2018 8:38 PM	
SURFACTANTS:			**Method: SM5540 C-2000**					**Analyst: BD**
MBAS (calibrated on MW340 LAS)	ND	0.0250	0.0625	NA		mg/L	12/21/2017 5:21 PM	
COLIFORM BY MPN:			**Method: SM9223B-QT**					**Analyst: BD**
E-Coli	ND	1	1	NA		MPN/100mL	12/21/2017 10:45 AM	
Total Coliform	11	1	1	NA		MPN/100mL	12/21/2017 10:45 AM	
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**					**Analyst: CF**
Chloride	3.77	0.20	1.00	NA		mg/L	12/26/2017 10:35 AM	
Sulfate	5.75	1.00	5.00	NA		mg/L	12/21/2017 11:25 PM	

REI Consultants, Inc. - Analytical Report

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 2:20:00 PM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-02A	**Matrix:**	Drinking Water
Client Sample ID:	KJL	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	199	5	10	NA		mg/L	12/21/2017 7:00 PM	
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	2	1	5	NA	J	mg/L	12/21/2017 5:00 PM	
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	7.10	NA	NA	NA	H	SU	12/22/2017 2:06 PM	
ORGANIC CARBON, TOTAL			**Method: SM5310 C-2000**				**Analyst: VS**	
Total Organic Carbon	0.74	0.20	1.00	NA	J	mg/L	12/27/2017 1:30 PM	

REI Consultants, Inc. - Analytical Report

Smith

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 4:30:00 PM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-03A	**Matrix:**	Drinking Water
Client Sample ID:	KRAS	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
METALS BY ICP-Low Level			**Method: EPA 200.7 Rev. 4.4 (1994)**					**Analyst: EP**
Aluminum	ND	0.0030	0.0050	NA		mg/L	12/26/2017 3:37 PM	
Arsenic	ND	0.0080	0.0200	NA		mg/L	12/26/2017 3:37 PM	
Barium	0.0070	0.0030	0.0050	NA		mg/L	12/26/2017 3:37 PM	
Calcium	0.191	0.0500	0.500	NA	J	mg/L	12/26/2017 3:37 PM	
Iron	0.212	0.0100	0.0500	NA		mg/L	12/26/2017 3:37 PM	
Manganese	ND	0.0030	0.0050	NA		mg/L	12/26/2017 3:37 PM	
SEMI-VOLATILE RANGE ORGANICS			**Method: SW8015C**					**Analyst: YT**
TPH (Diesel Range: C10 - C28)	ND	0.13	0.26	NA		mg/L	12/27/2017 7:36 AM	
TPH (Oil Range: C22 - C36)	ND	0.13	0.26	NA		mg/L	12/27/2017 7:36 AM	
Surr: o-Terphenyl	32.8	NA	17.6-135	NA		%Rec	12/27/2017 7:36 AM	
VOLATILE RANGE ORGANICS			**Method: SW8015C**					**Analyst: TKC**
TPH (Gasoline Range: C6 - C10)	ND	0.250	0.500	NA		mg/L	1/2/2018 9:09 PM	
Surr: 2,5-Dibromotoluene	69.1	NA	53.5-143	NA		%Rec	1/2/2018 9:09 PM	
VOLATILE ORGANIC COMPOUNDS			**Method: SW8021B**					**Analyst: TKC**
Benzene	ND	0.500	1.00	NA		µg/L	1/2/2018 9:09 PM	
Toluene	ND	0.500	1.00	NA		µg/L	1/2/2018 9:09 PM	
Ethylbenzene	ND	0.500	1.00	NA		µg/L	1/2/2018 9:09 PM	
m,p-Xylene	ND	1.00	2.00	NA		µg/L	1/2/2018 9:09 PM	
o-Xylene	ND	0.500	1.00	NA		µg/L	1/2/2018 9:09 PM	
Surr: 1,1,1-Trifluorotoluene	81.1	NA	57.1-139	NA		%Rec	1/2/2018 9:09 PM	
SURFACTANTS:			**Method: SM5540 C-2000**					**Analyst: BD**
MBAS (calibrated on MW340 LAS)	ND	0.0250	0.0625	NA		mg/L	12/21/2017 5:21 PM	
COLIFORM BY MPN:			**Method: SM9223B-QT**					**Analyst: BD**
E-Coli	ND	1	1	NA		MPN/100mL	12/21/2017 10:45 AM	
Total Coliform	33	1	1	NA		MPN/100mL	12/21/2017 10:45 AM	
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**					**Analyst: CF**
Chloride	6.29	0.20	1.00	NA		mg/L	12/22/2017 6:43 PM	
Sulfate	6.54	1.00	5.00	NA		mg/L	12/21/2017 11:44 PM	

REI Consultants, Inc. - Analytical Report

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 4:30:00 PM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-03A	**Matrix:**	Drinking Water
Client Sample ID:	KRAS	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	211	5	10	NA		mg/L	12/21/2017 7:00 PM	
TOTAL SUSPENDED SOLIDS			**Method: SM2540 D-1997**				**Analyst: KY**	
Total Suspended Solids	ND	1	5	NA		mg/L	12/21/2017 5:00 PM	
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	7.01	NA	NA	NA	H	SU	12/22/2017 2:07 PM	
ORGANIC CARBON, TOTAL			**Method: SM5310 C-2000**				**Analyst: VS**	
Total Organic Carbon	0.76	0.20	1.00	NA	J	mg/L	12/22/2017 5:58 PM	

REI Consultants, Inc. - Analytical Report

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 12:00:00 AM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-04A	**Matrix:**	Trip Blank
Client Sample ID:	TRIP BLANK	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
VOLATILE RANGE ORGANICS			**Method: SW8015C**				**Analyst: TKC**	
TPH (Gasoline Range: C6 - C10)	ND	0.250	0.500	NA		mg/L	1/3/2018 2:24 AM	PA/VA
Surr: 2,5-Dibromotoluene	85.4	NA	53.5-143	NA		%Rec	1/3/2018 2:24 AM	
VOLATILE ORGANIC COMPOUNDS			**Method: SW8021B**				**Analyst: TKC**	
Benzene	ND	0.500	1.00	NA		µg/L	1/3/2018 2:24 AM	VA
Toluene	ND	0.500	1.00	NA		µg/L	1/3/2018 2:24 AM	VA
Ethylbenzene	ND	0.500	1.00	NA		µg/L	1/3/2018 2:24 AM	VA
m,p-Xylene	ND	1.00	2.00	NA		µg/L	1/3/2018 2:24 AM	VA
o-Xylene	ND	0.500	1.00	NA		µg/L	1/3/2018 2:24 AM	VA
Surr: 1,1,1-Trifluorotoluene	87.4	NA	57.1-139	NA		%Rec	1/3/2018 2:24 AM	

REIC
Improving the environment, one client at a time...

REI Consultants, Inc.
PO Box 286
Beaver, WV 25813
TEL: (304)255-2500
Website: www.reiclabs.com

Sample Receipt Checklist

Client Name:	HGE001			Work Order Number:	17122738
RCPNo:	1	Date and Time Received:	12/20/2017 7:25:00 PM	Received by:	Doug Arthur
Completed By:	Blane Williams		Reviewed By:	Jimmy Suttle	
Completed Date:	12/21/2017 8:01:22 AM		Reviewed Date:	12/21/2017 10:38 AM	

Carrier Name: REIC

1.	Chain of custody present?	Yes [x]	No [ ]	
2.	Chain of custody signed when relinquished and received?	Yes [x]	No [ ]	
3.	Are matrices correctly identified on Chain of custody?	Yes [x]	No [ ]	
4.	Is it clear what analyses were requested?	Yes [x]	No [ ]	
5.	Custody seals intact?	Yes [ ]	No [ ]	Not Present [x]
6.	Samples in proper container type and preservative?	Yes [x]	No [ ]	
7.	Were correct preservatives noted on COC?	Yes [x]	No [ ]	NA [ ]
8.	Sample containers intact?	Yes [x]	No [ ]	
9.	Sufficient sample volume for indicated test?	Yes [x]	No [ ]	
10.	Were container labels complete?	Yes [x]	No [ ]	
11.	All samples received within holding time?	Yes [x]	No [ ]	
12.	Was an attempt made to cool the samples?	Yes [x]	No [ ]	NA [ ]
13.	Sample Temp. taken and recorded upon receipt?	Yes [x]	No [ ]	To 0.4 °C
14.	Water - Were bubbles absent in VOC vials?	Yes [x]	No [ ]	No Vials [ ]
15.	Are Samples considered acceptable?	Yes [x]	No [ ]	
16.	COC filled out properly?	Yes [x]	No [ ]	

Client Notification/Response

Client Name:	HGE001						Work Order Number:	17122738
Comment:								
Client Contacted:	Yes [ ]	No [ ]	NA [x]	Person Contacted:				
Contact Mode:	Phone [ ]	Fax: [ ]	Email: [ ]	In Person: [ ]				
Date Contacted:				Contacted By:				
Regarding:								
Client Instructions:								
Corrective Action:								

DAT Reports®

Data Analysis Technologies, Inc.
7715 Corporate Blvd.
Plain City, OH 43064
800-733-8644

Sample Analysis Certificate

Client:	REI Consultants, Inc.	Date:	1/12/2018
Address:	225 Airport Industrial Park Road	DAT Project ID:	1217048
	Beaver, WV 25813	Date Received:	12/26/2017

Attn: Jimmy Suttle
Client Project: COC 9559
Analysis: Hydrogen Sulfide-RSK175/ASTM D6228

The following samples were received on 12/26/2017:

DAT Sample ID	Client Sample ID	Date Sampled	Matrix
1217048-05 a/b	KPW 1300	12/20/2017	aqueous

Results: See attached summary.

QC: Met the criteria for the method.

Reviewed and approved for release by:

Ronald K. Mitchum, Ph.D.
President, DAT

DAT Reports®

Data Summary

Analysis:	Hydrogen Sulfide- Method RSK175/ASTM D6228
Client:	REIC-COC 9559
DATL Project:	1217048

Client ID	Lab ID	Date Sampled	H2S (mg/L)	RL (mg/L)	Q
KPW 1300 (17122738-01A)	1217048-05 a/b	20-Dec-17	ND	0.000552	

ND = Not detected
RL= Low calibration point
ppm=ug/ml (mg/L)

reports@datlab.com
www.datlab.com

DAT Laboratory, Inc.
7715 Corporate Blvd.
Plain City, OH 43064

800-733-8644

REIC

Improving the environment, one client at a time...

CHAIN OF CUSTODY RECORD

COC ID: 9559	PAGE: 1	OF: 1

ADDRESS
REI Consultants, Inc.
PO Box 286
Beaver, WV 25813
TEL: (304) 255-2500
FAX: (304) 255-2572
Website: www.reiclabs.com

Please Include Email Address of Report Recipient Whenever Possible!!!

SUB CONTRATOR: **DAT LAB** COMPANY: **DATA ANALYSIS TECHNOL**

ADDRESS: **7715 CORPORATE BLVD.**

CITY, STATE, ZIP: **PLAIN CITY, OH 43064**

PHONE: **(800) 733-8644** FAX: **(614) 873-0810**

ACCOUNT #: EMAIL:

SPECIAL INSTRUCTIONS / COMMENTS:

State Code: WV Please use SampleID as purchase order number.
After analysis, the samples do not need to be returned and can be disposed per your standard laboratory practices. Please email results to Jimmy Suttle at: jsuttle@reiclabs.com Thank you

ITEM	SAMPLE ID	Client Sample ID	Bottle Type	MATRIX	DATE COLLECTED	NUMBER OF CONTAINERS	HYDROGEN_SULFIDE_L_SUB (EPA
						*	0
1	17122738-01A	KPW	40ml G	Waste Water	12/20/2017 1:00:00 PM	2	√

ANALYTICAL PARAMETERS

* Preservation Codes:
0 None
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide/ Sodium Arsenite
6 Sodium Hydroxide
7 Ascorbic Acid
8 Sodium Sulfite/HCL
9 Potassium Dihydrogen Citrate
10 Bromium Chloride

COMMENTS:

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Blake Will	12-21-17	16:00	UPS	12-21-17	16:00
Relinquished By: UPS	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☒ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

Note: RUSH requests will incur surcharges!

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☒ EMAIL ☐ ONLINE

FOR LAB USE ONLY
Temp of samples 8 °C Attempt to Cool? _____
Comments: 12-26-17 1100
John Kattenbach 1217048

1217048B_ Page 3 of 5.

DAT SAMPLE RECEIVING

7715 Corporate Blvd. Plain City,OH 43064.

Project Number: 1217048

Date Received: 12/26/2017
Client Name: REI Consultants
Tracking number: 1Z26X7130375660054
Custody Seals ?: No

Carrier: UPS
Analysis: Hydrogen Sulfide
Package Temp: 8°C
COC: ☑ check if COC from client

Sample Information

Client ID:	Laboratory ID	Date	Matrix:	Container:	Comment:
CUFWI 0920	1217048-01 a/b	12/20/2017	aqueous	40mL VOA vial	in duplicate
CPIW 0940	1217048-02 a/b	12/20/2017	aqueous	40mL VOA vial	in duplicate
UCUS 1010	1217048-03 a/b	12/20/2017	aqueous	40mL VOA vial	in duplicate
LCUS 1035	1217048-04 a/b	12/20/2017	aqueous	40mL VOA vial	in duplicate
KPW 1300	1217048-05 a/b	12/20/2017	aqueous	40mL VOA vial	in duplicate

Laboratory Receiving Initials

1217048
12/26/2017 11:56:51 AM

DAT Labs Inc.
Sample Receipt Report

Client/Number: REI Consultants / 11098

Custodian Initial: JK Date: 12-26-17

Secondary Review: Initials: Date:

The client has been contacted.

_____ Yes _____ No

Upon receipt of samples, check if any of the following discrepancies have been noted.

	Discrepancy Type	*Specify applicable client ID or "all"*
	COC and samples do not match	
	No unique sample identifications	
	Samples received outside of the required temp criteria. **Receipt Temp:** 8° C	
	No preservation type was noted **Correction Factor:** - C	
	No date of collection stated **Corrected Temp:** 8° C	
	No time of collection stated	
	The sample collector was not named	
	Sample containers were not appropriate	
	Sample labels were destroyed or unreadable	
	Samples were received outside of holding time	
	There was not enough sample to perform the requested analysis.	
	Samples showed sign of damage or contamination.	
	Aqueous samples for volatile analysis: Headspace? Y N	If Yes, list sample ID(s) in details:

Details: _____

Sample pH for nonvolatile aqueous samples and presence or absence of headspace (Y or N) for VOA aqueous samples shall be recorded at time of sample log-in.
Under no circumstances shall VOA vials be opened at time of sample receipt.

Other Discrepancies:

Sample ID	**Discrepancy**

Container Return
Yes / No
Price:
Size:
Return Spl wt:

[X] ***Upon receipt, the samples met all of DAT's acceptance criteria.*** ***DAT Project #*** 1217048

Effective 05/03/11

DATFRM1049 Revision 5

1217048B_ Page 5 of 5.

GEOCHEMICAL TESTING
Environmental and Energy Analysis

2005 N. Center Ave.
Somerset, PA 15501

814/443-1671
814/445-6666
FAX: 814/445-6729

Thursday, January 4, 2018

Jimmy Suttle
REI CONSULTANTS, INC.
PO BOX 286
225 INDUSTRIAL PARK ROAD
BEAVER, WV 25813

Order No.: G1712D23

Dear Jimmy Suttle:

Geochemical Testing received 2 sample(s) on 12/22/2017 for the analyses presented in the following report.

There were no problems with the analyses and all QC data met NELAC, EPA, and laboratory specifications except where noted in the Case Narrative or Laboratory Results.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Timothy W Bergstresser

Timothy W. Bergstresser
Director of Technical Services

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306PA DEP

Geochemical Testing

Date: *04-Jan-18*

CLIENT: REI CONSULTANTS, INC.
Project:
Lab Order: G1712D23

CASE NARRATIVE

No problems were encountered during analysis of this workorder, except if noted in this report.

Under West Virginia's Laboratory Certification Program, Geochemical Testing's Laboratory Certificate I.D. is 141.

SAMPLE RECEIPT CHECKLIST

	Response
COC is present	Yes
COC is filled out in ink and legible	Yes
COC relinquished, signature, date, and time	Yes
Samples arrived within hold time	Yes
Containers properly preserved for the requested testing	Yes
Sample containers have legible labels	Yes
Sample preservation verified	Yes
Appropriate sample containers are used	Yes
Sample container(s) received at proper temperature	Yes
Zero headspace where required	Yes
Sufficient volume for all requested analyses	Yes

Comments on the above checklist: None

Legend:

ND - Not Detected
J - Indicates an estimated value.
U - The analyte was not detected at or above the listed concentration, which is below the laboratory quantitation limit.
B - Analyte detected in the associated Method Blank
Q - Qualifier QL -Quantitation Limit DF - Dilution Factor
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
** - Value exceeds Action Limit
H - Method Hold Time Exceeded
MCL - Contaminant Limit

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *04-Jan-18*

CLIENT:	REI CONSULTANTS, INC.	**Client Sample ID:**	17122738-03A
Lab Order:	G1712D23		
Project:		**Collection Date:**	12/20/2017 2:30:00 PM
Lab ID:	G1712D23-002	**Sampled By:**	REIC
Matrix:	AQUEOUS	**DateReceived:**	12/22/2017 10:55:36 AM

Analyses	Result	Q	MDL	PQL	Units	DF	Date Prepared	Date Analyzed
DISSOLVED GASSES			Analyst: **TEW**				**RSK 175**	**RSK 175**
Butane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:22 PM
Ethane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:22 PM
Methane, dissolved	0.18		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:22 PM
Propane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:22 PM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

CHAIN OF CUSTODY RECORD

17122738

HG ENERGY LLC

HGE001

Jimmy Suttle

REIC
& Industrial Consultants, Inc.

MAIN LABORATORY & CORPORATE HEADQUARTERS:
P.O. Box 286 • 225 Industrial Park Rd, Beaver, WV 25813
800-999-0105 • 304-255-2500 • www.reiclabs.com

SHENANDOAH Service Center
1557 Commerce Rd., Ste 201
Verona, VA 24482
540-248-0183

ROANOKE Service Center
3029-C Peters Creek Rd
Roanoke, VA 24019
540-777-1276

MORGANTOWN Service Center
16 Commerce Drive
Westover, WV 26501
304-241-5861

v13-0516 REIC use ONLY CLIENT ID _____ DATE _____ SHEET ____

Client: HG ENERGY PO # _____

Contact Person: Roger Heldman Phone: 304-420-1107

Address _____ City _____ State ____ Zip ____

Billing Address (if different) _____

City _____ State ____ Zip ____

Site ID & State: Spencer, WV Proj ID: Kaufman Unil Water Sampling Sampler: JDB

TURNAROUND TIME

NORMAL ○ RUSH TURNAROUND*: ○ 5 DAY ○ 3 DAY ○ 2 DAY ○ 1 DAY

*Rush work needs prior laboratory approval and will incur additional charges

Send Results Via: ◉ Email ○ Fax

All analytical requests are subject to REIC's Standard Terms and Conditions.

