Chatham County, NC

Meeting Agenda - Final

Board of Commissioners

Tuesday, June 13, 2017 **6:00 PM** **Agriculture & Conference Center - Exhibit Hall**

Special Meeting

CALL TO ORDER

BOARD PRIORITIES

17-2190 Presentation and update on a Natural Gas Development Impacts Study in Chatham County by Charles Yuill.

Attachments: Fracking_Moratorium_Ordinance

chatham pdfjune2optim

17-2191 Input from invited Advisory Boards and Committees

17-2192 Public Input

ADJOURNMENT

Chatham County, NC

Text File

File Number: 17-2190

Agenda Date: 6/13/2017 **Version:** 1 **Status:** Board Priorities

In Control: Planning **File Type:** Agenda Item

Presentation and update on a Natural Gas Development Impacts Study in Chatham County by Charles Yuill.

Action Requested:
Presentation and update on a Natural Gas Development Impacts Study in Chatham County by Charles Yuill.

Introduction & Background:
In August 2015, the Board of Commissioners adopted an ordinance instituting a temporary moratorium on oil and gas development activities within Chatham County. Section 7 of the moratorium includes two tasks to be completed during the moratorium.

Discussion & Analysis:
The moratorium expiration is 24 months from the adoption date, which is August 2017. The two tasks listed under section 7 are as follows:

a) Studies: The Board of Commissioners will hire a consultant or consultants with expertise regarding fracking and other oil and gas development activities and their impacts on the natural, man-made, and social environments and its economic benefits and costs. The consultant(s) will be tasked to study Chatham County and to analyze state and federal regulatory programs and to prepare a report for the Board regarding the full range of expected impacts on Chatham County, including financial impacts. The study will include the most current analysis of impacts in localities similar to Chatham County in other states and the effectiveness of local ordinances in managing these impacts. This study and report should be completed within the first year of the moratorium and will include the consultant's conclusions as to whether additional time is needed for thorough study.

b) Development of Conditional Use Ordinance: Upon completion of the study and report. The Board intends to develop a draft conditional use ordinance and/or other ordinances based on the report and the consultant's advice which will be coordinated with the revisions to the County's comprehensive zoning ordinance. The draft ordinance will be made for public review and comment and at least one public hearing will be held. Based on public comments the Board will finalize the ordinance and initiate the adoption procedure. Development of the ordinance and final approval is estimated to take one year.

The purpose of the meeting is to review initial findings and receive input from elected officials and advisory committee members. A final report will be presented during a future Board of Commissioners meeting.

Recommendation:
Receive presentation and provide input.

ORDINANCE OF THE
CHATHAM COUNTY BOARD OF COMMISSIONERS
INSTITUTING A TEMPORARY MORATORIUM ON OIL
AND GAS DEVELOPMENT ACTIVITIES
WITHIN CHATHAM COUNTY, NORTH CAROLINA

WHEREAS, the Chatham County Board of Commissioners at its July 20, 2015 regular meeting, in order to provide all interested persons a full and ample opportunity to express their views on the question of whether a moratorium should be imposed on oil and gas development activities (as hereinafter defined) in Chatham County, after due advertisement as by law required, conducted a public hearing for the purpose of hearing the views of the public, gathering information, and taking appropriate action pursuant to authority conferred in Article 18, Chapter 153A of the North Carolina General Statutes, the Chatham County Moratorium Ordinance, and other relevant law regarding the imposition of a moratorium on oil and gas development activities in Chatham County; and

WHEREAS, at the public hearing twenty-three (23) persons spoke in favor of a moratorium and urged the County Commissioners to impose a moratorium, and one (1) persons spoke against imposing a moratorium;

WHEREAS, the Board of Commissioners, based on its own research and information gathering and the views expressed at the public hearing, makes the following findings of fact with respect to the problems or conditions necessitating a moratorium on oil and gas development activities in Chatham County:

(1) The extraction of oil or gas in Chatham County poses a significant threat to the health, safety, and welfare of residents, neighborhoods, environment and natural features; and

(2) Significant environmental, community, and human health impacts have resulted from commercial oil and gas development in other states and the full extent of such impacts has not been determined yet; and

(3) Oil or gas development is a unique and novel industrial use in Chatham County and thus can best be regulated as a conditional use; and

(4) Chatham County is primarily rural in character, being dependent on agricultural and agribusiness activities for 38% of its income and being among the top North Carolina counties for livestock, dairy, poultry production, and total farm income; and

(5) Chatham County is home to a growing specialty agricultural market, including organic farming, that depends upon a clean environment; and

(6) Chatham County is a prime location for residential developments with residents employed in surrounding urban areas who seek a rural environment, and the County is dependent on the property taxes from these developments; and

(7) Chatham County is home to the Jordan Lake State Recreation Area, Lower Haw State Natural Area, Jordan Lake Educational State Forest, Deep River State Trail, White Pines Nature Preserve, Condoret Nature Preserve, Deep River Park, La Grange Riparian Reserve, and Harris Lake; and

(8) These recreation areas provide recreation and environmental education for hundreds of thousands of visitors annually and along with other parts of Chatham County provide critical habitat for species that are endangered, rare, federal species of concern, and species protected by the Bald and Golden Eagle Protection Act; including the bald eagle, Cape Fear shiner, Carolina darter, Red-cockaded woodpecker, American eel, Bachman's sparrow, Carolina Redhorse, Atlantic Pigtoe, Brook floater, Carolina Creekshell, Septima's Clubtail, Yellow Lampmussel, Buttercup Phacelia, Harperella, Sweet Pinesap, and Virginia Quillwort; and

(9) Chatham County is located in the Triassic Basin, a shale rock basin with high quality streams, rare diabase seepage bogs, buffer areas, and other essential geological and ecological resources; and

(10) Over 6,000 Chatham County residents depend on the public water supply sourced from Jordan Lake, and approximately 300,000 citizens from surrounding counties depend on Jordan Lake for their water supply; and

(11) Chatham County also currently purchases water from the Town of Siler City and the City of Sanford and is therefore dependent upon water from the Cape Fear, Haw, Deep, and Rocky Rivers; and

(12) Jordan Lake, the Haw River, the Deep River, and the upper Cape Fear River are likely water resources from which oil and gas operators would draw millions of gallons of water to use for oil and gas development; and

(13) The majority of Chatham County residents depend upon well water for private water supply; and

(14) Chatham County's unique geography and minimal separation between shale formations and groundwater supplies puts well water users disproportionately at risk of groundwater supply contamination; and

(15) The Jonesboro seismic fault runs through Chatham County and hydraulic fracturing has been associated with increased seismic activity; and

(16) Chatham County is home to historic underground coal mining operations that have left a network of subterranean tunnels throughout the County which have weakened the structural integrity of the bedrock substrata and may serve as conduits for hydraulic fracturing fluids; and

(17) Chatham County's local infrastructure, including roads, currently are subject to minimal traffic, most of which consists of private cars, light trucks, and agricultural vehicles, and oil and gas development will greatly increase traffic by both private and large, commercial vehicles which will greatly increase wear-and-tear on local infrastructure, resulting in increased repair and maintenance needs; and

(18) The hazardous materials used during oil and gas development and the potential for operational accidents will require existing emergency response providers to acquire additional training and to respond to additional emergency calls; and

(19) Hydraulic fracturing will generate large quantities of potentially toxic wastewaters that Chatham County's existing Bynum Wastewater Treatment Plant is not equipped to process; and

(20) Existing state statutes and regulatory programs for oil and gas development do not yet constitute the best management practices necessary to adequately ensure such activities will not negatively impact the air, soil, water, environment, and health of residents within Chatham County; and therefore do not adequately protect the health and welfare of the County's residents because they do not address oil or gas development's locality-specific effects on the unique natural, geologic, demographic, social, financial, and other conditions that exist within Chatham County's boundaries; and

(21) The Board finds it necessary to provide for additional time to study the impact of fracking and other oil and gas development activities that has been experienced in other states and to determine the adequacy of applicable State and federal regulatory programs in regulating and mitigating such impacts in Chatham County's particular natural and man-made environment, and to consider enactment of any appropriate additional best management practices to properly address such impacts; and

(22) The Board further finds it necessary to provide for additional time to study the impacts, including financial impacts, on the County's roads and other infrastructure and services and to determine the financial damages that may result to the County, its citizens and residents; and;

(23) The County has already initiated the process of revising and updating its zoning ordinance and considering whether, and to what extent, zoning should be extended to the currently unzoned portion of the County, which process is scheduled for completion in approximately twenty-one months. Zoning for oil and gas development and developing standards for appropriate County permits should be done in coordination with this update of the zoning ordinance;

WHEREAS, the Board of Commissioners of Chatham County has considered the following actions to address the problems or conditions set forth above and found them to be inadequate:

(1) The Board has considered taking no action. However there are serious questions, for the reasons hereinabove stated, whether the current state and federal regulatory programs are adequate to protect the County's interests, therefore it is not in the best interest of the County to allow oil and gas development activities without further study and appropriate local regulation.

