Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Injection Pump Net Horse Power Limitation

It can be calculated that the net horse power required to pump 1000 bbls per day of fluid at a surface injection pressure of 2593 psi, is about 45 hp. In my opinion, the EPA permit should restrict the injection pump system to 45 net hp, as an additional safeguard against the temptation to increase the injection pressure and injection rate above the specified maximum amounts.

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Table 1

Summary of information from gas well records for gas wells that have been drilled in the vicinity of the Zelman DIW

Permit #/ Well Name	Distance (feet) Direction from DIW	Top of Onondaga Limestone (ft)	Top of Huntersville Chert (ft)	Top of Oriskany Sandstone (ft)	Bottom of Oriskany Sandstone (ft)	Actual thickness of confining zone (ft)	Actual thickness of injection zone (ft)
20333 DuBois Deposit National Bank or Ginter	1481 N	7248	7266	7314	7343	18	77
20325-P Potter #1 (plugged)	1476 SSE	7617	7635	---	---	18	---
20327 Potter #2	1380 SSW	7219	7233	7288	7317	14	84
20336 Chapman	2950 SW	7195	7213	7269	7282	18	69
20341-P Carlson (plugged)	1745 NW	7281	7296	7351	7365	15	69

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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Zone of Endangering Influence Calculation

Comment: The Zone of Endangering Influence (ZEI) Calculation conducted by the EPA is not realistic based on the presence of nearby non-transmissive geologic faults. Use of the ¼ mile fixed radius Area of Review should be deemed to be unacceptable.

The Statement of Basis for the Zelman #1 disposal injection well (DIW) states the following in the section dealing with **Area of Review:**

To determine whether the one-quarter mile fixed radius was acceptable, EPA conducted a zone of endangering influence (ZEI) calculation using geologic and operational parameters provided in the permit application.The ZEI calculation confirmed that the one-quarter mile fixed radius chosen by Windfall was acceptable.

The formula for a ZEI calculation is given in 40 CFR §146.6. The equation found there is based on the following assumptions:

(i) The injection zone is homogenous and isotropic;

(ii) The injection zone has infinite area extent;

(iii) The injection well penetrates the entire thickness of the injection zone;

(iv) The well diameter is infinitesimal compared to "r" when injection time is longer than a few minutes; and

(v) The emplacement of fluid into the injection zone creates instantaneous increase in pressure.

In addition, the Statement of Basis for the Zelman #1 disposal injection well (DIW) states the following in the section dealing with **Geologic and Seismic Review:**

The permittee submitted, and EPA Region III has also obtained, geologic information of public record which indicates the possible presence of several faults within one-quarter mile of the injection well site.

Historic gas production results in the vicinity of the injection well site have shown that nearby faults appear to act as a geologic trap for gas production. Gas wells have been productive between the fault lines but non-productive outside these fault lines. This would indicate that the faults are not transmissive to gas migration and would also indicate good confinement of injection fluid and existing formation fluids as well.

Therefore, the presence of non-transmissive faults near the DIW invalidates assumption (i) dealing with a homogenous and isotropic injection zone and assumption (ii) dealing with an infinite injection zone area. The formula for a ZEI calculation given in 40 CFR §146.6 cannot be used in this situation.

The injection zone is not empty. Instead, it is full of brine with natural gas dissolved in it. This assumption is based on the presence of a pump jack on the Deposit Bank well. The operator of this well produces natural gas by pumping brine out of the wellbore thereby reducing the pressure on the brine and allowing the gas to be released out of solution. When wastewater is pumped down the DIW it will not go into empty pore space. Instead, the waste must displace the brine which is already present in those spaces.

The definition of a ZEI boundary is where the pressure in the injection zone is only great enough to raise whatever liquids are present in the injection zone up to the bottom level of the deepest freshwater zone, but no higher, if a conduit through the confining zone were to exist at that location.

To estimate a better ZEI, one could approximate the nontransmissive faults shown on the map submitted by Windfall with their application with two straight lines which form a V-shape. The point of the V would be just to the east of the DIW. Therefore, for any liquid to escape from the injection zone, it must all pass through the opening at the wide end of the "V". Chances are that the ZEI is going to have a shape similar to the sector of a circle with an angle of approximately 60 degrees.

The flow through the rounded end of a sector-shaped ZEI with impenetrable straight sides would have to be equal in quantity to the flow through a ¼ mile radius circular ZEI for an equivalent DIW in an isotropic injection zone. Since pressure at both ZEI boundaries must be the same, and since the thickness of the injection zone is the same, the length of the curved end of the sector-shaped ZEI must be the same as the circumference of the ideal ¼ mile radius circular ZEI (8290 feet) in order to achieve the same amount of vertical area to transmit the same amount of flow at the same pressure in the injection zone.

The result, if this logical sequence is valid, would be that the EPA should establish an area of review that follows along the fault lines out to the point where the pressure drops low enough to follow a circular curve over to the point on the other fault with the same pressure.

If an equivalent substitute for the ¼ mile Area of Review is required, and the equivalent substitute is to be the sector of a circle with inpenetrable straght sides intersecting at a 60 degree angle, the length of the sides would have to be 6 times ¼ mile which equals 1½ miles. The sector would be 1/6 of a full 360 degree circle. For the curved end to have the same length as the complete circumference of a smaller circle, the radius of the sector would have to be 6 times as long as the radius of the full circle. Refer to the attached diagram.

According to the diagram, USDWs located up to 1.2 miles from the Disposal Injection Well would be endangered if they were deep enough.

Incidently, the fluid pressure where the fault lines join together is probably going to be quite high if the fluid cannot escape through the faults.

The Atkinson water well (RMS 8-9-19) is located very close to the northernmost fault shown on the map, and possibly directly over that fault. Therefore, it would not be a surprise if this water well is contaminated by methane or brine as a consequence of high pressure caused by the injection operation.

