Drilling & Fracing of the Ross No. 1 in the Town Maryland, Otsego County, NY

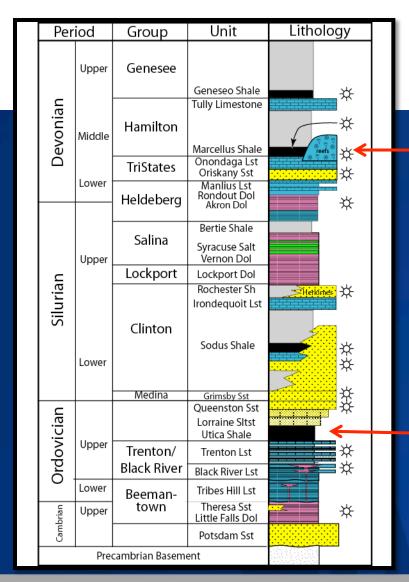




Richard Nyahay GastemUSA

New York Stratigraphy





The popular shale

New York's other shale

Before Environmental Awareness





 Two wells drilled and fraced in Northern
 Otsego County early fall of 2007 under current SGEIS guidelines by Covalent Energy

- •Used approximately 39,000 gals of water to frac well
- Things have changed

Listen to Concerns





•Listen to local concerns by attending many meetings that were held in the area during the last 3 years

(Binghamton Press and Sun Bulletin, December 2009)

Questions to be answered



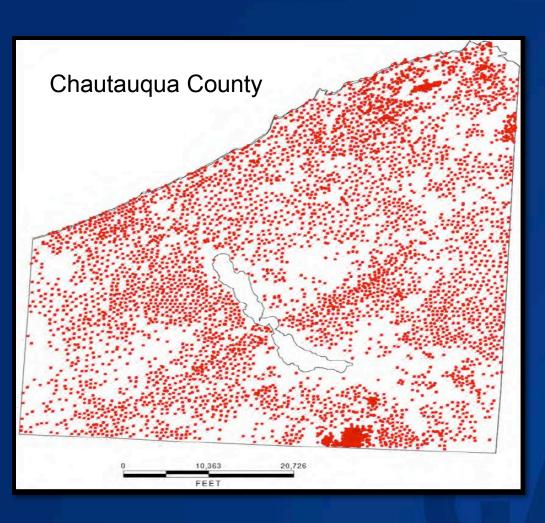
Cobleskill Times Journal July 30, 2008

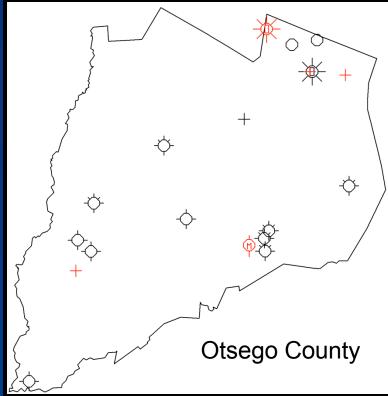
- •What will our communities be like with a gas well every mile?
- •What does the drilling program entail?
- •Where will the millions of gallons of water required for each well come from and will the withdrawal process be monitored?
- •What chemicals are the drillers mixing in the water?
- •What will happen to this water mixture after drawing it from the well? No treatment facilities have been identified yet.
- •Since there is no guarantee the aquifers won't be affected, what recourse is available for property owners?
- Will local taxpayers have to pay for roads damaged by the drilling process?
- •Will gas lines be buried on our properties?
- •Will leases hurt our ability to sell our property?

Don Barber, supervisor, Town of Caroline, Candidate for State Senate

Well Density







Before a drilling permit is received



- Ross 1 permit took over year to obtain
- A target formation is selected
- Meet with NYDEC Divisions to obtain a drilling permit
- Well casing requirements are put forth for to the NYDEC for review
- Frac constituents to be used are submitted for review to the NYDEC
- A plan for containment and disposal of frac fluids are also submitted for review by the NYDEC

Headworks Analysis



FINAL HEADWORKS ANALYSIS REPORT

January 26, 2006

Prepared By:

Michael J. Sligar Chief Operator

William T. Field Memorial Pollution Control Plant 700 William T. Field Drive Watertown, New York 13601

Phone: (315) 785 7840 Fax: (315) 770-2095 E-Mail: pepwinny@imenet.net

USEPA, Region 2 Order EPA-CWA-02-02005-3190

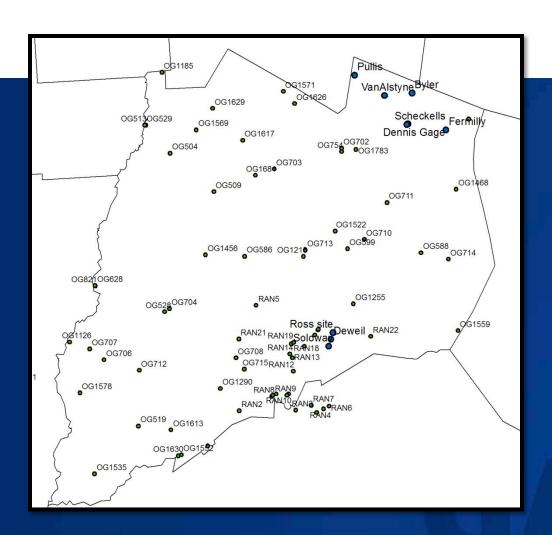
Volume I

 An extensive guide to characterize the nature and level of wastewater loadings treated at the Watertown Publicly Owned Treatment Works(POTW)

 One of four EPA approved Industrial Pre-treatment Programs in the State

Baseline studies





• Find all available information on water wells from online sources and those used from past studies. (local,county, and state agencies, and student theses)

Begin a Sampling Program





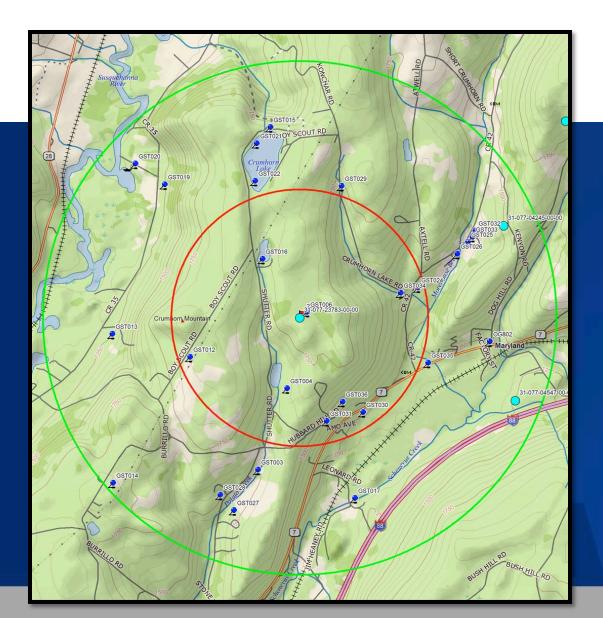
Sponsored a undergraduate to collect water samples from an area of interest to develop a baseline
Student produced poster at GSA this past March

Analytes Tested



- Major elements (Ca, Mg, Na, K)
- Trace Elements (Fe,Sr,Ba, As,Pb,Hg,Cr)
- Volatile Organic Substances
- Gross Alpha & Beta
- Methane
- Alkalinity
- TSS
- TDS
- Chlorides & Sulfate

Target an area of interest





- Established a 2 mile radius of interest (green line) and a inner radius of 1 mile (red line).
- Tested 18 residential wells
- Tested 12 surface waters
- Add more points if necessary

Permits





Now two permits are needed, plus an approved water source

Water Sources









SUSOUEHANNA RIVER BASIN COMMISSION

1721 North Front Street . Harrisburg, Pennsylvania 17102-2391 Phone (717) 238-0423 • Fax (717) 238-2436 Web http://www.srbc.net

APPROVAL BY RULE 18 CFR § 806.22(f) FOR CONSUMPTIVE WATER USE RELATED TO NATURAL GAS WELL DEVELOPMENT

ABR-20090818

A. PROJECT SPONSOR (Name and Address)

Mr. Jon Kelafant COVALENT ENERGY CORPORATION

4106 Lorcom Lane Arlington, VA 22207 B. PAD LOCATION

Pad ID: Ross 1 (NOI 2009-238)

Municipality: Maryland Town

County: Otsego

APPROVAL AUTHORIZES the consumptive use of water of up to 0.0790 million gallons per day (mgd).