(2) The zoning ordinance is not by itself an adequate regulatory tool because it would either allow or not allow oil and gas development within designated zones without the necessary information regarding the location of the oil or gas reserves. Furthermore, in zones where it would be allowed as an industrial use, there must be standards specific to oil and gas development because of its highly unusual nature. This is a circumstance for which conditional use zoning may be appropriate to protect the public health and safety of the residents of Chatham County.

(3) Other existing County ordinances generally applicable to development such as erosion and sedimentation control, water supply watershed regulations, setbacks and buffers regulate only specific, limited impacts and, even taken together, are not adequate to regulate the wide range of impacts of oil and gas development.

(4) Establishing a permitting process for oil or gas development without thorough study would be premature and could result in standards that are inadequate to regulate or mitigate the local impacts, or that are unnecessarily stringent and might be subject to legal challenge as preempted by the state regulatory programs. The state regulatory program has been only recently finalized and is currently subject to legal challenge and more time is needed for Chatham County to determine what conditions are necessary and reasonable to supplement the State programs without being subject to preemption.

WHEREAS, the County has determined that the foregoing actions or alternative courses of action are not adequate because hydraulic fracturing or fracking is a relatively new method of extracting subsurface oil and gas and the County staff is not sufficiently informed as to the potential dangers to the public of this method and how to best regulate the same within the limited authority granted to local governments by the North Carolina General Assembly.

WHEREAS, the County has determined that a twenty-four (24) months moratorium on oil and gas development will provide the County an opportunity to update in its current land use ordinances without being required to approve such development under its current, inadequate ordinances; and

WHEREAS, the Board of Commissioners of Chatham County has determined that the moratorium imposed by the Ordinance shall terminate on August 16, 2017 and that the duration of the moratorium imposed is reasonable because that is the minimum period of time that it will take to address the problems caused by oil and gas activities. The only reasonable alternatives to imposing this moratorium are (i) adopting a hastily prepared ordinance that may exceed the County's regulatory authority, or (ii) allowing oil and gas activities without providing the citizens of the County the necessary land development guidance and review tools required to protect the public health and safety; and

WHEREAS, it is the expressed intent of the Board of Commissioners to lift the moratorium as soon as possible and to that end it will instruct all consultants, boards, and committees working on the problems and conditions necessitating the moratorium to complete their work as soon as reasonably possible so that the required ordinance or ordinances will be in place and development can resume at the earliest possible time, but with the proper safeguards in place to protect the citizens, residents, and property owners of Chatham County;

NOW, THEREFORE, be it ordained by the Chatham County Board of Commissioners:

Section 1. *Recitals Incorporated by Reference*. The above and foregoing recitals are incorporated in the Ordinance by reference.

Section 2. *Authority*. This Ordinance is enacted pursuant to (1) the General Statutes of the State of North Carolina, Section 153A-121, which grants Chatham County general ordinance-making power; (2) General Statute, Section 153A-123, which grants Chatham County the authority to enforce its ordinances; (3) General Statute, Section 153A-340, which grants Chatham County the authority to adopt zoning and development regulation ordinances to promote health, safety, morals, or the general welfare, including the authority to adopt temporary moratoria; (4) General Statute, Section 113-415.1, which addresses the County's ordinance-making powers related to oil and gas development; and (5) the Chatham County Moratorium Ordinance.

Section 3. *Definitions*. The words and phrases defined in this Section shall have the following meaning when found in this Ordinance:

(1) "Drilling" shall mean the sinking, penetrating, boring, or digging of a shaft or hole in the earth for any purpose.

(2) "Gas" shall mean all natural gas, including casing-head gas, coal-bed methane, and all other hydrocarbons not defined as oil in Subsection (6).

(3) "Horizontal Drilling" shall mean drilling at an angle greater than three degrees from vertical.

(4) "Hydraulic Fracturing," or "Fracturing," or "Fracking" shall mean all stages of the treatment of a well by the application of hydraulic fracturing fluid under pressure

that is expressly designed to initiate or propagate fractures in a target geologic formation to enhance production of oil or gas.

(5) "Natural Features" shall mean the water resources, land resources, air resources, geologic resources, animal species, and plant species within a municipality's boundaries.

(6) "Oil" shall mean crude petroleum oil and other hydrocarbons, regardless of gravity, which are produced at the well in liquid form by ordinary production methods, and which are not the result of condensation of gas after it leaves the reservoir.

(7) "Oil or Gas Development" shall mean all or any part of the process of exploration, development or production of oil or gas, including without limitation, drilling, casing, operation, fracturing, completion, plugging and abandonment of wells, pads, impoundments and other associated activities.

(8) "Oil or Gas Operator" shall mean a person who acquires a lease or other property interest in surface and/or subsurface lands for the purpose of conducting exploration for or extracting oil or gas.

(9) "Oil or Gas Owner" shall mean the person who has the right to drill into and to produce from any pool, and to appropriate the production either for himself or for himself and others.

(10) "Person" shall mean any natural person, corporation, association, partnership, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind.

(11) "Water Supply" or "Water Resources" shall mean any groundwater or surface water intended or used for human consumption; household purposes; farm, livestock, or garden purposes; or for conservation and preservation purposes.

(12) "Well" shall mean any new or existing shaft or hole drilled, sunk, bored, or dug into the earth or into underground strata for the extraction, injection, or placement of any oil, liquid, or gas; or any new or existing shaft or hole drilled, sunk, bored, dug or used in conjunction with such extraction, injection, or placement of any oil, liquid, or gas using hydraulic fracturing, fracturing, or fracking methods. The term "well" does not include any shaft or hole drilled, sunk, bored, or dug into the earth for the sole purpose of testing for, pumping, or extracting therefrom potable, fresh, or usable water for household, domestic, industrial, agricultural, public use, or other activity not related to oil or gas development activities.

Section 4. *Jurisdiction*. This ordinance shall apply to all of Chatham County except for those areas included with incorporated municipalities and their extraterritorial jurisdictions.

Section 5. *Purpose*. The purpose of the moratorium is to allow the Chatham County Board of Commissioners time to review the Mining and Energy Commission's regulations and other state and federal regulations applicable to oil and gas development to determine whether such regulations adequately protect the County and its citizens from the impacts of hydraulic fracturing and other oil and gas development activities, and to develop standards and conditions to be implemented through a conditional use permit or other appropriate mechanisms to address any impacts that are not adequately addressed by applicable state and federal regulations.

Section 6. *Imposition of Moratorium on the Oil and Gas Development Activities*. There is hereby established a twenty-four (24) months moratorium on any County approval required by law for oil and gas development activities. It shall be unlawful and a violation of this Ordinance for any person within the jurisdiction to which this Ordinance applies to engage in oil or gas development activities that require a County permit. The Board will use this twenty-four (24) months moratorium period to study the impacts of oil and gas development activities in other states and develop a plan to regulate and mitigate impacts from these activities that are not addressed adequately by State and federal regulatory programs, the existing County Zoning Ordinance, and other ordinances, giving consideration to the particular natural and man-made environment of Chatham County.

Section 7. *Action and Schedule*.

(a) Studies. The Board of Commissioners will hire a consultant or consultants with expertise regarding fracking and other oil and gas development activities and their impacts on the natural, man-made, and social environments and its economic benefits and costs. The consultant(s) will be tasked to study Chatham County and to analyze state and federal regulatory programs and to prepare a report for the Board regarding the full range of expected impacts on Chatham County, including financial impacts. The study will include the most current analysis of impacts in localities similar to Chatham County in other states and the effectiveness of local ordinances in managing those impacts. This study and report should be completed within the first year of the moratorium and will include the consultant's conclusions as to whether additional time is needed for thorough study.

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Section 8. *Enforcement and Penalties*.

