

#### west virginia department of environmental protection

Office of Oil and Gas 601 57th Street, S.E. Charleston, WV 25304 (304) 926-0450 fax: (304) 926-0452

Austin Caperton, Cabinet Secretary www.dep.wv.gov

#### Monday, April 1, 2019 PERMIT MODIFICATION APPROVAL Horizontal 6A / New Drill

HG ENERGY II APPALACHIA, LLC 5260 DUPONT ROAD PARKERSBURG, WV 26101

Re:

Permit Modification Approval for NAYS 1209 N-3H

47-033-05936-00-00

Extend intermediate string, 17.5", by 150' through storage field.

#### HG ENERGY II APPALACHIA, LLC

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926-0450.

James A. Martin Chief

Operator's Well Number: NAYS 1209 N-3H Farm Name: HG ENERGY II APPALACHIA, LLC

U.S. WELL NUMBER: 47-033-05936-00-00

Horizontal 6A New Drill

Date Modification Issued: 04/01/2019

Promoting a healthy environment.

API NO. 47-033 - 05936

OPERATOR WELL NO. Nays 1209 N-3H
Well Pad Name: Nays 1209

# STATE OF WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS WELL WORK PERMIT APPLICATION

1) Well Opera	ntor: HG Ener	gy II Appalachia,	4945	19932	Harrison	Union	West Milford 7.5'
			Oper	rator ID	County	District	Quadrangle
2) Operator's	Well Number:	Nays 1209 N-3H		_ Well Pa	ad Name: Nay	s 1209	
3) Farm Name	e/Surface Owne	r; Nays / HG Energy II A	ppalachia	Public Ro	ad Access: Ki	ncheloe Ru	n Rd/SLS 35
4) Elevation, o	current ground:	1002' E	levation	, proposec	l post-construc	tion: 1007'	
5) Well Type	(a) Gas x				derground Stora		
	Other						
				Deep	_		-2/12
0.5.1.		lorizontal X		-			52W
	d: Yes or No No				- 4		2/7/20
		(s), Depth(s), Anti-				Pressure(s):	
V		51' in thickness. A	nticipate	d pressure	at 4314#.		
	otal Vertical De	•					
9) Formation a	t Total Vertical	Depth: Marcellu	S				
10) Proposed 7	Total Measured	Depth: 22,030'					
11) Proposed H	Horizontal Leg 1	Length: 14,824'					
12) Approxima	ate Fresh Water	Strata Depths:	135', 8	500'			
13) Method to	Determine Fres	h Water Depths:	Nearest	offset we	ell data		
		epths: None noted	in offse	ets			
15) Approxima	ate Coal Seam D	Depths: 660' to 66	5'				
16) Approxima	ate Depth to Pos	ssible Void (coal m	ine, kars	t, other):	None		
		on contain coal sea to an active mine?		es	No	x	
(a) If Yes, pro	ovide Mine Info	: Name:					
		Depth:					
		Seam:					DECENTED
		Owner:				y	Office of Oil and Gas
							FFR 1 2 2019

WV Department of Environmental Protection WW-6B (04/15)

API NO. 47	
OPERATOR WELL NO.	Nays 1209 N-3H
Well Pad Name: Nays	1209

# 18)

### CASING AND TUBING PROGRAM

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
Conductor	30"	New	LS	157.5	100'	100'	Drilled In
Fresh Water	20"	NEW	J-55	94	600'	600'	40% excess, yield =1.20,CTS
Coal	13 3/8"	NEW	J-55	68	1735'	1735' /	40% excess yield = 1.20,CTS
Intermediate	9 5/8"	NEW	J-55	40	2500'	2500'	40% excess yield Lead/0% Evens T
Production	5 1/2"	NEW	P-110	23	22030'		20% excess yield = 1.19, tail yield = 1.04
Tubing							
Liners			1 - 1				

50W 2/1/2019

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	30"	30"	.500				CTS
Fresh Water	20"	24"	.438	2110	1200	Type 1, Class A	30 % excess yield = 1.20, CTS
Coal	13 3/8"	17 1/2" /	.480 /	3450 /		Type 1/Class A	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	12 1/4"	.395	3950		Type 1/Class A	40% excess yield = 0% Excess Lead 40
Production	5 1/2"	8 1/2"	.415	14520	12500	Type 1/ClassA	20% arcess yield = 1.19, bill yield 1 04.0
Tubing							
Liners							