From*:

Public Water Supply System(s) Worcester Water District No. 2

0.030 (subject to system availability)

Commission-Approved Source(s)

Maximum Daily Quantity (mgd)

Other Source(s)

Maximum Daily Quantity (mgd)

The project sponsor shall comply with mitigation in accordance with 18 CFR Section 806.22(f)(5) by payment of the consumptive use fee in accordance with 18 CFR Section 806.22(b)(3). The rate of payment, after appropriate notice to consumptive users of water using this method of compliance, is subject to change at the Susquehanna River Basin Commission's

*Or any other source subsequently authorized or approved for this pad location under 18 CFR Section 806.22(f)(11).

Frac sample from Sheckels No. 1







Needed a sample from the previous well fraced to begin discussions

Sheckels No. 1 analysis



- Two sampling events one on 10 /27/2008 the other on 03/19/2009
- Analyzed for Gross gamma 10/27/2008
- Analyzed for Metals 10/27/2008
- Analyzed for Volatiles 10/27/2008
- Analyzed for Semi-volatiles 03/19/2009
- Analyzed for Oil & Grease 03/19/2009
- Analyzed for TOC 03/19/2009
- Analyzed for COD 03/19/2009
- Analyzed for BOD 03/19/2009

Sheckels No. 1 analysis

COVALENT ENERGY CORPORATION RADIOCHEMICAL ANALYSIS SUMMARY SHECKELLS GAS WELL 1 10/24/08



	6NYCRR Part 380.11	Sheckells Gas Well
Sample Location	Table III Discharge Limits to Sewers	
EPA 8021 STARS (ppb)	pCi/L	pCi/L
Cobalt-60	30,000	ND
Zinc-65	50,000	1
Barium-133	200,000	3
Cesium-134	80,000	3
Cesium-137	7,000,000	11
Potassium-40	40,000	110
Thallium-208	600	10
Bismuth-212	700,000	78
Lead-212	20,000	13
Bismuth-214	3,000,000	16
Lead-214	1,000,000	21
Actinium-228	300,000	28
Thorium-234	50,000	ND
Uranium-235	3,000	6

<u>Ross 1 Drillina P</u>ermit

85-20-2 (2/06 ALB-DL) - 25c NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF MINERAL RESOURCES PERMIT TO DRILL 31-077-23783-00-00 Expiration Date 11/26/US (If drilling is not commenced by the expiration date) Pursuant to Article 23 of the Environmental Conservation Law. Covalent Energy Corporation of 4106 Lorcom Lane, Arlington VA 22207 is authorized to drill the in the Town of _____ Maryland ____ County_ as described in the Owner's Application for Permit, dated 5/9/08 and all subsequent submittals to the Department. NOTIFY THE DIVISION OF MINERAL RESOURCES AT LEAST 24 HOURS PRIOR TO SPUDDING THE WELL PHONE: (518) 402-8056 (Albany Office) SPECIAL INSTRUCTIONS OR CONDITIONS Issuance of this permit is conditioned upon the following: 1. Notice To All Drilling Operators; 2. Drilling Permit Conditions; 3. NYSDEC Casing and Cementing Practices; 4. Spacing and Integration Conditions; and 5. Wildcat Supplementary Conditions (If blank, permit is unconditioned) Failure to conform to ECL 23, 6NYCRR Parts 550 - 559 and the SPECIAL INSTRUCTIONS OR CONDITIONS above or attached may result in the suspension of this permit. Issued by:

M. Malf Dinected, But Oth Recurred June 1, 2009

Department Representative and Title

Date This permit, or a copy certified by the department, must be publicly displayed by the owner at the well site during the drilling operation and must at all times be visible, legible and protected from the elements.

BURFACE CASING

RECOMMENDED CENTRALIZER-HOLE SIZE COMBINATIONS		
Controller Size inches	Minimum Hale Stees Inches	Moreum Charpes Inches
4-12	8-18	169
5-12	7-98	1-78
6-58	8-12	1-78
7	0.04	5-3/6
9.59	10-546	
9-06	12-114	288
13-38	17-102	4.18

The casing shall be of sufficient strength to contain any expected formation or stimulation pressures.

Following comerting and removal of comerting equipment, the operator shall wait until a compressive strength of 500 psi is achieved before the casing is disturbed in any way. The operator shall test or require the cementing contractor in test the minim visitor for rid and temperature prior to mixing the cement and to record the results of the cementing tickets and or the drilling log. WOC time shall be adjusted based on the results of the test.

The annular space between the surface casing and the production string shall be verted at all times. If the armular cas is to be produced, a pressure relief value shall be installed in an appropriate manner and set at a pressure approved by the Regional Mineral Resources office.

WHEN REQUESTED BY THE DEPARTMENT IN WRITING, EACH OPERATOR MUST SUBMIT CENENT TICKETS AND OR OTHER COCCUMENTS THAT INDICATE THE ABOVE SPECE CATIONS HAVE BEEN FOULDWED.

THE CASING AND DEMENTING PRACTICES ABOVE ARE DESIGNED FOR TYPICAL PRODUCTION CASING: CEMENTING. THE DEPARTMENT WILL REQUIRE ADOTTONAL NEASURES FOR WELLS DRILLED IN PHYROMENTALLY OR TECHNICALLY SENSITIVE AREAS (I.A. PRINARY OR PRINCIPAL AQUIFERS).

THE DEPARTMENT RECOGNIZES THAT VARIATIONS TO THE ABOVE PROCEDURES MAY BE INDICATED IN SITE SPECFIC INSTANCES. SUCH VARIATIONS WILL REQUIRE THE PRIOR APPROVAL OF THE REGIONAL MINERAL

SPACING AND INTEGRATION CONDITIONS

WELL NAME: Ross I

- Sparine unit. The spacine unit established for this well is 39.81 acres in size and is valid only Sparing until the sparing and constrained at the well a 22st seek as the well-here is within the target formation no less than 660 feet from any unit boundary.
- permanently plugging back or deepening the well to another formation, or drilling directionally to another bottom-hole location, in the absence of any required additional well permit. The application for any such required additional permit must include a proposed spacing unit for the
- Multiple, shallower or deeper completions that do not require an additional well permit. denth(s) for which a soucine unit is required pursuant to ECL \$23-0501, but for which the spacing unit described by Condition 1 is not valid, until after the well operator has submitted a proposed spacing unit for the formation(s) and/or depth(s) proposed for completion and the Department has authorized the proposed operations.
- shall held the entire production proceeds attributable to uncontrolled spacing unit acreage in an

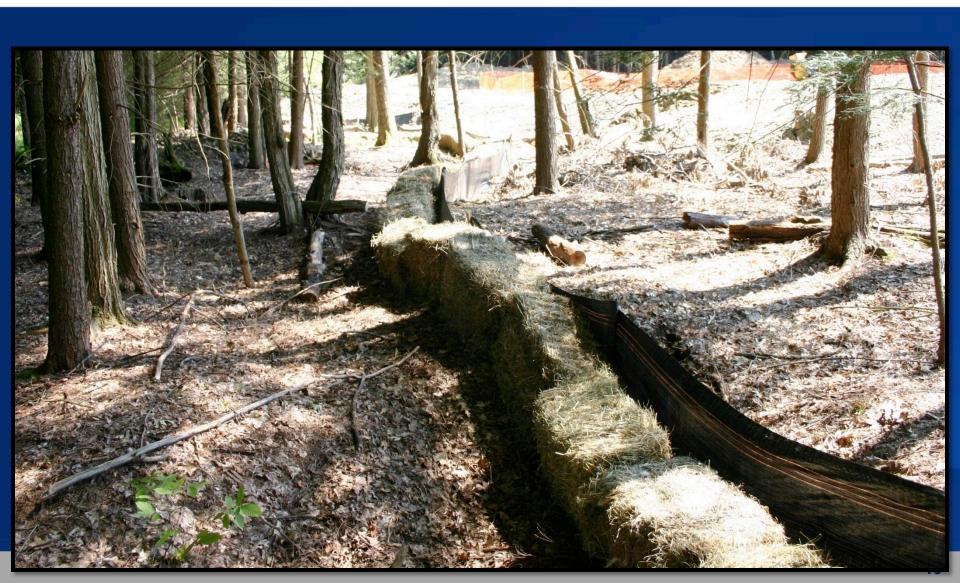
- All pipes and lines which are associated with well control and which are downstream of the casing head spool must be securely chained to anchors. Appropriate amounts of water and drilling mud additives to make up, weight and
- Appropriate amounts or water and driving that accentives to make up, weight and condition drilling fluid, and to combat loss of circulation must be on site to aid in well 10. Redundant mud pumping capability must be on site while drilling below surface casing.