(a) This Ordinance may be enforced by any legal or equitable remedies available, including, but not limited to, injunctive relief. The County Manager shall have the authority to direct the County Attorney, or any such other legal

counsel as may be employed, to take appropriate legal action to address any violation of this Ordinance.

(b) Penalties. Any person engaging in oil and gas development activities in violation of the Ordinance shall be guilty of a misdemeanor pursuant to North Carolina General Statute, Section 14-4 and shall be subject to a fine of $500 per offense. Each day that such person continues to violate this section after receiving notice from the County Manager, his agents, or any law enforcement officer of Chatham County, that this Ordinance has been violated shall be considered a separate and distinct offense.

Section 9. *Moratorium Expiration*. The moratorium established by this Ordinance shall expire upon the earliest of (a) enactment of a comprehensive land use plan and/or a permitting process by the County establishing standards and conditions to address any impacts of oil and gas development activity, or (b) twenty-four (24) months from the date this Ordinance is adopted; provided that if at the end of the 24 months period the Board determines based on advice of its consultants that more time is needed to develop an effective ordinance, or if material changes have been made to state or federal regulatory programs so as to require additional study, the Board may extend this moratorium for such additional time as is necessary.

Section 10. *Limitation on Moratorium*. This moratorium shall not apply to the following:

(a) Any development determined to be vested pursuant to N.C. Gen. Stat. §153A-344.1

(b) Any development for which substantial expenditures have already been made in good faith reliance on valid administrative approval.

Section 11. *Severability*. If any portion of this Ordinance is deemed unconstitutional or unenforceable by a court of competent jurisdiction, the remainder shall remain in full force and effect.

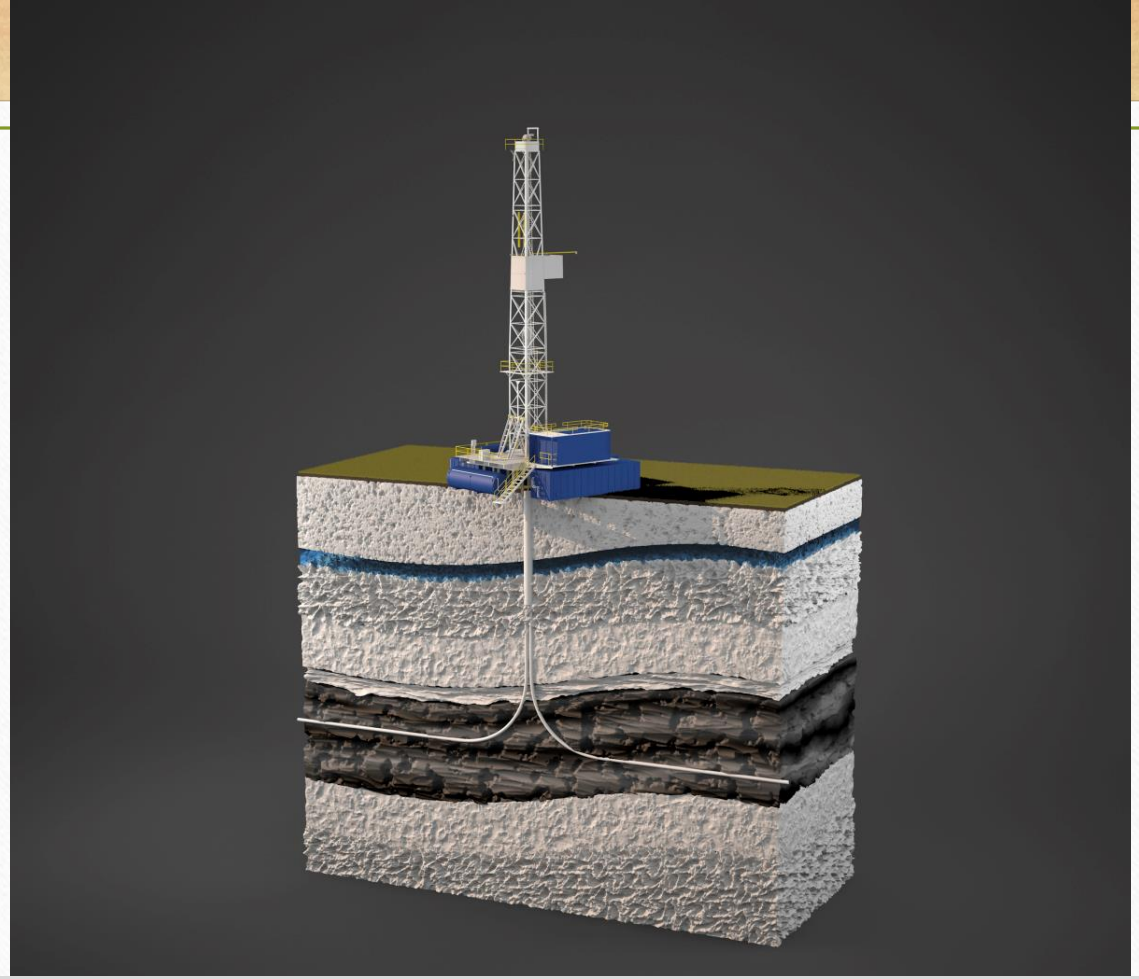
Section 12. *Effective Date*. This Ordinance shall be in full force and effect from and after adoption.

ADOPTED THIS THE 17th DAY OF AUGUST, 2015 BY THE CHATHAM COUNTY BOARD OF COMMISSIONERS.

James G. Crawford

James G. Crawford, Chairman
Chatham County Board of Commissioners

CHATHAM COUNTY OF NORTH CAROLINA
OFFICIAL SEAL
FOUNDED 1771



Unconventional (Constrained Shale Bed) Natural Gas Resource Considerations and Conditions for Chatham County, North Carolina

June 2017

This presentation

- A component of on-going Comprehensive Planning for Chatham County
- Emphasis is on potential landscape, land use and community development aspects of unconventional (hydraulic fracturing) natural gas development in the County.

Before we go on – a working definition…..

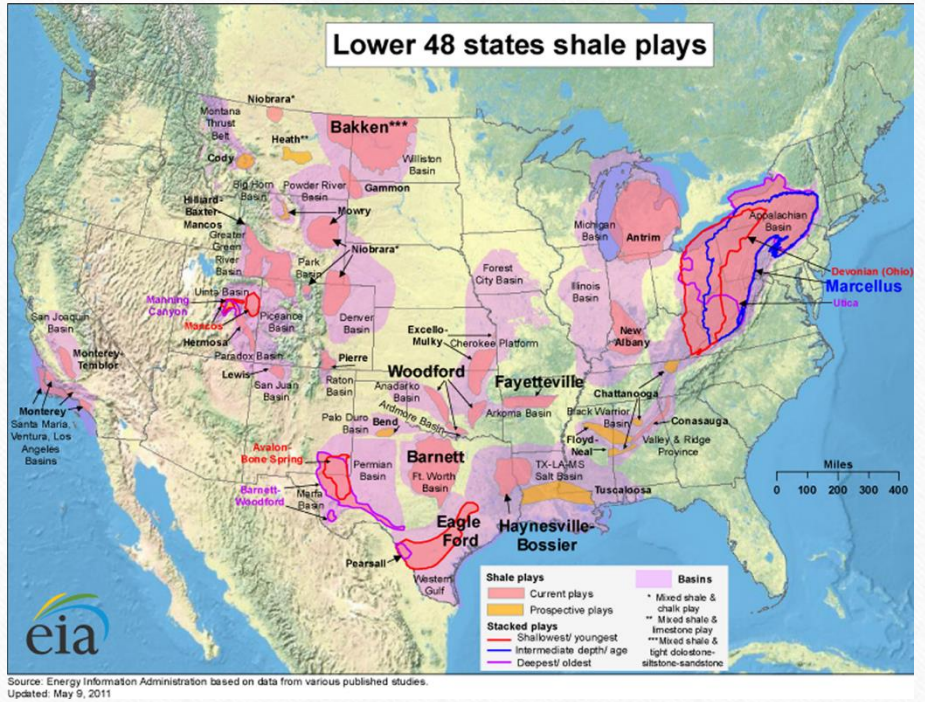
- Hydraulic Fracturing or fracking (will continue with this term) is drilling into the earth before a high-pressure water mixture is directed at the rock to release the gas or oil inside. Water, sand, and chemicals are injected to the rock at very high pressures which allows the gas to flow through the formation out to the head of the well.
- Fracking has gained significance as the nation has turned to natural gas as a preferred fuel.