ANALYSIS & METHOD REQUESTED

- pH, Specific Gravity, Barium, Specific Conductance, Iron, Magnesium, Chloride,
- Manganese, Total Dissolved Solids, Hydrogen Sulfide, Sodium, Alkalinity,
- Hardness, Total Organic Carbon
- See Comments
- Total Petroleum Hydrocarbons (GRO,DRO,ORO0, BTEX,pH, Al,
- Arsenic,Barium, Calcium, Chloride, Detergents (MBAS), Iron,
- Manganese, TDS, TSS, TOC, Dissolved Methane,
- Dissolved Ethane, Dissolved Butane, Dissolved Propane
- Bacteria (Total Coliform)

SAMPLE ID	No. & Type of Containers	Sampling Date/Time	Matrix	Sample Comp/Grab	10	11	12	13	14	15	16	17	18
KPW	2P / 3G	12/20/17 1300	W Water	Grab	X	X	X	X					
KJL	9G / 4P	12/20/17 1420	D Water	Grab				X	X	X	X	X	X
KRAS	7G / 4P	12/17/17 1630	D Water	Grab				X	X	X	X	X	X
Trip Blank	1G												

ENTER PRESERVATIVE CODE(S):

0 None
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide/ Sodium Arsenite
6 Sodium Hydroxide
7 Ascorbic Acid
8 Sodium Bisulfate/Methanol
9 Ammonium Chloride
10 CRA Buffer
11 Sodium Sulfite/ Hydrochloric Acid
12 _____ *

*(Use blank for a preservative not listed.)

COMMENTS:
Scotty Gross Project
Jimmy Suttle PM

CUSTODY SEALS [ ] Y [X] N

Corrected temp at arrival: .4 °C ICED? Y X N ___ IR # 1 Containers provided by: [X] REIC [ ] Client Delivered by: [ ] Client [X] REIC [ ] UPS [ ] FedEx [ ] USPS

RELD	Date/Time	RECD	Date/Time	RELD	Date/Time
12-20-17 1835					
12-21-17 0600					
RECD	Date/Time	RELD	Date/Time	RECD	Date/Time
RELD	Date/Time	RECD	Date/Time	RECD	Date/Time

Laboratory Results

Geochemical Testing

Date: *04-Jan-18*

CLIENT:	REI CONSULTANTS, INC.	**Client Sample ID:**	1712278-02A
Lab Order:	G1712D23		
Project:		**Collection Date:**	12/20/2017 2:20:00 PM
Lab ID:	G1712D23-001	**Sampled By:**	REIC
Matrix:	AQUEOUS	**DateReceived:**	12/22/2017 10:55:36 AM

Analyses	Result	Q	MDL	PQL	Units	DF	Date Prepared	Date Analyzed
DISSOLVED GASSES			Analyst: **TEW**				**RSK 175**	**RSK 175**
Butane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:06 PM
Ethane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:06 PM
Methane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:06 PM
Propane, dissolved	ND		0.010	0.020	mg/L	1	12/27/17 1:06 PM	01/02/18 2:06 PM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

APPENDIX F

Area Permit Wells

API #	Well Type (Injection, Production, Observation, Monitoring)	Well Status (Active, Abandoned, Shut-in, Plugged)	Northing (UTM NAD 83 Meters)	Easting (UTM NAD 83 Meters)

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

APPENDIX G

API #	Operator	Farm Name	Well No	Producing Formation
47-087-03022	H G Energy LLC	Bays, J. H.	1	Big Injun
47-087-01955	H G Energy LLC	Bays, J. H.	6	Big Injun
47-087-04492	H G Energy LLC	Bays, J. H.	601	Big Injun
47-087-02435	H G Energy LLC	Chambers, C. B.	4	Devonian Shale
47-087-03050	H G Energy LLC	Chambers Heirs	1	Big Injun
47-087-02436	H G Energy LLC	Chambers Heirs	5	Big Injun
47-087-02994	H G Energy LLC	Chambers Heirs	6	Big Injun
47-087-03032	H G Energy LLC	Chambers Heirs	7	Big Injun
47-087-03247	H G Energy LLC	Chambers Heirs	8	Big Injun
47-087-03035	H G Energy LLC	Chambers Heirs	10	Big Injun
47-087-03033	H G Energy LLC	Chambers Heirs	11	Big Injun
47-087-02993	H G Energy LLC	Chambers Heirs	15	Big Injun
47-087-02438	H G Energy LLC	Chambers Heirs	17	Big Injun
47-087-02439	H G Energy LLC	Chambers Heirs	18	Big Injun
47-087-00913	H G Energy LLC	Chambers Heirs	21	Big Injun
47-087-01076	H G Energy LLC	Chambers Heirs	23	Big Injun
47-087-03076	H G Energy LLC	Douglas, Cynthia (TR #1)	2	Big Injun
47-087-02980	H G Energy LLC	Douglas, Cynthia (TR #2)	3	Big Injun
47-087-03075	H G Energy LLC	Douglas, Cynthia (TR #3)	4	Big Injun
47-087-02995	H G Energy LLC	Harris, J.A.	14	Big Injun
47-087-01872	H G Energy LLC	Harris, J.A.	16	Big Injun
47-087-01927	H G Energy LLC	Harris, J.A.	17	Big Injun
47-087-01962	H G Energy LLC	Harris, J.A.	18	Big Injun
47-087-01953	H G Energy LLC	Harris, J.A.	19	Big Injun
47-087-00970	H G Energy LLC	Kaufman, Wm.	W-2	Big Injun
47-087-00971	H G Energy LLC	Kaufman, Wm.	W-3	Big Injun
47-087-00978	H G Energy LLC	Kaufman, Wm.	W-4	Big Injun
47-087-00984	H G Energy LLC	Kaufman, Wm.	W-5	Big Injun
47-087-00987	H G Energy LLC	Kaufman, Wm.	W-6	Big Injun
47-087-00988	H G Energy LLC	Kaufman, Wm.	W-8	Big Injun
47-087-00992	H G Energy LLC	Kaufman, Wm.	W-10	Big Injun
47-087-00993	H G Energy LLC	Kaufman, Wm.	W-11	Big Injun
47-087-00994	H G Energy LLC	Kaufman, Wm.	W-12	Big Injun
47-087-00995	H G Energy LLC	Kaufman, Wm.	W-13	Big Injun
47-087-00996	H G Energy LLC	Kaufman, Wm.	W-14	Big Injun
47-087-01004	H G Energy LLC	Kaufman, Wm.	W-15	Big Injun
47-087-01032	H G Energy LLC	Kaufman, Wm.	W-16	Big Injun
47-087-01053	H G Energy LLC	Kaufman, Wm.	W-17	Big Injun
47-087-01055	H G Energy LLC	Kaufman, Wm.	W-18	Big Injun
47-087-01068	H G Energy LLC	Kaufman, Wm.	W-20	Big Injun

47-087-01079	H G Energy LLC	Kaufman, Wm.	W-21	Big Injun
47-087-02981	H G Energy LLC	Kaufman, Wm.	4	Big Injun
47-087-00894	H G Energy LLC	Kaufman, Wm.	5	Big Injun
47-087-00909	H G Energy LLC	Kaufman, Wm.	6	Big Injun
47-087-00963	H G Energy LLC	Kaufman, Wm.	7	Big Injun
47-087-01923	H G Energy LLC	Kaufman, Wm.	29	Big Injun
47-087-04489	H G Energy LLC	Kaufman, Wm.	604	Big Injun
47-087-04490	H G Energy LLC	Kaufman, Wm.	605	Big Injun
47-087-04491	H G Energy LLC	Kaufman, Wm.	606	Big Injun
47-087-02578	H G Energy LLC	Kincaid, S. B.	3	Devonian Shale
47-087-03040	H G Energy LLC	Lewis, Asbury	1	Big Injun
47-087-00027	H G Energy LLC	Lewis, Asbury	2	Big Injun
47-087-03041	H G Energy LLC	Lewis, Asbury	3	Big Injun
47-087-01026	H G Energy LLC	Lewis, Asbury	5	Big Injun
47-087-01095	H G Energy LLC	Lewis, Asbury	6	Big Injun
47-087-01096	H G Energy LLC	Lewis, Asbury	7	Big Injun
47-087-04493	H G Energy LLC	Lewis, Asbury	602	Big Injun
47-087-00565	H G Energy LLC	Simmons, David	2	Big Injun
47-087-02743	H G Energy LLC	Simmons, David	3	Big Injun
47-087-03061	H G Energy LLC	Simmons, David	6	Big Injun
47-087-03030	H G Energy LLC	Simmons, David	10	Big Injun
47-087-03047	H G Energy LLC	Simmons, David	11	Big Injun
47-087-02988	H G Energy LLC	Simmons, David	12	Big Injun
47-087-03013	H G Energy LLC	Simmons, David	13	Big Injun
47-087-03053	H G Energy LLC	Simmons, David	14	Big Injun
47-087-03048	H G Energy LLC	Simmons, David	15	Big Injun
47-087-03045	H G Energy LLC	Simmons, David	17	Big Injun
47-087-03029	H G Energy LLC	Simmons, David	19	Big Injun
47-087-03031	H G Energy LLC	Simmons, David	23	Big Injun
47-087-02986	H G Energy LLC	Simmons, David	24	Big Injun
47-087-00889	H G Energy LLC	Simmons, David	26	Big Injun
47-087-01027	H G Energy LLC	Simmons, David	27	Big Injun
47-087-01072	H G Energy LLC	Simmons, David	28	Big Injun
47-087-01086	H G Energy LLC	Simmons, David	29	Big Injun
47-087-01873	H G Energy LLC	Simmons, David	31	Big Injun
47-087-01954	H G Energy LLC	Simmons, David	32	Big Injun
47-087-02082	H G Energy LLC	Simmons, David	33	Big Injun

APPENDIX H

GROUNDWATER PROTECTION PLAN

Facility Name: Clover Produced Water Disposal

County: Roane

Facility Location:

Postal Service Address:	Kaufman Rd, Spencer, WV 25276		
Latitude :	38 Degrees 45' 32"	Longitude:	81 Degrees 15' 45"

Contact Information:

Person:	Roger Heldman
Phone Number:	304-420-1107
E-mail Address:	rheldman@hgenergyllc.com

Date: 5/21/18

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

Tank failure / leak
Pipeline failure/ leak
Fluids (bactericide, corrosion inhibitor, etc) transfer
Stuffing box failure
well completion / workover activities

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

Secondary containment is installed around tanks adequate to hold the volume of the largest tank. Pipelines are routinely monitored and patroled for leaks. Pipelines are registered with the WV 811 to minimize possibiilty of being damaged by others. Pressure monitoring / shut down controls on pump. Workover fluids are properly contained and disposed of. The injection well is monitored for mechanical integrity failures and is pressure tested every five years.

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

Non corrosive materials are utilized as much as possible. Shut down controls installed on injection pump.

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

This facility is currently covered by an existing UIC permit No. 2D0871056. Storage tanks are registered uder WV tank regulations. Any spills / leaks are reported to WVDEP /EPA.

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

There are no know ground water quality issues in this area. Only two of the residences with in the AOR utilize water wells for domestic use. The analytical results from these two wells are enclosed with this application.

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

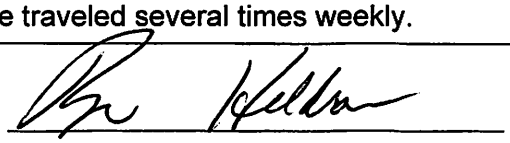
No waste material are or will be used for deicing or fill material.

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.

The operators of this facility are instructed to routinely monitor tank conditions, secondary containment conditions, and patrol injection lines. They are trained yearly regarding ground water protection. Part of this training involves prevention of oil & chemical spills and the prompt clean up / remediation of any spill. Prior to the release of any storm water from secondary containment it is tested to assure that it meets guidelines for discharge.

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

Secondary containment, pipelines, and injection equipment are inspected and documented a minimum of every 90 days. The injection well and producing wells are visited several times weekly. The wellheads are inspected for any indication of mechanical integrity. Any issues are addressed when discovered. The majority of the production pipelines and the injection line are located parallel to roadways which are traveled several times weekly.

Signature: 

Date: 5/21/18

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

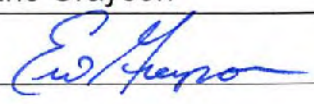
From: H G Energy LLC
5260 Dupont Rd
Parkersburg, WV 26101

Date: 5/21/18

Subject: Underground Injection Control (UIC) Permit Application
2D0871056
Requirement for Financial Responsibility

I, Eric Grayson, 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: Eric Grayson

Signature: 

Date: 5/21/18

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.

This is not a commercial facilty

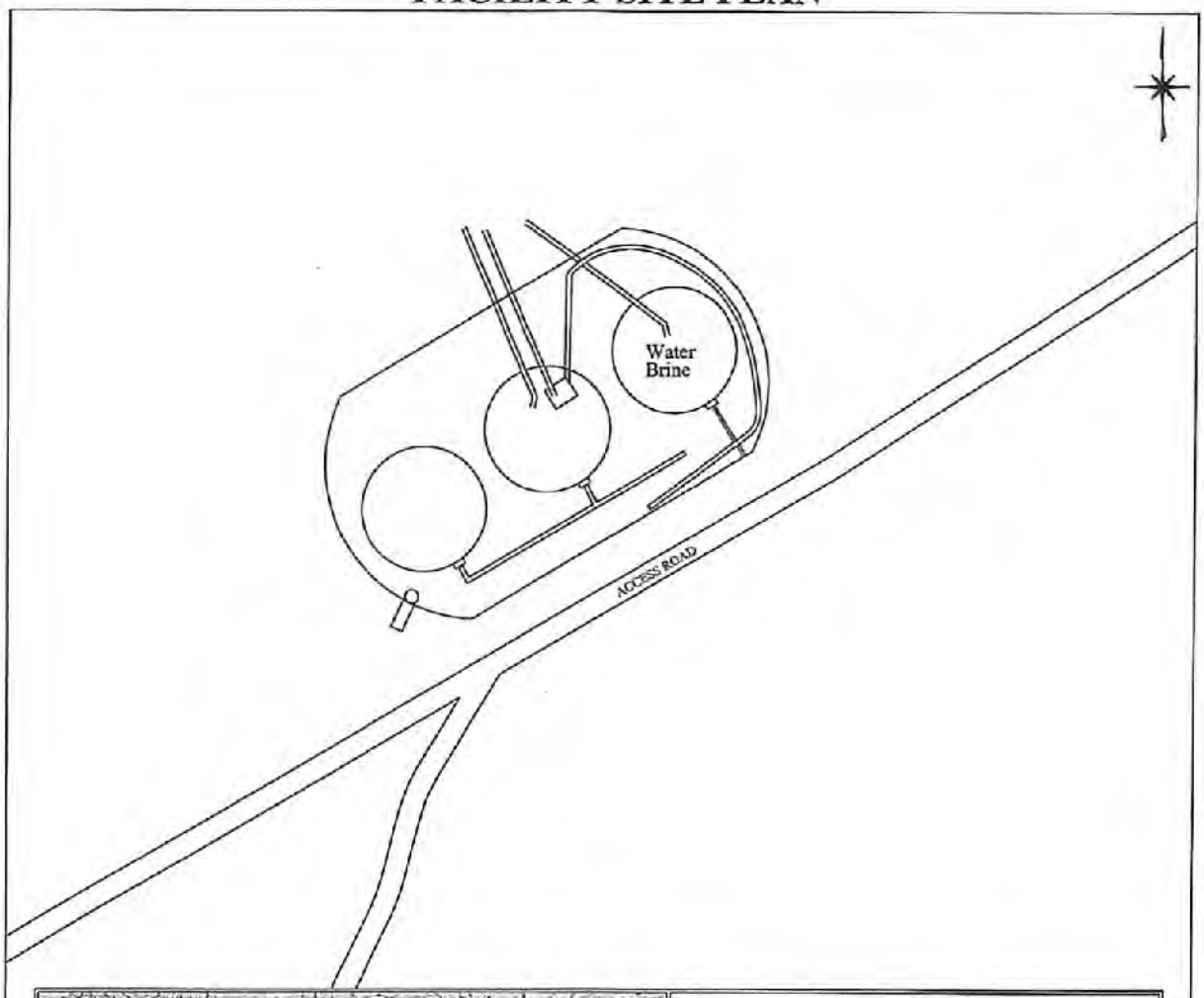
APPENDIX K

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

Permit/approvals	ID Number
Hazardous Waste Management Program under RCRA	
NPDES Program	
Prevention of Significant Deterioration (PSD)	
Nonattainment Program	
Dredge or Fill	
NPDES/NPDES – Stormwater	
WVDEP – Office of Waste Management (OWM) – Solid Waste Facility	
WVDEP – OWM – RCRA (Hazardous Waste TSD or Transporter)	
WVDEP – OWM – UST	
CERCLA – Superfund	
WV Voluntary Remediation – Brownfields	
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act	
Well Head Protection Program (WHPP)	
Underground Injection Control (UIC)	2D0871056
Toxic Substances Control Act (TSCA)	
Best Management Plans	
Management of Used Oil	
Other Relevant Permits (Specify):	
WV DEP Tank Registrations	See Appendix B

Fig No 1

FACILITY SITE PLAN



HG ENERGY, LLC
SPCC PLAN

Drawn By KAB
File Name Clover Area
Scale
Date 11-6-14
Point No.

Facility Name: Kaufman, Wm. W-5, W-6, W-8, W-12, W-13, W-17, W-18, W-20, W-21, 5, 605 & 606

State: WV

County: Roane

District: Smithfield

Name of Nearest Stream: Millstone Run

Direction & Distance from Facility: 185° @ 300'

~STORAGE TANKS~

No. 3

Volume bbl: 210

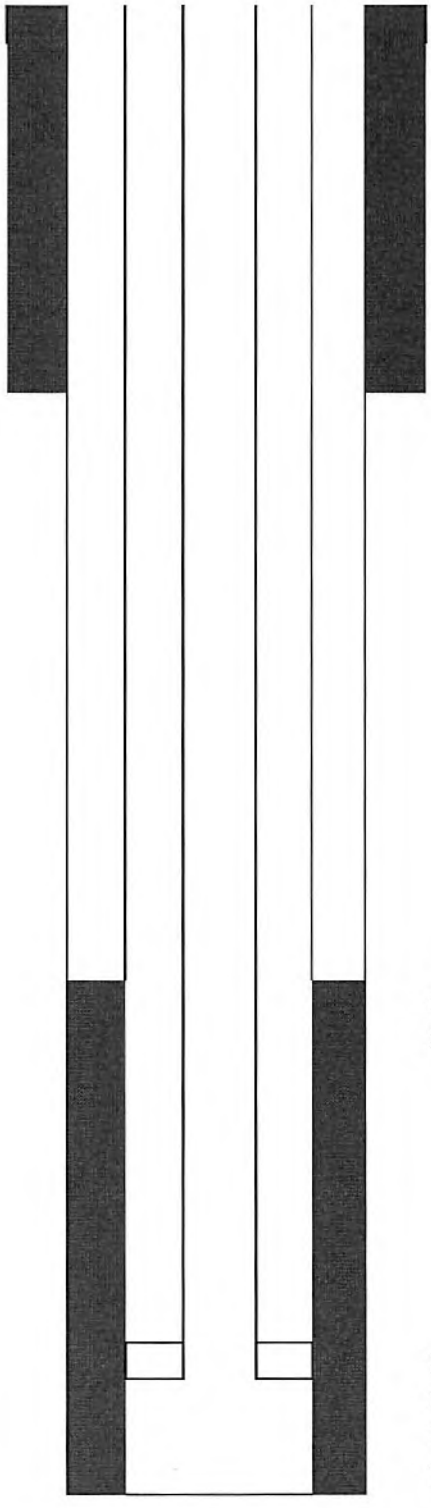
Tank #'s: 321-323

Dike Dimensions: 150' peri. X 2.2' depth

Calculated Capacity: 471 bbl

W M Kaufman W-19
47-087-01056

FIG No. 2



Drive pipe 9'

8 5/8" csng set @ 466'- CTS

est TOC = 2025'

2078'-2193' Big Lime

2103' 2 3/8" tubing on tension packer
2209'-2220' Big Injun perforations
2235'-2277' Shale
TD 2275' 4 1/2" csng @ 2272'

5/24/2018

Not to scale

Kaufman Lease File

RI bureau of mines
report of investigations 6992

RESERVOIR STUDY OF THE WILLIAM KAUFMAN LEASE CLOVER-RUSH RUN OILFIELD, ROANE COUNTY, W. VA.