- Appropriate pressure central procedures and equipment must be employed while tripping, lagging and running casing into the well.
- "Recommended Practices For Safe Drilling of Wells Containing Hydrogen Solfide."
- 15. Any deviation from the above conditions must be approved by the Department prior

WILDCAT SUPPLEMENTARY DRILLING CONDITIONS

Straw & silt fence surrounding site





Closed Systems





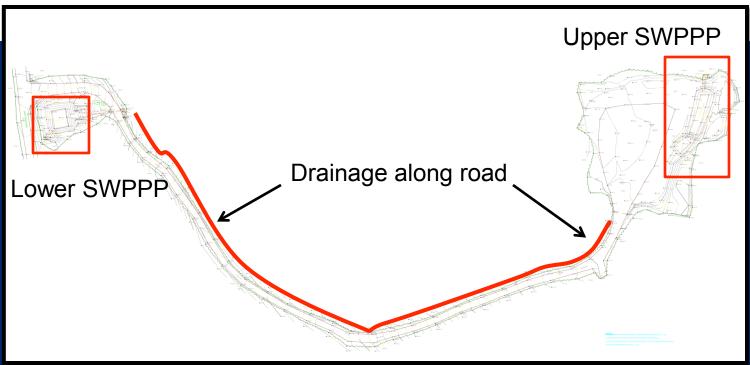


Well cuttings contained

Water stored in closed frac tanks

Stormwater Pollution Prevention Plan (SWPPP)





The New York State Department of Environmental Conservation is requiring Construction Stormwater General Permit Coverage for Article 23 Drilling Activities. Beginning May 31, 2010 all eligible well sites are covered under the Construction Stormwater General Permit.(Gasper, 2010)

Upper SWPPP







Hay bales and silt fences cannot be used across ditches or swales. Only stone or manufactured check dams should be used across areas of concentrated flow. (Gasper, 2010)

Lower SWPPP







A site operator must also have a 'trained contractor' on site at least once daily when there are active soil disturbances activities being performed. (Gasper, 2010)

Upper storm water pollution preventation pit being inspected by engineer





Casing





Fresh water aquifers are generally less than 500 feet deep

Every casing string is cemented to surface by pumping cement down pipe and circulating back up between the outside of pipe and the wellbore

More than a million pounds of steel casing in each well

Ross 1 casing program



- Conductor was set through the glacial till to a solid rock seat.
- 16 inch to 126' and 10 inch to 138'
- 7 inch Surface Casing was set at 780' and cemented to surface. This is 95' below the deepest water well found within 2 miles.
- 4.5 inch casing to 4950' cemented to surface.

Drilling begins, upper casing installed





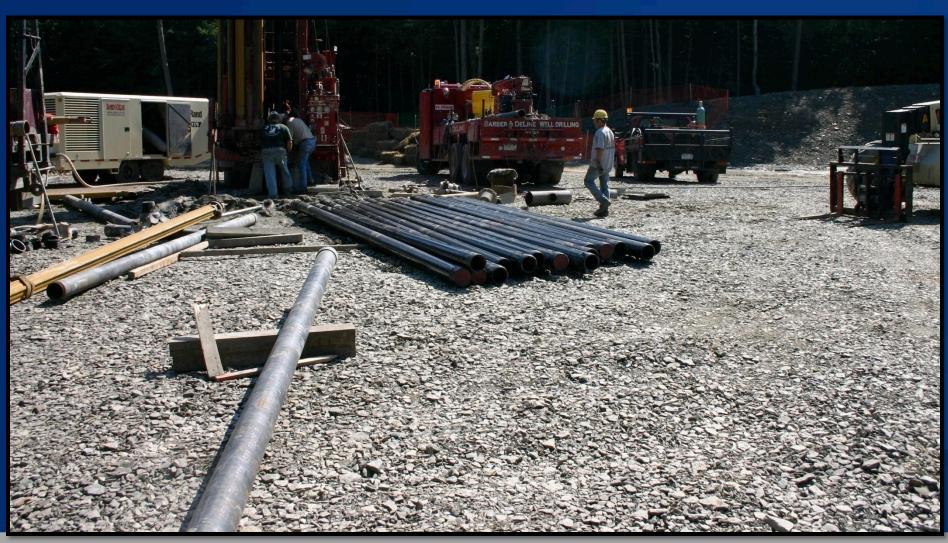
NYDEC Inspector on site





Seven inch drill casing





Production casing & casing coupler





Cement Truck





Cement pipe





Cement pipe installed between casings





Cement trucks pumping a liquid cement to drill hole





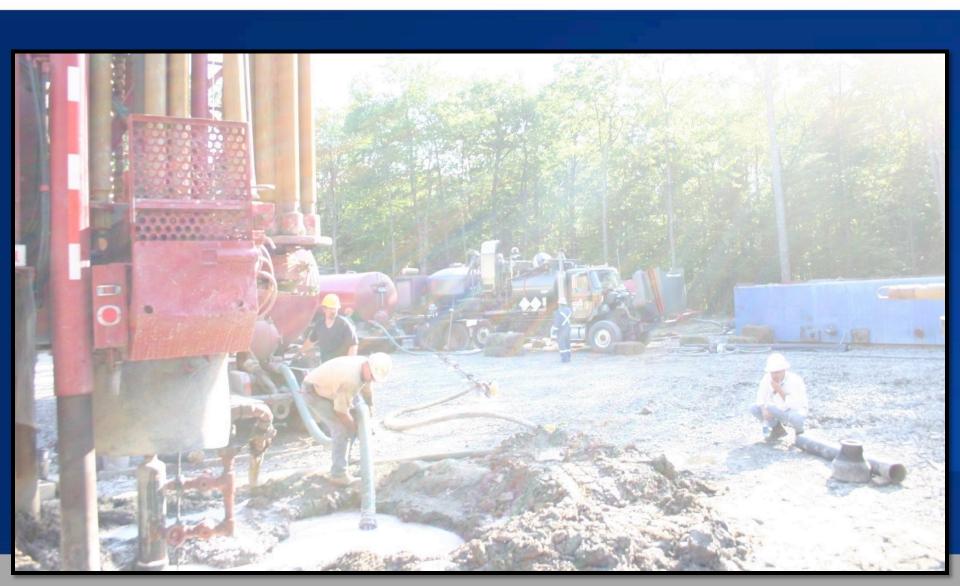
Cement pipe between casings





NYDEC inspector watching over casing cement job





Surface casing cement job complete





Site cleared awaiting a bigger rig to finish drilling well to TD





Blow out preventer is set on top the well





New rig arrives, & close up of a drill bit





Well cuttings piped to closed container





Well cuttings in closed container





Pump truck removing well cuttings from container





Well cuttings transferred to bucket loader





Well cuttings transferred to dump trucks to be transferred to a solid waste site







Radiological Survey Report

Marcellus Shale Drilling Cuttings

from Tioga and Bradford Counties, Pa. and

New England Waste Services of N.Y., Inc. Landfill Sites in Chemung, NY Campbell, NY Angelica, NY

April 2010

Performed by:

CoPhysics Corporation 1242 Route 208 Monroe, NY 10950

Theodor & Robon Theodore E. Rahon, Ph.D.