### **PACKERS**

Kind:	
Sizes:	
Depths Set:	
	RECEIVED Office of Oil and

FEB 1 2 2019

WV Department of Environmental Protection

Well Pad Name: Nays 1209

19) Describe proposed well work, including the drilling and plugging back of any pilo	mot no	JUUL	ally	or ar	CK O	Daci	ing	ıuggıı	na pi	g ar	arilling	tne t	including	work.	well	oposed	Describe r	19)
---	--------	------	------	-------	------	------	-----	--------	-------	------	----------	-------	-----------	-------	------	--------	------------	-----

Drill the vertical depth to the Marcellus at an estimated total vertical depth of approximately 6900 feet. Drill horizontal leg to estimated 14824 TMD, stimulate and be capable of producing from the Marcellus Formation. Should we encounter an unanticipated void in the coal, we will install a minimum of 20' of casing below the void but not more than 100' below the void, set a basket and grout to surface.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

The stimulation will be completed with multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will be utilized on each stage using sand, water, and chemicals. See attached list. Maximum pressure not to exceed 12,500 psi.

- 21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 16.148 acres
- 22) Area to be disturbed for well pad only, less access road (acres): 10.834 acres

23) Describe centralizer placement for each casing string:

No cantralizors will be used with conductor casing.
Freshwater - contrailized every 3 joints to surface.
Coal - Sow Spring on every jatill
lintermodate - Bow Spring on first 2 joints from every third joint to 100' from surface.
Intermodate - Bow Spring on first 2 joints then every third joint to 100' from surface.
Production - Furth a Spring carnibater every 5 joints from the top of the curve.

24) Describe all cement additives associated with each cement type:

Conductor -N/A, Casing to be drilled in wf Dual Rotary Rig.
First Nature - 15.6 pog PRE-1 + 3% brace CaC1, 40% Excess Yeld = 1.20, CTS
First Nature - 15.6 pog PRE-1 + 2.5% brace CaC1, 40% Excess Teld : 15.9 pog PNE-1 + 2.5% brace CaC1 are Not Excess. CTS
Coal - Lead: 15.9 pog PNE-1 + 2.5% brace CaC1, 40% Excess, Tail: 15.9 pog PNE-1 + 2.5% brace CaC1 are Not Excess. CTS
Intermediate - Lead: 15.4 pog PNE-1 + 2.5% brace CaC1, 40% Excess, Tail: 15.9 pog PNE-1 + 2.5% brace CaC1, are Not Excess. CTS
Intermediate - Lead: 15.4 pog PNE-1 + 2.5% brace CaC1, 40% Excess, Lead Yield=1,94, CTS
Production - Lead: 1.45 pog PNE-1 + 0.35% brace CaC1 + 0.75 galdek FP13L + 0.3% brace ASCA1 + 0.5% brace ASCA

25) Proposed borehole conditioning procedures:

Conductor - Ensure the hole is dean at TD.
Fristh Water - Done casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.
Cool - Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.
Intermediate - Once casing is at setting depth, Circulate and condition and at TD. Circulate a minimum of one hole volume prior to pumping cement.
Intermediate - Once casing is at setting depth, Circulate and condition must at TD. Circulate a minimum of one hole volume prior to pumping cement.
Production - Once no bottom/TD with casing, circulate at max ablowable pump rate for at least 2x betterns up, or until natures and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.

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FEB 1 2 2019

WV Department of Environmental Protection

<sup>\*</sup>Note: Attach additional sheets as needed.

#### Diane White

From: James H Moore Iii < James.H.Moore.Iii@dominionenergy.com>

Sent: Wednesday, February 06, 2019 11:55 AM

To: Diane White; Ronald L. Walden

Cc: Josh Hinton

Subject: RE: Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas

Storage Field

Diane,

DETI agrees/approves of HG Energy setting the 13-3/8" casing shoe 150' below the base of the Gantz Sand (Storage Zone) for the NAYS 1209 wells 1H,2H,3H,4H,5H,6H.



Thanks,

Jamie.