Presentation Organization

- **A basic review – will be brief**
- **Environmental issues most often associated with fracking**
- **Fracking 2017 – advances over recent years**
- **A case study from Pennsylvania**
- **Fracking and Chatham County**
- **Questions**

Fracking – some background and important relevant terns

- Fracking has been around since 1947.
- Has become important with the recognition of the natural gas available in Devonian and Triassic Shales.
- Emphasis has been on larger basins but a great deal of fracking occurs in smaller shallow basins and rift basins

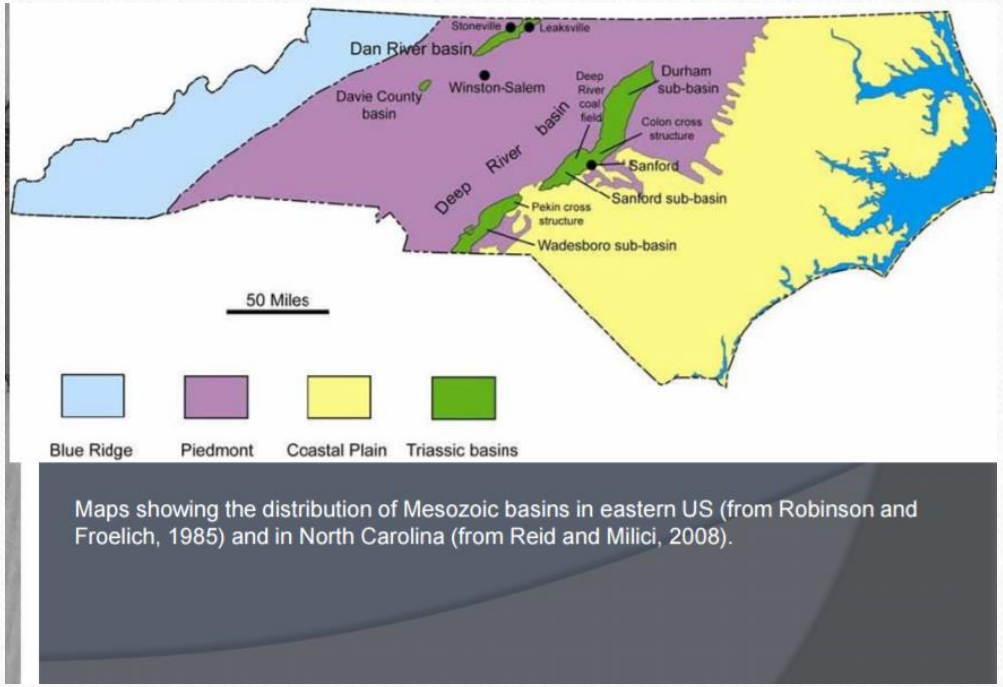


Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

Extent of fracking

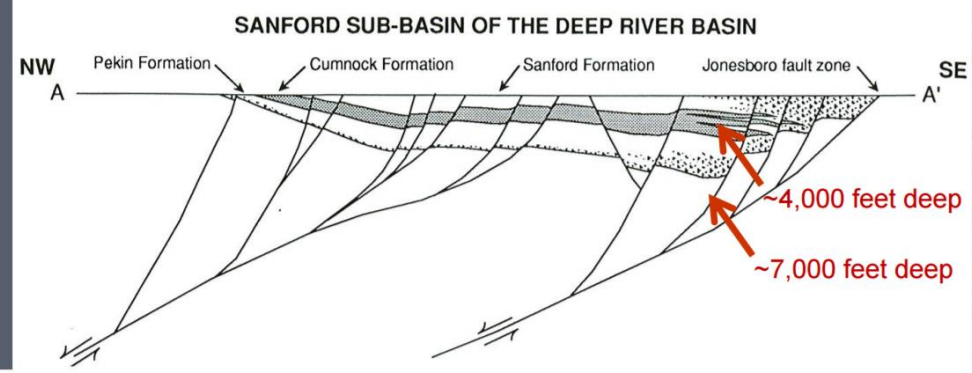
- Active fracking in 21 states with 5 more poised for fracking in the near future
- 34 states have laws and regulations on the books to facilitate fracking
- Three states have bans or moratoriums – Vermont, Maryland, and New York
- One multi-state region has a fracking moratorium – The Delaware River Basin (a primary water supply watershed for NYC). However, that moratorium is expected to be lifted.

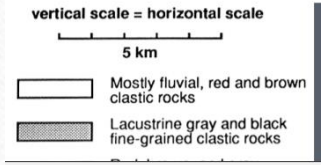
The rift basins of North Carolina with a cross section through the Deep River Basin



Maps showing the distribution of Mesozoic basins in eastern US (from Robinson and Froelich, 1985) and in North Carolina (from Reid and Milici, 2008).