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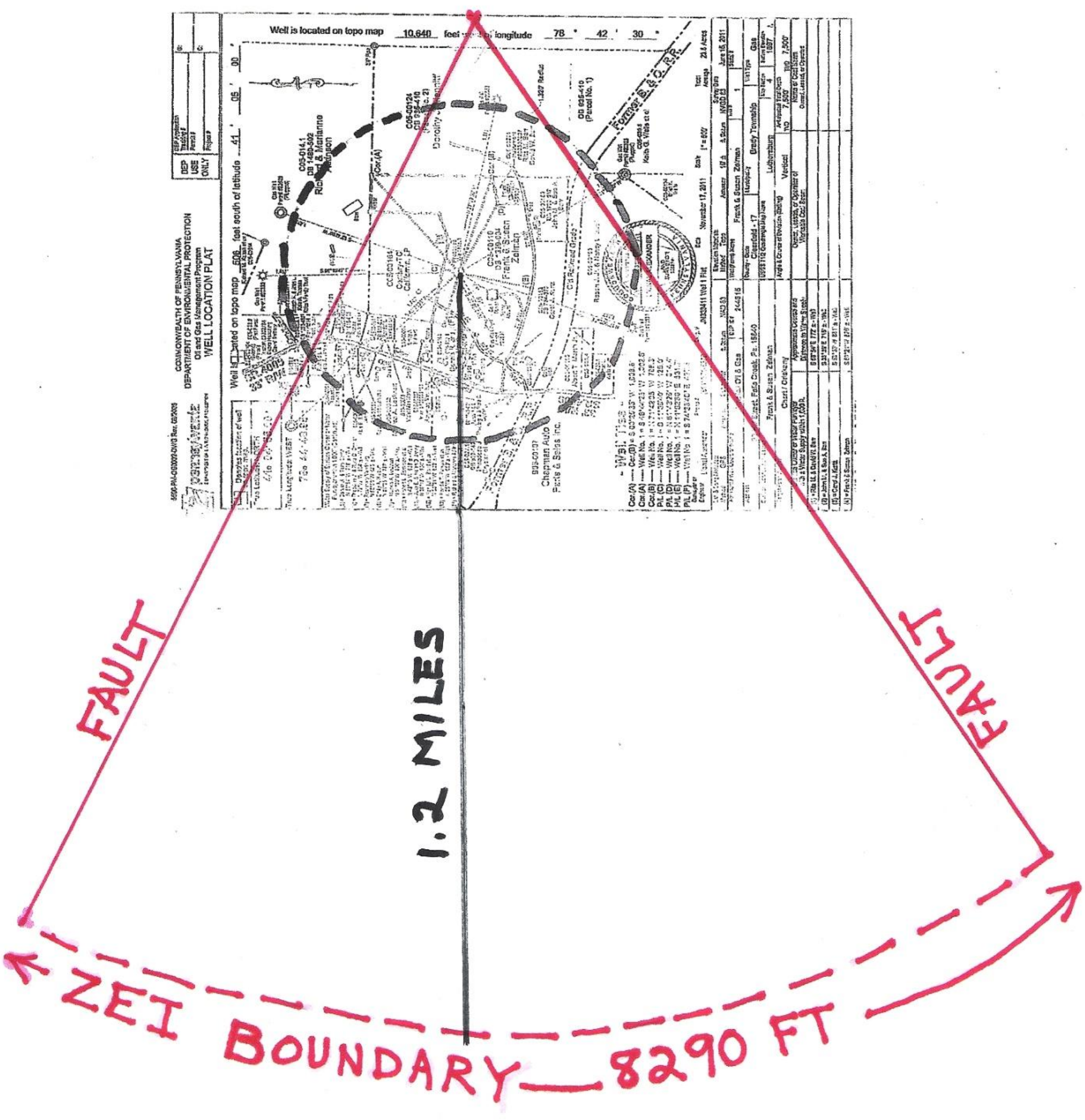
Also, the plugged Carlson gas well (Permit # 20341-P) would be located in the larger ZEI. This well is famous throughout the neighborhood for the fumes and/or methane that it emits in spite of being plugged. One would conclude that contamination of nearby drinking water aquifers is likely to occur because the casing cement and plugging of this well are suspect.



Zelman #1 Disposal Injection Well Estimated Zone of Endangering Influence (ZEI) Assuming Nontransmissive Faults

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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Casing & Cementing

Comment: The draft permit (see attachment #1) specifies a simpler casing and cementing system than what was proposed by Windfall Oil & Gas in their permit application (see attachment #2). The EPA should change their casing and cementing requirement to include a 2nd ground water protective string of casing installed from the surface to a depth of 375 feet and cemented back to the surface.

When the Atkinson water well (RMS 8-9-19) was drilled in the fall of 1992, water was initially found at approximately 150 feet. The quantity of water at that depth was insufficient. Water was next encountered at approximately 300 feet.

The quantity of water there was thought to be adequate and the Atkinsons used the well at that depth for about 10 years. However, under heavy use, the well would be sucked dry. In 2009, the driller come back and drilled the well 60 feet deeper in an effort to get a larger reservoir at the bottom. The performance of the well improved.

In my opinion, the permit should require the Zelman injection well to be constructed according to the proposed casing and cementing plan which has 5 telescopic layers of casing outside of the injection tube as opposed to the draft permit plan, which has only 3 layers of casing outside of the injection tube.

The Atkinson water well driller said that they have to worry about the injection well taking their water. First, the DIW driller would install the 170' ground water protective string as specified in the draft permit. Then when he drills through the Atkinson's aquifer and continues drilling to a depth of 1000', that hole could drain the aquifer.

It would be better if the DIW driller drilled down through the second aquifer until a structurally intact rock layer is encountered. Then he should stop drilling, install a casing and seal around the casing with cement. Then he could continue drilling with a smaller bit without draining water from the second aquifer.

There is anecdotal history of neighbors having their well water contaminated or lost temporarily when the local Oriskany gas wells were first drilled in the 1960s.