Jamie Moore
Geologist II
Gas Storage Department
Dominion Energy Transmission, Inc.
925 White Oaks Boulevard
Bridgeport, WV 26330
Office-681-842-3372
Work Cell-304-859-1561
Personal Cell 540-641-4044



From: Diane White [mailto:dwhite@hgenergyllc.com]

Sent: Tuesday, February 05, 2019 4:32 PM

To: James H Moore Iii (GasInfrastructure - 2); Ronald L. Walden (GasInfrastructure - 2)

Cc: Josh Hinton

Subject: [External] Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas Storage Field

Jamie and Ron,

Attached are the well schematics for the Nays 1209 N laterals. The revisions which will be requested are to allow for the 150 feet additional casing through the storage field as per your conversations with Josh Hinton.

If you can send back approval via email I'll include that with my request to the DEP for the permit of the Gas

Thank You, Diane

FEB 1 2 2019



## 1209 N-3H Marcellus Shale Horizontal Harrison County, WV

		1							Harrison Co	ounty, WV	
						1209 N	N-3H SH	IL	2	37379.88N 173237	2.89E
Ground Elev	ation		1007			1209	N-3H LI	0	2	37684.42N 173185	0.91E
Azm			341.49	3°		1209 N	N-3H BH	IL _	2	51742.28N 172714	5.22E
WELLBORE DIAG	GRAM	HOLE	CASING	GEOLOGY TOP BASE		MUD CEMENT		CENTRALIZERS CONDITIONING COMME			
		30"	30" 157.5# LS	Conductor	0	100	AIR	N/A, Casing to be drilled in w/ Dual Rotary Rig	N/A	Ensure the hole is clean at TD.	Conductor casing = 0,5" w thickness
			- 1					15.6 ppg PNE-1 + 3%		Once casing is at setting depth, circulate a minimum	Surface casing = 0.438" w
	х	24"	20" 94# J-55	Fresh Water	0	135	AIR	bwoc CaCl 40% Excess	Centralized every 3 joints to surface	of one hole volume with	thickness
x	V		3.00	Fresh Water	Fresh Water 0 600 Yield=1.20 / CTS	7	Fresh Water prior to pumping cement.	Burst=2110 psi			
				Kittaning Coal	660	665		Lead: 15.4 ppg PNE-1 +	Bow Spring on every	Once casing is at setting	
			13-3/8" 68#	Little/Big Lime	1126 / 1167	1151 / 1243	AIR / KCL	2,5% bwoc CaCl 40% Excess / Tail: 15.9	joint	depth, Circulate and condition at TD. Circulate a	Intermediate casing = 0.4
x	X	17.5"	J-55 BTC	Injun / Gantz (Storage)	1243 / 1535	1349 / 1585	Salt Polymer	ppg PNE-1 + 2.5% bwoc	*will also be running ECP for isolating	minimum of one hole	wall thickness Burst=3450 psi
				Intermediate 1	0	1735	, ciyillor	CaCl zero% Excess. CTS	slorage zone*	volume prior to pumping cement.	Duist-0430 psi
x	x			Fifty / Thirty Foot	1650 / 1730	1697 / 1742		Lead: 15.4 ppg PNE-1 +		Once casing is at setting	
				Gordon Stray / Gordon	1785 / 1850	1850 / 1940	AIR / KCL	2.5% bwoc CaCl	Bow Spring on first 2	depth, Circulate and	Intermediate casing = 0,3
		12.25"	9-5/8" 40# J-55 BTC	5th Sand	2035	2070	Salt	40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc	joints then every third joint to 100' form	condition mud at TD. Circulate a minimum of one	wall thickness
x	X		3,000,0	Bayard Sand	2125	2160	Polymer	CaCl	surface	hole volume prior to	Burst=3950 psi
				Intermediate 2	0	2500		zero% Excess. CTS		pumping cement.	
	X			Speechley	2745	2763			Run 1 spiral centralizer		
		8.5" Vertical		Balltown	2965	3005	9.0ppg		every 5 joints from the		
		6.5 Vertical		Benson	4050	4083	SOBM Lead: 14.5 pt	<u>Lead</u> : 14.5 ppg POZ:PNE-1 + 0.3%	top of the curve to		
				West Falls	4620	5865		bwoc R3 + 1% bwoc	surface.		
				Rhinestreet	5865	6140		EC1 + 0.75 gal/sk FP13L + 0.3% bwoc		Once on bottom/TD with casing, circulate at max	
				Cashaqua	6140	6341		MPA170		allowable pump rate for at	Production casing = 0,4
X N	X o		5-1/2" 23#	Middlesex	6341	6421	11.5ppg-	Tail: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75		least 2x bottoms up, or until returns and pump	wall thickness Burst=14520 psi
Ş. Ş.	Office of Oil and o	8.5" Curve	P-110 HC	West River	6421	6514	12.5ppg	gal/sk FP13L + 50%		pressures indicate the hole	Note:Actual centralize
Dep	B o	肃	CDC HTQ	Burkett	6514	6540	SOBM	bwoc ASCA1 + 0.5% bwoc MPA170	Run 1 spiral centralizer every 3 joints from the	is clean. Circulate a minimum of one hole	schedules may be chang due to hole conditions
part	<u>0</u>	T C		Tully Limestone	6540	6644		20% Excess	1st 5.5" long joint to the	volume prior to pumping	due to note conditions
Pro	an 2	¥		Hamilton	6644	6863		Lead Yield=1.19 Tail Yield=1.94	top of the curve.	cement.	
nt o	and Gas 2019			Marcellus	6863	6914	0.5	CTS			
WV Department of Environmental Protection	as	8.5" Lateral		TMD / TVD (Production)	22030	6900	11.5ppg- 12.5ppg SOBM				
183	533			Onondaga	6914		SOBW				