Generalized cross section



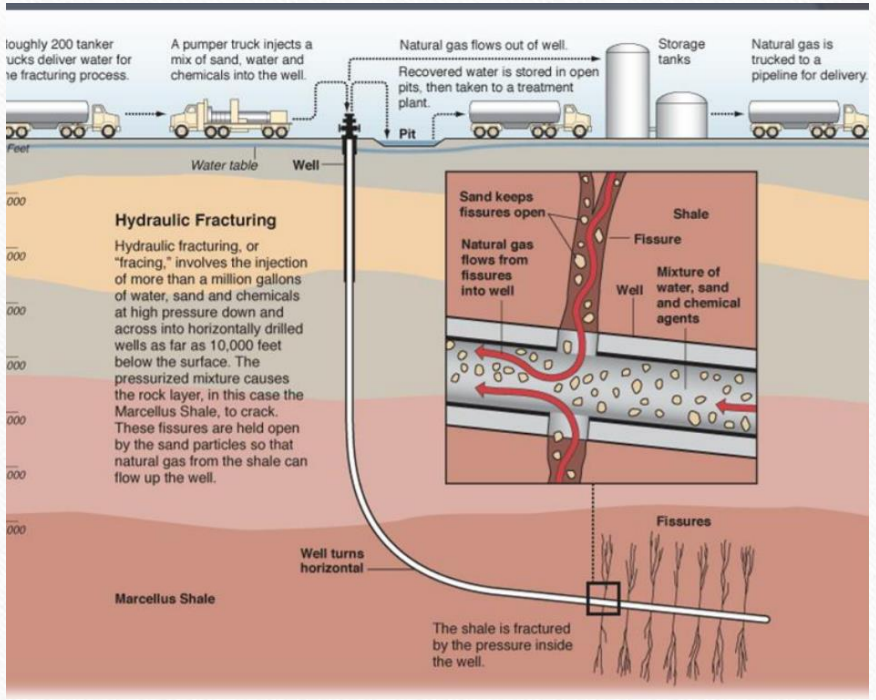


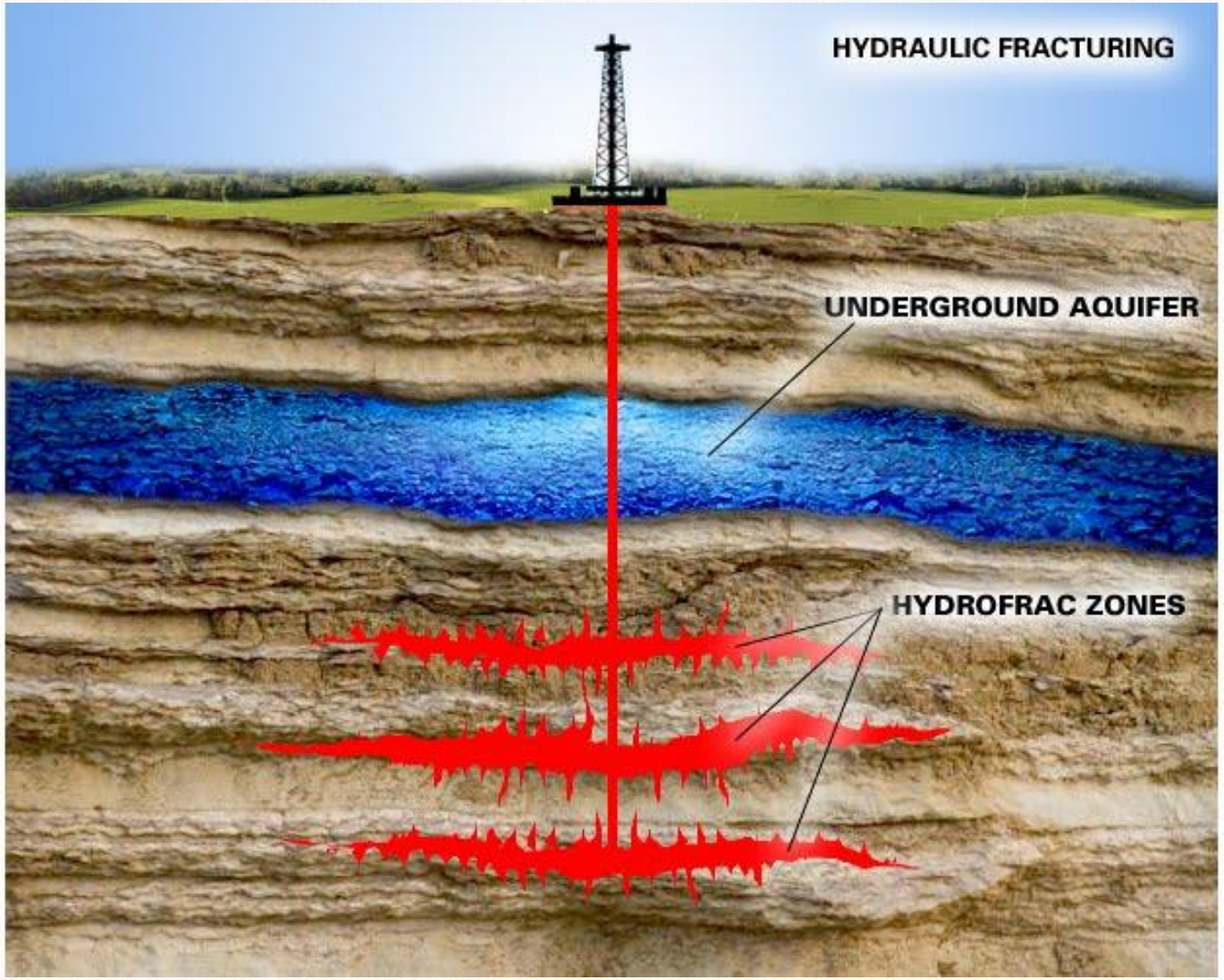
Sanford: red and gray siltstone and shale

Cumnock: black & gray shale, sandstone and coal

The basic process

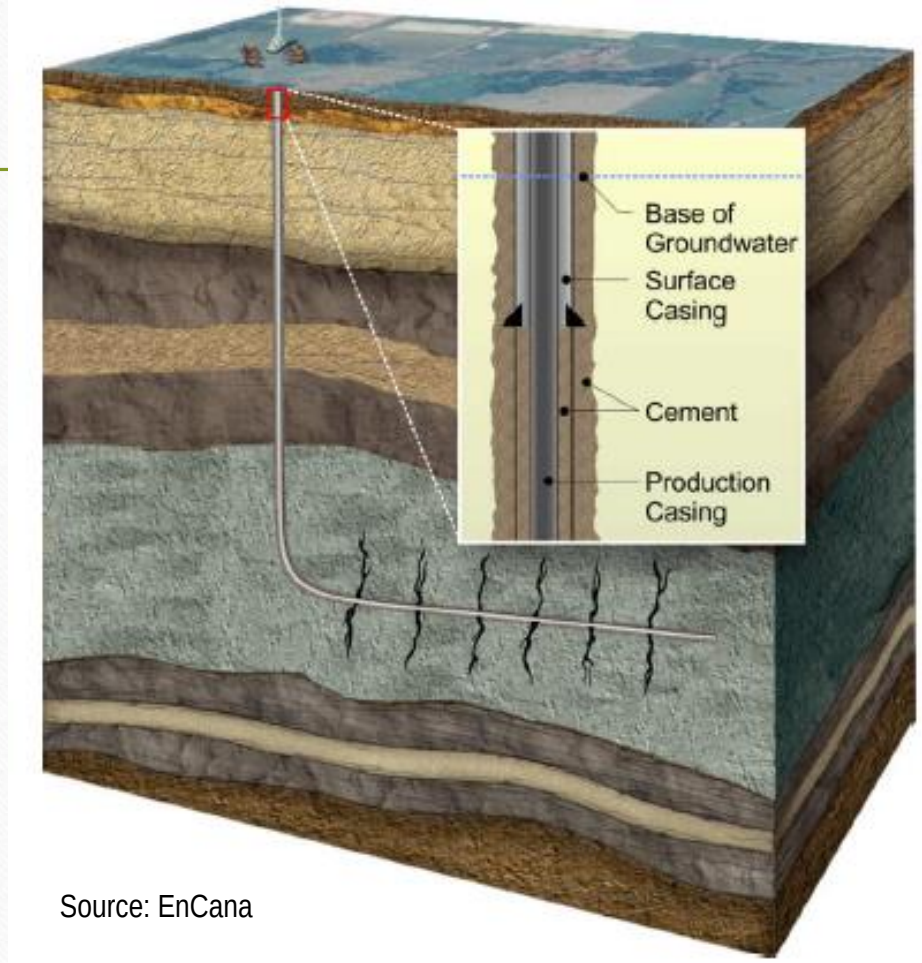
- Prospecting
- Locate potential well locations
- Fracking can be
  - Horizontal drilling
  - Vertical shaft fracking
  - Deep fracking
  - Shallow fracking – will be relevant in later discussions (fracking formations less than 3,000 feet deep).
  - The process complexity is the source of many potential problems




HYDRAULIC FRACTURING
UNDERGROUND AQUIFER
HYDROFRAC ZONES

What Changed the Game?

Horizontal Well with Multi-Stage Fracturing



Source: EnCana

- Natural gas production from <u>shallow, fractured shale formations</u> not new
  - First shale well drilled in Fredonia, NY in 1821
  - First fractured well in 1947
  - 2.5 million fractures to date worldwide; > 1 million in U.S.
- What "changed the game" was the recognition that one could "create a permeable reservoir" and high rates of gas production by using intensively stimulated horizontal wells

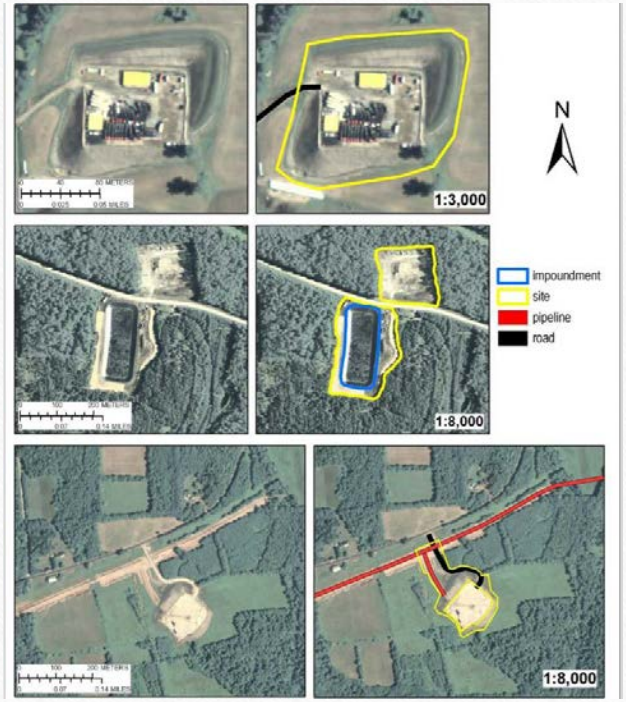
So fracking is a high-energy introduced process