Certified Health Physicist

Date: 4/26/2010



Well cuttings found to be safe to add as fill in landfills in New York

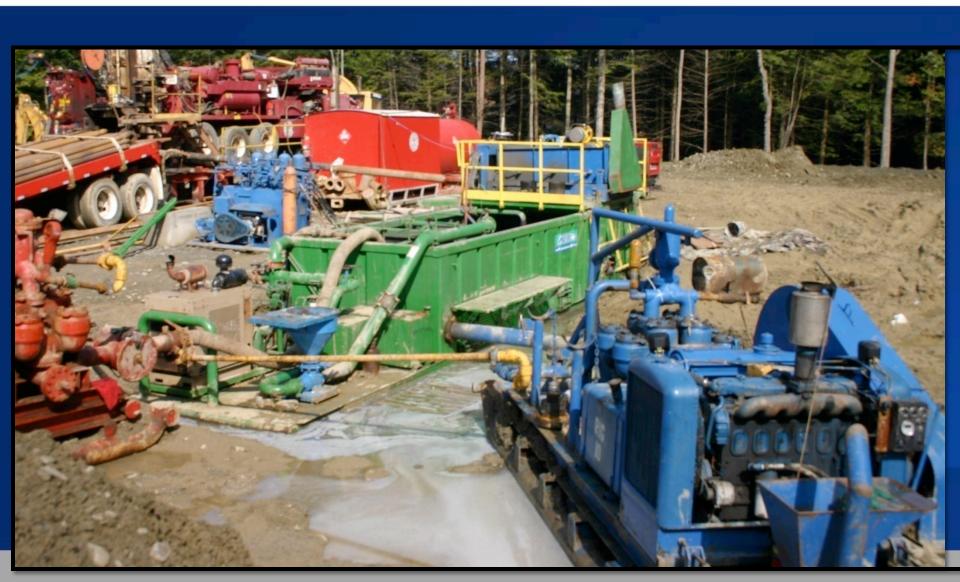
Drilling proceeds 24/7





Drilling mud mixer





Perfed Zones



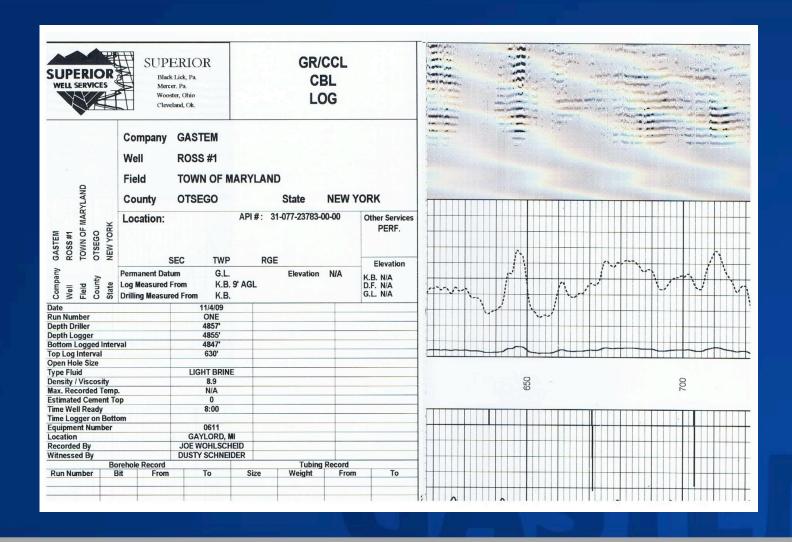
85-1	WELL DRILLING AND COMPLETION REPORT PAGE 2 OF 2								
WE	L NAME AND NUMBER	ATTA	ACH ADDITIO		MATION AS NECESS				
	lis No.1				0 7 7 7 2		9 [0]	0 0 0	
P R E	TYPE OF TEST (dst, bail, etc.)	ZONES TESTE	D (TMD)	DURATIO OF TEST (h		AND AMOUNTS F	PRODUCED	AND OTHER DATA	
O T		ft. to	ft.						
E C O M P S T		ft. to	ft.						
0 N		ft. to	ft.						
С	COMPLETION EQUIPMEN	T: List tubing, pack	er, rods, pump	o, bridges, etc	;; note sizes and dep	ths WELL COM	IPLETED OF ft. to	PEN HOLE (TMD) ft.	
C O M P D L A	None (4.5" casing	g only w 4.5"	x 3000 p	sig valve	on top)				
E T T A	PERFORATED INTERVAL: 2,450 ft. to	s (TMD) 2,371		F SHOTS	PERFORATED INTE 2,123 ft. to		ontinued 2,026 ft.	NO. OF SHOTS	
- O N	ft. to			51	ft. to		ft.	84	
L	ft. to		ft.		ft. to		ft.		
	ZONES TREATED (TMD)		DETAILS: typ	e and volume	of materials, rates, b	reakdown psi, ave	erage treatm	ent psi, isip, etc.	
S T	2,450 ft. to	2,371 _{ft.}	20,760 gal g	el water, 13	9mscf N2, 320 sks s	sand, 30 bpm, 36	600 psig, 27	788 psig, 1120 psig	
M L	2,123 _{ft. to}	2,026 _{ft.}	24,160 gal g	el water, 11	6mscf N2, 320 sks	sand, 30 bpm, 45	500psig, 24	198 psig, 1390 psig	
ULATA	ft. to	ft.							
- li	ft. to	ft.							
O N	ft. to	ft.							
\vdash	ft. to	ft.							
P R	FORMATION TESTED		GAS TEST		en Flow OIL TES			UT-IN PRESSURE	
0 D T	No initial complet		Build Up	□ Dr	awdown Pun	np LFlow		cepsi. blepsi.	
lo -	DUBATION OF FLOWIN	IC TEST DATA							

Completion Reports can be seen at ESOGIS.com



Cement Bond Log





Frac Ingredients



Additive Type	Main Ingredients	Purpose	Common Use
Friction reducer	Polyacrylamide (non-hazardous)	Reduces friction between fluid and pipe	Cosmetics; soil conditioner; some children's toys
Anti- Microbial Agent	Glutaraldehyde	Eliminates bacteria in the water that produce corrosive byproducts	Disinfectant; sterilize medical and dental equipment and surfaces
Scale inhibitor	Ethylene glycol	Prevents scale deposit in the pipe	Automotive anti- freeze, household cleaners, de-icing agent
Diluted Acid	7.5% Hydrochloric Acid	Help dissolve cement and minerals and help	Swimming pool chemical and cleaner
719161	7.57.3	initiate fractures	(Holko, 2011)

Fracing Operations

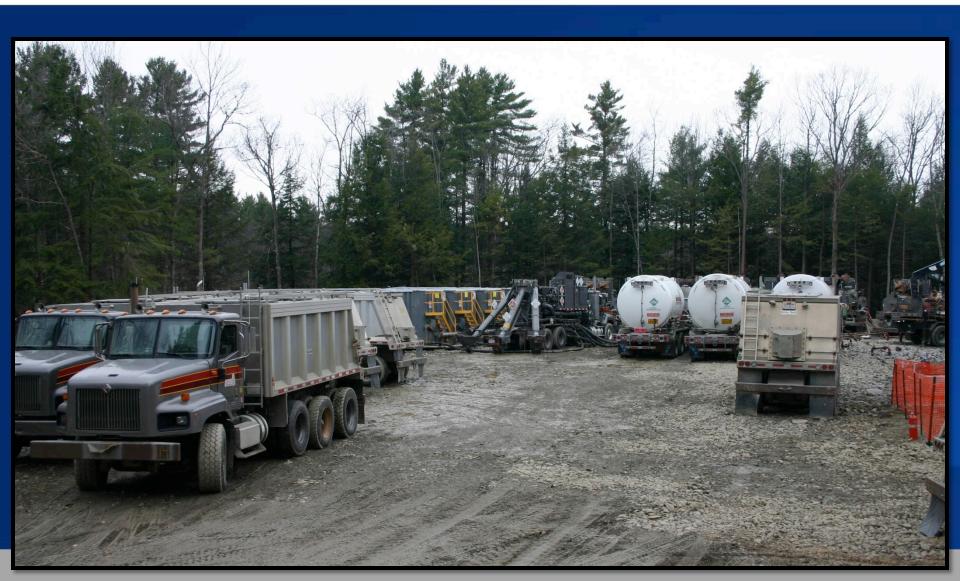




- •Used approximately 79,000 gallons of water allowed by current SGEIS to frac the Ross #1
- NYDEC, SRBC NYSHD, ProPublica, and the Sierra Club were onsite during fracing operations

Occurred on November 11, 2009





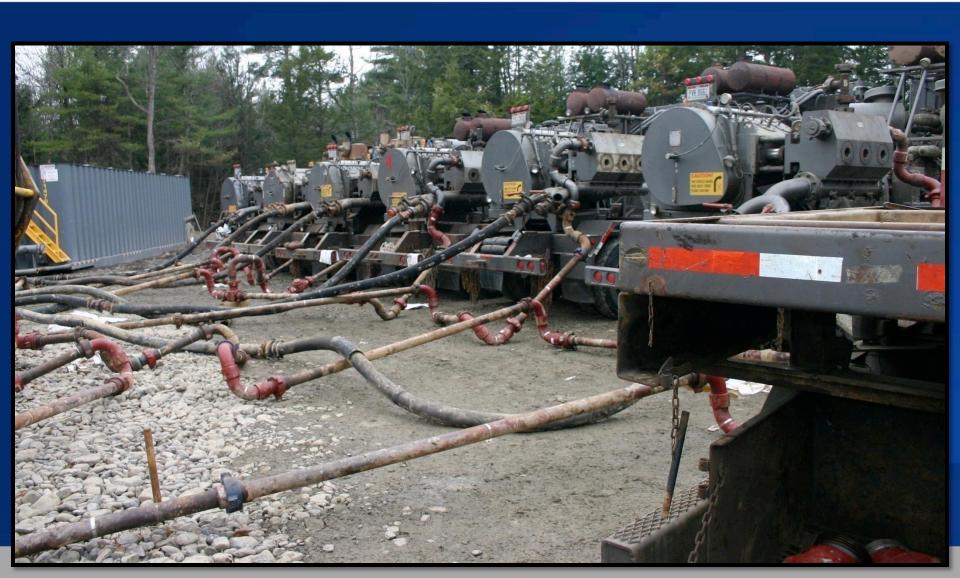
















Testing frac water





Frac Water stored in closed tanks

Frac water tested before being delivered to Watertown POTW

Frac Water Analysis



<u>TestAmerica</u>

THE CRABER IN ENVIRONMENTAL TESTING

Strategic Environmental, LLC 25 1/2 Water Street Baldwinsville, NY 13027 Work Order: RSK0955