By Karl-Heinz Frohne

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

July 1967

This document is released by the Bureau of Mines in recognition of the necessity for prompt and timely reporting. It is understood that the information contained herein may be superseded by subsequent publications. Some concessions in form and style are made in the interest of timeliness.

Walter R Howard
Director

RESERVOIR STUDY OF THE WILLIAM KAUFMAN LEASE CLOVER-RUSH RUN OILFIELD, ROANE COUNTY, W. VA.

By Karl-Heinz Frohne

* * * * * * * * * * * * report of investigations 6992

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BUREAU OF MINES
Walter R. Hibbard, Jr., Director

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ILLUSTRATIONS--Continued

TABLES

RESERVOIR STUDY OF THE WILLIAM KAUFMAN LEASE, CLOVER-RUSH RUN OILFIELD, ROANE COUNTY, W.VA.

by

Karl-Heinz Frohne[1]

ABSTRACT

This report presents the findings of a study of a portion of the Clover-Rush Run oilfield located in Roane County, W. Va. The study was made to investigate the possibilities of secondary oil recovery in the Big Injun sandstone underlying the William Kaufman lease. Reservoir properties, original reserves, and primary oil recovery are also presented.

The investigation is based on a core analysis and related labortory tests, well records, field production data, and subsurface information from the Kaufman property. A theoretical primary oil recovery of 9.7 percent of original oil in place is predicted for the reservoir.

A waterflood performance prediction of a hypothetical pilot area was made by use of a computer. The prediction showed that, based on laboratory oil-water relative permeability curves, the water-injection time needed to initiate oil production is excessive and that the stabilized water-injection and corresponding oil-production rates are very low. This precludes waterflooding the reservoir on an economic basis.

A prediction for secondary oil recovery by gas injection was attempted but could not be completed because essential reservoir data were not available. In July 1965, the lease operator initiated, and is currently conducting, a gas-injection program, but there had been no increase in oil production up to November 1966.

INTRODUCTION

Production records and well logs show that primary oil production from the Big Injun sand has been by solution-gas drive in the Clover-Rush Run oilfield. Solution gas is the most inefficient of natural drives and can be

[1]Petroleum research engineer, Morgantown Petroleum Research Laboratory, Bureau of Mines, Morgantown, W. Va.

expected to recover only 5 to 25 percent (2)[2] of oil in place. Primary oil recovery from Appalachian area reservoirs is usually in the lower end of this range because of the very low permeability of the hydrocarbon-bearing formations, thus a large part of the oil is unrecovered.

In order to aid the reclamation of this valuable resource, the Bureau of Mines is currently engaged in evaluating methods of increasing the secondary recovery of oil from selected Appalachian area reservoirs. The work, of which this report is a part, is being carried out under the Bureau's Reservoir Evaluation Project by utilizing detailed core analyses and other field data to perform reservoir evaluations and provide secondary recovery recommendations. The plans and objectives of the project have been described in detail in another publication (7).

Even though one of the older Kaufman wells produced from the Big Lime formation, the only zone of consequence underlying the lease is the Big Injun sandstone which is the main area of interest of this report. At the present time, the lease operator is injecting natural gas into the Big Injun formation in order to stimulate oil recovery. This project is described in more detail later in the report.

A preliminary report on the Kaufman lease and the well cored by the Bureau has been published (6).

ACKNOWLEDGMENTS

The cooperation of the Pennzoil Co., operator of the William Kaufman lease, in providing well records, logs, and other data for this report is acknowledged.

GENERAL GEOLOGY

Location and Topography

The Clover-Rush Run oilfield is located in Smithfield and Spencer Districts, Roane County, W. Va. (fig. 1). The area topography is typical of the Appalachian Plateau. Outcropping rocks belong to either the Dunkard Series of the Lower Permian Period or the Monongahela Series of the Pennsylvania Period (5). The rugged terrain, formed by stream erosion of the plateau, consists mainly of narrow V-shaped valleys and steep ridges, although a few bottom lands and flat-topped hills can be found. Maximum elevation differences are on the order of 600 feet.

Area Structure and Stratigraphy

The Clover-Rush Run oilfield lies on the western flank of the Arches Fork anticline, and the Big Injun sand strikes north 30° east (4). In the Kaufman lease area, the sand dips to the northwest at about 70 feet per mile.

[2]Underlined numbers in parentheses refer to items in the list of references at the end of this report.

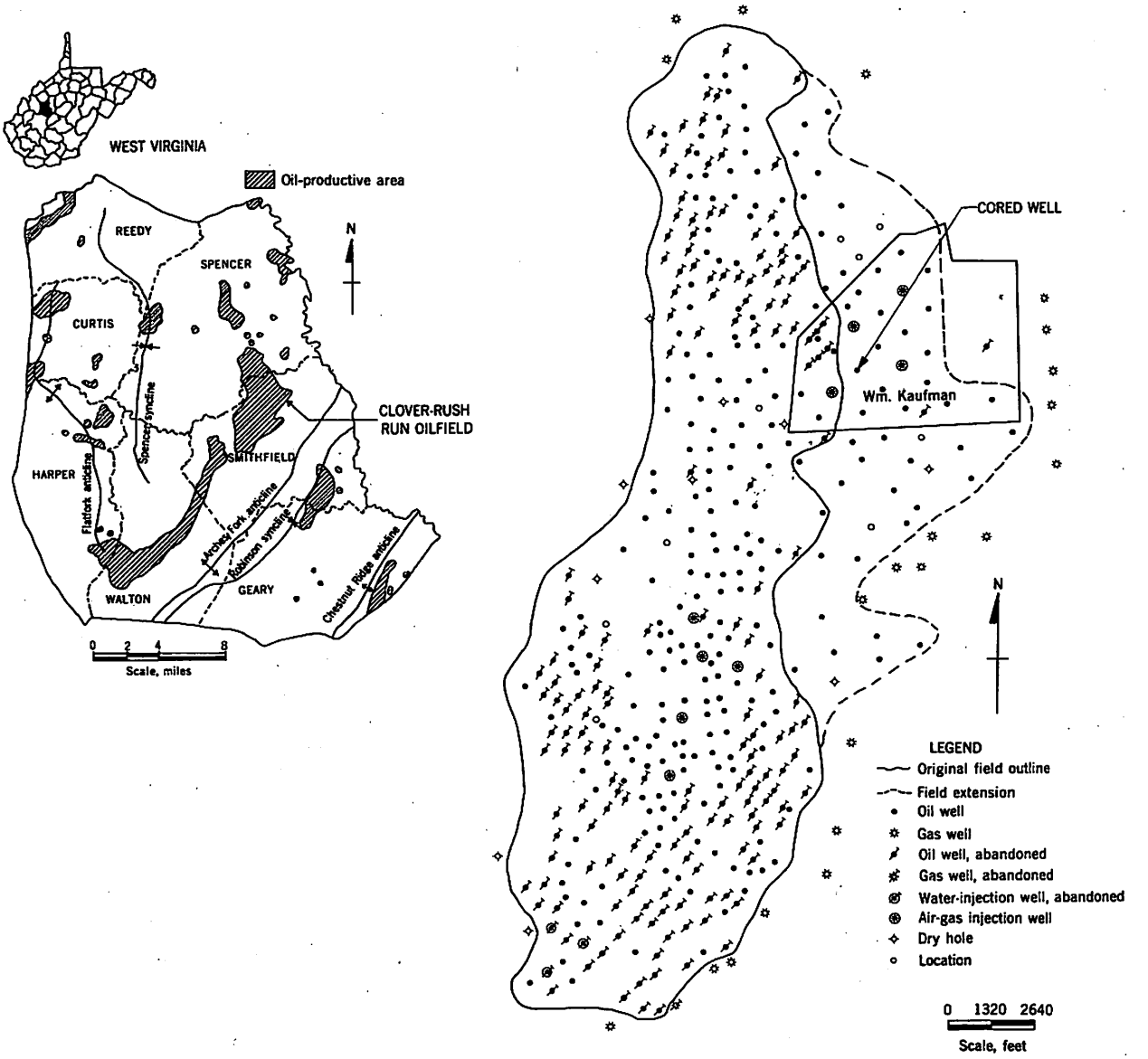

FIGURE 1. - Oil-Productive Areas in Roane County, W. Va., and the William Kaufman Lease in the Clover-Rush Run Oilfield.

A generalized geologic column for Roane County illustrates the stratigraphy of the area (fig. 2). Below the outcropping Dunkard and Monongahela formations lie the intermingled sandstones, limestones, shales, and coal seams of the Pennsylvanian Period. Next come the limestones, sands, and shales of the Mississippian Period, including the basal Greenbrier limestone and dolomite and the Keener and Big Injun sandstones which were cored in well P-7 on the William Kaufman lease.

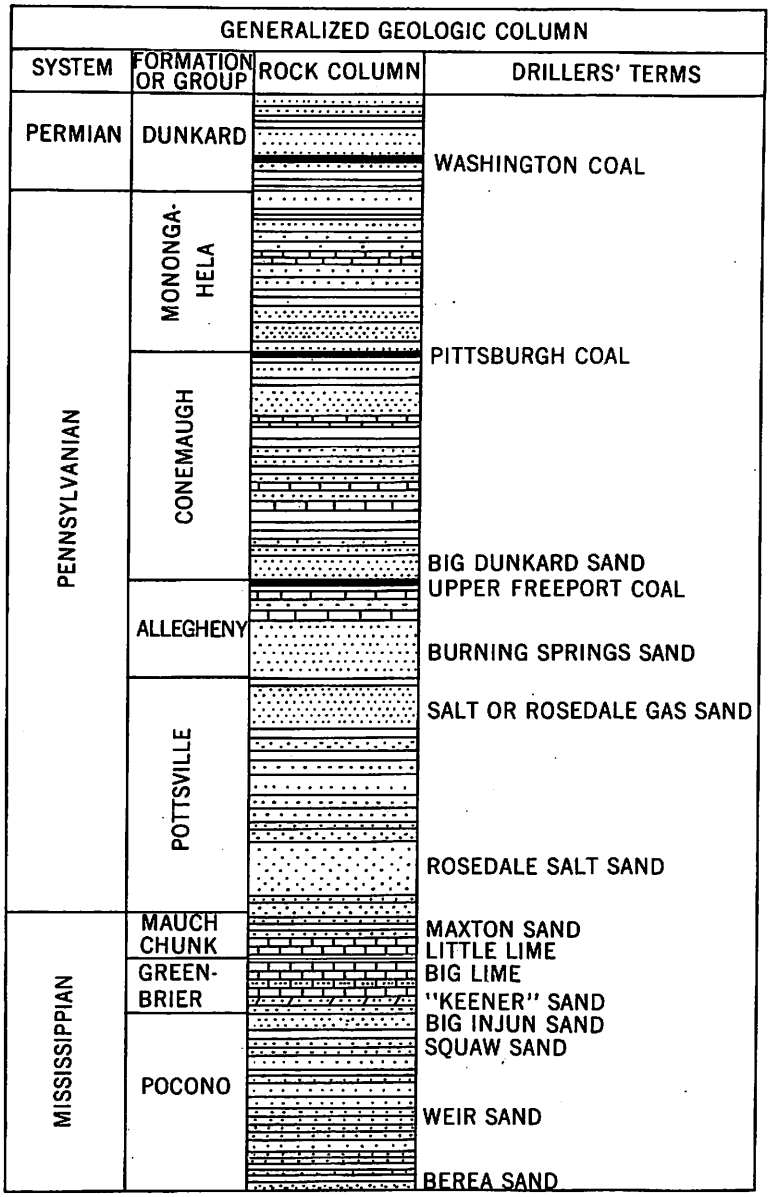

FIGURE 2. - Generalized Geologic Column of Subsurface Formations, Clover-Rush Run Oilfield.

FIELD DEVELOPMENT AND LEASE HISTORY

Development of Clover-Rush Run Oilfield

The original discovery well for the Clover-Rush Run oilfield was Heasley and Co. well 1, drilled on the L. D. Chambers lease in 1909. An oil-productive area of about 4,200 acres had been outlined by 1926 through development drilling, and by 1961 approximately 350 wells had been completed within the original field limits (fig. 1).

In the summer of 1961 a development boom began; about 60 new wells were drilled, and approximately 1,600 new productive acres were added to the northeastern side of the field by the summer of 1964. A large part of this drilling activity took place on the Kaufman lease.

Initial production from the old wells within the original field boundaries ranged from 2 to 40 barrels of oil per day. The use of hydraulic fracturing then raised the initial oil-production rates of the new development wells to a range of 15 to 250 barrels per day.

History of William Kaufman Lease

The present Kaufman lease (fig. 3) consists of 700 acres and was originally part of a larger Heasley and Co. holding. Sometime between 1909 and 1918, three oil wells were drilled within the lease area. About 1918, the Carter Oil Co. bought the lease and drilled three more producing wells. Next, the Hope Construction and Refining Co. leased the property. By 1920, Hope had also drilled three wells, each of which initially produced less than five barrels of oil per day. Finally the South Penn Oil Co., now the Pennzoil Co., bought the Kaufman lease from Hope in 1943 and completed two new oil wells by 1962.

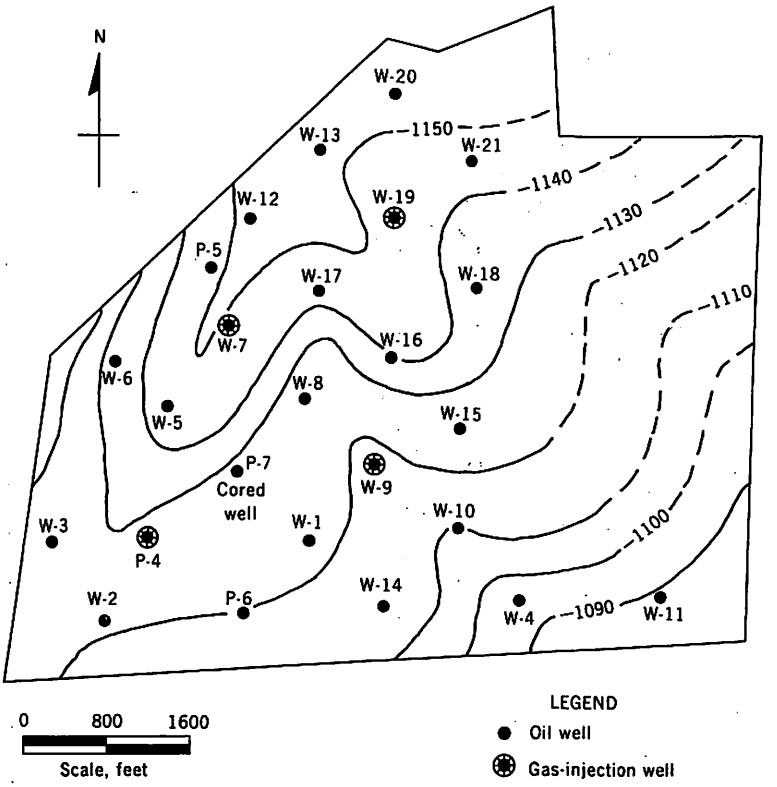

FIGURE 3. - Structure Contour Map on Top of Big Injun Sand, William Kaufman Lease, Clover-Rush Run Oilfield.

All of the producing wells on the Kaufman lease except one of the wells drilled by South Penn had been abandoned by the summer of 1962 when a new flurry of development activity hit the lease. This drilling program produced 24 new oil wells in the Big Injun sandstone by July 1964 when development was stopped. A permeability pinchout in the formation to the northeast limits the new field addition. The Kaufman property is situated in this area of low to zero permeability, and lease wells had only slight shows of oil on initial completion. After fracturing, however, the wells produced 15 to 50 barrels of oil per day.

CORING AND LOGGING OPERATIONS

Kaufman lease well P-7 was cored in September 1963 by personnel of the Pennzoil Co. and the Bureau of Mines. The 3½-inch-diameter core was taken with rotary tools using a low-water-loss bentonite water-base mud. The cored interval extended from 2,131 to 2,212 feet with 100-percent recovery.

A group of well logs, including guard, spontaneous potential, 16- and 64-inch normals, continuous velocity, gamma ray-neutron, and caliper, was run after coring operations were completed. The log curves covering the cored interval have been previously published (6).

RESERVOIR DATA

Structure

The Big Injun sandstone underlying the Kaufman lease is at an average depth of 2,200 feet. The reservoir is bounded on the downdip western edge of the field by water and updip by a permeability pinchout which cuts across the northeastern corner of the Kaufman property. The sand ranges in gross thickness from 50 feet on the downdip side of the field to 15 feet updip, and averages 24 feet under the Kaufman lease. Structure and isopachous maps of the Big Injun sand are shown in figures 3 and 4, respectively.

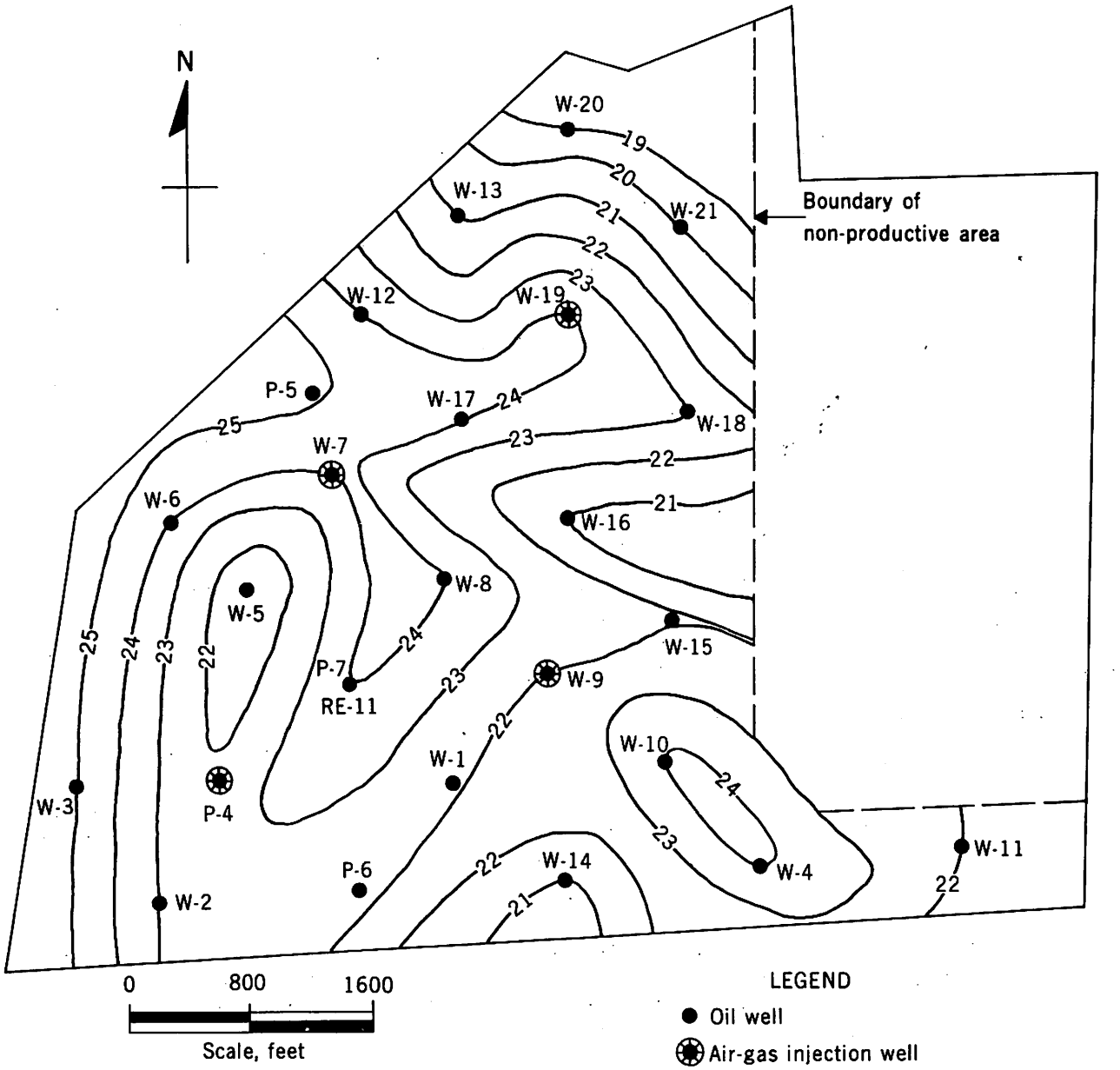

FIGURE 4. - Isopachous Map of the Big Injun Sand, William Kaufman Lease, Clover-Rush Run Oilfield.