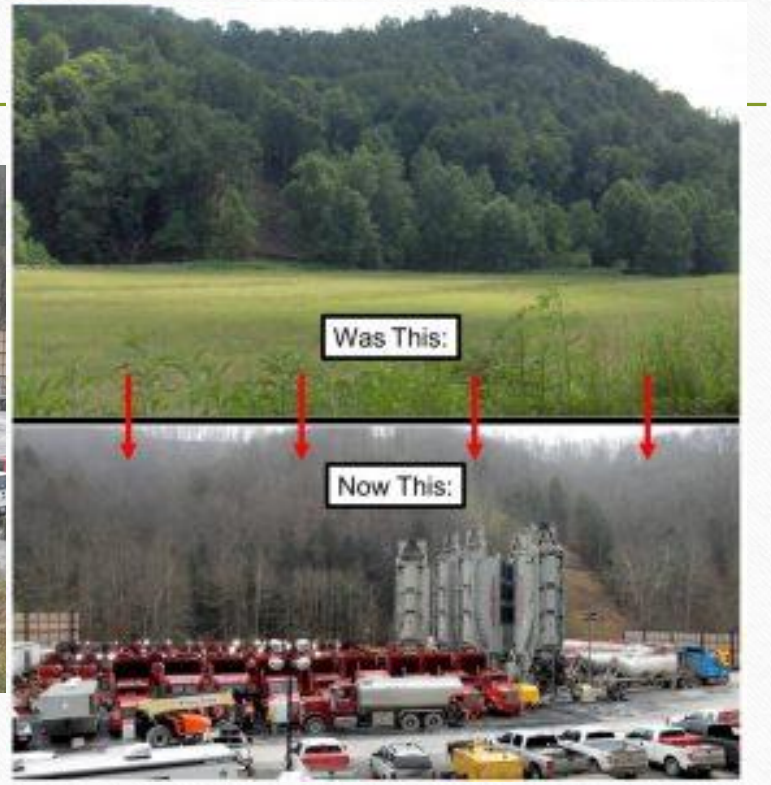
- Fracking is used where formations (primarily shale) are "tight" with little or no natural fracturing and openings with little opportunity to utilize pressure differentials to move gas up the shaft to the wellhead.
- Typically fracking introduces new pressures down the borehole in excess of 10,000 psi.
- It is the fracking fluid/mixture (water, sand or ceramics, and chemicals) that is pressurized.
- A variety of chemicals are used for a variety of reasons – improve slickness, reduce or destroy bacteria, reduce corrosion in the metal well casing, etc.
- Sand is used to deliver fracking fluid mixtures and to maintain openings in the shale.

Fracking chemicals

- Specific listings are protected as trade secrets… but analysis has shown that what are referred to as volatile organic chemicals are heavily utilized.
- Over 750 different chemicals have been detected many of which pose potential human health risks.
  - Biocides
  - Corrosion inhibitors
  - Friction reducers
  - Iron control
  - pH adjustors

What does it look like in the landscape?

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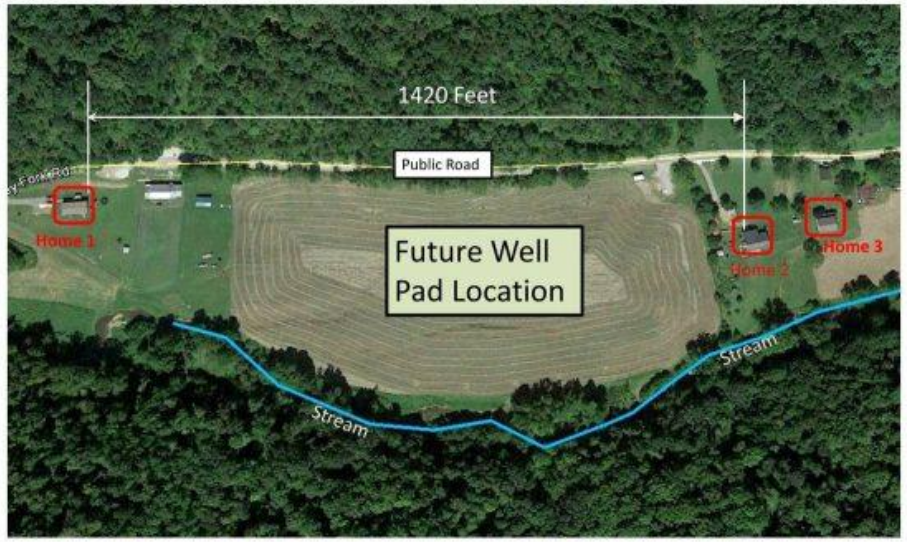
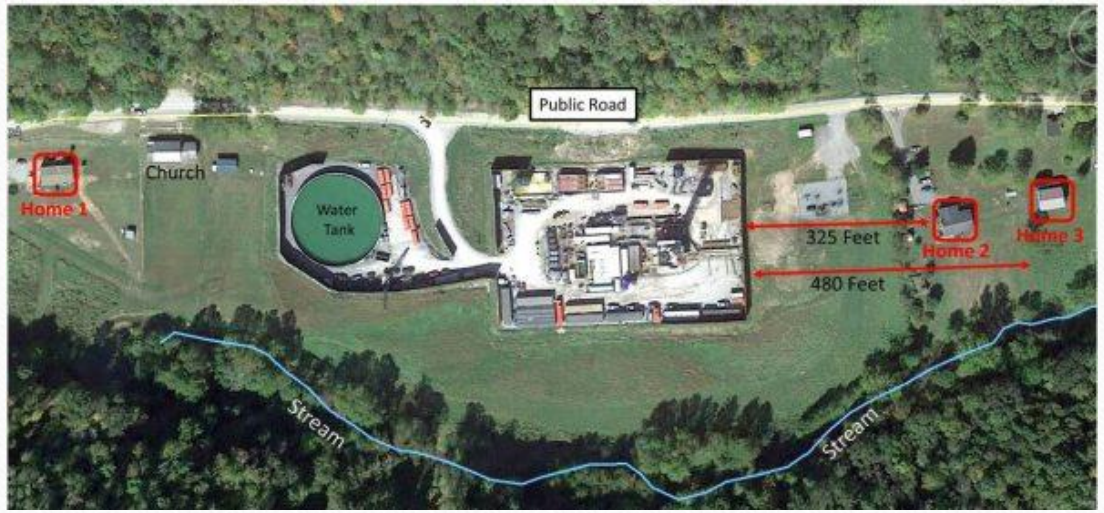

1420 Feet
Public Road
Future Well
Pad Location
Home 1
Home 2
Home 3
Stream
Stream


Public Road
Church
Water
Tank
Home 1
325 Feet
Home 2
480 Feet
Home 3
Stream
Stream

Logistics yard, paved road impacts, and flaring

Before we move on it is important to introduce a few important legal / regulatory components

- Amendments to the CWA (Clean Water Act) in 2005 remove fracking well locations and fracking from state and/or regional regulatory discretions
- The **Halliburton** exemption removes injection wells from state injection well regulations
- The above combine to provide a special regulatory framework for fracking.
- **Forced or mandatory pooling**
  - Old concept - 38 states have forced pooling regulations
    - Originated in the Midwest and Great Plains with the Public Land Survey.
  - Pennsylvania and West Virginia do not – both states rely on aspects of pooled leases
  - North Carolina does not have mandatory pooling.

One more area worth discussing – mineral rights

- Connected and severed mineral rights – can become complex situations
- Severed mineral rights can and are often subdivided
  - For example in the case of heirs
  - Can be split spatially or by formation vertically
- In the case of severed rights most legal deference is with the mineral owner in that the mineral owner generally has full access to the benefits of mineral ownership
  - Drilling and development
  - Secondary development
  - Pipelines can be a bit more complex

Also important

- State law prohibits local governments from implementing ordinances that regulate oil and gas development.

- However, moratoriums can be implemented and continued so long as such moratoriums are of fixed durations.

On the ground fracking operations are designed as systems

- **Access roads**
- **Drill sites which become drill pads**
- **Well pads and supporting technology and environmental control features including various ponds and excavated areas for storage / evaporation of return and produced water. Ponds are used for water storage and as evaporation ponds so that potentially toxic solids can be removed and transported offsite for landfilling or other disposal.**
  - **Fluid mixing and warming equipment**
  - **Vapor control measure equipment**
  - **Storage**
- **May have on-site or nearby injection wells**
- **Pipelines**
- **Compressor stations and gathering compressors**
- **Existing infrastructure – roads, landfills**

The process……..