Project: Covalent Ross I 08-732

Project Number: Covalent Ross 1

		Executive Summary - Detections							
	Sample	Data				Dił	Date		
Analyte	Result	Qualifiers	RL	MDL	Units	Fac	Analyz		
Sample ID: RSK0955-01	(TANK 71440	FLOW BAC	K - Water)		Samı	pled: 11	/19/09 12:3		
Volatile Organic Compo	ounds by EPA	8260B							
Bromomethane	1.8		1.0	0.28	ug/L	1.00	11/21/09		
Chloroethane	1.9		1.0	0.32	ug/L	1.00	11/21/09		
Chloromethane	8.0		1.0	0.35	ug/L	1.00	11/21/09 1		
Toluene	74		1.0	0.51	ug/L	1.00	11/21/09 1		
Non-Halogenated Volat	ile Organics								
Ethylene Glycol	35	В	10	1.7	mg/L	1.00	11/23/09		
Diethylene glycol	5.7	J, B	10	2.6	mg/L	1.00	11/23/09		
Triethylene Glycol	11	C7, B	10	2.9	mg/L	1.00	11/23/09		
Semivolatile Organics I	oy GC/MS								
Acetophenone	13		4.7	0.51	ug/L	1.00	11/24/09 (
Bis(2-chloroethyl)ether	11		4.7	0.38	ug/L	1.00	11/24/09 (
Bis(2-ethylhexyl) phthalate	2.1	J	4.7	1.7	ug/L	1.00	11/24/09 (
Di-n-butví phthalate	1.4	J	4.7	0.29	ua/L	1.00	11/24/09		

Frac Water Analysis



Total Metals by SW 846	Series Metho	ods.					
Arsenic	0.0068	J	0.0100	0.0056	mg/L	1.00	11/24/09
Barium	15.3	D08	0.0200	0.0030	mg/L	10.0	11/24/09
Beryllium	0.0010	J	0.0020	0.0002	mg/L	1.00	11/24/09
Cadmium	0.0011		0.0010	0.0003	mg/L	1.00	11/24/09
Calcium	489		0.5	0.1	mg/L	1.00	11/24/09
Chromium	0.0049		0.0040	0.0009	mg/L	1.00	11/24/09
Copper	0.0046	J	0.0100	0.0013	mg/L	1.00	11/24/09
Iron	38.1		0.050	0.019	mg/L	1.00	11/24/09
Lead	0.0066		0.0050	0.0030	mg/L	1.00	11/24/09
Magnesium	22.6		0.200	0.043	mg/L	1.00	11/24/09
Manganese	1.26		0.0030	0.0002	mg/L	1.00	11/24/09
Nickel	0.0153		0.0100	0.0013	mg/L	1.00	11/24/09
Potassium	61.6		0.500	0.050	mg/L	1.00	11/24/09
Sodium	2600	D08	10.0	3.2	mg/L	10.0	11/24/09
Zinc	0.155		0.0100	0.0015	mg/L	1.00	11/24/09
Lithium	6390	D14	10.0	0.6	ug/L	10.0	11/23/09
Strontium	34100	D08, B	80.0	2.0	ug/L	100	11/24/09
General Chemistry Para	ameters						
Alkalinity, Total	295		5.00	0.79	mg/L	1.00	11/23/09
Ammonia as N	11.6	D08	0.200	0.090	mg/L	10.0	11/23/09
Biochemical Oxygen	174		2.0	2.0	mg/L	1.00	11/20/09
Demand						4.00	4.4.0
Chemical Oxygen	985		10.0	2.5	mg/L	1.00	11/25/09
Demand Total Hardness	1350	D08	40.0	10.5	~ /I	20.0	11/25/09
	0.256	D08	0.0500	0.0260	mg/L	2.00	11/20/09
Methylene Blue Active	0.256	D08	0.0500	0.0260	mg/L	2.00	11/20/09
Substances Phenolics, Total Recoverable	0.025		0.010	0.005	mg/L	1.00	11/29/09

TestAmerica Buffalo - 10 Hazelwood Drive Amherst, NY 14228 tel 716-691-2600 fax 716-691-7991 www.testamericainc.com

TDS & Chlorides



Total Dissolved Solids from Ross No.1 after testing = 6460 mg/l Chlorides from Ross No.1 after testing = 5070 mg/l

Flow back from Ross No.1 would be approximately 35,000 gallons therefore TDS would equal 1886 pounds and Chlorides would be 1480 pounds (Silgar, 2010)

This would represent 3% of what is loaded upon the Watertown POTW per day(Sligar, 2010)

Pre-testing Toxicity



Bio Analytic tested flowback against microbial population that exist in the POTW activated sludge aeration tank and in the lead primary anerobic digestor.

With the aerobic culture and anerobic culture exhibiting full tolerance to volume proportions for the flow the flowback water of 20 % and 5%, respectively, it is evident that if toxicity were the sole issue than the entire 35,000 gallons may be delivered at once and discharged at either the facility headworks or directly injected to the anerobic digesters.(Sligar 2010)

Additional Testing



Report March 5, 2010

Short-Term, High-Intensity Monitoring Program
Required by the New Discharge Notification
Issued by NYS Department of Environmental Conservation
Division of Water, Bureau of Water Permits
Notification Dated: December 29, 2009
Submitted by:
POTW, City of Watertown, NY
SPDES NY 002 5984
Executive Summary

On December 29, 2009 the New York State Department of Environmental Conservation (NYSDEC) approved the City of Watertown's Pollution Control Plant (the STP) as a disposal site for "flowback" wastewater extracted from the Ross #1 well. This deep vertical well was developed to extract natural gas from Utica Shale deposits in Otsego County, NY. Approximately 35,000 gallons were delivered to the STP on January 5, 6 & 7, 2010 via seven tankers (3 shipments received each the 5th and 6th). The seventh tanker carried only 250 gallons (the wash water that was used to clean the storage tanks that had held the well flowback water the months it had been stored at the Otsego site).

Exhaustive testing had been accomplished on the flowback water prior to the approval by the NYSDEC. This testing had formed the basis by which the approval was granted. Based upon the known quantity and character of the flowback water, assurance was obtained that the City's STP could successfully treat and dispose of the wastewater. As a confirmation, the NYSDEC required the City to conduct representative and targeted sampling of the flowback water received as well as subsequent performances of the STP for a 35 day period commencing with the receipt of the first tanker. This report summarizes the results of the ordered testing.

Thawing out frozen flowback





Cleaned out water tanks

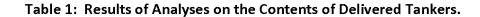




Flowback from Ross No.1

			mg/l								
Tanker#	gallons	Chloride	Toluene	Total Solids	Sus. Solids	Dis. Solids					
1	5,460	6,698	0.052	44,850	420	44,430					
2	5,460	5,198	0.047	9,876	110	9,766					
3	5,460	9,397	< 0.010	15,526	550	14,976					
4	5,460	10,197	0.036	17,562	130	17,432					
5	5,460	9,997	0.031	16,106	140	15,966					
6	5,460	8,897	0.027	15,568	250	15,318					

			pounds							
Tanker#	gallons	Chloride	Toluene	Total Solids	Sus. Solids	Dis. Solids				
			·							
1	5,460	305	0.002	2,042	19	2,023				
2	5,460	237	0.002	450	5	445				
3	5,460	428	XXX	707	25	682				
4	5,460	464	0.002	800	6	794				
5	5,460	455	0.001	733	6	727				
6	5,460	405	0.001	709	11	698				
Total	32,760	2,294	0.009	5,441	73	5,368				
Average	5,460	382	0.001	907	12	895				







Tanker % of Typical STP daily loading



	Total Solids	Suspended Solids	Dissolved Solids	Toluene	Chloride
Typical STP Influent (pounds per day)	89,410	19,303	70,107	< 0.34	24,273
Typical STP Effluent (pounds per day)	78,202	1,481	76,721	< 0.15	25,268
Total Tanker					
Deliveries from Ross #1 (pounds)	5,441	73	5,368	0.009	2,294
Tanker % of typical STP daily loading	3.1%	0.2%	3.8%	1.3%	4.8%

Water Quality Not Tested Originally



- Coliform
- Nitrate
- Nitrite
- Surfactants
- Hydrogen Sulfide

Looking to develop partnerships with state ,local and federal agencies to test for these components and others to be identified if necessary.