WW-6B (04/15)

# Previous Permit

4703364508/20619

API NO. 47-\_\_

OPERATOR WELL NO. Nays 1209 N-3H
Well Pad Name: Nays 1209

STATE DEPARTMENT OF ENVIRONM

E OF OIL AND GAS

# WELL WORK PERMIT APPLICATION

1) Well Operator: HG Ener	gy II Appalachia,	494519932	Harrison	Union	West Milford 7.5'
		Operator ID	County	District	Quadrangle
2) Operator's Well Number:	Nays 1209 N-3H	Well P	ad Name: Nay	rs 1209	
3) Farm Name/Surface Owne	Nays / HG Energy II App	palachia Public R	oad Access: Ki	ncheloe Ru	in Rd/SLS 35
4) Elevation, current ground:	1002' EI	evation, propose	d post-construc	tion: 1007	
5) Well Type (a) Gas <u>x</u> Other	Oil	Un	derground Stor	age	
	Shallow x	Deep			SOW
I	Horizontal X				50W 10/22/2018
6) Existing Pad: Yes or No	No		_		
<ol> <li>Proposed Target Formation Marcellus at 6863'/6914' an</li> </ol>				Pressure(s):	
8) Proposed Total Vertical De	epth: 6900'	**************************************			
9) Formation at Total Vertica	I Depth: Marcellus	3			
10) Proposed Total Measured	Depth: 22,030'				
11) Proposed Horizontal Leg	Length: 14,824'				
12) Approximate Fresh Wate	r Strata Depths:	135', 500'			
13) Method to Determine Fre	sh Water Depths:	Nearest offset v	vell data		
14) Approximate Saltwater D		in offsets			
15) Approximate Coal Seam	Depths: 660' to 66	5'			
16) Approximate Depth to Po			: None		
17) Does Proposed well local directly overlying or adjacent		ms Yes		10 X	
(a) If Yes, provide Mine In	fo: Name:			F	RECEIVED
(a) 11 100, p. 0 100 11111	Depth:			Office	of Oil and Gas
	Seam:			N	OV 1 4 2018
	Owner:				
				Environa	epartment of rental Pretection

WW-6B (04/15) API NO. 47-\_\_\_\_OPERATOR WELL NO. Nays 1209 N-3H
Well Pad Name: Nays 1209

### 18)

#### **CASING AND TUBING PROGRAM**

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
Conductor	30"	New	LS	157.5	100'	100'	Drilled In
Fresh Water	20"	NEW	J-55	94	600'	600'	40% excess, yield =1.20,CTS
Coal	13 3/8"	NEW	J-55	54.5	1635'	1635'	40% excess yield = 1.20,CTS
Intermediate	9 5/8"	NEW	J-55	40	2500'	2500'	40% excess viola Load/ 0% Excess Tel.
Production	5 1/2"	NEW	P-110	23	22030'	22030'	20% excess yield = 1.18, tall yield = 1.44
Tubing							-
Liners							