Lithology

The cored interval in Kaufman well P-7 included the basal Greenbrier limestone and the Keener and Big Injun sandstone formations. The Greenbrier, locally called Big Lime, is light gray to gray brown, is slightly sandy and oölitic, and contains traces of glauconite (6). The basal section consists of light gray to tan, granular, calcareous, and glauconitic dolomite bottomed by a conglomerate of calcium carbonate, cemented quartz pebbles, and pieces of limestone.

The conglomerate grades into what is known locally as the Keener sandstone which extends from 2,168 to 2,182 feet. This is a white, medium- to coarse-grained, calcareous sandstone with a quartz pebble, limestone fragment, and clay material conglomerate at the bottom.

The Keener is immediately followed by the oil-productive Big Injun, a light-gray, fine-grained, subgraywacke sandstone that covers the interval 2,182 to 2,206 feet. The formation is glauconitic, very slightly calcareous, and contains traces of mica and argillaceous material. The argillaceous matter consists of illite and kaolinite which, together with montmorillonite, coat the quartz grains and occupy some of the pore spaces. The quartz grains are poorly sorted and loosely bonded, primarily by the coating clay material.

Core Analysis

The Kaufman lease contains 800 acres, 567 of which are considered oil productive based on logs and production records of wells. Kaufman well P-7, located near the center of the productive area and one of the best producers on the lease, has a total sand thickness of 24 feet for the Big Injun.

Using 0.1 millidarcy as a limiting minimum permeability, only 12.5 feet, or 52 percent of the total interval of well P-7, are considered effective net sand. This factor has been applied to the effective area gross sand volume of the lease, as determined from the isopachous map, to give an areally weighted average net sand thickness of 12.7 feet.

Core data for the Big Injun sand in Kaufman well P-7 are summarized below:

	Interval	
	Effective	Total
Thickness.....feet..	12.5	24.0
Air permeability..... millidarcy..	.8	.5
Porosity.....percent..	15.2	12.7
Saturation:		
Oil.....do..	8.7	7.4
Water.....do..	65.1	68.0

Complete core analysis data for the portion of the cored interval, which includes the Keener and Big Injun sands, are presented in table A-1.

Log Analysis

Quantitative analyses of the logs run in Kaufman well P-7 gave no conclusive results for the Big Injun reservoir. Water saturations calculated from guard log resistivities and core porosities gave an average value of 25 percent for the gross sand interval. This is much lower than the established area saturation of approximately 50 percent. A possible explanation for the low reading is that fresh-water-mud filtrate may have invaded the logged interval.

Porosities for the Big Injun sandstone were calculated from both neutron and velocity logs. The average neutron log value of 9.5 percent is lower than the core analysis figure of 12.7 percent, which may be due to the presence of free gas saturation in the formation. The velocity log, however, gave a value of 21.7 percent. This high porosity may be the result of velocity log signal attenuation, or cycle skipping; also due to a free-gas saturation.

The caliper log showed that the borehole was very uniform and in-gage through the Big Injun interval, indicating a uniformly hard formation.

Reservoir Limits

As mentioned previously, only 567 acres of the 800-acre Kaufman property are considered commercially oil productive. The remaining 233 acres (fig. 4) have not been assigned reserves. This is based on Kaufman well P-3, the only well drilled on this part of the lease. The exact location of this well is not known, but its approximate position is shown in figure 1. No formal records are available for well P-3, but operating personnel believe that the well was plugged and abandoned shortly after completion. Only a few quarts of oil were bailed out after the well was shot with nitroglycerin.

The eastern side of the commercially nonproductive area is formed arbitrarily by the lease line, and the western and southern sides are based on one-half well spacing from the adjacent row of Kaufman lease wells. During 1964 and 1965, the M & M Drilling Co. of Spencer, W. Va., drilled and completed four gas wells (fig. 1) about 900 feet east of the Kaufman lease. The wells had estimated initial open flows of 1 million cubic feet per day, and oil production ranged from a show to 20 barrels per day.

In view of this production to the east, only a test well, completed with modern techniques in the portion of the lease now considered nonproductive, will determine if the formation underlying this part of the Kaufman property contains any producible oil reserves.

Reservoir Temperature and Pressure

On May 1, 1964, several bottom-hole surveys were taken in Kaufman well P-7. One of the measurements was a reservoir temperature survey which recorded a formation temperature of 74° F for the Big Injun sand.

Leasewide bottom-hole pressure surveys were conducted on three occasions on wells on the Kaufman property. Tests run in November 1963, gave an areally weighted average pressure of 462 psig for the Big Injun sand; in June 1964, the pressure was 379 psig; and in May 1965, it had dropped to 268 psig.

Since the formation in the lease area had been tapped as early as 1909 when reservoir-pressure surveys were unheard of, an original formation pressure had to be estimated. Using established area pressure gradients applicable to the Big Injun sandstone, the original formation pressure was estimated as 700 psig. The original crude oil is assumed to have been saturated at the initial reservoir pressure of 700 psig.

Permeability

Permeability measurements were made in the laboratory on sample plugs cut at 1-foot intervals from the core material from Kaufman well P-7. The average air permeabilities of the gross and net effective intervals of the Big Injun sandstone are 0.5 and 0.8 millidarcy, respectively. These values illustrate the extreme tightness of the sand, especially since well P-7 is considered the best oil producer on the lease. Core analysis results, including a complete list of permeabilities, are given in table A-1.

Reservoir-Fluid Saturations

Oil and water saturations were also measured at 1-foot intervals along the core. Average oil and water saturations of the effective net interval are 8.7 and 65.1 percent, respectively. These values cannot be considered representative since the well was cored with a fresh-water-base drilling mud, and because filtrate invasion and solution-gas expansion undoubtedly took place during coring.

Analysis of the electric log gave an average water saturation of 25 percent over the gross sand interval. This value, also, may be too low because of mud filtrate invasion of the logged formation.

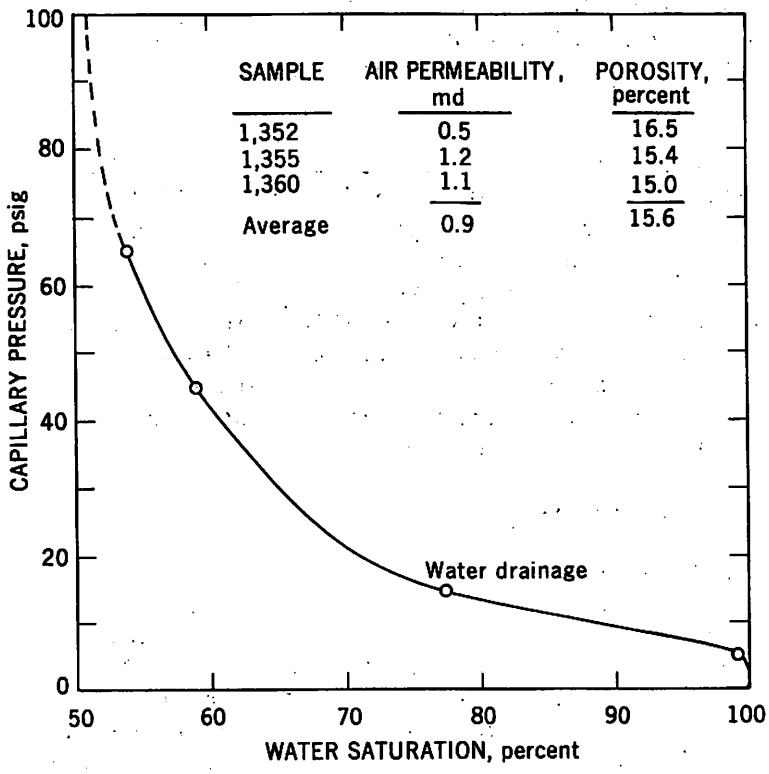

FIGURE 5. - Capillary Pressure Versus Water Saturation for the Big Injun Sand in Kaufman Well P-7, Clover-Rush Run Oilfield.

Finally, a graph of capillary pressure versus water saturation (fig. 5) prepared from laboratory test data shows an irreducible water saturation of 51 percent. This value is in agreement with established saturations of the Big Injun sandstone in the area and is used in this report.

To date, no water has been produced from the Kaufman lease, and the 51-percent saturation is considered immobile and equal to the original reservoir water saturation. The original oil saturation would then be 49 percent, based on the assumption that the reservoir was initially 100 percent liquid filled.

Reservoir-Fluid Properties

Because the area under study has been produced since 1909, no direct analysis of the original reservoir fluids is available. However, a reservoir-fluid sample taken from Kaufman well P-7 in May 1964, when the bottom-hole sampling pressure of the well was 483 psig, was analyzed. By using a technique reported by Clark (1), and several assumed factors, this fluid analysis has been adjusted to represent the original reservoir fluid.

An outline for pressure-volume-temperature analysis tests necessary to fully utilize the above adjustment procedure is given in appendix B. The outline applies where the fluid sampling pressure is lower than the original reservoir pressure. The adjustment procedure and original and adjusted PVT analysis data for Kaufman well P-7 are given in appendix C.

In May 1964, the stock-tank crude oil gravity was 48.3° API at 60° F and the crude oil viscosity was 2.43 centipoises at 77° F.

RESERVOIR PERFORMANCE

Primary-Performance Prediction

The primary-recovery mechanism of the Big Injun sandstone under the Kaufman property is a dissolved-gas or depletion drive. This production method is inherently the most inefficient natural drive and, in the Appalachian area, will usually produce only about 5 to 25 percent of the oil in the reservoir.

The crude oil originally in place was calculated volumetrically, using core, electric log, and fluid analysis data, and was found to be 3,291,000 stock-tank barrels, or 457 barrels per acre-foot. A prediction of primary recovery was then made by analysis (3) of the production-decline curve (fig. 6) for the Kaufman lease. Overall primary recovery over the producing life from the original reservoir pressure of 700 psig to theoretical lease abandonment conditions--10 barrels of oil per day--was calculated to be 319,000 stock-tank barrels of oil. This represents a recovery of 9.7 percent of the oil in place, or 44 barrels per acre-foot, by primary solution-gas drive. Theoretical abandonment conditions would be reached in April 1970.

Secondary Recovery

Waterflood Prediction

A computer prediction for theoretical secondary oil recovery by waterflooding the Big Injun sandstone under the Kaufman property was made. The hypothetical pilot area consisted of a pattern of four 5-spots totaling 23 acres. An essential part of the prediction is based on the oil-water relative permeability curves obtained in the laboratory (fig. 7). As can be seen from the curves, the relative permeability to oil at initial conditions is good. This may explain the initial completion gages of 15 to 50 barrels of oil per day after fracturing. The relative permeability to water, however, stays very low through the laboratory test range of water saturations.

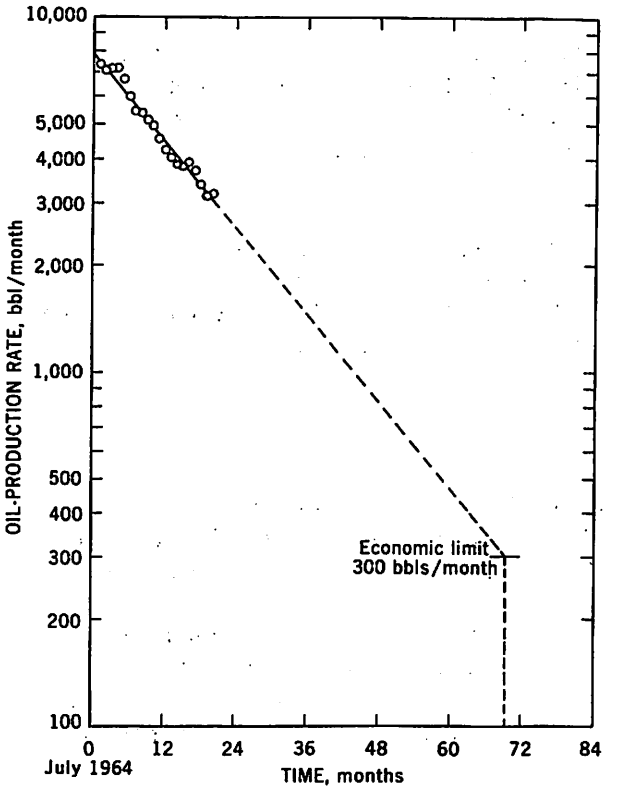

FIGURE 6. - Production Decline Curve for the William Kaufman Lease, Clover-Rush Run Oilfield.

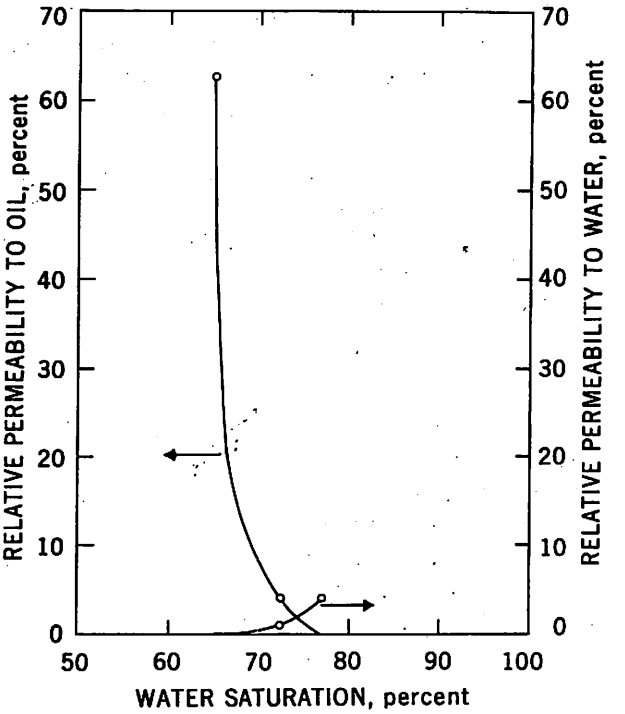

FIGURE 7. - Oil and Water Relative Permeability Curve for the Big Injun Sand in Kaufman Well P-7, Clover-Rush Run Oilfield.

Due to this low relative water permeability, the predicted time required to fill the initial gas saturation space in the pilot area with water and for oil production to begin is 17 years. After fill-up, the stabilized water-injection rate reached was less than one-half barrel per well per day, and the oil-production rates were correspondingly low. These low water-injection and oil-production rates preclude waterflooding the lease on an economic basis under present-day reservoir technology.

Gas-Injection Project

A prediction of secondary-recovery performance by gas injection could not be made because of the absence of essential data, such as a gas-oil relative permeability relationship. Several attempts to determine a K_g/K_o curve in the laboratory failed because of the tightness of the core samples. Reasonable theoretical K_g/K_o curves could not be estimated for the same reason.

At the present time, the lease operator is conducting a gas-injection program on the property. The project was started July 1, 1965, with the reinjection of lease-produced gas into four wells (fig. 3). Lease injection volumes have averaged 400,000 to 500,000 cubic feet per day since the project was begun.

To date, there has been gas breakthrough in several producing wells, including well P-7. The rapidity with which breakthrough occurred in some wells seems to indicate at least partial communication between injection and producing wells. The communication may possibly be through joints or hydraulically induced fractures. An east-west trend in the direction of communication has also been observed.

After 14 months of gas injection, no production increase was noted. In the last few months, however, the rate of decline of oil production has been partially arrested. A program to decrease the high producing gas-oil ratios in order to conserve reservoir energy was recently initiated by selectively choking back some producers.

SUMMARY

Because of the inherent inefficiency of the solution-gas drive, primary recovery will be only a fraction of the oil reserves in the Big Injun sand, and more than 90 percent of the oil will be left behind in the reservoir. Secondary recovery by waterflooding is precluded by the relative oil-water permeability characteristics of the sand, and a prediction of secondary recovery by gas injection could not be made because essential reservoir data were not available. In order to stimulate oil production, the Kaufman lease operator is currently reinjecting natural gas into the producing formation.

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6. Overbey, William K., Jr., and Donald M. Evans. Appalachian Region Oilfield Reservoir Investigations, Basal Greenbrier Limestone and Dolomite and "Keener" and Big Injun Sands, Clover-Rush Run Field, Smithfield District, Roane County, W. Va. Producers Monthly, v. 29, No. 5, May 1965, pp. 22-24.

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APPENDIX A.--CORE ANALYSIS DATA FOR KAUFMAN WELL P-7

TABLE A-1. - Core analysis results, Kaufman well P-7

Sample	Depth, ft	Air permeability, md	Porosity, pct	Fluid saturation, percent pore space		Oil content, bbl/acre-ft	Salinity, equivalent NaCl, ppm
				Oil	Water		
1,304	2,140.0	<0.1	0.1	(1)	(1)	(1)	(1)
1,305	2,141.0	<.1	.6	-	-	-	-
1,306	2,142.0	<.1	.6	-	-	-	-
1,307	2,148.9	<.1	.1	-	-	-	-
1,308	2,150.4	<.1	4.9	-	-	-	-
1,309	2,151.0	<.1	5.1	-	-	-	200,000
1,310	2,151.4	<.1	4.5	-	-	-	-
1,311	2,152.6	<.1	6.3	-	-	-	194,000
1,312	2,161.0	<.1	5.4	-	-	-	200,000
1,313	2,165.0	<.1	.4	-	-	-	159,000
1,314	2,165.6	.5	1.7	-	-	-	-
1,315	2,166.0	<.1	1.5	-	-	-	-
1,316	2,166.4	<.1	1.5	-	-	-	-
1,317	2,167.0	<.1	2.1	-	-	-	-
1,318	2,167.4	<.1	1.6	-	-	-	-
1,319	2,168.0	<.1	1.9	-	-	-	146,000
1,320	2,168.5	<.1	.6	-	-	-	-
1,321	2,169.0	.2	3.2	8.8	17.1	23	-
1,322	2,169.6	.3	3.5	-	-	-	-
1,323	2,170.2	.2	5.4	4.3	27.8	18	-
1,324	2,170.9	.2	6.3	1.8	16.9	9	13,000
1,325	2,171.5	.1	6.1	4.0	31.8	19	-
1,326	2,172.0	.5	8.1	-	-	-	-
1,327	2,172.5	.3	5.7	-	-	-	-
1,328	2,173.0	.3	5.3	21.4	12.8	90	317,000
1,329	2,174.0	.2	5.3	-	-	-	-
1,330	2,175.0	<.1	4.0	4.9	75.1	-	-
1,331	2,175.5	<.1	2.6	-	-	-	-
1,332	2,177.0	.5	2.4	-	-	-	116,000
1,333	2,177.8	<.1	1.8	-	-	-	-
1,334	2,178.2	.1	11.6	-	-	-	-
1,335	2,179.0	.8	11.6	5.7	63.5	52	-
1,336	2,179.4	1.7	11.9	.1	52.0	1	-
1,337	2,180.0	<.1	3.5	-	-	-	178,000
1,338	2,180.5	.6	12.7	-	-	-	-
1,339	2,181.0	<.1	2.9	-	-	-	-
1,340	2,182.0	.1	12.4	3.5	70.1	35	-
1,341	2,182.5	.4	14.8	-	-	-	-
1,342	2,183.0	.2	11.9	-	-	-	176,000
1,343	2,184.0	<.1	7.8	-	-	-	-
1,344	2,185.0	.1	13.3	2.1	73.9	22	-
1,345	2,186.0	.1	11.5	2.1	85.2	20	188,000
1,346	2,187.0	<.1	2.6	-	-	-	-
1,347	2,188.0	<.1	2.6	-	-	-	-
1,348	2,189.0	.2	13.5	3.1	69.9	34	190,000
1,349	2,190.0	<.1	12.0	3.2	77.0	31	-
1,350	2,191.0	.4	14.3	14.3	56.7	160	-
1,351	2,192.0	<.1	5.2	4.6	80.7	19	200,000
1,352	2,193.0	.5	16.5	9.6	61.3	124	-
1,353	2,194.0	1.0	16.5	11.0	61.5	142	-
1,354	2,195.0	.6	16.5	8.7	61.4	113	188,000
1,355	2,196.0	1.2	15.4	8.6	67.2	104	-
1,356	2,197.0	1.1	15.5	8.8	67.9	106	-
1,357	2,198.0	1.0	15.6	9.4	64.8	115	184,000
1,358	2,199.0	.5	15.2	9.2	68.5	109	-
1,359	2,200.0	.8	16.4	8.9	61.9	115	-
1,360	2,201.0	1.1	15.0	10.3	63.9	120	183,000
1,361	2,201.7	1.8	15.5	8.0	64.6	97	-
1,362	2,209.0	.1	13.1	-	-	-	-
1,363	2,212.0	.1	10.2	-	-	-	-
Average	-	.4	9.3	7.1	58.1	70	159,000

[1]No test run.