Well Testing Well A



Analysis	Groundwater or Drinking Water Standard or Guidance Value	Well A 8/20/08	Well A 12/17/09	Well A 3/26/10
Calcium	No standard	26 mg/l	27 mg/l	27 mg/l
Magnesium	No standard	6.1 mg/l	5.9 mg/l	5.6 mg/l
Sodium	20 mg/l	37 mg/l	39 mg/l	40 mg/l
Potassium	No standard	0.93 mg/l	0.57 mg/l	0.84 mg/l
Iron	300 μg/l	Not Detected	Not Detected	Not Detected
Arsenic	25 μg/l	Not Detected	1.9 µg/l	Not Detected
Barium	1000 μg/l	64 μg/l	62 µg/l	60 µg/l
Chromium	50 μg/l	Not Detected	6.6 µg/l	Not Detected
Lead	15 μg/l	Not Detected	Not Detected	Not Detected
Mercury	0.7 μg/l	Not Detected	Not Detected	Not Detected
Strontium	No Standard	570 ug/l	580 μg/l	540 μg/l
Chloride	250 mg/l	1.6 mg/l	1.1 mg/l	1.5 mg/l
Total Dissolved Solids	500 mg/l	230 mg/l	210 mg/l	190 mg/l
Volatile Organic Compounds	Standards vary by compound	Not Detected	Not Detected	Not Detected
Dissolved Methane	10 mg/l	Not Detected	Not Detected	Not Detected

Well Testing Well B



Laboratory Analysis	Groundwater or Drinking Water Standard or Guidance Value	Well B 8/6/09	Well B 9/30/09	Well B 1/13/10	Well B 4/20/10
Calcium	No standard	32 mg/l	31 mg/l	32 mg/l	33 mg/l
Magnesium	No standard	8 mg/l	7.8 mg/l	8.0 mg/l	8.2 mg/l
Sodium	20 mg/l	26 mg/l	24 mg/l	25 mg/l	26 mg/l
Potassium	No standard	0.68 mg/l	0.59 mg/l	0.73 mg/l	0.73 mg/l
Chloride	250 mg/l	2 mg/l	2 mg/l	2.5 mg/l	2.6 mg/l
Iron	300 μg/l	55 ug/l	64 ug/l	50 ug/l	59 ug/l
Lithium	No standard	10 ug/l	8.4 ug/l	11 ug/l	Not Analyzed
Manganese	300 μg/l	210 ug/l	230 ug/l	Not Analyzed	Not Analyzed
Arsenic	25 μg/l	Not Detected	Not Detected	1.6 ug/l	Not Analyzed
Barium	1000 μg/l	35 μg/l	38 ug/l	40 ug/l	38 ug/l
Chromium	50 μg/l	11 μg/l	Not Detected	3.9 ug/l	Not Detected
Lead	25 μg/l	Not Detected	Not Analyzed	Not Analyzed	Not Detected
Strontium	No standard	170 μg/l	170 ug/l	180 ug/l	170 ug/l
Sulfate	250 mg/l	6.6 mg/l	Not Detected	5.7 mg/l	11 mg/l
Alkalinity	No standard	160 mg/l	160 mg/l	170 mg/l	160 mg/l
Total Dissolved Solids	500 mg/l	220 mg/l	190 mg/l	162 mg/l	190 mg/l
Total Suspended Solids	No standard	Not Detected	Not Detected	Not Detected	Not Detected
Dissolved Methane	10 mg/l	Not Detected	Not Detected	Not Detected	Not Detected

Data after one year



Aaron Sulkey											
Gastem-USA											
		Residential Wells			Surface Waters						
Analysis:	Groundwater or Drinking Water Standard or Guidance Value	Range Before	Average	Range After	Average	Range Before	Average	Range After	Average	2006 USGS Range (8 wells)	Ross Utica Flowback Analysis
Arsenic	25 ug/l	0-2.1 ug/l	0.13125 ug/l	0-3.3 ug/l	.06 ug/l	0-0	0	0-0	0	< 2 ug/l	6.8 ug/l
Barium	1000 ug/l	1.8-120 ug/l	53.053 ug/l	1.8-130 ug/l	53.215 ug/l	0-24 ug/l	7.412 ug/l	0-8.9 ug/l	3.437 ug/l	15-1730 ug/l	15300 ug/l
Strontium	No standard	1.8-630 ug/l	244.154 ug/l	1.8-620 ug/l	275.09 ug/l	16 ug/l	16 ug/l	12-33 ug/l	19.083 ug/l	117-11600 ug/l	34100 ug/l
Sulfate	250 mg/l	0-14 mg/l	7.638 mg/l	0-16 mg/l	6.494 mg/l	3.8-8.5 mg/l	5.8 mg/l	4.4-6.8 mg/l	5.35 mg/l	3.6-1120 mg/l	36.3 mg/l
Methane	10 mg/l	0-6 mg/l	.5 mg/l	0-5 mg/l	.35 mg/l	0-0	0	0-0	0	NR	Not Analyzed
Total Dissolved Solids	500 mg/l	39-230 mg/l	149.538 mg/l	39-220 mg/l	150.35 mg/l	0-280 mg/l	46.25 mg/l	25-100 mg/l	55.833 mg/l	NR	6460 mg/l
Total Suspended Solids	No Standard	0-12 mg/l	0.857 mg/l	0-6mg/l	.375 mg/l	0-73 mg/l	25.571 mg/l	0-14 mg/l	6.25 mg/l	NR	88.9 mg/l
Volatile Organic Compounds	Standards Vary by Compound	Not Detected	Not Detected	Not Detected	Not Detected	0-0	0	0-0	0	NR	
Calcium	No standard	7.1-36 mg/l	20.636 mg/l	7-32 mg/l	19.74 mg/l	3.5-20 mg/l	7.113 mg/l	3-15 mg/l	6.971 mg/l	13-254 mg/l	489 mg/l
Magnesium	No Standard	1.7-8.1 mg/l	4.7 mg/l	1.7-8 mg/l	4.292 mg/l	.51-2.1 mg/l	1.1 mg/l	.73-2.2 mg/l	1.183 mg/l	2.38-162 mg/l	22.6 mg/l
Sodium	20 mg/l	2-62 mg/l	21.06 mg/l	1.7-41 mg/l	25.48 mg/l	.77-7.3 mg/l	2.745 mg/l	1.1-10 mg/l	3.17 mg/l	7.68-85.4 mg/l	2600 mg/l
Potaasium	No standard	.2797 mg/l	.588 mg/l	.2398 mg/l	.508 mg/l	0-1 mg/l	.204 mg/l	.295 mg/l	.444 mg/l	.43-2.00 mg/l	61.6 mg/l
Iron	300 ug/l	0-420 ug/l	64.75 ug/l	0-1000 ug/l	90.5 ug/l	110-1,600 ug/l	661.25 ug/l	180-840 ug/l	454.28 ug/l	<6-303 ug/l	38.1 mg/l
Chromium	50 ug/l	0-6.2 ug/l	.931 ug/l	0-6.7 ug/l	1.81 ug/l	0-1.1 ug/l	.138 ug/l	0-5.9 ug/l	.842 ug/l	<.8-1.5 ug/l	4.89 ug/l
Chloride	250 mg/l	0-42 mg/l	9.313 mg/l	1.1-84 mg/l	12.906 mg/l	1.5-2.1 mg/l	1.8 mg/l	1.6-21 mg/l	6.829 mg/l	2.92-50.6 mg/l	5070 mg/l
Lead	25 ug/l	0-54 ug/l	5.023 ug/l	1-110 ug/l	8.63 ug/l	0-0 ug/l	0 ug/l	0-0 ug/l	0 ug/l	<.06-6.19 ug/l	6.6 ug/l
Alkalinity	No Standard	20-180 mg/l	94.462 mg/l	20-160 mg/l	85.75 mg/l	0-55 mg/l	17.125 mg/l	14-48 mg/l	27 mg/l	115-344 mg/l	295 mg/l
NOTE, All informat	ian ia haaad an IItiaa I	Eman inh									
NOTE: All information is based on Utica Frac job VOC: Volitile Organic Compounds (EPA 524.2)									UTICA VOC Flow		
voc: volitile Organ	ic Compounds (EPA :	524.2)								Bromoethane	1.8 ug/l
										Chloroethane	1.9 ug/l
1 mg=1,000 ug										Chloromethane	<u> </u>
NR = Analyse Not Ru	ın									Toulene	74 ug/l