50W 10/22/2018

ТҮРЕ	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	30"	30"	.500				CTS
Fresh Water	20"	24"	.438	2110	1200	Type 1, Class A	30 % excess yield ≈ 1.20, CTS
Coal	13 3/8"	17 1/2"	.380	2730		Type 1/Class A	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	12 1/4"	.395	3950		Type 1/Class A	40% excess yield = 0% Excess Lead, 40
Production	5 1/2"	8 1/2"	.415	14520	12500	Type 1/ClassA	20% excess yield = 1.19, ts5 yield 1.54.6
Tubing							
Liners			:				

### **PACKERS**

Office of Gil and Gas
NOV 1 4 2018
V/V Distriction of Environmental Protection

API NO. 47-\_\_\_-

OPERATOR WELL NO. Nays 1209 N-3H

Well Pad Name: Nays 1209

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill the vertical depth to the Marcellus at an estimated total vertical depth of approximately 6900 feet. Drill horizontal leg to estimated 14824 TMD, stimulate and be capable of producing from the Marcellus Formation. Should we encounter an unanticipated void in the coal, we will install a minimum of 20' of casing below the void but not more than 100' below the void, set a basket and grout to surface.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

The stimulation will be completed with multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will be utilized on each stage using sand, water, and chemicals. See attached list. Maximum pressure not to exceed 12,500 psi.

- 21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 16.148 acres
- 22) Area to be disturbed for well pad only, less access road (acres): 10.834 acres

23) Describe centralizer placement for each casing string:

No contrainers will be used with conductor easing. Freshwater - contraited every 3 joints to surface. Coal - Bow Spring on every joint

intermediate - Bow Spring on that 2 plants then every that joint to 100 from surface.

Production - Run 1 spiral centralizer every 3 joints from the top of the curve to surface. Run 1 spiral centralizer every 3 joints from the 1st 6.5° long joint to the top of the curve.

24) Describe all cement additives associated with each cement type:

Conductor 44%, Cashing to be diffied in will Dust Retain Play.

First Water 1-5 Eapp Pliff-1 = 9% there CRL4 (MV Excess Yield = 1.20, CTS

Coal - Lack 16.4 pag Pliff-1 = 9.2% there CRL4 (MV Excess Yield = 1.20, CTS

Coal - Lack 16.4 pag Pliff-1 = 9.2% there CRL4 (MV Excess Yield = 1.20, CTS

Coal - Lack 16.4 pag Pliff-1 = 9.2% there CRL4 (MV Excess Yield = 1.20 there CRL4)

Extended to 1.20 there CRL4 = 9.2% there CRL4 (MV Excess Yield = 1.20 there CRL4)

Extended to 1.20 there CRL4 = 9.2% there CRL4 (MV Excess Yield = 1.20 there CRL4)

Extended to 1.20 there CRL4 = 9.2% there CRL4

25) Proposed borehole conditioning procedures:

Conductor - Ensues the hole to death of TD.

Frinch Midter: Once caching the studing depth, dended a minimum of one hole volume with Fresh Wester prior to pumping cament.

Coal - Other cassing is at earting depth, Circulate and condition at TD. Circulate and enshirum of one hole volume prior to pumping cament.

Intermediate - Once casting is at earting depth, Circulate and condition and at TD. Circulate a minimum of one hole bedwine prior to pumping cament.

Intermediate - Once casting is at earting depth, Circulate and condition that at TD. Circulates a minimum of one hole without prior to pumping cament.

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NOV 1 4 2018

WV Department of Environmental Protection

\*Note: Attach additional sheets as needed.