APPENDIX B.--RECOMMENDED ANALYSES FOR PRESSURE-VOLUME-TEMPERATURE SAMPLES AT PRESSURES BELOW ORIGINAL RESERVOIR PRESSURE

The following tests are considered necessary for maximum use of pressure-volume-temperature (PVT) data in reservoir calculations:

(If the PVT sample is saturated, record test data relative to oil at reservoir temperature and pressure at sampling time; if not saturated, relate the data to oil at saturation pressure and reservoir temperature.)

1. Differential liberation at reservoir temperature at different pressures, including liberated gas, gas specific gravity and compressibility, and oil shrinkage factors.

2. Flash separation of sample oil in 0, 25, 50, and 100 psig separators, recording separator GOR, oil shrinkage, and oil API gravity.

3. Pressure-volume relationship at reservoir temperature, including thermal expansion.

4. Oil viscosity at various pressures, and oil compressibility over several pressure ranges.

The foregoing PVT analysis data can then be adjusted to original reservoir conditions for use in reservoir calculations (1).

APPENDIX C.--PRESSURE-VOLUME-TEMPERATURE ANALYSIS ADJUSTMENT PROCEDURE

Given a PVT analysis taken at a pressure lower than initial conditions, the procedure and equations outlined below (1) can be used to adjust the PVT data to original reservoir conditions.

Given p_i = estimated original reservoir pressure = 700 psig,

p_s = reservoir pressure at PVT sampling time = 468 psig,

p = some lower pressure = 400 psig,

T_r = reservoir temperature = 74° F,

G_{l_s} = differentially liberated gas from p_s to p = 25 scf per bbl of saturated oil at p_s, T_r,

G_l = adjusted gas value, scf per bbl of saturated oil at p_i, T_r,

B_o/B_{o_s} = differential shrinkage factor, bbl saturated oil at p per bbl saturated oil at p_s, T_r,

B_o/B_{o_i} = adjusted differential shrinkage factor, bbl saturated oil at p per bbl saturated oil at p_i, T_r,

B_o = adjusted formation volume factor, bbl saturated oil at p per bbl stock-tank oil,

SF = adjusted flash shrinkage factor, stb oil per bbl initial reservoir oil,

CGV = corrective gas volume, cu ft gas per bbl oil at p_s, T_r,

COV = corrective oil volume, bbl oil at p_i, T_r per bbl oil at p_s, T_r.

Find

$$CGV = \frac{p_i - p}{p_s - p} (G_{l_s}) \qquad (1)$$

$$= \frac{700 - 468}{468 - 400} (25)$$

$$= 85 \text{ scf},$$

$$COV = 1 + \left[\left(\frac{p_i - p_s}{p_s - p}\right) \left[(B_o/B_{os} \text{ at } P_s) - (B_o/B_{os} \text{ at } p)\right]\right] \quad (2)$$

$$= 1 + \left[\left(\frac{700 - 468}{468 - 400}\right) \left[1.0000 - 0.9920\right]\right]$$

$$= 1.027 \text{ bbl at } p_i, T_r/\text{bbl at } p_s, T_r,$$

$$G_l = \frac{G_{ls} + CGV}{COV}, \quad (3)$$

$$B_o/B_{oi} = \frac{B_o/B_{os}}{COV}, \quad (4)$$

$$B_o = \frac{B_o/B_{oi}}{SF}. \quad (5)$$

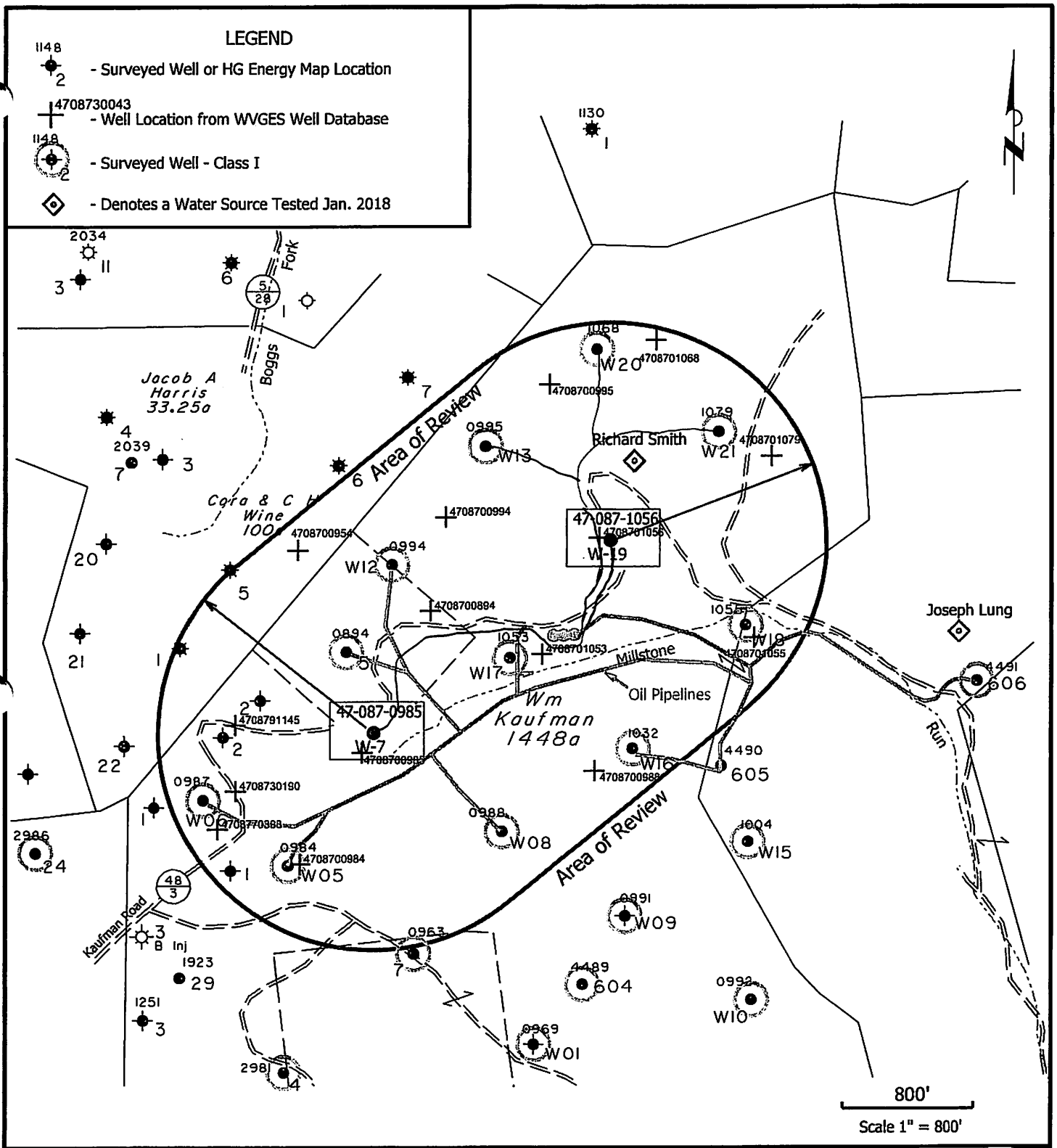
This adjustment procedure is applied to Kaufman well P-7 in table C-1.

TABLE C-1. - Original and adjusted pressure-volume-temperature analyses data, Kaufman well P-7

Reservoir pressure, psig[1]	G_{ls}[1]	G_l[2]	B_o/B_{os}[1]	B_o/B_{oi}[2]	B_o[2]
700.....	-	0	-	1.000	1.264
468.....	4	87	1.0000	.974	1.231
450.....	10	92	.9976	.971	1.228
400.....	29	111	.9920	.966	1.221
300.....	68	149	.9752	.950	1.201
200.....	112	192	.9556	.930	1.176
100.....	166	244	.9306	.906	1.145
0.....	340	414	.8193	.798	1.009

[1]Original PVT analysis data.
[2]Adjusted values.

Fig No. 4



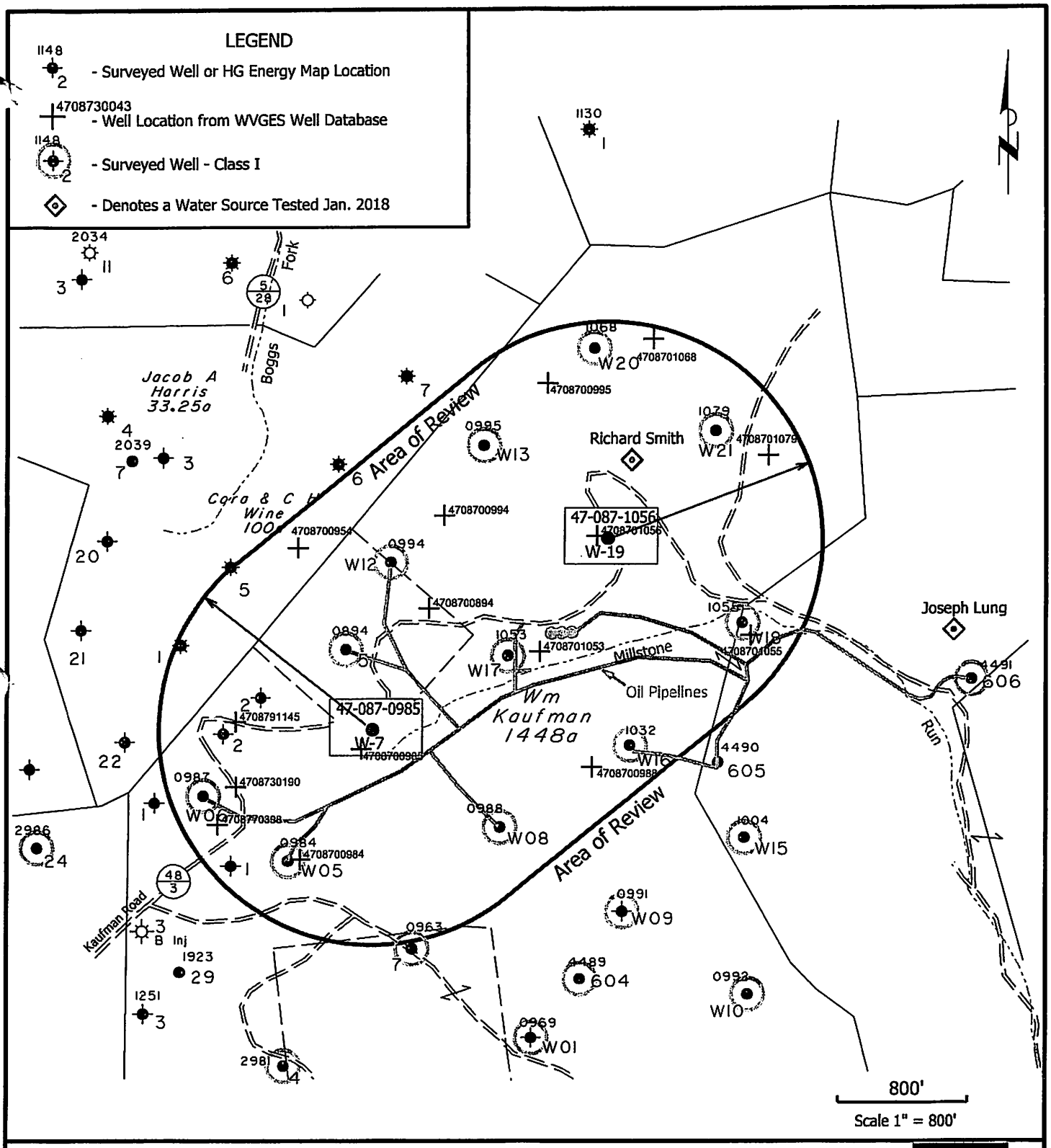
- CLOVER FIELD -
Injection Wells
Wm. Kaufman No.W-7 (47-087-00985)
Wm. Kaufman No.W-19 (47-087-01056)

ROANE CO., WV

Map Showing All Known Wells
Within the Quarter-Mile AOR
& WVGES Well Data Spots

1/25/2018

HG ENERGY



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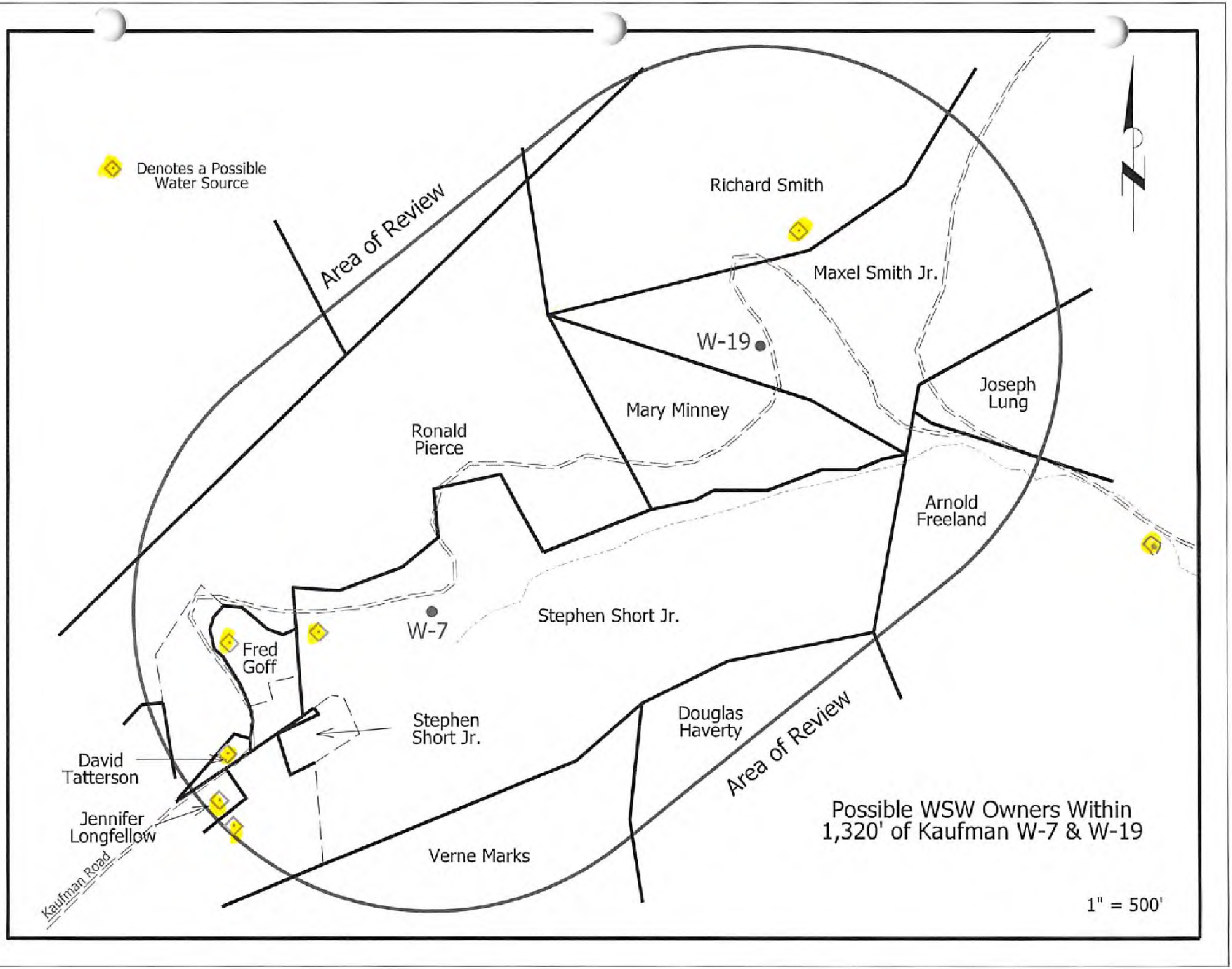
HG ENERGY LLC


Denotes a Possible Water Source
Area of Review
Richard Smith
Maxel Smith Jr.
W-19
Joseph Lung
Mary Minney
Ronald Pierce
Arnold Freeland
W-7
Stephen Short Jr.
Fred Goff
Stephen Short Jr.
Douglas Haverty
Area of Review
David Tatterson
Jennifer Longfellow
Verne Marks
Kaufman Road
Possible WSW Owners Within 1,320' of Kaufman W-7 & W-19
1" = 500'

Form OG-10

STATE OF WEST VIRGINIA
DEPARTMENT OF MINES
OIL AND GAS DIVISION 16

JUL 24 1

PRINT COPY

Quadrangle SPENCER

Permit No. ROA-1056

WELL RECORD

Oil or Gas Well Oil & G (KIND)

Company WOLF'S HEAD OIL REFINING COMPANY, INC.
Address P. O. Box 1588, Parkersburg, W. Va.
Farm Wm. Kaufman Acres 800
Location (waters) Millstone Run
Well No. W-19 Elev. 1060.85
District Smithfield County Roane
The surface of tract is owned in fee by Maxel Smith
Otto Route Address Spencer, W. Va.
Mineral rights are owned by Alfred M. Oppenheimer, II, et al
300 South Lang Avenue Address Pittsburgh 8, Pa.
Drilling commenced June 12, 1964
Drilling completed June 19, 1964
Date Shot - From To
With
Open Flow /10ths Water in Inch
/10ths Merc. in Inch
Volume Drilled w/Rotary (Show Only) Cu. Ft.
Rock Pressure No Test lbs. hrs.
Oil bbls., 1st 24 hrs.
WELL ACIDIZED

Casing and Tubing	Used in Drilling	Left in Well	Packers
Size			
16			Kind of Packer Steel Shoe
13			Float Collar
10 3/4"OD	9'	9'	Guide Shoe
8¾ 5/8"OD	466'	466'	Size of 2½"OD
6⅝			4½"OD
~~xxxx~~ 4½"OD/ Tallay	2286'	2286'	Depth set 454'
S.L.M.	2272'	2272'	2248'
2			2272'
2 3/8"OD	2251.83'	2251.83	Perf. top
Liners Used			Perf. bottom
			Perf. top
			Perf. bottom

CASING CEMENTED 8 5/8" SIZE 454 No. Ft. Surface to: 6/13/64
4½" 2272 6/20/64
COAL WAS ENCOUNTERED AT - FEET INC
FEET INCHES FEET INC
FEET INCHES FEET INC

WELL FRACTURED 6/27/64 - Used: 1,050 Bbls. Water, 46,000 # Sand, 300 Gal. BDA Acid, 175# 350# J-84, 20 Gal. Deterger and 35 Gal. Freflo
RESULT AFTER TREATMENT Gas - 50,000 Cu. Ft. Oil - 25 Bbls.
ROCK PRESSURE AFTER TREATMENT 400 Lbs.
Fresh Water - Feet - Salt Water Feet

Formation	Color	Hard or Soft	Top	Bottom	Oil, Gas or Water	Depth	Remarks
Top Soil			0	10			
Conductor				9			
Red Rock			10	20			
Slate			20	85			
Sand			85	200			
Slate			200	230			
Red Rock			230	265			
Slate			265	295			
Sand			295	395			
Slate			395	420			
Red Rock			420	430			
Sand			430	470			
Slate			470	485			
Red Rock			485	495			
Slate			495	515			
Red Rock			515	525			
Slate			525	675			
Red Rock			675	735			
Sand			735	765			
Red Rock			765	815			
Slate			815	840			
Sand			840	905			
Red Rock			905	925			
Slate			925	965			
Red Rock			965	985			
Slate			985	1245			
Sand			1245	1350			
Slate			1350	1375			
Sand			1375	1400			

RECEIVED
West Virginia
Dept. of Mines
JUL 27 1964

(over)

Formation	Color	Hard or Soft	Top 10	Bottom	Oil, Gas or Water	Depth Found	Remarks
Slate			1400	1570			
Sand			1570	1620			
Slate			1620	1730			
Sand			1730	1760			
Slate			1760	1805			
Sand			1805	1920			
Slate			1920	1990			
Sand			1990	2027			Water
Little Lime			2027	2062			
Pencil Cave			2062	2078			
					Oil & Gas	2115-2120	Show Only
Big Lime			2078	2193			
Keener			2193	2202			
Big Injun			2202	2235			
Pay			2206	2216			Show
Slate			2235	2277			
4½" Casing				2272			
TOTAL DEPTH				2277			

W 19

Date July 13, 19 64

APPROVED WOLF'S HEAD OIL REFINING COMPANY, INC., Owner

By George W. Wilsman

George W. Wilsman, (Title) Agent

FORM No. 1 89 1M 2/60 M'G. 9283A

WOLF'S HEAD OIL REFINING COMPANY, INCORPORATED

~~SOUTHERN PENN OIL COMPANY~~

RCC

NEW WELL REPORT

LEASE No. 81219 — 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL No. W-7 N. ___ S. 47 E. ___ W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY ___ QUAD

LOCATION MADE September 20, 1963 — DRILLING COMMENCED November 20, 1963

RIG COMMENCED November 20, 1963 — DRILLING COMPLETED November 27, 1963

RIG COMPLETED November 20, 1963 — DEPTH 2219' SAND Big Injun

RIG CONTRACTOR Denning Drilling Co., Inc. — DRILLING CONTRACTOR Denning Drilling Co., Inc.