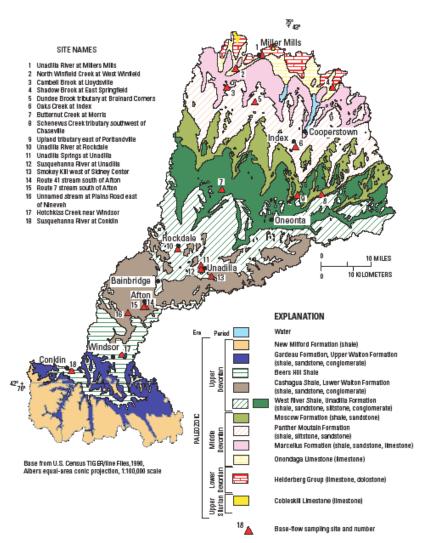
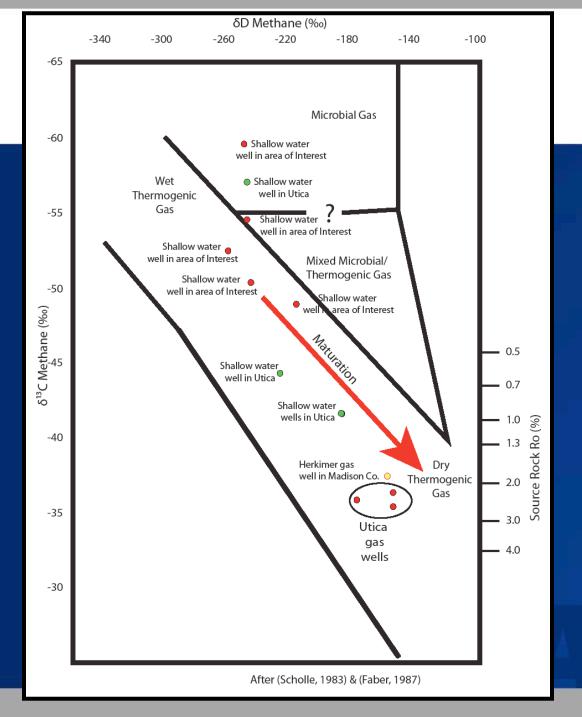


Figure 3C. Bedrock geology of the upper Susquehanna River Basin, N.Y. (Modified from New York State Geological Survey, Map and Chart Series No. 15, Fisher and others, 1970.)



- Wells geochemistry reflect bedrock geology
- 8 wells tested in
 Otsego County for
 2006 USGS study
- •To date GastemUSA has tested 121 wells and 30 surface waters





Gas Isotopes & Microseepages

73

Wells cuttings study



Mineralogy and Geochemistry of Well

Cuttings and

Well Cuttings Leachate

Prepared for:

Gastem USA

By:

Bruce Selleck

Jaclyn Baughman

Alison MacNamee

Colgate University Department of

Geology

February 7, 2011

Developing Partnerships



Hydrogeologic Characterization and Water-Quality Assessment in Relation to Marcellus and Utica Shale Gas Development in Otsego County, New York

- USGS Water Resources Troy and Ithaca NY
- State Health Department
- SUNY College at Oneonta
- Otsego County Planning Office
- Otsego County Soil and Water Conservation District
- Invited Industry partners

Independent Testing for Verification



- West Virginia Water Research Institute
- USGS Reston, Virginia
- New York State Health Department
- Dr. Stephen Osborn Duke University

We look to send more samples from future wells

Independent testing Dr. Osborn of Duke University



Aaron Sulkey													
Gastem-USA											Resident	ial Wells	
		Residential Wells				Surface Waters				Duke Analysis			
Analysis:	Groundwater or Drinking Water Standard or Guidance Value	Range Before	Average	Range After	Average	Range Before	Average	Range After	Average	2006 USGS Range (8 wells)	Range	Average	Ross Utica Flowback Analysis
Arsenic	25 ug/l	0-2.1 ug/l	0.13125 ug/l	0-3.3 ug/l	.6 ug/l	0-0	0	0-0	0	< 2 ug/l	0	0	6.8 ug/l
Barium	1000 ug/l	1.8-120 ug/l	53.053 ug/l	1.8-130 ug/l	53.215 ug/l	0-24 ug/l	7.412 ug/l	0-8.9 ug/l	3.437 ug/l	15-1730 ug/l	6.26-118 ug/l	65.07 ug/l	15300 ug/l
Strontium	No standard	1.8-630 ug/l	244.154 ug/l	1.8-620 ug/l	275.09 ug/l	16 ug/l	16 ug/l	12-33 ug/l	19.083 ug/l	117-11600 ug/l	0	0-0	34100 ug/l
Sulfate	250 mg/l	0-14 mg/l	7.638 mg/l	0-16 mg/l	6.494 mg/l	3.8-8.5 mg/l	5.8 mg/l	4.4-6.8 mg/l	5.35 mg/l	3.6-1120 mg/l	4.35-18.59 mg/l	9.90 mg/l	36.3 mg/l
Methane	10 mg/l	0-6 mg/l	.5 mg/l	0-5 mg/l	.35 mg/l	0-0	0	0-0	0	NR	0-2.71 mg/l	.477 mg/l	Not Analyzed
Total Dissolved Solids	500 mg/l	39-230 mg/l	149.538 mg/l	39-220 mg/l	150.35 mg/l	0-280 mg/l	46.25 mg/l	25-100 mg/l	55.833 mg/l	NR	NR	NR	6460 mg/l
Total Suspended Solids	No Standard	0-12 mg/l	0.857 mg/l	0-6mg/l	.375 mg/l	0-73 mg/l	25.571 mg/l	0-14 mg/l	6.25 mg/l	NR	NR	NR	88.9 mg/l
Volatile Organic Compounds	Standards Vary by Compound	Not Detected	Not Detected	Not Detected	Not Detected	0-0	0	0-0	0	NR	NR	NR	
Calcium	No standard	7.1-36 mg/l	20.636 mg/l	7-32 mg/l	19.74 mg/l	3.5-20 mg/l	7.113 mg/l	3-15 mg/l	6.971 mg/l	13-254 mg/l	17.72-33.59 mg/l	25.61 mg/l	489 mg/l
Magnesium	No Standard	1.7-8.1 mg/l	4.7 mg/l	1.7-8 mg/l	4.292 mg/l	.51-2.1 mg/l	1.1 mg/l	.73-2.2 mg/l	1.183 mg/l	2.38-162 mg/l	7.77-8.46 mg/l	5.94 mg/l	22.6 mg/l
Sodium	20 mg/l	2-62 mg/l	21.06 mg/l	1.7-41 mg/l	25.48 mg/l	.77-7.3 mg/l	2.745 mg/l	1.1-10 mg/l	3.17 mg/l	7.68-85.4 mg/l	5.31-71.12 mg/l	25.67 mg/l	2600 mg/l
Potaasium	No standard	.2797 mg/l	.588 mg/l	.2398 mg/l	.508 mg/l	0-1 mg/l	.204 mg/l	.295 mg/l	.444 mg/l	.43-2.00 mg/l	NR	NR	61.6 mg/l
Iron	300 ug/l	0-420 ug/l	64.75 ug/l	0-1000 ug/l	90.5 ug/l	110-1,600 ug/l	661.25 ug/l	180-840 ug/l	454.28 ug/l	<6-303 ug/l	0-0	0	38.1 mg/l
Chromium	50 ug/l	0-6.2 ug/l	.931 ug/l	0-6.7 ug/l	1.81 ug/l	0-1.1 ug/l	.138 ug/l	0-5.9 ug/l	.842 ug/l	<.8-1.5 ug/l	0-11.65 ug/l	1.059 ug/l	4.89 ug/l
Chloride	250 mg/l	0-69 mg/l	9.313 mg/l	1.1-84 mg/l	12.906 mg/l	1.5-2.1 mg/l	1.8 mg/l	1.6-21 mg/l	6.829 mg/l	2.92-50.6 mg/l	1.07-66.82 mg/l	14.23 mg/l	5070 mg/l
Lead	25 ug/l	0-54 ug/l	5.023 ug/l	1-110 ug/l	8.63 ug/l	0-0 ug/l	0 ug/l	0-0 ug/l	0 ug/l	<.06-6.19 ug/l	0-0	0	6.6 ug/l
Alkalinity	No Standard	20-180 mg/l	94.462 mg/l	20-160 mg/l	85.75 mg/l	0-55 mg/l	17.125 mg/l	14-48 mg/l	27 mg/l	115-344 mg/l	36.88-182 mg/l	114.64 mg/l	295 mg/l
NOTE: All information is based on Utica Frac job									UTICA VOC Flow	back			
VOC: Volitile Organic Compounds (EPA 524.2)									Bromoethane			1.8 ug/l	
										Chloroethane			1.9 ug/l
1 mg=1,000 ug										Chloromethane			8.0 ug/l
NR = Analyse Not Run									Toulene			74 ug/l	
Duke: 11 Wells (Ross#1); 2 wells undisclosed per homeowners request to Duke													

EPA Study



DRAFT Hydraulic Fracturing Study Plan

-- Science Advisory Board Review --

February 7, 2011

Within the scope of this study, prospective case studies will focus on key areas such as the full lifecycle and environmental monitoring. To address these issues, key research activities will include water and soil monitoring before, during, and after hydraulic fracturing activities.