- **Drill to below depths of concern and case in metal and concrete**
- **Continue drilling into formations of interest – typically the above are a ten day process**
- **Once drilling is complete then fracking can be initiated – typically a two to three day process**
- **Wells may have up to 20 fracs**
- **Once fracking is complete the fracking equipment is removed and the site is prepped for production**

A typical well site and well pad

- **8 to 15 acres**
- **Total area**
  - **60% can be restored after construction and well development – revegetation, water control, and other mitigation**
  - **Well pad – 25% of remaining area will remain disturbed –**
  - **Pipelines 4% remains disturbed after revegetation**
  - **Ponds 5%**
  - **Roads 7%**

Potential environmental impacts

- **Site preparation and drilling**
  - **Seismic – minor issues**
  - **Well pad, roadway and pipeline construction – governed by state regulations**
    - **Erosion and sedimentation**
  - **Local roads – heavy vehicles and raw materials haulage**
  - **Drilling cuttings disposal – treated as hazardous waste – removed to offsite for disposal or treatment.**
  - **Accidents / equipment failures**
    - **Surface water pollution**
    - **Accidents generally impact surface water and borehole failures impact groundwater**

Fracking impacts

- **Water use – one to four million gallons of water per frac – water is from local surface and / or groundwater sources**
  - **200 or more tanker trucks per frac**
- **Potential leakage of fracking chemicals**
  - **Typically 30 trucks sand and 10 chemicals trucks per frac**
- **Leakage in aquifers is generally due to well casing or concrete failures**
- **Leakage in storage facilities generally impacts surface water**

- Produced / flow water treatment and disposal
  - Injection
  - Storage, evaporation and landfilling
  - Treatment using specialized treatment facilities – water can be recycled
- Methane and other fugitive gas
  - Condensers
  - Flaring – limited usage

Gas production impacts

- **Gas leakage**
- **Noise – primarily from traffic and compressors – compressor noise can be significant**
- **Fugitive gases from compressor stations**
  - **Fugitive leaks in compressor hardware**
  - **Pollution emitted by compressors**
- **Continued well defects – monitoring has greatly improved**

A couple of notes

- **Seismic impacts have received a great deal of notoriety – however drilling and fracking have proven to have negligible impacts – significant impacts have been due to injection wells**
- **Methane gas has received a great deal of press as well – negligible methane escape during drilling and fracking – during well operation fugitive methane releases have been a common occurrence.**

Some often overlooked impacts

- **Well pads, roads, and pipelines result in significant landscape fragmentation**
  - **Loss of quality forests**
  - **Loss of interior forests**
  - **Loss of quality forest edges**
  - **Fragmentation of agricultural fields**
- **Community impacts**
  - **Perceptions of community health**
  - **Perceptions about environmental quality and health**
  - **Residential structures and land not being leased decreased in value**

Fracking 2017

- **Methane flaring use is on the decline with improved hardware removing 98% of the methane produced that typically escapes. Example in Pennsylvania wells can now flare a maximum of 30 days a year encouraging use of improved hardware.**
- **Injection well usage is on the decline with specialized treatment options on the rise.**
- **Specialized landfills are being developed to handle the most hazardous wastes once water and solids have been separated**

A Case Study – Washington County PA

- **Marcellus Shale**
- **Heavy hydraulic fracturing in the County**
- **Location of a number of major problems and fracking related issues**

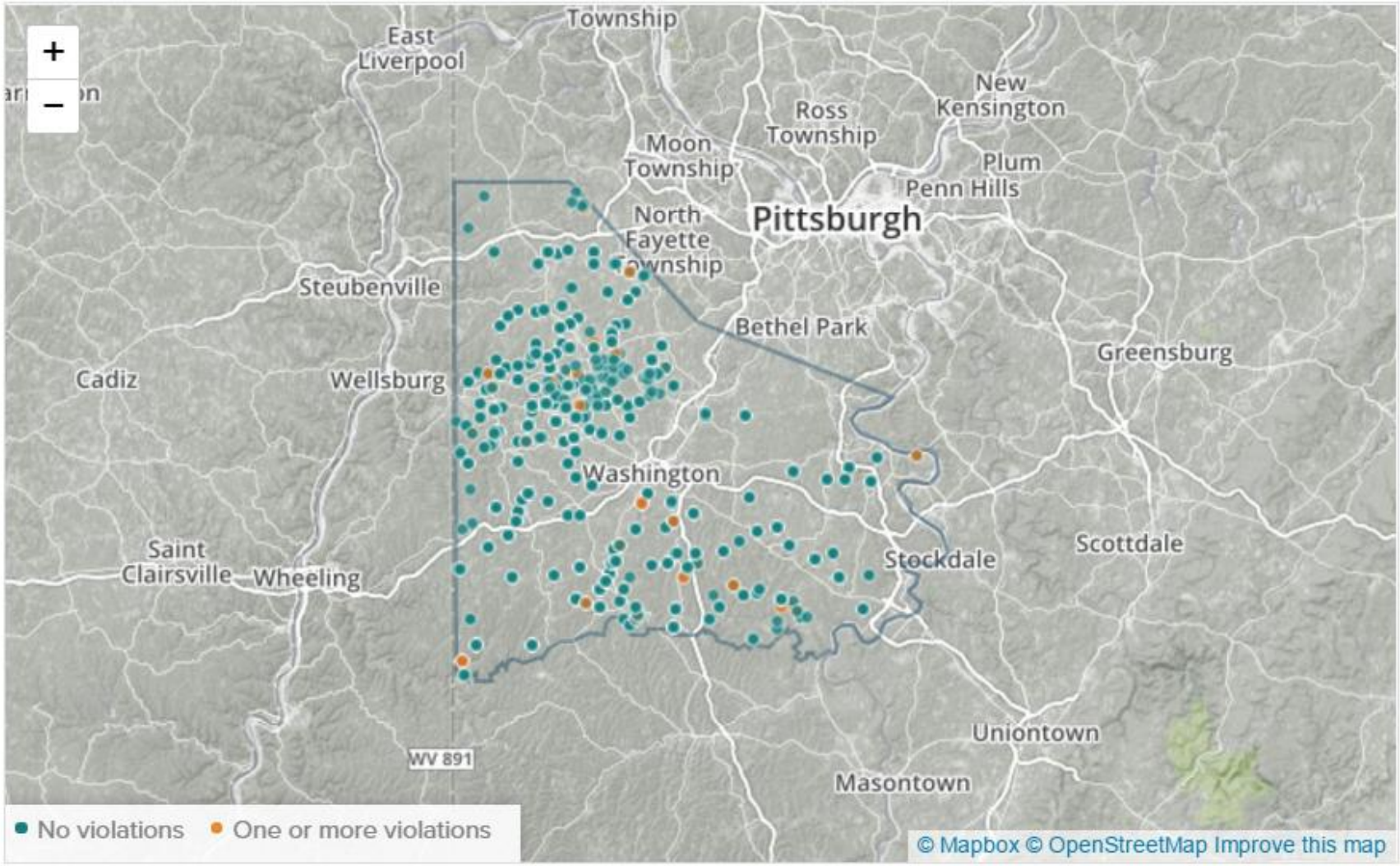
Washington County

ACTIVE WELLS

1,146

VIOLATIONS

153



Site preparation


447 447


447 447
RESIDUAL
WASTE
RT4723
RT4723


BEST LINE
EQUIPMENT

A storage / evaporation basin and a compressor / gathering facility

Washington County summary

- **Major companies**
  - **Range Resources**
  - **Chevron**
  - **Chesapeake Appalachia**
  - **Noble Energy**
  - **EQT**
- **Issues**
  - **A number of violations – drinking water well damage – over 100 complaints since 2015 with fewer violations.**
  - **Number of spills and accidents with resultant short-term surface water and shallow ground water damage**
  - **One township – East Findlay – without pubic drinking water wells since 2015.**
  - **A major well pad fire in January 2017. Fire was rapidly extinguished though limited evacuations were required – hardware malfunction. Human error accidents are rare**