ELEVATION: FLOOR ___ GROUND 1003.40 — WORK ORDER No. AFE # WH-13-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
Clay	0	10							
Sand	10	70							
Red Rock	70	110							
Shale	110	130							
Sand	130	172	172						
Shale	172	200							
Sand	200	240							
Red Rock	240	295							
Sand	295	375							
Sandy Shale	375	575							
Shale	575	600							
Red Rock	600	610							
Shale	610	630							
Sand	630	635							
Shale	635	670							
Sand	670	705							
Sand & Shale	705	935							
Sand	935	1020							
Shale	1020	1040							
Sand	1040	1150							
Shale	1150	1300							
Sand	1300	1350							
Sand & Shale	1350	1435							
Sand	1435	1500							
Shale	1500	1530							
Sandy Shale	1530	1600							
Sand	1600	1665							
Lime	1665	1770							
Sand	1770	1925							
Shale	1925	1955							
Little Lime	1955	1970							
Sandy Shale	1970	1975							
Big Lime	1975	2130							
Keener Sand	2130	2141							
Big Injun	2141	2170							
Oil & Gas	2141	2170		Show					
Shale	2170	2219							
4½" Casing		2219	2219						
Total Depth		2219	2219						

(OVER)

NEW WELL REPORT – CONT'D.

W-7

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL			PULLED OUT		
	TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	IN
8-5/8"	Tally	174	2			
4½" OD	Tally	2230	7			
2-3/8"						
Tbg.	Tally	2230	—			

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in_____Inch

_____ /10ths Merc. in_____Inch

Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.

Rock Pressure_____lbs. _____hrs.

Oil *See Electric Log bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8" OD	172	11-21-63
Float Collar	4½" OD	2188	11-29-63
Guide Shoe	4½" OD	2219	11-29-63

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED_____

DATE WELL FRACTURED December 12, 1963

NAME OF COMPANY Halliburton Company

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 900 Bbls. Oil
Used: 36,000# Sand
Used: 300 Gal. NCA Acid
Used: 550# Adamite II
Used: 50 Gal. Hyflo

BREAKDOWN PRESSURE 1300#

PUMPING PRESSURE 1700 - 2500#

AVERAGE PUMPING RATE/MINUTE 18.9 Bbls.

PUMPING TIME 43 Minutes

RESULT AFTER TREATMENT } GAS 42,000 CU. FT.

OIL 33 BBLS.

ROCK PRESSURE AFTER TREATMENT 508 LBS.

CASING CEMENTED

Surface To:

8-5/8" SIZE 172 FT. 11-21-63 D/

4½" SIZE 2219 FT. 11-29-63 D/

SIZE _____ FT. _____ D/

USED IN CEMENTING 8-5/8" OD CASING:

25 Bags - Cement

1 Bag - Calcium Chloride

Cemented by: Well Service, Inc.

USED IN CEMENTING 4½" OD CASING:

65 Cuft. - Pozmix Cement (Consisting of 33 Cuft. Columbia Cement and 32 Cuft. Pozmix A and 1 Bag Halliburton Gel, blended 2% w/65 Cuft. Pozmix Cement.

500 Gals. - Mud Flush

Cemented by: Halliburton Compar

REMARKS: Drilled 10-5/8" Hole from Surface to 172'.
Drilled 7-7/8" Hole from 172' to 2219'.

Note: Rotary Tools Used.
Note: 12 - 5' Moto-mail Cleaners & 4 Centralizers.

Note: This well was logged by McCullough Tool Company on 11-27-63.

Note: This well was drilled according to Rule 11, under Section 13, of Article 4, Chapter 22, of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C. C. Cousins

SUPERINTENDENT

Form No. 399 IM 11/62 M'O. 9929

WOLF'S HEAD OIL REFINING COMPANY, INC.
SOUTH PENN OIL COMPANY

RC ✓

NEW WELL REPORT

LEASE NO. [redacted] 61219 800 ACRES — WORKING DISTRICT Spencer #4

Wm. Kaufman FARM — WELL NO. W-21 N. ____ S. 47 E. ____ W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY ____ QUAD.

LOCATION MADE June 9, 19 64 — DRILLING COMMENCED July 13, 19 64

RIG COMMENCED July 13, 19 64 — DRILLING COMPLETED July 19, 19 64

RIG COMPLETED July 13, 19 64 — DEPTH 2260' SAND Big Injun

RIG CONTRACTOR Gerald D. Jones — DRILLING CONTRACTOR Gerald D. Jones

ELEVATION: FLOOR ____ GROUND 1045.56 — WORK ORDER NO. APE #WH-38-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
Top Soil	0	10							
Conductor		10	10						
Sand	10	35							
Red Rock	35	60							
Sand	60	100							
Slate	100	170							
Sand	170	205							
Red Rock	205	225							
Slate	225	300							
Sand	300	320							
Slate	320	430							
Sand	430	470	432						
Slate	470	500							
Red Rock	500	535							
Slate & Shale	535	600							
Red Rock	600	625							
Slate	625	705							
Sand	705	740							
Slate	740	770							
Red Rock	770	785							
Sand	785	820							
Slate	820	1120	1120						
Sand	1120	1150							
Slate	1150	1225							
Lime	1225	1250							
Slate	1250	1350							
Sand	1350	1370							
Slate	1370	1465							
Sand	1465	1530							
Slate	1530	1630							
Sand	1630	1695							
Slate	1695	1730							
Sand	1730	1910							
Slate	1910	2040							
Little Lime	2040	2079							
Big Lime	2079	2190							
Oil & Gas	2127	2160		Show					
Oil & Gas	2175	2185		Show					
Big Injun	2190	2212							
Oil & Gas	2192	2210		Show					
Shale	2210	2260							
4½" Casing		2260	2260						
Total Depth		2260	2260						

(OVER)

NEW WELL REPORT — CONTINUED

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL TRANSFER NO.	PUT IN WELL FEET	PUT IN WELL INCH	PULLED OUT TRANSFER NO.	PULLED OUT FEET	PULLED OUT INC
10-3/4" OD	S.L.M.	10	--			
8-5/8" OD	Talley	432	--			
4½" OD	Talley	2274	--			
2-3/8" OD						
Tbg.	Talley	2211	--			

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in ____ Inch

/10ths Merc. in ____ Inch

Volume Show (drilled w/Rotary) Cu. Ft.

Rock Pressure No test lbs. ____ hrs.

Oil Show bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Baker Shoe	10-3/4" OD	10	7/15/64
Steel Shoe	8-5/8" OD	432	7/15/64
Float Collar	4½" OD	2233	7/19/64
Guide Shoe	4½" OD	2260	7/19/64

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED ____

DATE WELL FRACTURED July 24, 1964

NAME OF COMPANY Halliburton

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds.)

Used: 42,916 Gals. Water
Used: 53,500 # Sand
Used: 250 Gals. - HCA
Used: 400 # - WAC - 8
Used: 25 Gals. - Detergor
Used: 35 Gals. - Norfis

BREAKDOWN PRESSURE 2000#

PUMPING PRESSURE 2300 - 2600#

AVERAGE PUMPING RATE/MINUTE 32.2

PUMPING TIME 32 mins.

RESULT AFTER TREATMENT: GAS 39,000 CU. FT.

OIL 12 BBLS.

ROCK PRESSURE AFTER TREATMENT 240 LBS.

CASING CEMENTED

Surface to:

8-5/8" SIZE 432 FT. 7-15-64 DA

4½" SIZE 2260 FT. 7-19-64 DA

SIZE ____ FT. ____ DA

USED IN CEMENTING 8-5/8" CASING:

60 Bags - Bulk Cement

1 Bag - Calcium Chloride

Cemented by: Well Service, Inc.

USED IN CEMENTING 4½" CASING:

45 Bags - Columbia Cement

5 Bags - Aquagel

1 Bag - Lime

5 Gals. - Resinent

Cemented by: Well Service, Inc.

REMARKS: Note: Drilled 8¾" Hole from Surface to 432'
Drilled 6¾" Hole from 432' to 2260'

Note: Used 5 centralizers @ 1976', 213[illegible], 2169', 2200', 2235'

Note: This well was logged by Schlumberger on 7-19-64.

Note: This well was perforated by Basin Survey on 7-22-64 @ 2197' - 5 way Jet

Note: This well was drilled according to Rule 11, under Section 13 of Article 4, Chapter 22 of the Code of the Department of Mines, Oil & Gas Division.

APPROVED

C. C. Cawley

SUPERINTENDENT

12-C

Form No. C69 IM 11/62 M'G. 9929

WOLF'S HEAD OIL REFINING CO., INC.
~~SOUTH PENN OIL COMPANY~~

Rec

NEW WELL REPORT

LEASE No. 81219 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL No. W-18 N. ____ S. 47 E. ____ W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY ____ QUAD.

LOCATION MADE May 1, 1964 — DRILLING COMMENCED June 1, 19 64

RIG COMMENCED May 28, 1964 — DRILLING COMPLETED June 6, 19 64

RIG COMPLETED May 29, 1964 — DEPTH 2097' SAND Big Injun

RIG CONTRACTOR Gerald D. Jones — DRILLING CONTRACTOR Gerald D. Jones

ELEVATION: FLOOR ____ GROUND 875.44 — WORK ORDER No. APE # WH-30-H. Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
op Soil	0	5			Slate	2047	2097		
onductor		15	15		4½" Casing		2095	2095	
and	5	20							
ed Rock	20	30			Total Depth		2097	2097	
and	30	50							
Late	50	100							
and	100	140							
Late	140	160							
and	160	185							
Late	185	195							
ed Rock	195	210							
and	210	250							
Late	250	305							
and	305	340							
Late	340	390							
and	390	420							
ed Rock	420	450							
and	450	500							
Late	500	600							
and	600	625							
ed Rock	625	650							
Late	650	780							
and	780	800							
Late	800	900							
and	900	950							
ale	950	1000							
and	1000	1050							
Late	1050	1100							
and	1100	1175							
Late	1175	1200							
and	1200	1300							
Late	1300	1350							
and	1350	1400							
Late	1400	1450							
and	1450	1500							
Late	1500	1645							
lt Sand	1645	1725		Water					
lack Slate	1725	1845							
ttle Lime	1845	1885							
g Lime	1885	2005							
g Injun	2005	2035							
l & Gas	2009	2026		Show Only					
reak	2035	2040							
g n	2040	2047							

(OVER)

WP

Bottom of Shot				
Feet of Fl[illegible] Hole When Shot				
Results:				

PACKER RECORD

INITIAL PRODUCTION FIRST 24 HOURS	KIND	SIZE	DEPTH SET	DATE SET
Open Flow /10ths Water in Inch	Steel Shoe	8-5/8" O.D.	393'	6-2-64
/10ths Merc. in Inch	Float Collar	4½" O.D.	2064'	6-6-64
Volume Drilled w/Rotary (Show only) Cu. Ft.	Guide Shoe	4½" O.D.	2095'	6-6-64
Rock Pressure None lbs. hrs.				
Oil bbls., First 24 hrs.				

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED

DATE WELL FRACTURED 6-12-64

NAME OF COMPANY Dowell

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds.)

Used: 1020 Bbl. Water
Used: 60,000 # Sand
Used: 250 Gal. B.D.A.
Used: 175 # J-38
Used: 350# J-84
Used: 20 Gal. Detergent
Used: 35 Gal. Freflo

BREAKDOWN PRESSURE 1350#

PUMPING PRESSURE 2200# & 3200#

AVERAGE PUMPING RATE/MINUTE 21.4

PUMPING TIME 50 Min.

RESULT AFTER TREATMENT { GAS 30,000 CU. FT. / OIL 9 BBLS.

ROCK PRESSURE AFTER TREATMENT 465 LBS.

CASING CEMENTED

Surface to:

8-5/8" SIZE 393 FT. 6-2-64 DATE

4½" SIZE 2095 FT. 6-6-64 DATE

SIZE FT. DATE

Used in Cementing 8-5/8" Casing:
55 Bags Marquette Common Bulk Cement
2-HA-5 Blended 2%
Cemented by: Halliburton

Used in Cementing 4½" Casing:
40 Bags Cement
6 Bags Aquagel
1 Bag Lime
5 Gal. Resiment
Cemented by Well Service, Inc.

REMARKS: Note: Drilled 8½" Hole from Surface to 393'
Drilled 6¼" Hole from 393' to 2097'

Note: Used 5 Centralizers @ 2064', 2033', 2002', 1971' & 1940'

Note: This well was logged by Schlumberger on 6-6-64.

Note: Perforated @ 2018' with 1 - 6 way Jet on Single Plane by Basin Surveys, Inc.

Note: This well was drilled according to Rule 11, under Section 13 of Article 4, Chapter 22 of the code of the Department of Mines, Oil and Gas Division.

APPROVED

C C Cranwell

SUPERINTENDENT

FORM No. 989 IM 11/62 M-G. 9929

WOLF'S HEAD OIL REFINING, COMPANY, INC.
~~SOUTH PENN OIL COMPANY~~

Ree

NEW WELL REPORT

LEASE NO. 81219 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL NO. W-17 N. S. 47 E. W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — QUAD.

LOCATION MADE 4-21- 19 64 — DRILLING COMMENCED 5-14- 19 64

RIG COMMENCED 5-11- 19 64 — DRILLING COMPLETED 5-21- 19 64

RIG COMPLETED 5-14- 19 64 — DEPTH 2190' SAND Big Injun

RIG CONTRACTOR Gerald D. Jones — DRILLING CONTRACTOR Gerald D. Jones

ELEVATION: FLOOR GROUND 971.38 — WORK ORDER NO. AFE # WH-29-W. Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
p Soil	0	5			Black Sand	1875	1905		
" Casing		10	10		Sand	1905	1965		
nd	5	80			Little Lime	1965	1970		
d Rock	80	90			Slate	1970	1980		
nd	90	120			Oil & Gas	2020	2035		Show
d Rock	120	130			Big Lime	1980	2100		
ate	130	180			Keener	2100	2110		
nd	180	250			Oil & Gas	2110	2122		
ter		190		½ Bailer Hr.	Big Injun	2110	2136		
d Rock	250	275			Oil & Gas	2125	2136		Show
ate	275	300			Slate	2136	2190		
d Rock	300	325			4½" Casing		2190	2190	
ate	325	340							
nd	340	375			Total Depth		2190	2190	
d R	375	395							
ate	395	400							
d Rock	400	420							
ate	420	460							
" Casing		470	470						
nd	460	500							
ate	500	600							
d Rock	600	640							
ate	640	780							
d Rock	780	800							
ate & Shells	800	860							
d Rock	860	890							
ate	890	900							
d Rock	900	915							
ate	915	920							
d Rock	920	930							
ate	930	1035							
nd	1035	1115							
ate	1115	1195							
nd	1195	1285							
ate	1285	1335							
d Rock	1335	1355							
ate	1355	1400							
nd	1400	1440							
d Rock	1440	1465							
nd	1465	1500							
ate	1500	1580							
nd	1580	1675							
ate	1675	1700							
nd	1700	1875							

W-1

(OVER)

W17

NEW WELL REPORT – CONTINUED

INITIAL TORPEDO RECORD	CASING AND TUBING RECORD						
	SIZE	PUT IN WELL			PULLED OUT		
Date of Shot		TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INC
	10-3/4"O.D.	S.L.H.	10	00			
Name of Torpedo Co.	8-5/8"O.D.	S.L.H.	470	00			
No. of Quarts	4½"O.D.	Talley	2204	.00			
Length of Shell							
Diameter of Shell							
Length of Anchor							
Top of Shot							
Bottom of Shot							
Feet of Fluid in Hole When Shot							
Results:							

INITIAL PRODUCTION FIRST 24 HOURS	PACKER RECORD			
	KIND	SIZE	DEPTH SET	DATE SET
Open Flow /10ths Water in Inch	Steel Shoe	8-5/8"	470	5-16-64
/10ths Merc. in Inch	Float Collar	4½"	2159'	5-22-64
Volume Drilled W/Rotary Cu. Ft.	Guide Shoe	4½"	2190	5-22-64
Rock Pressure None lbs. hrs.				
Oil bbls., First 24 hrs.				

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED

DATE WELL FRACTURED 6-2-64

NAME OF COMPANY Halliburton

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds.)

Used: 1,050 Bbls. Water
Used: 50,000 # Sand 20-40
Used: 300 Gal. H.C.A.
Used: 350 # WAC-8
Used: 25 Gal. Aqua Frac
Used: 40 Gal. Norflo

BREAKDOWN PRESSURE 1000

PUMPING PRESSURE 1500 - 2900

AVERAGE PUMPING RATE/MINUTE 20

PUMPING TIME 52½ Mins.

RESULT AFTER TREATMENT { GAS 30,000 CU. FT. / OIL 30 BBLS.

ROCK PRESSURE AFTER TREATMENT 450 LBS.