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Attachment #1

From the Draft Permit:

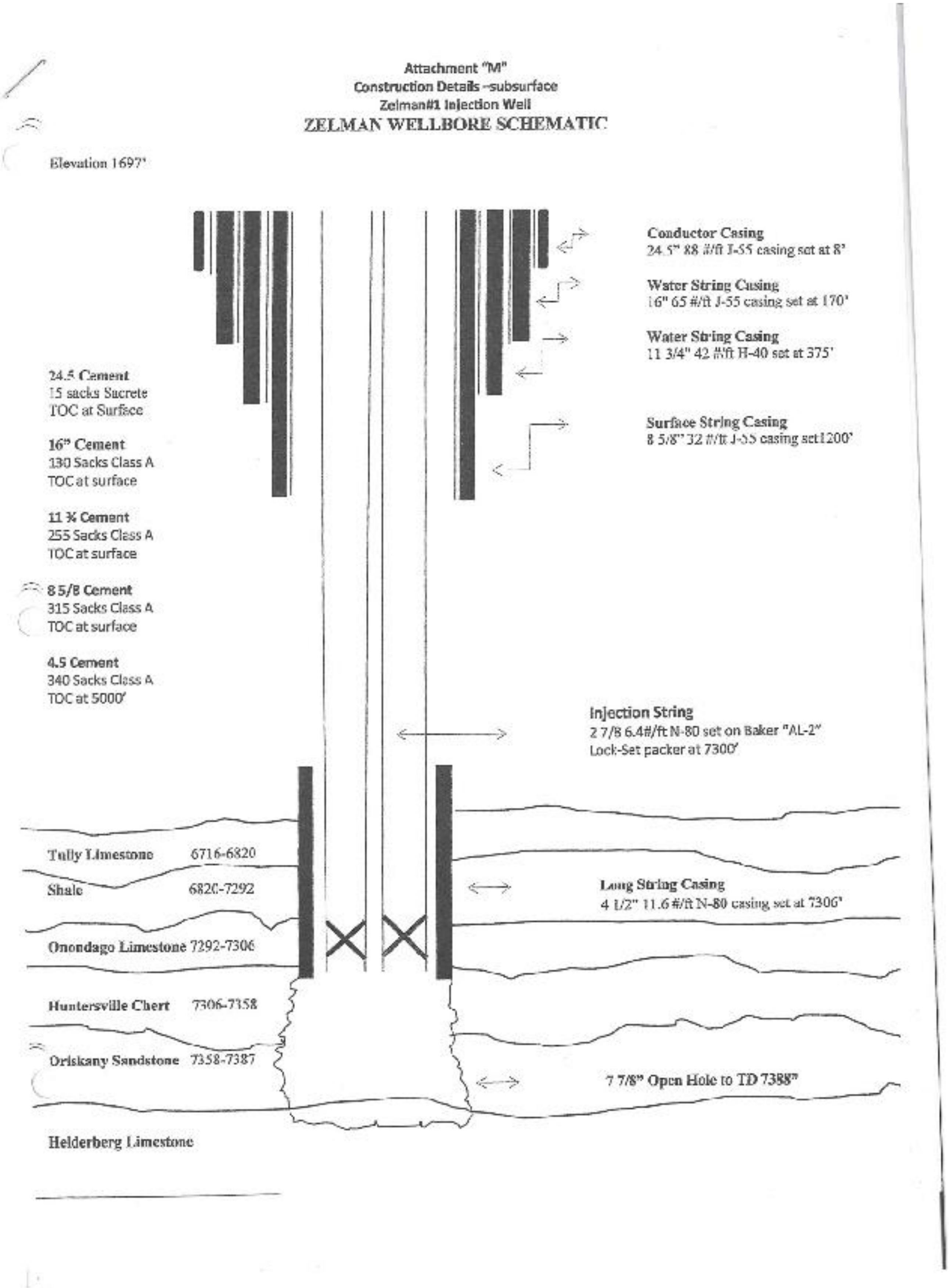
PART III

A. Construction Requirements

2. Casing and Cementing. The permittee shall case and cement the well to prevent the movement of fluids into or between underground sources of drinking water. The casing and cement used in the construction of the well shall be designed for the life expectancy of the well. A ground water protective string of casing shall be installed from the surface to a depth of approximately 170 feet and cemented back to the surface. Surface casing shall be installed from the surface to a depth of approximately 1000 feet and cemented back to the surface. The injection zone shall be isolated by the placement of long string casing to total depth,

approximately 7300 feet, and cemented back to approximately 5000 feet below land surface. Injection shall occur through a tubing string and packer installed inside the long string casing and set above the injection zone.

Attachment #2



Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Injection and Confining Zones

Comment: Based on 5 well records from nearby natural gas wells, the Onondaga Limestone confining zone, immediately above the Huntersville Chert/Oriskany injection zone, is only between 14 and 18 feet thick and **NOT** approximately 50 feet thick, as is stated in the Statement of Basis. In addition, the Huntersville Chert/Oriskany formation injection zone is 69 to 84 feet thick and not 87 feet as stated in the Statement of Basis.

The Statement of Basis for the Zelman #1 disposal injection well (DIW) states the following:

> **Injection and Confining Zones:** Injection of fluids for disposal is limited by the permit to the Huntersville Chert/Oriskany Formation in the interval between approximately 7300 feet through 7387 feet. This injection zone is separated from the lowermost USDW by an interval of approximately 6500 feet, while the confining zone, immediately adjacent to the injection zone, is comprised of approximately 50 feet of limestone.

Refer to Table 1 for a summary of information from gas well records for gas wells that have been drilled in the vicinity of the DIW.