# 1209 N-3H Marcellus Shale Horizontal Harrison County, WV

									Harrison Co		<u> </u>		
		· · · · · · · · · · · · · · · · · · ·			<u> </u>	1209 [	N-3H SH	L	2	37379.88N 173237	2.89E		
Ground	Elevation		1007	t .		1209 N-3H LP				237684.42N 1731850.91E			
Α	zm		341.493°			1209 N-3H BHL				251742.28N 1727145.22E			
WELLBOR	RE DIAGRAM	HOLE	CASING	GEOLOGY	TOP	BASE	MUD	CEMENT	CENTRALIZERS	CONDITIONING	COMMENTS		
aluararai	Notice State Section 1	-				<b>-</b>	<u> </u>		<del></del>		·		
	x	30"	30" 157.5# LS	Conductor	0	100	AIR	N/A, Casing to be drilled in w/ Dual Rotary Rig	N/Á	Ensure the hole is clean at TD.	Conductor casing = 0.5" w thickness		
			20"					15.6 ppg PNE-1 + 3% bwoc CaCl	Centralized every 3	Once casing is at setting depth, circulate a minimum	Surface casing = 0.438° v		
	X	24"	24" 24# J-55	Fresh Water	0	135, 500	AIR	40% Excess	joints to surface	of one hale valume with Fresh Water prior to	thickness Burst=2110 psi		
X				Fresh Water	0	600		Yield=1.20 / CTS		pumping cement.	Buist-2110 psi		
				Kittaning Coal	660	665	[ {	Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl		Once casing is at setting depth, Circulate and			
		17.5"	13-3/8" 68#	Little/Big Lime	1126 / 1167	1151 / 1243	AIR / KCL - Salt	40% Excess / Tail: 15.9	Bow Spring on every	condition at TD. Circulate a	Intermediate casing = 0.4 wall thickness		
X		17.5	J-55 BTC	Injun / Gentz (Storage)	1243 / 1535	1349 / 1585	Polymer	ppg PNE-1 + 2.5% bwoc CaCl	joint	minimum of one hole volume prior to pumping	Burst=3450 psi		
				Intermediate 1 (Shoc 50' below storage)	0	1635		zero% Excess. CTS		cement.			
X				Fifty / Thirty Foot	1650 / 1730	1697 / 1742		Lead: 15.4 ppg PNE-1 +		Once casing is at setting			
		'	Gordon Stray / Gordon	1785 / 1850	1850 / 1940	AIR / KCL	2.5% bwoc CaCl	Bow Spring on first 2	depth, Circulate and	Intermediate casing = 0.			
	X	12.25"	9-5/8" 40# J-55 BTC	5th Sand	2035	2070	Salt	40% Excess / Tall: 15.9 ppg PNE-1 + 2.5% bwoc	joints then every third joint to 100' form	condition mud at TD. Circulate a minimum of one	wall thickness		
X			3-35 810	Bayard Sand	2125	2160	Polymer	CaCl	surface	hole volume prior to	Burst=3950 psi		
				Intermediate 2	0	2500		zero% Excess. CTS		pumping cement.			
×	X			Speechley	2745	2763					• • • • • • • • • • • • • • • • • • • •		
		8.5" Verlical	5" Vertical	Balltown	2965	3005	9.0ppg SOBM		Run 1 spiral centralizer every 5 joints from the top of the curve to surface.				
West.				Benson	4050	4083		<u>Lead</u> : 14.5 ppg POZ;PNE-1 + 0.3%					
				West Falls	4620	5865	1	bwoc R3 + 1% bwoc	surface.				
				Rhinestreet	5865	6140		EC1 + 0.75 gal/sk FP13L + 0.3% bwoc		Once on bottom/TD with casing, circulate at max			
				Cashaqua -	6140	6341		MPA170		allowable pump rate for at	Production casing = 0.4		
<b>X</b>	X		5-1/2" 23#	Middlesex	6341	6421	11.5ppg-	Tail: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75		least 2x bottoms up, or until returns and pump			
		8.5" Curve	P-110 HC	West River	6421	6514	12.5ppg	gal/sk FP13L + 50%		pressures indicate the hole	Note:Actual centraliz		
			CDC HTQ	Burkett	6514	6540	SOBM	bwec ASCA1 + 0.5% bwec MPA170	Run 1 spiral centralizer every 3 joints from the	is clean. Circulate a minimum of one hole	schedules may be char due to hole condition		
*****				Tully Limestone	6540	6644	1	20% Excess	1st 5.5" long joint to the	volume prior to pumping	day to hole condition		
				Hamilton	6644	6863	İ	Lead Yield=1.19 Tail Yield=1.94	top of the curve.	cement.			
100				Marcellus	6863	6914		CTS					
		8.5" Lateral		TMD / TVD (Production)	22030	6900	11.5ppg- 12.5ppg SOBM						
X	X			Onondaga	6914								
			210		A CONTRACTOR								
		0' TVD / 7206' MD			5.5" Hole - Cemente 5-1/2" 23# P-110 Ho		1		+/-1482	24' ft Lateral	TD @ +/-6900' TVD +/-22030' MD		