CASING CEMENTED

Surface to

8-5/8" SIZE 470 FT. 5-16-64 DA

4½" SIZE 2190' FT. 5-22-64 DA

SIZE FT. DA

Used in Cementing 8-5/8" Casing
100 Bags Portland Cement
2 Bags Aquagel
4 HA-5
Cemented by Halliburton

Used in Cementing 4½" Casing
40 Bags Reg. Cement
3 - 100# Bentonite
50# Lime
Cemented by Dowell

REMARKS: Note: Drilled W/Rotary

Note: Drilled 12¼" hole from surface to 470'
Drilled 7-7/8" hole from 470' to 2190'

Note: This Well was Logged by Schlumberger on 5-22-64

Note: Perforated by Basin Surveys on 6-1-64
2 - Holes @ 2111'-9" 3 Holes @ 2123'-9"

Note: Used 5 Centralizers @ 2178', 2139', 2109', 2048' & 2017'

Note: This Well was drilled according to Rule 11, under Section 13 of Article 4, Chapter 22 of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C C Caraway

SUPERINTENDENT

Form No. 989 IM 11/62 M'G. 9929

WOLF'S HEAD OIL REFINING CO. INC.
~~SOUTH PENN OIL COMPANY~~

RCC ✓

NEW WELL REPORT

LEASE NO. 81219 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL NO. W-16 N. — S. 47 E. — W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — QUAD.

LOCATION MADE 3-23- 1964 — DRILLING COMMENCED 4-29- 1964

RIG COMMENCED 4-27- 1964 — DRILLING COMPLETED 5-9- 1964

RIG COMPLETED 5-29- 1964 — DEPTH 2371' SAND Big Injun

RIG CONTRACTOR Gerald Jones — DRILLING CONTRACTOR Gerald Jones

ELEVATION: FLOOR — GROUND 1162.93 — WORK ORDER NO. AFE # [illegible]-28-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
p Soil	0	10			Slate	2020	2115		
" Casing		10'	10'		Little Lime	2115	2167		
d Rock	10	20			Pencil Cave	2167	2175		
nd	20	50			Big Lime	2175	2300		
ate	50	100			Injun Sand	2300	2330		
d Rock	100	125			Oil & Gas Pay	2315	2330		
nd	125	170			Slate	2330	2371		Log
ate	170	200			4½" Casing			2365	
nd	200	270							
d Rock	270	280			Total Depth		2371	2371	
ate	280	300							
d Rock	300	320							
ate	320	380							
d	380	385							
ate Shell	385	400							
nd	400	450							
ate	450	500							
d Rock	500	520							
ate	520	530							
d Rock	530	560							
Casing		571'	571'						
ate	560	760							
nd	760	790							
d Rock	790	800							
ate	800	870							
d Rock	870	900							
nd	900	930							
ter		930'							
ate	930	1185							
nd	1185	1220							
ate	1220	1320							
nd	1320	1340							
ate	1340	1400							
nd	1400	1535							
ate	1535	1555							
nd	1555	1635							
ate	1635	1665							
nd	1665	1740							
ate	1740	1755							
nd	1755	1800							
ate	1800	1825							
nd	1825	1990							
ter	1850	1900							
yer d	1990	2020							

(OVER)

NEW WELL REPORT — CONTINUED

W 16

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. Qts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL TRANSFER NO.	PUT IN WELL FEET	PUT IN WELL INCH	PULLED OUT TRANSFER NO.	PULLED OUT FEET	PULLED OUT INCH
10-3/4"	S.L.M.	10'				
8-5/8"	S.L.M.	571'				
7"	S.L.M.	1150			1150	
4½"	Talley	2384'				
2-3/8"	Talley	2308				
Tbg.						

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in Inch

/10ths Merc. in Inch

Volume Drilled w/Rotary Cu. Ft.

Rock Pressure None Taken lbs. hrs.

Oil bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8"	571'	5-1-64
Float Collar	4½" O.D.	2338'	5-10-64
Guide Shoe	4½" O.D.	2385'	5-10-64

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED

DATE WELL FRACTURED May 15, 1964

NAME OF COMPANY Halliburton

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds.)

Used: 1000 Bbl. Water
Used: 48000 # Sand 20-40
Used: 300 Gal. NCA 15%
Used: 400# WAC-8
Used: 25 Gal. Aqua Frac
Used: 40 Gal. Nor Flow-II

BREAKDOWN PRESSURE 1100

PUMPING PRESSURE 1550 - 2700

AVERAGE PUMPING RATE/MINUTE 28?

PUMPING TIME 44 Minutes

RESULT AFTER TREATMENT — GAS 111,000 CU. FT.

OIL 15 Bbls. BBLS.

ROCK PRESSURE AFTER TREATMENT 520 LBS.

CASING CEMENTED

8-5/8" SIZE 571' FT. 5-1-64 DATE — Surface to:

4½" SIZE 2385' FT. 5-10-64 DATE

SIZE FT. DATE

Used in Cementing 8" Casing:
80 Bags Cement
3 Bags HA-5 Blended 2%
Cemented by Halliburton Co.

Used in Cementing 4½" Casing:
40 Bags Cement
6 Bags Aquagel
5 Gal. Resiment
Cemented by Well Service, Inc.

REMARKS: Note: Drilled w/Rotary

Note: Used 4 Centralizers @ 2111', 2274', 2305', 2338'

Note: This well was Logged by McCullough Tool Co. on 5-10-64

Note: Drilled 8¾" hole from surface to 571'

Note: Drilled 6¼" hole from 571' to 2371'

Note: Perforations: Triple Frac - Notch Cutter @ 2261'

Note: This well was Drilled according to Rule 11, under Section 13 of Article 4 Chapter 22 of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C. C. Conner

SUPERINTENDENT

Fo 9 1M 11/63 M'G. 8923

RCC

WOLF'S HEAD OIL REFINING CO, INC.

[illegible]

NEW WELL REPORT

LEASE NO. 81219   800 ACRES   WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM   WELL NO. W-20 N. ___ S. 47 E. ___ W. 37

Smithfield DISTRICT OR TOWNSHIP   Roane COUNTY ___ QUAD.

LOCATION MADE May 21, 1964   DRILLING COMMENCED June 27, 1964

RIG COMMENCED June 26, 1964   DRILLING COMPLETED July 8, 1964

RIG COMPLETED June 27, 1964   DEPTH 2255'   SAND Big Injun

RIG CONTRACTOR Gerald D. Jones   DRILLING CONTRACTOR Gerald D. Jones

ELEVATION: FLOOR ___ GROUND ___   WORK ORDER NO. AFE # WH-32-W. Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
p Soil	0	10			Sand	1400	1470		
nductor		9	9		Slate	1470	1505		
late	10	20			Sand	1505	1525		
and	20	80			Slate	1525	1575		
late	80	100			Sand	1575	1625		
and	100	145			Slate	1625	1685		
late	145	195			Sand	1685	1720		
d Rock	195	215			Slate	1720	1780		
and	215	295			Sand	1780	1910		Water
late	295	330			Black Slate	1910	1995		
d Rock	330	350			Little Lime	1995	2032		
late	350	370			Pencil Cave	2032	2063		
d Rock	370	395			Big Lime	2063	2170		
lat	395	410			Keener	2170	2193		
d Rock	410	430			Oil & Gas	2170	2175		Show
and	430	450	437		Oil & Gas	2180	2193		Show
late	450	475			Big Injun	2193	2213		
d Rock	475	500			Oil & Gas	2193	2202		Show
late	500	520			Slate	2213	2255		
and	520	540			4½" Casing	[illegible]	2253	2253.96	
d Rock	568	565							
late	565	580			Total Depth		2255	2255	Drillers
and	580	600							
late	600	625							
d Rock	625	650							
late	650	700							
and	700	760							
late	760	795							
d Rock	795	825							
late	825	865							
and	865	900							
late	900	925							
d Rock	925	940							
late	940	955							
d Rock	955	975							
and	975	1000							
late	1000	1065							
d Rock	1065	1090							
and	1090	1125							
late	1125	1165							
and	1165	1200							
late	1200	1250							
and	1250	1300							
lat	1300	1400		Water					

(OVER)

NEW WELL REPORT — CONTINUED

INITIAL TORPEDO RECORD	CASING AND TUBING RECORD						
	SIZE	PUT IN WELL			PULLED OUT		
		TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INC
Date of Shot	10 3/4" O.D.	S.L.M.	9	-			
Name of Torpedo Co.	8 5/8" O.D.	S.L.M.	437	00			
No. of Quarts	4½" O.D.	Talley	2276	46			
Length of Shell	2 3/8" O.D.	Talley	2260	00			
Diameter of Shell							
Length of Anchor							
Top of Shot							
Bottom of Shot							
Feet of Fluid in Hole When Shot							
Results:							

INITIAL PRODUCTION FIRST 24 HOURS	PACKER RECORD			
	KIND	SIZE	DEPTH SET	DATE SET
Open Flow /10ths Water in ____ Inch	Steal Shoe	8 5/8" O.D.	437	6-28-64
____ /10ths Merc. in ____ Inch	Float Collar	4½" O.D.	2226	7-8-64
Volume Show (Drilled W/Rotary) Cu. Ft.	Guide Shoe	4½" O.D.	2253.96	7-8-64
Rock Pressure No Test lbs. ____ hrs.				
Oil ____ bbls., First 24 hrs.				

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED ____

DATE WELL FRACTURED 7-15-64

NAME OF COMPANY Halliburton

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds.)

Used: 35,500 Gals. Water
Used: 48,500 # Sand 20-40
Used: 300 Gal. MCA 15%
Used: 500# WAC-8
Used: 35 Gal. Morflo
Used: 20 Gal. ~~KCL~~ Aquafrac

BREAKDOWN PRESSURE 1200#
PUMPING PRESSURE 2000 - 3000
AVERAGE PUMPING RATE/MINUTE 18.8
PUMPING TIME 45 Min.
RESULT AFTER TREATMENT { GAS 40,000 CU. FT. / OIL 20 BBLS.
ROCK PRESSURE AFTER TREATMENT 340 LBS.

CASING CEMENTED

Surface to:

8 5/8" SIZE 437 FT. 6-28-64 DA
4½" SIZE 2253.96 FT. 7-8-64 DA
____ SIZE ____ FT. ____ DA

Used in Cementing 8 5/8" Casing:
75 Bags - Bulk Cement
2 Bags - Calcium Chloride
Cemented by: Well Services, Inc.

Used in Cementing 4½" Casing:
45 Bags - Cement
6 Bags - Baroid Aquagel
1 Bag - Lime
Cemented by: Well Services, Inc.

REMARKS: Note: Drilled 8¾" Hole from Surface to 437' Note: Used 5 Centralizers @ 2070', 2130', 2161', 2193' & 2228'
Drilled 6¼" Hole from 437' to 2255'

Note: This Well was logged by Lane Wells on 7-8-64 @ 2257' Total Depth

Note: Perforated @ 2178½ Triple Frac Notch Cutter

Note: This well was drilled according to Rule 11, under Section 13 of Article 4, Chapter ___ of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C. C. Cameron
SUPERINTENDENT

Form No. 989 IM 2/60 M'G. 9283A

WOLF'S HEAD OIL REFINING COMPANY, INCORPORATED
SOUTH PENN OIL COMPANY

Rec

NEW WELL REPORT

LEASE NO. 81219 — 600 ACRES — WORKING DISTRICT Spencer #4

M. Kaufman FARM — WELL NO. W-6 N. ____ S. 47 E. ____ W. 38

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — ____ QUAD.

LOCATION MADE November 12, 19 63 — DRILLING COMMENCED December 4, 19 63

RIG COMMENCED November 29, 19 63 — DRILLING COMPLETED December 12, 19 63

RIG COMPLETED December 4, 19 63 — DEPTH 2335' — SAND Big Injun

RIG CONTRACTOR Denning Drilling Co., Inc. — DRILLING CONTRACTOR Denning Drilling Co., Inc.

ELEVATION: FLOOR ____ GROUND 1132.36 — WORK ORDER NO. AFE #WH-10-W.V.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
Shale	0	407	407						
Red Rock	407	575							
Sand	575	735							
Shale	735	750							
Red Rock	750	790							
Shale	790	820							
Sand	820	830							
Shale	830	1425							
Sandy Shale	1425	1640							
Sand	1640	1665							
Shale	1665	1725							
Sand	1725	1805							
Red Rock	1805	1840							
Sand & Shale	1840	1855							
Sand	1855	2015							
Sand & Shale	2015	2104							
Little Lime	2104	2150							
Big Lime	2150	2255							
Keener Sand	2255	2270							
Big Injun	2270	2295							
Oil & Gas	2270	2295		Show					
Lime & Shale	2295	2335							
4½" Casing		2335	2335						
Total Depth		2335	2335						

(OVER)

NEW WELL REPORT — CONT'D.

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL TRANSFER NO.	PUT IN WELL FEET	PUT IN WELL INCH	PULLED OUT TRANSFER NO.	PULLED OUT FEET	PULLED OUT INC
8-5/8"	Tally	410	--			
4½" OD	Tally	2379	6			
2-3/8" Tbg.	Tally	2345	--			

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in_____Inch

_____ /10ths Merc. in_____Inch

Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.

Rock Pressure None Taken lbs. _____hrs.

Oil See Electric Log bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8" OD	407'	12-6-63
Float Collar	4½" OD	2304'	12-13-63
Guide Shoe	4½" OD	2335'	12-13-63

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED _____

DATE WELL FRACTURED 12-26-63

NAME OF COMPANY Dowell

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 37500 Gals. Water
Used: 58,000 Lbs. Sand
Used: 300 Gal. Mud Acid
Used: 40 Gal. Freflo
Used: 35 Gal. Detergen
Used: 400 lbs. J-84
Used: 200 lbs. J-98

BREAKDOWN PRESSURE 1200#

PUMPING PRESSURE 1300 - 1700 Lbs.

AVERAGE PUMPING RATE/MINUTE 32 Bbls.

PUMPING TIME 27 minutes

RESULT AFTER TREATMENT } GAS 38000 CU. FT.
OIL 32 BBLS.

ROCK PRESSURE AFTER TREATMENT 495 LBS.

CASING CEMENTED

Surface to:

8-5/8" SIZE 407 FT. 12-6-63 DA

4½" SIZE 2335 FT. 12-13-63 DA

____ SIZE ____ FT. ____ DA

USED IN CEMENTING 8-5/8" CASIN

50 Bags - Cement

1 Bag - Calcium Chloride

Cemented by: Well Service, Inc

USED IN CEMENTING 4½" CASING:

65 cu. ft. Posmix Cement (Consisting of 33 cu. ft. of Columbia Cement and32 cu. ft. fo Posmix -A and 1-Hall. Gel. blended 2% with 65 cu. of Posmix Cement.

500 Gals. - Mud Flush

Cemented by: Halliburton Company

REMARKS: Drilled 10-5/8" Hole from Surface to 407'.
Drilled 7-7/8" Hole from 407' to 2335'.

Note: Rotary Tools Used.

Note: Used 18 - 5' Sections of Roto-Ne Cleaners & 39 B-Z Lok Limits & 1# Halliburton Weld-A.

Note: This well was logged by McCullough Tool Company on December 13, 1963.

Note: This well was drilled according to Rule 11, under Section 13, of Article 4, Chapter 22 of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C C Caruso

SUPERINTENDENT

Form No. 989 IM 2/60 M'G. 9282A

WOLF'S HEAD OIL REFINING COMPANY, INCORPORATED

[redacted]

NEW WELL REPORT

LEASE NO. 81219 — 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL NO. W-5 N. — S. 47 E. — W. 38

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — QUAD.

LOCATION MADE September 20, 19 63 — DRILLING COMMENCED October 19, 19 63

RIG COMMENCED October 18, 19 63 — DRILLING COMPLETED October 27, 19 63

RIG COMPLETED October 19, 19 63 — DEPTH 2270' SAND Big Injun

RIG CONTRACTOR Denning Drilling Co., Inc. — DRILLING CONTRACTOR Denning Drilling Co., Inc.

ELEVATION: FLOOR — GROUND 1040.47 — WORK ORDER NO. AFE # WH-8-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
Shale & Shell	0	65							
Red Rock	65	155							
Sand	155	260	260						
Sand & Shale	260	365							
Shale & RedRock	365	535							
Sand & Shale	535	1325							
Sand	1325	1370							
Shale	1370	1405							
Sand & Shale	1405	1996							
Sand & Lime	1996	2060							
Big Lime	2060	2170							
Oil	2102	2118		Show Only					
Keener Sand	2170	2190							
Mg[illegible]n	2190	2210							
Oil [illegible]as	2190	2210							
Sand & Lime	2210	2293							
Shale & Lime	2293	2270							
8" Casing		2270	2270						
Total Depth		2270	2270						

(OVER)

NEW WELL REPORT — CONT'D.

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL			PULLED OUT		
	TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INC.
8-5/8"	Tally	262	--			
4-1/2"	Tally	2276'	1			
2-3/8"						
Tubing	Tally	2294	--			

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow ____ /10ths Water in ____ Inch

____ /10ths Merc. in ____ Inch

Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.

Rock Pressure ____ lbs. ____ hrs.

Oil *See Electric log bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8"OD	260	10-20-63
Float Collar	4½" 9.5#	2238	10-27-63
Guide Shoe	4½" 9.5#	2270	10-27-63

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED ____

DATE WELL FRACTURED 11- 8-63

NAME OF COMPANY Dowell

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 870 Bbls. Oil
Used: 43,000# Sand
Used: 300 Gals. Dowell X-Service
Used: 300 Gals. Mud Acid
Used: 40 Gals. Freflo

BREAKDOWN PRESSURE 1300#

PUMPING PRESSURE 2600 to 3150#

AVERAGE PUMPING RATE/MINUTE 20.5 Bbls.

PUMPING TIME 43 Minutes

RESULT AFTER TREATMENT | GAS 35,000 CU. FT.

OIL 30 BBLS.

ROCK PRESSURE AFTER TREATMENT 480 LBS.

CASING CEMENTED

From Surface to:

8-5/8" SIZE 260 FT. 10-20-63 DATE

4-1/2" SIZE 2270 FT. 10-27-63 DATE

SIZE ____ FT. ____ DATE

USED IN CEMENTING 8-5/8" CASING:

30 Bags - Cement

Cemented by: Gerald D. Jones

USED IN CEMENTING 4-1/2" CASING:

65 Bags - Portland Cement
500 Gals - Mud Flush
1 Lb. - Halliburton Weld-A
3 - Baker Centralizers
18 - 5' Sections of Roto-Hall Cleaners

Cemented by: Halliburton Co.

S-M

REMARKS: Drilled 10-5/8" Hole from Surface to 260'
Drilled 7-7/8" Hole from 260' to 2270'

Note: Rotary Tools Used

Note: This well was logged by McCullough Tool Company on October 26, 1963.

Note: This well was drilled according to Rule 11, under Section 13, of Article 4, Chapter 22, of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C. C. Cravens

SUPERINTENDENT

FORM NO. 589 IM 2/60 M'G. 9202A

GULF'S HEAD OIL REFINING COMPANY, INC.
SOUTH PENN OIL COMPANY

NEW WELL REPORT

LEASE NO. 81219 — 800 ACRES — WORKING DISTRICT Spencer #4

Kaufman FARM — WELL NO. W-8 — N. — S. 47 — E. — W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — QUAD.

LOCATION MADE September 23, 1963 — DRILLING COMMENCED December 17, 1963

RIG COMMENCED December 13, 1963 — DRILLING COMPLETED January 13, 1964

RIG COMPLETED December 17, 1963 — DEPTH 2430' — SAND Big Injun

RIG CONTRACTOR Denning Drilling Co., Inc. — DRILLING CONTRACTOR Denning Drilling Co. Inc.