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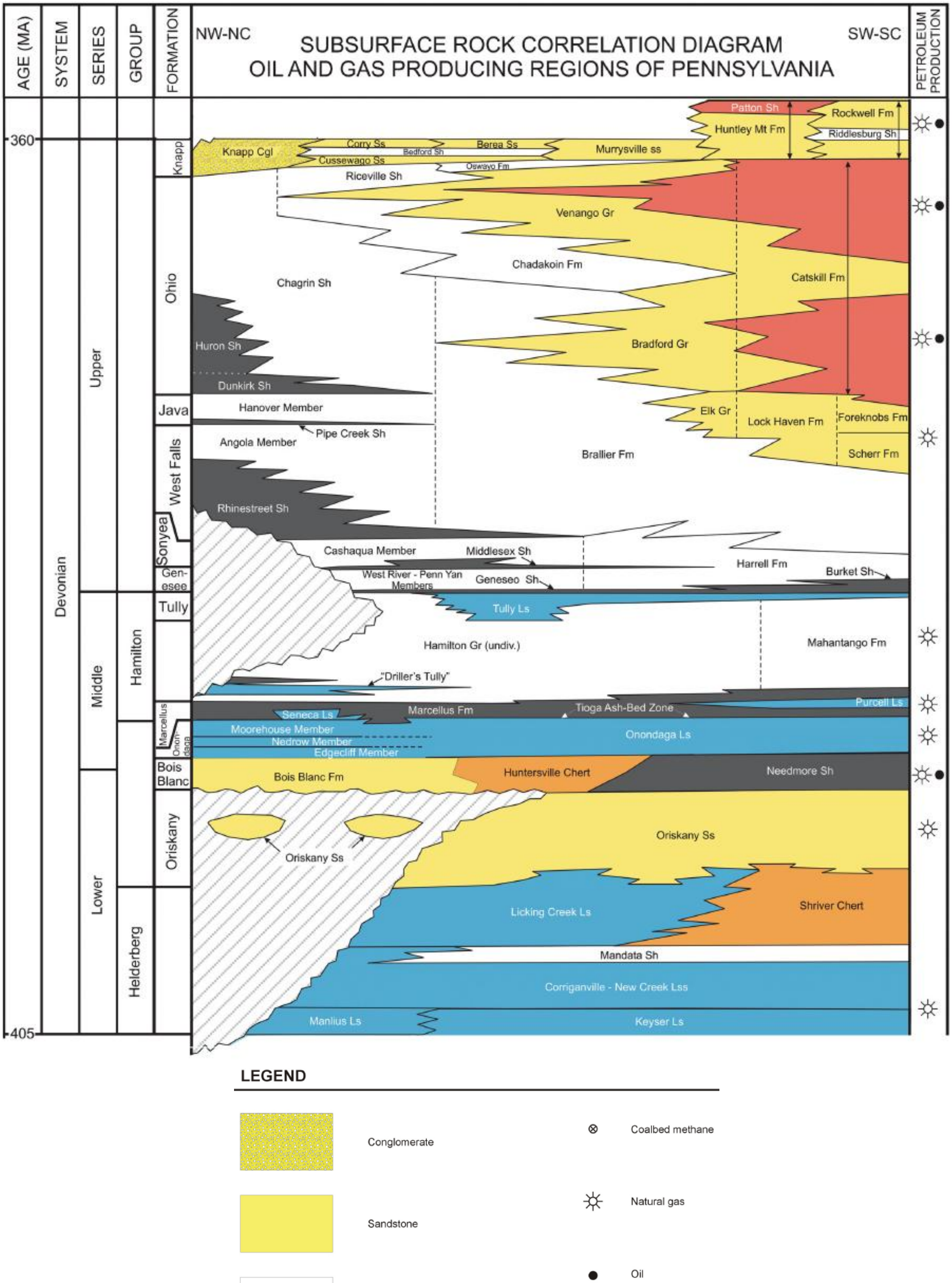

http://www.dcnr.state.pa.us/topogeo/drc/correlationchart.pdf Richard L. Atkinson ~ 221 Deer Lane, DuBois, PA 15801
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5500-PM-OG0002-DWG Rev. 09/2008

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Oil and Gas Management Program

WELL LOCATION PLAT

DEP USE ONLY	DEP Application Tracking #	G:
	Permit #	C:
	Project #	

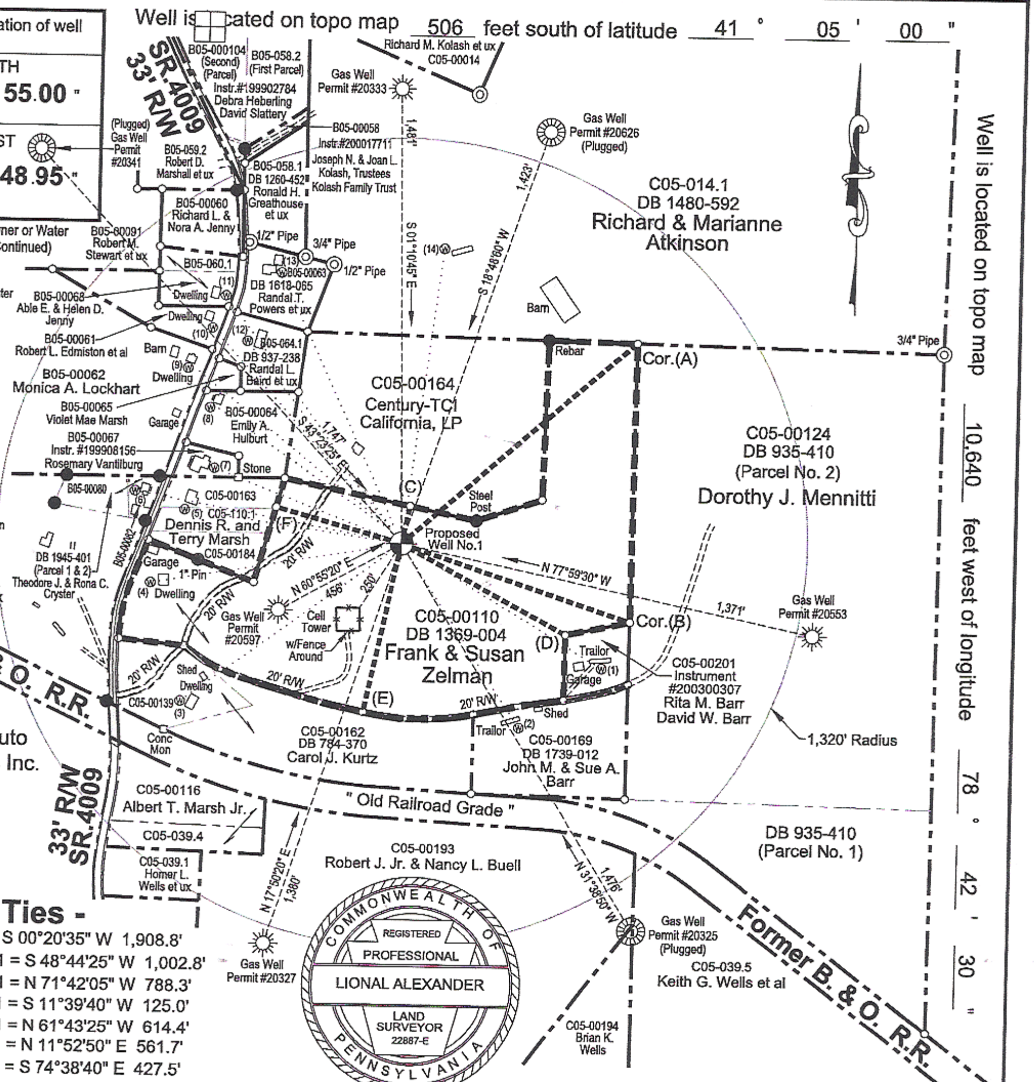
Denotes location of well on topo map.