TABLE F2. PROSPECTIVE CASE STUDIES

Formation	Location	Potential Outcomes	Partners
Bakken Shale	Berthold Indian	Baseline water quality data, comprehensive monitoring	NDDMR-Industrial Commission, University
	Reservation, ND	and modeling of water resources during all stages of the	of North Dakota, EPA Region 8, Berthold
		HF process	Indian Reservation
Barnett Shale	Flower Mound/	Baseline water quality data, comprehensive monitoring	NDDMR-Industrial Commission, EPA Region
	Bartonville, TX	and modeling of water resources during all stages of the	8, Mayor of Flower Mound
		HF process	
Marcellus	Otsego Co., NY	Baseline water quality data, comprehensive monitoring	NYSDEC; Gastem, USA; others TBD
Shale		and modeling of water resources during all stages of the	
		HF process	
Marcellus	TBD, PA	Baseline water quality data, comprehensive monitoring	Chesapeake Energy, PADEP, others TBD
Shale		and modeling of water resources during all stages of the	
		HF process in a region of the country experiencing	
		intensive HF activity	
Marcellus	Wyoming Co, PA	Baseline water quality data, comprehensive monitoring	DOE, PADEP, University of Pittsburgh,
Shale		and modeling of water resources during all stages of the	Range Resources, USGS, landowners, EPA
		HF process	Region 3
Niobrara	Laramie Co., WY	Baseline water quality data, comprehensive monitoring	WOGCC, Wyoming Health Department,
Shale		and modeling of water resources during all stages of the	landowners, USGS, EPA Region 8
		HF process, potential epidemiology study by Wyoming	
		Health Department	
Woodford	OK or TX	Baseline water quality data, comprehensive monitoring	OKCC, landowners, USGS, EPA Region 6
Shale or		and modeling of water resources during all stages of the	
Barnett Shale		HF process	

Ross Well Summer of 2010





Marcellus Frac at The Ross 1

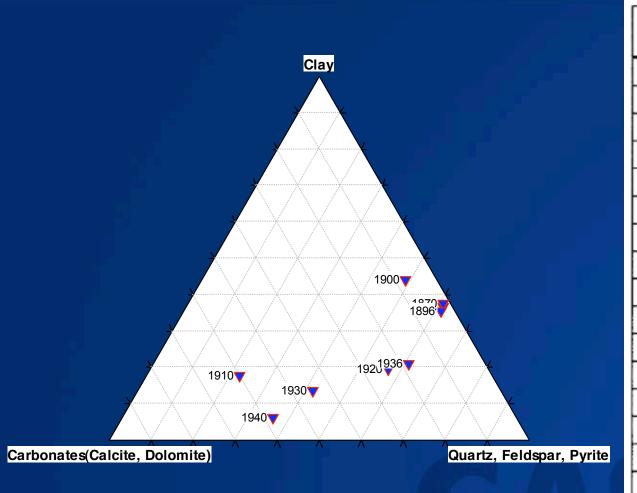




Well fraced with nitrogen and a lot less water

Marcellus Core in Chenango Co.



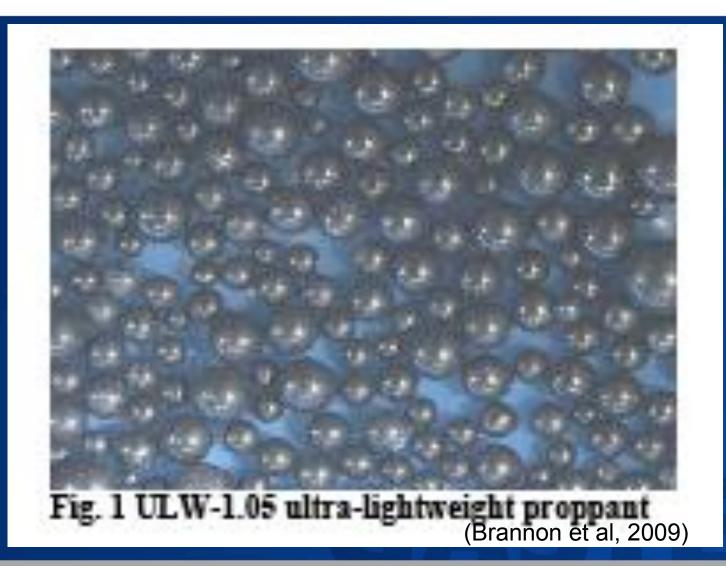


Depth (ft)	Lithology			
1675.5	silty carbonaceous mdst			
1860.0	silty carbonaceous shale			
1870.0	silty carbonaceous mdst			
1890.0	silty carbonaceous shale			
1896.3	silty carbonaceous shale			
1900.0	silty carbonaceous shale			
1910.0	fractured, calcareous shale			
1920.0	fossiliferous carbon. shale			
1922.0	calcareous mdst			
1922.0	calcareous mdst			
1925.5	fossiliferous carbon, shale			
1930.0	fossiliferous carbon, shale			
1930.2	fossiliferous carbon. shale			
1933.9	fossiliferous carbon, shale			
1936.0	silty carbonaceous shale			
1940.0	calcareous shale/mdst			
1955.6	calcareous mdst			

(EOG Resources)

Ultra-light Proppant





Flowback fluid seperated







CASTEN

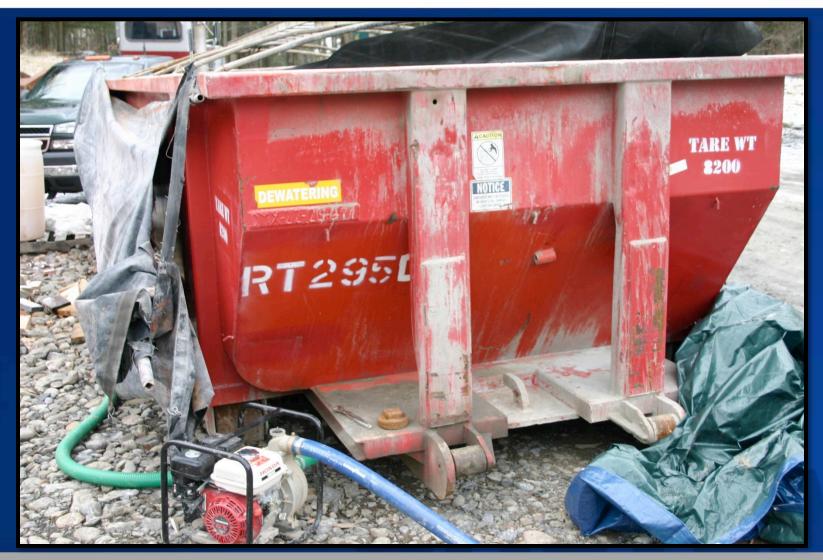
Saw dust mixed with flowback to take out lightweight propant





Filtering and Dewatering





Lessons Learned



- Will the Utica flowback chemistry change when a larger amount of water is used?
- More study and documentation is needed to show method of hydrofracturing does not effect ground water
- •Transparency is necessary for effective communication to move the process ahead
- New supplemental guidelines will be in effect by the end of the year, this process has allowed some of these concepts to be tested

Acknowledgements



- Mike Sligar, Chief Operator Watertown POTW
- Aaron Sulkey Gastem USA
- Tiffany Mc Givern Utica College
- Adam Schoonmaker Utica College

GASTEN