ELEVATION: FLOOR — GROUND 1224.85 — WORK ORDER NO. AFE WH-7-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
hale	0	850	850						
d Rock	850	949							
hale	949	1400							
nd	1400	1480							
hale	1480	1485							
nd	1485	1525							
ndy Shale	1525	1540							
nd	1540	1685							
hale	1685	1725							
nd	1725	1765							
hale	1765	1775							
nd	1775	1875							
nd & Lime	1875	1910							
hal	1910	1925							
lme le	1925	1975							
nd	1975	2005							
nd & Chert	2005	2040							
lme & Sand	2040	2100							
ndy Shale	2100	2125							
hale	2125	2166							
ittle Lime	2166	2215							
g Lime	2215	2348							
nner Sand	2348	2362							
g Injun	2362	2379							
l & Gas	2362	2379		Show Only					
hale	2379	2430							
5" Casing		2427	2427						
Total Depth		2430	2430						

(OVER)

NEW WELL REPORT – CONT'D.

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL			PULLED OUT		
	TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INC
8-5/8"	S.L.H.	266	0			
4½" OD	S.L.H.	2427	0			
2-3/8"						
Tbg.	Fully	2379	0			

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8" OD	266'	12-20-63
Float Collar	4½" OD	2397'	1-14-64
Guide Shoe	4½" OD	2427'	1-14-64

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in_____Inch

/10ths Merc. in_____Inch

Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.

Rock Pressure None Taken lbs. _____hrs.

Oil_____bbls., First 24 hrs.

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED_____

DATE WELL FRACTURED 1-22-64

NAME OF COMPANY Halliburton Company

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 40,000 Gals. Water
Used: 45,000 Lbs. Sand
Used: 40 Gals. Korflo
Used: 30 Gals. Sudo
Used: 300 Gals. Acid 15% HCA
Used: 350 Lbs. WAC-8

BREAKDOWN PRESSURE 600# 1800 to 2400#

PUMPING PRESSURE

AVERAGE PUMPING RATE/MINUTE 20 bbls. 15 bbls.

PUMPING TIME 30,000

RESULT AFTER TREATMENT } GAS 30 Mcfs. CU. FT.

OIL 500# BBLS.

ROCK PRESSURE AFTER TREATMENT LBS.

8-M

CASING CEMENTED

Surface to:

8-5/8" SIZE 266 FT. 12-20-63 DA

4½" SIZE 2427 FT. 1-14-64 DA

SIZE FT. DA

USED IN CEMENTING 8-5/8" CA

35 - Bags Cement

1 - Bag Calcium Chloride

Cemented by: Well Service, Inc.

USED IN CEMENTING 4½" CASING:

65 - Bags Cement

500 - Gals. Mud Acid

Cemented by: Dowell

REMARKS: Drilled 10-5/8" Hole from Surface to 266'
Drilled 7-7/8" Hole from 266' to 2430'

Note: Rotary Tools Used.
Note: 5 Centralizers Used.

Note: Approx. 80' of 8-5/8" casing was damaged beyond repair by Contractor.

Note: This well drilled according to Rule 11, under Section 13 of Article 4, Chapter 22 of the Code of The Department of Mines, Oil and Gas Division.

APPROVED

C C Carson
SUPERINTENDENT

Form No. 989 1M 2/60 M'G. 9282A

WOLF'S HEAD OIL REFINING COMPANY, INCORPORATED

[illegible]

NEW WELL REPORT

Lease No. 81219   800 Acres   Working District Spencer # 4

Wm. Kaufman Farm   Well No. W-12   N. ___   S. 47   E. ___   W. 37

Smithfield District or Township   Roane County   ___ Quad.

Location Made September 27, 1963   Drilling Commenced October 28, 1963

Rig Commenced October 26, 1963   Drilling Completed November 6, 1963

Rig Completed October 28, 1963   Depth 2380'   Sand Big Injun

Rig Contractor Denning Drilling Co., Inc.   Drilling Contractor Denning Drilling Co., Inc.

Elevation: Floor ___   Ground 1152.09   Work Order No. AFE # WH-29-W.Va.

FORMATION RECORD

Kind	Top	Bottom	Steel Line Meas.	Test	Kind	Top	Bottom	Steel Line Meas.	Test
and & Shale	0	120							
ed Rock	120	185							
and	185	205							
ed Rock	205	225							
and	225	250							
hale	250	275							
and	275	325							
ed Rock	325	335							
and	335	344	340						
ed Rock	344	630							
lue Shale	630	720							
ed Rock	720	870							
and	870	985							
hal	985	1010							
and	1010	1385							
hale	1385	1435							
and	1435	1510							
late	1510	1730							
hale	1730	1915							
and	1915	1955							
hale	1955	2135							
ittle Lime	2135	2150							
hale	2150	2155							
and	2155	2198							
hale	2198	2185							
ig Lime	2185	2296							
il	2220	2240		Show Only					
encer Sand	2296	2310							
ig Injun	2310	2335							
il & Gas	2316	2330							
hale	2335	2380							
5" Casing		2377	2377						
Total Depth		2380	2380						

(OVER)

NEW WELL REPORT – CONT'D.

INITIAL TORPEDO RECORD

Date of Shot	
Name of Torpedo Co.	
No. of Quarts	
Length of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD

SIZE	PUT IN WELL			PULLED OUT		
	TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INC
8-5/8"	Tally	344	--			
4½"OD	Tally	2992	9			
2-3/8" tubing	Tally	2979	2			

INITIAL PRODUCTION FIRST 24 HOURS

Open Flow /10ths Water in Inch

/10ths Merc. in Inch

Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.

Rock Pressure lbs. hrs.

Oil *See Electric Log bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8" OD	340	10-29-69
Float Collar	4½" OD	2957	11- 7-69
Guide Shoe	4½" OD	2977	11- 7-69

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED

DATE WELL FRACTURED 11-10-69

NAME OF COMPANY Halliburton Company

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 693 Bbls. Oil
Used: 45,000# Sand
Used: 30 Gals. Hyflo
Used: 600# Adomite II
Used: 300 Gals. HCl Acid

BREAKDOWN PRESSURE 600#

PUMPING PRESSURE 1500 to 3100#

AVERAGE PUMPING RATE/MINUTE 18.6 Bbls.

PUMPING TIME 45 Minutes

RESULT AFTER TREATMENT | GAS 60,000 CU. FT.

OIL 35 BBLS.

ROCK PRESSURE AFTER TREATMENT 3100# LBS.

CASING CEMENTED

8-5/8" SIZE 340 FT. 10-29-69 DA

4-1/2" SIZE 2977 FT. 11- 7-69 DA

SIZE FT. DA

USED IN CEMENTING 8-5/8" CASING:

90 Bags - Cement

Cemented by: Gerald D. Jones

USED IN CEMENTING 4½" CASING:

500 Gals. - Mud Flush

65 Cuft. - Pozmix Cement (Consisti of 33 Cuft. Columbia Cement & 32 Cuft. of Pozmix A & 1 Halliburton Gel.)

90# - Roto-Hall Cleanere & 5 Cents Sleave.

16 - Halliburton Hold-A

Cemented by: Halliburton Co.

REMARKS: Drilled 10-5/8" Hole from Surface to 355'
Drilled 7-7/8" Hole from 355' to 2980'.

Note: Rotary Tools Used.

Note: This well was logged by Schlumberger on November 7, 1969.

Note: This well was drilled according to Rule 11, under Section 19, of Article 4, Chapter 22 of the Code of the Department of Mines, Oil and Gas Division.

APPROVED

C. C. Carlson

SUPERINTENDENT

FORM No. 989 IM 2/60 M'G. 9282A

WOLF'S HEAD OIL REFINING COMPANY, INCORPORATED
~~SOUTHERN OIL COMPANY~~

RCR

NEW WELL REPORT

LEASE NO. 81219 — 800 ACRES — WORKING DISTRICT Spencer # 4

Wm. Kaufman FARM — WELL NO. W-13 N. S. 47 E. W. 37

Smithfield DISTRICT OR TOWNSHIP — Roane COUNTY — QUAD.

LOCATION MADE October 3, 19 63 — DRILLING COMMENCED November 10, 19 63

RIG COMMENCED November 8, 19 63 — DRILLING COMPLETED November 17, 19 63

RIG COMPLETED November 10, 19 63 — DEPTH 2313' SAND Big Injun

RIG CONTRACTOR Denning Drilling Co., Inc. — DRILLING CONTRACTOR Denning Drilling Co., Inc.

ELEVATION: FLOOR — GROUND 1096.46' — WORK ORDER NO. AFE # WH-25-W.Va.

FORMATION RECORD

KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST	KIND	TOP	BOTTOM	STEEL LINE MEAS.	TEST
Clay & Shale	0	350	350						
Shale&RedRock	350	400							
Sand & Shale	400	690							
Sand	690	735							
Red Rock	735	740							
Shale	740	785							
Sand & Shale	785	790							
Sand	790	805							
Shale	805	880							
Red Rock	880	930							
Sand & Shale	930	1120							
Sand	1120	1135							
Shale	1135	1145							
Sand	1145	1480							
Shale	1480	1490							
Red Rock	1490	1500							
Shale	1500	1535							
Sand	1535	1815							
Shale & Lime	1815	1870							
Sand	1870	2025							
Shale	2025	2050							
Sand	2050	2065							
Little Lime	2065	2110							
Pencil Cave	2110	2115							
Big Lime	2115	2235							
Keener Sand	2235	2250							
Big Injun	2250	2265							
Oil & Gas	2253	2261							
Shale	2265	2313							
4½" Casing		2313	2313						
Total Depth		2313	2313						

(OVER)

NEW WELL REPORT — CONT'D.

INITIAL TORPEDO RECORD	
Date of Shot	
Name of Torpedo Co.	
No. arts	
Len of Shell	
Diameter of Shell	
Length of Anchor	
Top of Shot	
Bottom of Shot	
Feet of Fluid in Hole When Shot	
Results:	

CASING AND TUBING RECORD						
SIZE	PUT IN WELL			PULLED OUT		
	TRANSFER NO.	FEET	INCH	TRANSFER NO.	FEET	INCH
8-5/8"	Tally	354	—			
4½"OD	Tally	2330	10			
2-3/8"						
Tbg.	Tally	2333	6			

INITIAL PRODUCTION FIRST 24 HOURS
Open Flow /10ths Water in Inch
/10ths Merc. in Inch
Volume Show Oil & Gas (Drilled w/Rotary) Cu. Ft.
Rock Pressure lbs. hrs.
Oil * See Electric Log bbls., First 24 hrs.

PACKER RECORD

KIND	SIZE	DEPTH SET	DATE SET
Steel Shoe	8-5/8"OD	350	11-11-63
Float Collar	4½" OD	2293	11-18-63
Guide Shoe	4½" OD	2313	11-18-63

ACIDIZATION OR FRACTURING RECORD

DATE WELL ACIDIZED

DATE WELL FRACTURED November 27, 1963

NAME OF COMPANY Dowell

(List below materials used in Acidizing or Fracturing, i.e., Sand, Crude Oil, Gasoline, Water, Kerosene, Mothballs, Acid, etc., giving gallons, barrels and pounds).

Used: 775 Bbls. Oil
Used: 48,000# Sand
Used: 50 Gals - Freflo
Used: 450# Adomite II
Used: 350 Gals. HDA Acid

BREAKDOWN PRESSURE 1350#

PUMPING PRESSURE 2800 to 3400#

AVERAGE PUMPING RATE/MINUTE 18 Bbls.

PUMPING TIME 44 Minutes

RESULT AFTER TREATMENT — GAS 37,000 CU. FT.

OIL 33 BBLS.

ROCK PRESSURE AFTER TREATMENT 497 LBS.

CASING CEMENTED

Surface to:

8-5/8" SIZE 350 FT. 11-11-63 DATE

4-1/2" SIZE 2313 FT. 11-18-63 DATE

SIZE FT. DATE

USED IN CEMENTING 8-5/8" CASING:

50 Bags - Cement

Cemented by: Well Service, Inc.

USED IN CEMENTING 4-1/2" CASING:

65 Bags - Cement
500 Gals - Mud Flush
1# - Halliburton Weld-A
18 - 5' Sections of Roto-Wall Cleaners.
4 — Centralizers

Cemented by: Halliburton Company

W-13

REMARKS: Drilled 10-5/8" Hole from Surface to 350'. Note: Rotary Tools Used.
Drilled 7-7/8" Hole from 350' to 2313'.

Note: This well was logged by Schlumberger on November 12, 1963.

Note: This well was drilled accordingto Rule 11, under Section 13, of Article 4, Chapter 22, of the Code of the Department of Mines, Oil & Gas Division.

APPROVED

C C Crawford
SUPERINTENDENT

DBPix Evaluation

HG ENERGY 12/20/2017
KAUFMAN PROJECT

SITE: (KPI) Kaufman Produced Water
Sample Time : 1300 Reading Time : 1304
Readings: pH = 6.39 Temp= 8.2 Cond = 167.4 D.O. = 1.85
GPS = 38 45 27.8 and 81 15 48.7 =/- 21ft Flow = 250 mls / 90sec
Out of pipe in building (filtered)

SITE: (KJL) Kaufman Joseph Lung
Sample Time : 1420 Reading Time: 1424
Readings: pH= 7.81 Temp= 12.8 Cond= 792us D.O. =1.74
GPS = 38 45 13.3 and 81 15 17.0 +/- 27ft Let Run 3 minutes
out of bathroom sink

SITE: (KRAS) Kaufman Richard A Smith
Sample time: 1630 Reading Time: 1635
Readings: pH= 7.39 Temp= 12.5 Cond = 408us D.O. = 2.97
GPS = 38 45 38.0 and 81 15 42.1 +/-11ft Let Run 3 minutes
outside spigot on side of home

Field Meters Used: pH/Temp/Cond = BIOFM1
D.O. = BIOFM4D

REI Consultants, Inc.
PO Box 286
Beaver, WV 25813
TEL: (304) 255-2500
Website: www.reiclabs.com

Improving the environment, one client at a time...

3029-C Peters Creek Road
Roanoke, VA 24019
TEL: 540.777.1276

1557 Commerce Road, Suite 201
Verona, VA 24482
TEL: 540.248.0183

16 Commerce Drive
Westover, WV 26501
TEL: 304.241.5861

Monday, January 15, 2018

Roger Heldman
HG ENERGY LLC
5260 DUPONT RD
PARKERSBURG, WV 26101

TEL: (304) 420-1107
FAX:

RE: KAUFMAN UNIT WATER SAMPLING
Work Order #: 17122738

Dear Roger Heldman:

REI Consultants, Inc. received 4 sample(s) on 12/20/2017 for the analyses presented in the following report.

Sincerely,

Jimmy Suttle
Project Manager
(304) 250-6234

REI Consultants, Inc. - Case Narrative

WO#: 17122738

Date Reported: 1/15/2018
Original

Client: HG ENERGY LLC

Project: KAUFMAN UNIT WATER SAMPLING

The analytical results presented in this report were produced using documented laboratory SOPs that incorporate appropriate quality control procedures as described in the applicable methods. Verification of required sample preservation (as required) is recorded on associated laboratory logs. Any deviation from compliance or method modification is identified within the body of this report by a qualifier footnote which is defined at the bottom of this page.

All sample results for solid samples are reported on an "as-received" wet weight basis unless otherwise noted.

Results reported for sums of individual parameters, such as TTHM and HAA5, may vary slightly from the sum of the individual parameter results, due to rounding of individual results, as required by EPA.

The test results in this report meet all NELAP and/or VELAP requirements for parameters clearly designated as PA, VA, PA/VA, or VELAP in the column labeled NELAP.

Please note if the sample collection time is not provided on the Chain of Custody, the default recording will be 0:00:00. This may cause some tests to be apparently analyzed out of hold.

All tests performed by REIC Service Centers are designated by an annotation on the test code. All other tests were performed by REIC's Main Laboratory in Beaver, WV.

DEFINITIONS:
MCL: Maximum Contaminant Level
MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.
Mg/Kg or mg/L: Units of part per million (PPM) - milligram per Kilogram (weight/weight) or milligram per Liter (weight/volume).
NA: Not Applicable
ND: Not Detected at the PQL or MDL
PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a "J" qualifier.
Qual: Qualifier that applies to the analyte reported.
TIC: Tentatively Identified Compound, Estimated Concentration denoted by "J" qualifier.
Ug/Kg or ug/L: Units of part per billion (PPB) - microgram per kilogram (weight/weight) or microgram per liter (weight/volume).

QUALIFIERS:
X: Reported value exceeds required MCL
B: Analyte detected in the associated Method Blank at a concentration > 1/2 the PQL
E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.
H: Holding time for preparation or analysis has been exceeded.
J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the MDL. The result reported is an estimate.
S: % REC (% recovery) exceeds control limits

CERTIFICATIONS:
Beaver, WV: WVDHHR 00412CM, WVDEP 060, VADCLS 00281, KYDEP 90039, NCDWQ 466, PADEP 68-00839, VADCLS(VELAP) 460148
Bioassay (Beaver, WV): WVDEP 060, VADCLS(VELAP) 460148, PADEP 68-00839
Roanoke, VA: VADCLS(VELAP) 460150
Verona, VA: VADCLS(VELAP) 460151
Morgantown, WV: WVDHHR 003112M, WVDEP 387

REI Consultants, Inc. - Analytical Report

WO#: 17122738

Date Reported: 1/15/2018
Original

Client:	HG ENERGY LLC	**Collection Date:**	12/20/2017 1:00:00 PM
Project:	KAUFMAN UNIT WATER SAMPLING	**Date Received:**	12/20/2017
Lab ID:	17122738-01A	**Matrix:**	Waste Water
Client Sample ID:	KPW	**Site ID:**	SPENCER, WV

Analysis	Result	MDL	PQL	MCL	Qual	Units	Date Analyzed	NELAP
METALS BY ICP-Low Level			**Method: EPA 200.7 Rev. 4.4 (1994)**				**Analyst: EP**	
Barium	86.1	0.300	0.500	NA		mg/L	12/28/2017 5:00 PM	PA/VA
Iron	53.7	0.100	0.500	NA		mg/L	12/26/2017 7:40 PM	PA/VA
Magnesium	2,460	0.500	5.00	NA		mg/L	12/26/2017 7:40 PM	PA/VA
Manganese	0.986	0.0300	0.0500	NA		mg/L	12/26/2017 7:40 PM	PA/VA
Sodium	40,800	300	1,000	NA		mg/L	1/3/2018 8:30 AM	PA/VA
HARDNESS			**Method: SM2340 B-1997**				**Analyst: EP**	
Hardness, Total (As CaCO3)	37,900	100	100	NA		mg/L	12/28/2017 5:00 PM	VA
ANIONS by ION CHROMATOGRAPHY			**Method: EPA 300.0, Rev.2.1 (1993)**				**Analyst: CF**	
Chloride	94,000	1,000	5,000	NA		mg/L	12/26/2017 10:16 AM	PA/VA
SPECIFIC GRAVITY			**Method: SM2710 F-2004**				**Analyst: SF**	
Specific Gravity	1.107 @ 22/4°C	NA	NA	NA		NA	12/21/2017 3:16 PM	
CONDUCTIVITY @ 25 °C			**Method: SM2510 B-1997**				**Analyst: KY**	
Specific Conductivity	140,000	NA	NA	NA		µmho/cm	12/21/2017 6:23 PM	PA/VA
TOTAL DISSOLVED SOLIDS			**Method: SM2540 C-1997**				**Analyst: KY**	
Total Dissolved Solids	119,000	50	100	NA		mg/L	12/21/2017 7:00 PM	PA/VA
ALKALINITY to pH 4.3			**Method: SM2320 B-1997**				**Analyst: VS**	
Alkalinity, Total (As CaCO3)	108	1.0	20.0	NA		mg/L	12/22/2017 9:49 AM	PA/VA
pH - LAB TEST, HOLD TIME EXPIRED:			**Method: SM4500-H+-B-2000**				**Analyst: VS**	
pH	6.47	NA	NA	NA	H	SU	12/22/2017 9:49 AM	
ORGANIC CARBON, TOTAL			**Method: SM5310 C-2000**				**Analyst: VS**	
Total Organic Carbon	1.62	0.20	1.00	NA		mg/L	12/27/2017 1:14 PM	PA/VA