True Latitude: NORTH 41° 04' 55.00"

True Longitude: WEST 78° 44' 48.95"

Well is located on topo map 506 feet south of latitude 41° 05' 00"

Well is located on topo map 10,640 feet west of longitude 78° 42' 30"



Water Supply of Surface Owner or Water Purveyor within 1,000' (Continued)

- (5) = Dennis R. & Terry Marsh N 81°54' W 716' ± - Well
- (6) = Theodore J. & Rona C. Cryster N 79°32' W 884' ± - Well
- (7) = Rosemary Vantilburg N 68°56' W 659' ± - Well
- (8) = Emily A. Hulburt N 55°35' W 767' ± - Well
- (9) = Monica A. Lockhart N 51°33' W 904' ± - Well
- (10) = Robert L. Edmiston et al N 42°13' W 938' ± - Well
- (11) = Able E. & Helen D. Jenny N 36°17' W 994' ± - Well
- (12) = Randal L. Baird et ux N 38°21' W 832' ± - Well
- (13) = Randal T. Powers et ux N 25°02' W 969' ± - Well
- (14) = Richard & Marianne Atkinson N 07°06' E 971' ± - Well

- Well Ties -

- Cor.(A) —— Cor.(B) = S 00°20'35" W 1,908.8'
- Cor.(A) —— Well No. 1 = S 48°44'25" W 1,002.8'
- Cor.(B) —— Well No. 1 = N 71°42'05" W 788.3'
- P/L (C) —— Well No. 1 = S 11°39'40" W 125.0'
- P/L (D) —— Well No. 1 = N 61°43'25" W 614.4'
- P/L (E) —— Well No. 1 = N 11°52'50" E 561.7'
- P/L (F) —— Well No. 1 = S 74°38'40" E 427.5'

Surveyor or Engineer: Lional Alexander	Phone #: (814) 371-5578	Dwg. #: JN336411 Well 1 Plat	Date: November 17, 2011	Scale: 1" = 500'	Tract Acreage: 23.8 Acres	
Lat. & Long Metadata Method: GPS	Accuracy: Submeter ft.	Datum: NAD 83	Elevation Metadata Method: Topo	Accuracy: 10' ± ft.	Datum: NVGD 88	Survey Date: June 15, 2011
Applicant / Well Operator Name: Windfall Oil & Gas	DEP ID#: 244615	Well(Farm) Name: Frank & Susan Zelman	Well #: 1	Serial #:		
Address: 63 Hill Street, Falls Creek, Pa. 15840		County - Code: Clearfield - 17	Municipality: Brady Township	Well Type: Gas		
Surface Landowner / Lessor: Frank & Susan Zelman		USGS 71/2 Quadrangle Map Name: Luthersburg	Map Section: 4	Surface Elevation: 1697 ft.		
Target Formation(s): Chert / Oriskany		Angle & Course of Deviation (Drilling): Vertical	Anticipated Total Depth TVD: 7,500'	TMD: 7,500'		

Surface Owner or Water Purveyor with a Water Supply within 1,000 ft.	Approximate Course and Distance to Water Supply	Owner, Lessee, or Operator of Workable Coal Seam	Name of Coal Seam Owned, Leased, or Operated
(1) = Rita M. & David W. Barr	S 58°54' E 772' ± - Well		
(2) = John M. & Sue A. Barr	S 33°39' E 715' ± - Well		
(3) = Carol J. Kurtz	S 53°38' W 881' ± - Well		
(4) = Frank & Susan Zelman	S 80°21' W 826' ± - Well		

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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Well Drilling Specifications Overseen Jointly by EPA and PA DEP

Comment: The EPA should defer to the PA DEP for their specifications for certain aspects of how the DIW is to be constructed and the DEP should jointly participate with the EPA in enforcing those specifications.

A Disposal Injection Well is defined as a "well" by the Pennsylvania Consolidated Statutes Title 58 Oil and Gas:

§ 3203. Definitions

"Well." A bore hole drilled or being drilled for the purpose of or to be used for producing, extracting or injecting gas, petroleum or another liquid related to oil or gas production or storage, including brine disposal, but excluding a bore hole drilled to produce potable water.

All wells drilled in PA need a DEP permit per PA Statute:

§ 3211. Well permits.

(a) **Permit required.--**No person shall drill or alter a well, except for alterations which satisfy the requirements of subsection (j), without having first obtained a well permit under subsections (b), (c), (d) and (e)

In addition, Title 40 of the PA Code, Chapter 78 states the following:

§ 78.11. Permit requirements.

(a) No person may drill or alter a well unless that person has first obtained a permit from the Department.

(b) No person may operate a well unless one of the following conditions has been met:

(1) The person has obtained a permit under the act.

The operator must have a well control and disposal Plan.

§ 78.55. Control and disposal plan.

(a) Prior to generation of waste, the well operator shall prepare and implement a plan under § 91.34 (relating to activities utilizing pollutants) for the control and disposal of fluids, residual waste and drill cuttings, including tophole water, brines, drilling fluids, additives, drilling muds, stimulation fluids, well servicing fluids, oil, production fluids and drill cuttings from the drilling, alteration, production, plugging or other activity associated with oil and gas wells.

The PA Code gives the well operator the following responsibility regarding water supplies:

§ 78.51. Protection of water supplies.

(a) A well operator who affects a public or private water supply by pollution or diminution shall restore or replace the affected supply with an alternate source of water adequate in quantity and quality for the purposes served by the supply as determined by the Department.

If a person has his water supply contaminated from the drilling of a brine disposal well as opposed to an oil or gas well, the PA DEP is not obligated to take enforcement action according to 25 PA Code 78.51:

(b) A landowner, water purveyor or affected person suffering pollution or diminution of a water supply as a result of drilling, altering or operating an oil or gas well may so notify the Department and request that an investigation be conducted.

However, the regulation in 25 PA Coce 78.81 obligates the driller to the following:

§ 78.81. General provisions.

(a) The operator shall conduct casing and cementing activities under this section and § § 78.82—78.87 or an approved alternate method under § 78.75 (relating to alternative methods). The operator shall case and cement a well to accomplish the following:

(1) Allow effective control of the well at all times.

(2) Prevent the migration of gas or other fluids into sources of fresh groundwater.

(3) Prevent pollution or diminution of fresh groundwater.

(4) Prevent the migration of gas or other fluids into coal seams.

(b) The operator shall drill through fresh groundwater zones with diligence and as efficiently as practical to minimize drilling disturbance and commingling of groundwaters

Sections 78.82 to 78.87 have to do with the following:

78.82. Use of conductor pipe.
78.83. Surface and coal protective casing and cementing procedures.
78.83a. Casing and cementing plan.
78.83b. Casing and cementing—lost circulation.
78.83c. Intermediate and production casing.
78.84. Casing standards.
78.85. Cement standards.
78.86. Defective casing or cementing.
78.87. Gas storage reservoir protective casing and cementing procedures.

Each of these regulations refers to a "well" and is not limited to a "conventional" or "unconventional" well.

Especially noteworthy is § 78.83(c) which has the purpose of protecting aquifers when they are penetrated by the "well".

§ 78.83(c) …The surface hole shall be drilled using air, freshwater, or freshwater-based drilling fluid. Prior to cementing, the wellbore shall be conditioned to ensure an adequate cement bond between the casing and the formation. The surface casing seat shall be set in consolidated rock….

The PA DEP has overseen the drilling of many thousands of "wells", "conventional wells", and "unconventional wells" over decades. They have recently updated their regulations to prevent the repetition of episodes of drinking water contamination.

The EPA should therefore defer to the PA DEP for their specifications as to how the DIW is to be constructed. Also, the PA DEP should jointly participate with the EPA in enforcing those specifications.

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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

Injection Fluid Confinement

Comment: "Confinement of the injection fluid and existing formation fluids" (from the EPA Statement of Basis) is not necessarily desirable in the case of the Zelman DIW. Also, the depth of the top of the Oriskany Sandstone at the Potter #1 (20235-P) gas well is a concern because it is 412 feet deeper than it is at the Potter #2 (20327) gas well on the other side of a fault about 1200 ft. away. The Atkinson water well may be above the crest of a small anticline and therefore susceptible to methane contamination.

The Statement of Basis for the Zelman#1 DIW states the following in the section dealing with Geologic and Seismic Review:

Historic gas production results in the vicinity of the injection well site have shown that nearby faults appear to act as a geologic trap for gas production. Gas wells have been productive between the fault lines but non-productive outside these fault lines. This would indicate that the faults are not transmissive to gas migration and would also indicate good confinement of injection fluid and existing formation fluids as well.

The theoretically perfect disposal injection well for gas well wastewater would be drilled into a reservoir which is infinite in its horizontal extent and isotropic. That way the injection pressure is dissipated in as short a distance as possible. The flow of injected fluid and the existing fluids which must be displaced would be radially away from the injection well since it would not encounter any obstacles which influence the flow pattern and pressure distribution. Confinement of the injected fluid is not desirable in this case because it is a liquid and is not nearly as compressible as natural gas being pumped into a storage reservoir.

Examination of the well records (Exhibit #1) of the five deep gas wells just outside the Area of Review shows a productive gas well (permit #20333) outside of the faults in addition to the gas well (permit #20327) between the fault lines. Refer to the Statement of Basis above.

It would seem more accurate to postulate that gas wells drilled on the uplifted side of the faults have been more productive since the deformation of the strata has resulted in the formation of traps where natural gas accumulated in a gaseous state, as opposed to remaining in solution with the brine which fills the other pores of the Huntersville Chert/Oriskany Sandstone.

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Furthermore, if the top of the Onondaga Limestone is referenced to sea level, there is a 412 ft. difference (Exhibit #1) between the Potter #1 and Potter #2 gas wells. Somehow this caused the Potter #1 gas well to be a dry hole. Since the fault is between these gas wells, it seems that the Onondaga confining layer is not intact and continuous within the Area of Review. This means that fluids injected into the injection zone may end up entering into rock strata located above the Onondaga confining layer if these fluids pass through the fault.

The Atkinson water well (RMS 8-9-19) is located 895 ft. from the proposed DIW and on the uplifted side of the northernmost fault within the Area of Review. This water well could possibly be directly above the crest of a small anticline (see Exhibit #2) created near the fault. The well water was tested for methane (not by Windfall) and was shown to have <.30 mg/L on 11/13/11. Therefore there must be a pathway for methane to get into the aquifer. Where the methane originated is unknown (shallow gas or deep gas).

Methane concentrations in water of as little as 1 milligram per liter (mg/L) can lead to explosive levels if the gas is allowed to accumulate in a poorly ventilated confined space. When the injection pump at the proposed DIW is turned on, existing formation fluids containing dissolved methane may be forced up the small anticline and if the injection pump is turned off at a later time releasing the pressure, there may be an escape of methane out of solution. Since methane gas has far less density than brine at the same pressure, it may be able to travel into the aquifer and increase the level of methane in the well water above a safe level.

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Exhibit #1

Summary of Information from Well Records of Gas Wells That Have Been Drilled in the Vicinity of the Proposed Zelman #1 DIW and from Zelman Wellbore Schematic

Permit #/ Well Name	Date drilling completed	Date plugged	Elevation (ft above sea level)	Top of Onondaga Limestone (ft below sea level)	Actual thickness of confining zone (ft)	Actual thickness of injection zone (ft)	Side of Fault
20333 DuBois Deposit National Bank or Ginter	12/23/60	——	1642	5606	18	77	U
20325-P Potter #1 (plugged)	9/26/60	10/13/60 (dry hole)	1627	5990	18	——	D
20327 Potter #2	9/29/60	——	1641	5578	14	84	D
20336 Chapman	1/13/61	——	1544	5651	18	69	U
20341-P Carlson (plugged)	11/26/60	8/8/79	1644	5637	15	69	D
Zelman #1 Disposal Injection Well	Proposed	——	1697	5595	14	81	——

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Exhibit #2

Description	**English:** Dividing fault between Appalachian Mountains and Allegheny Plateau. A major geologic fault (directly behind small trees) can be seen in a new roadcut about 10 miles north of en:Williamsport, Pennsylvania on new Route 15. The fault is just about at the line that divides the folded en:Appalachian Mountains and the merely uplifted en:dissected plateau of the en:Allegheny Plateau. On the left hand (south side) is metamorphic rock. On the right hand is en:sedimentary rock, which, as one continues northward becomes mostly horizontal. Image copyleft: Image taken by me, released under GFDL, Pollinator 06:08, Dec 25, 2004 (UTC)
Date	2004-12-25 (original upload date)
Source	Transfered from en.wikipedia
Author	Pollinator at en.wikipedia
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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

There was human activity which induced seismic events that occurred at the Northstar 1 Class 2 injection well in the Youngstown, OH area.

Before January 2011, Youngstown, Ohio, which is located on the Marcellus Shale, had never experienced an earthquake, at least not since researchers began observations in 1776. However, in December 2010, the Northstar 1 injection well came online to pump wastewater from fracking projects in Pennsylvania into storage deep underground. In the year that followed, seismometers in and around Youngstown recorded 109 earthquakes, the strongest registering a magnitude-3.9 earthquake on Dec. 31, 2011. The well was shut down after that quake.

With only one seismometer deployed in the Youngstown area, state geologists lacked the necessary data on the earthquakes' depth and exact location to draw a direct correlation between the seismic events and the deep injection well.

Once sufficient monitoring equipment was in place, the focal depths of events were found to be about 4,000 ft (1,220 m) laterally and 2,500 ft (760 m) vertically from the wellbore terminus.

There is only one seismometer in the vicinity of the proposed Windfall/Zelman #1 DIW. This seismometer is located at the Penn State-DuBois Campus. It is part of the Penn State Seismic Network.

The reforms listed below will make Ohio's Class II deep injection wells among the most carefully monitored and stringently regulated disposal wells in the nation. Ohio will seek the following reforms to its Class II deep injection well program:

- Requires a review of existing geologic data for known faulted areas within the state and avoid the locating of new Class II disposal wells within these areas;
- Requires a complete suite of geophysical logs (including, at a minimum, gamma ray, compensated density-neutron, and resistivity logs) to be run on newly drilled Class II disposal wells. A copy of the completed log, with analytical interpretation will be submitted to ODNR;
- Evaluates the potential for conducting seismic surveys;
- Requires operators to plug back with cement, prior to injection, any well drilled in Precambrian basement rock for testing purposes.
- Requires the submission, at time of permit application, of any information available concerning the existence of known geological faults within a specified distance of the proposed well location, and submission of a plan for monitoring any seismic activity that may occur;
- Requires a measurement or calculation of original downhole reservoir pressure prior to initial injection;\
- Requires the installation of a continuous pressure monitoring system, with results being electronically available to ODNR for review;
- Requires the installation of an automatic shut-off system set to operate if the fluid injection pressure exceeds a maximum pressure to be set by ODNR;
- Requires the installation of an electronic data recording system for purposes of tracking all fluids brought by a brine transporter for injection;

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To bolster its earthquake monitoring capabilities, ODNR will purchase four additional portable seismometers. These sophisticated monitoring devices will augment existing seismometers where necessary, and provide state geologists with quick access to detailed data on seismic activity. In addition, ODNR is in the process of identifying an “outside” expert with experience in seismicity, induced seismicity, and Class II injection wells to conduct an independent review of the currently available technical information, as well as information to be supplied by the injection well owners in the vicinity of the Northstar 1 well. This independent analysis will provide a scientific third party evaluation and analysis of all technical information to ensure thoroughness of the process.

The Region 3 EPA should copy the ODNR and institute the same reforms for their Class 2 Disposal Injection Well program.

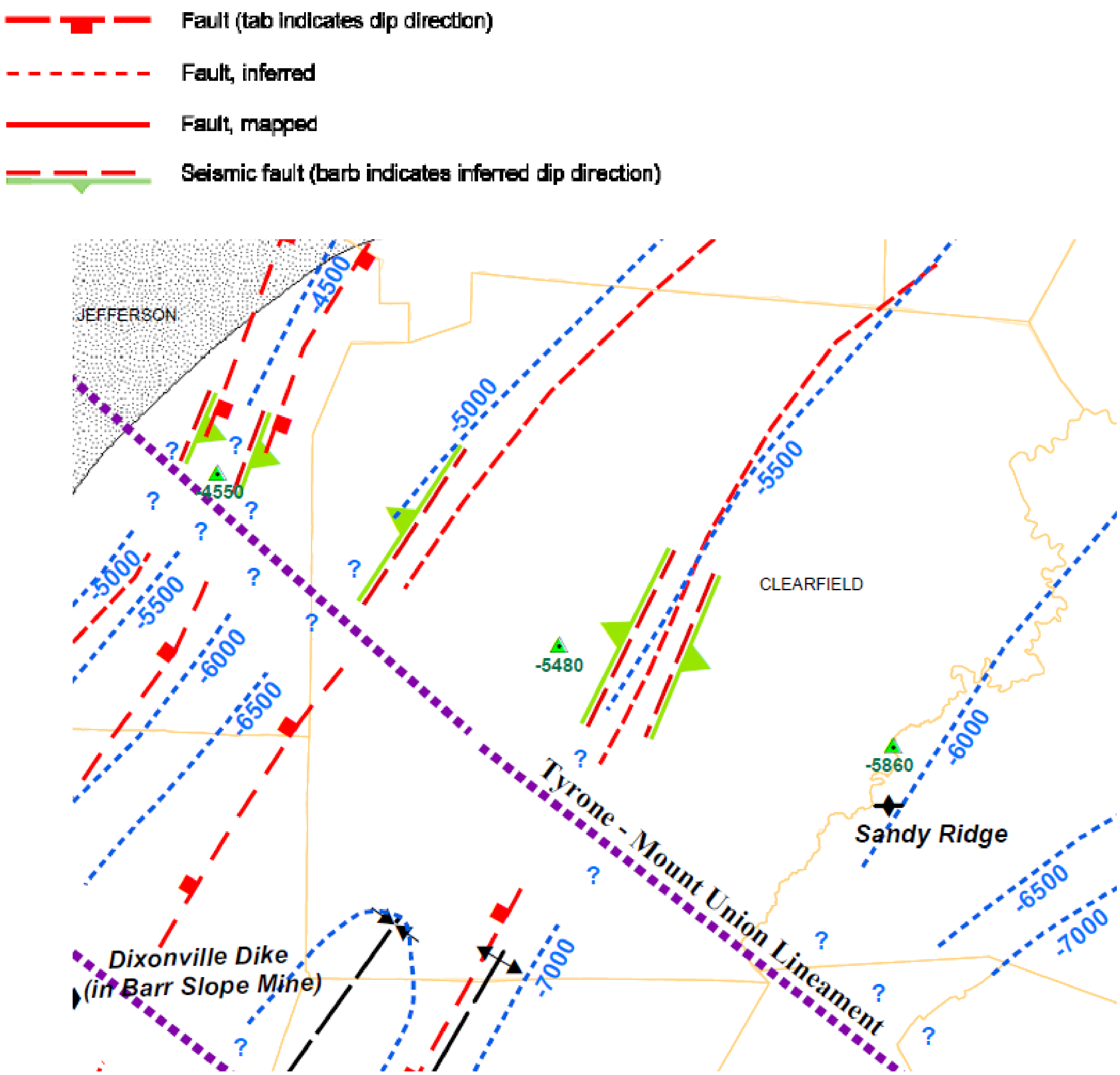
The following, “PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA” shows seismic faults in the general area of the proposed Zelman #1 DIW, which is in the northwestern part of Clearfield County.

Seismic faults are seismically active geologic faults. This is a category of all geologic faults which may be seismically active and cause earthquakes or be long inactive.

PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA

SYMBOLS LEGEND

Pennsylvania database



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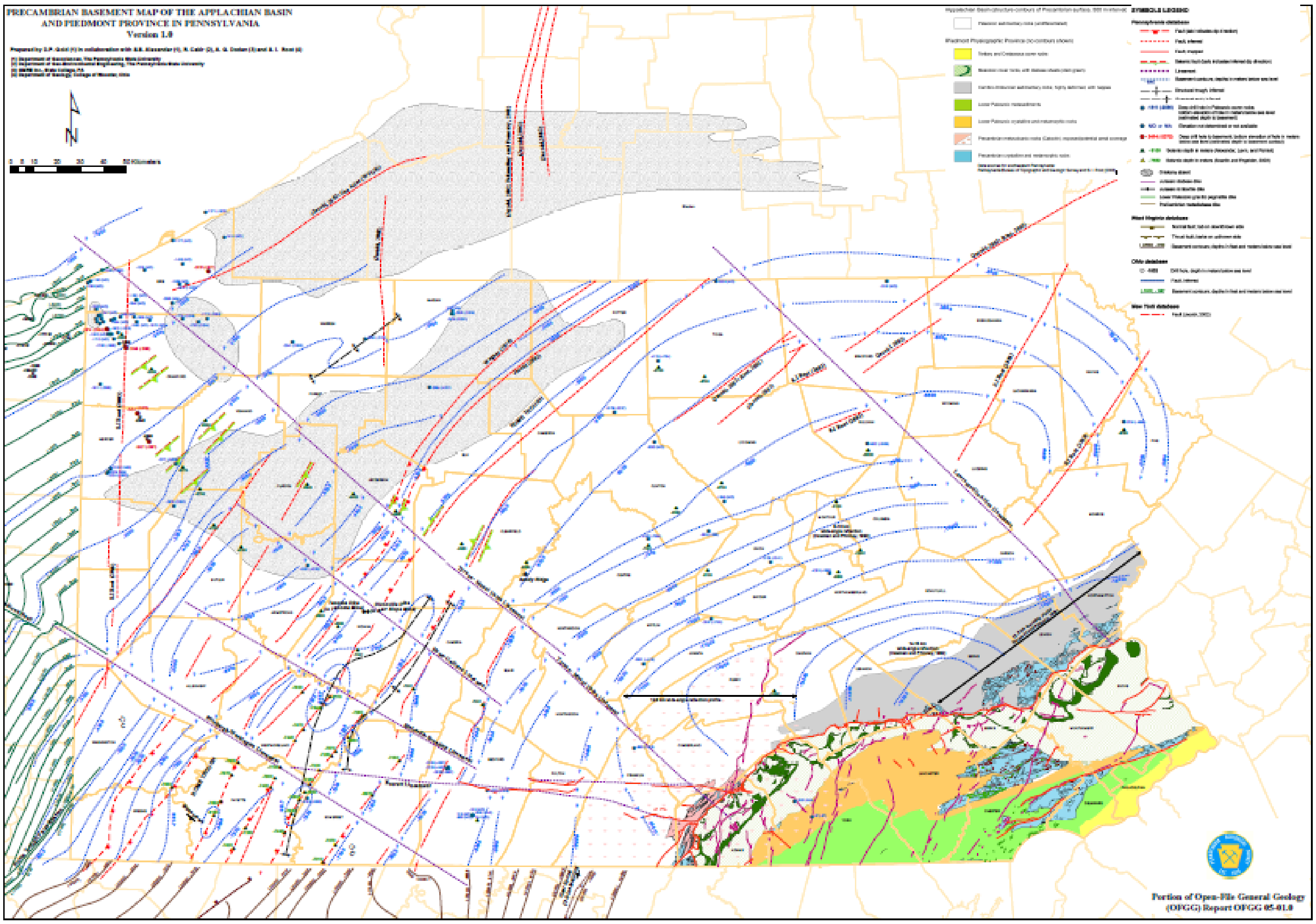
PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA



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