While we are in Washington County – one more topic to discuss – site restoration

MARCELLUS
SHALE COALITION™

RECOMMENDED PRACTICES:
Site Planning, Development and Restoration

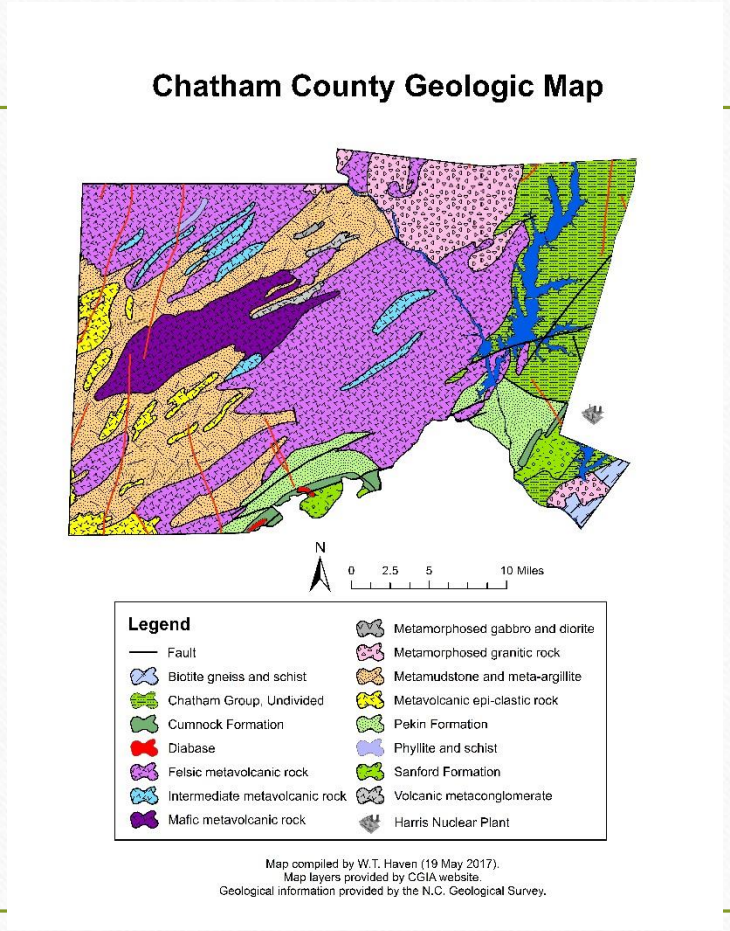
MSC RP 2012-1 April 26, 2012, Updated June 20, 2013

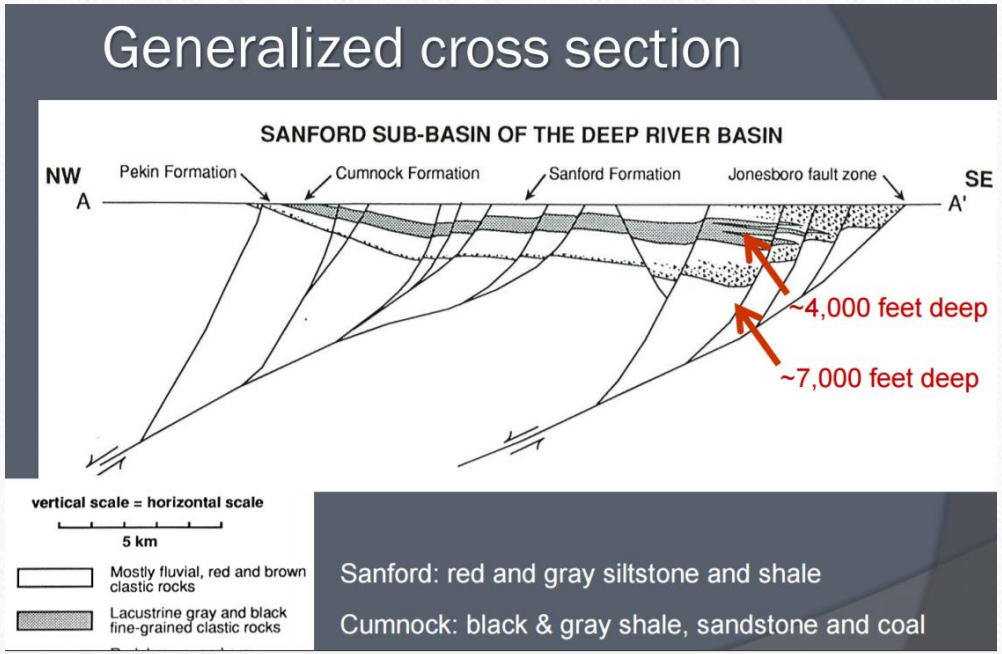
Table 2-1. Site Planning, Development and Restoration Process Recommended Practices

Each step in the following table may be implemented as appropriate.

Major Steps in the Process	Elements for Reducing Impacts, and for Improving Restoration and Final Reclamation Outcomes
Identify Local Need for Site	Determine the operational needs and ideal location(s) for well pad(s), access road(s), pipelines, gas compression and processing facilities, water pipelines and impoundments, and other necessary facilities.
Generate Unconstrained Conceptual Site Plan	Prepare an unconstrained conceptual site plan free of potential landowner, regulatory or environmental constraints based on what would be ideal from an operational perspective.
Conduct a Constraints Analysis	Conduct fact-finding to identify constraints including regulatory/zoning/siting constraints, landowner and local community desires/preferences, environmental and public resource constraints, highway access constraints and the presence of other sensitive locations.
Refine Concept	Adjust the conceptual site plan to account for known constraints. Consideration should be given to minimizing surface disturbance. Impacts may be reduced by using brownfield or industrial areas and previously cleared land, if practical. It may be possible to use existing logging roads and trails when planning access roads or pipeline right of ways. Another option is to plan for pipelines adjacent to existing roads. In addition, there may be opportunities for coordination of infrastructure with other companies, for example: use of shared right of ways for pipeline corridors, pooling of mineral rights to optimize the number of well pads, etc.
Discuss Plans with Surface Owner(s); Alter Site Concept as Needed	Welcome input from the surface owner(s) and consider changes to the overall design. This may include a discussion of the refined concept plan and how this concept would fit within their existing and planned future uses of the site, making adjustments as appropriate.
Identify Site Features to Retain or Protect	Identify features to be retained – including timber, stumps, slashing, mulch, topsoil, ponds or stock watering devices, access roads, etc. – and account for retention of these items in site planning.
Prepare Final Site Plan from Previous Concepts; Highlight Retained Features	Prepare context-sensitive site plan while accounting for potential future oil and gas extraction from other formations.
Implement E&S and Other Environmental Controls	Build the site. Ensure that planned erosion and sedimentation (E&S), stormwater and other environmental controls are installed and maintained. Consider using permanent controls such as sedimentation basins, with potential future use, over temporary measures that can be damaged and may require multiple replacements over time.
Implement Partial Restoration During Operational Life	Reclaim portions of the site that will not be needed during the post drilling, production phase so as to minimize the impact of the project. Try to avoid additional disturbance of stable soils while minimizing soil compaction and new disturbances required to access other formations. Note that the original development phase of well pads, as well as of pipelines, gas compression and processing facilities, often requires a larger footprint than operational phases.
Implement Final Restoration Conducive to Surface Owner's Plans and Objectives	Conduct final restoration upon completion of the project. Well pads will be in use for decades, whereas surface disturbances for buried gathering or transmission pipelines can be fully reclaimed soon after installation. In re-contouring a site, control erosion and storm water runoff, minimize site compaction, apply lime and fertilizer as necessary, seed with use-adapted mix, mulch appropriately, and plant trees and shrubs as appropriate.
Conduct Site Monitoring, Maintenance and Repair	Conduct site monitoring, maintenance and repair throughout the life of the project. Although listed last in this process, site monitoring, maintenance and repair begins with initial site development and continues until the site is fully restored and the site is permanently closed. Critical elements include repair of access controls and gates, security fencing, ruts or washouts (often caused by uncontrolled all-terrain vehicle access), and revegetation of areas where initial efforts did not yield desired results.

To our interest – Chatham County





Some background

- **The County has been concerned about potential fracking since 2009**
- **The USGS and NCGS have been focused in the region with current estimates being about 1.7 tcf of gas in the Deep River Basin**
- **The Cumnock Formation is the primary potential gas bearing formation in the Basin.**
- **This means**
  - **The gas bearing formation is extremely shallow in the County**
  - **The formation also is in less than 5% of the County.**

Introducing a new concept – shallow fracking

- Shallow fracking – less than 3,000 foot depths – some as shallow as 100 feet. Shallow fracking places fracking closer to potential formations of concern such as aquifers.
- Generally vertical borehole fracking with limited horizontal fracking.
- Water usage is only minimally reduced
- Construction and fracking can occur more rapidly

- Shallow wells typically have a higher percentage of aquifer leakage
- If fracking ever occurs in Chatham County it will be shallow fracking due to the relatively shallow depths of the Cumnock Formation.

Shallow wells

- Many times do not have the depth for horizontal fracking – horizontal drilling can turn only 1 to 4 degrees per 50 feet of depth so up to 500 feet of additional well depth is required for horizontal drilling.

- Fracking with vertical wells does reduce well spacing – often on 40 acre or less spacings. Spacing is generally a function of geology and well performance which can be estimated from a test well.

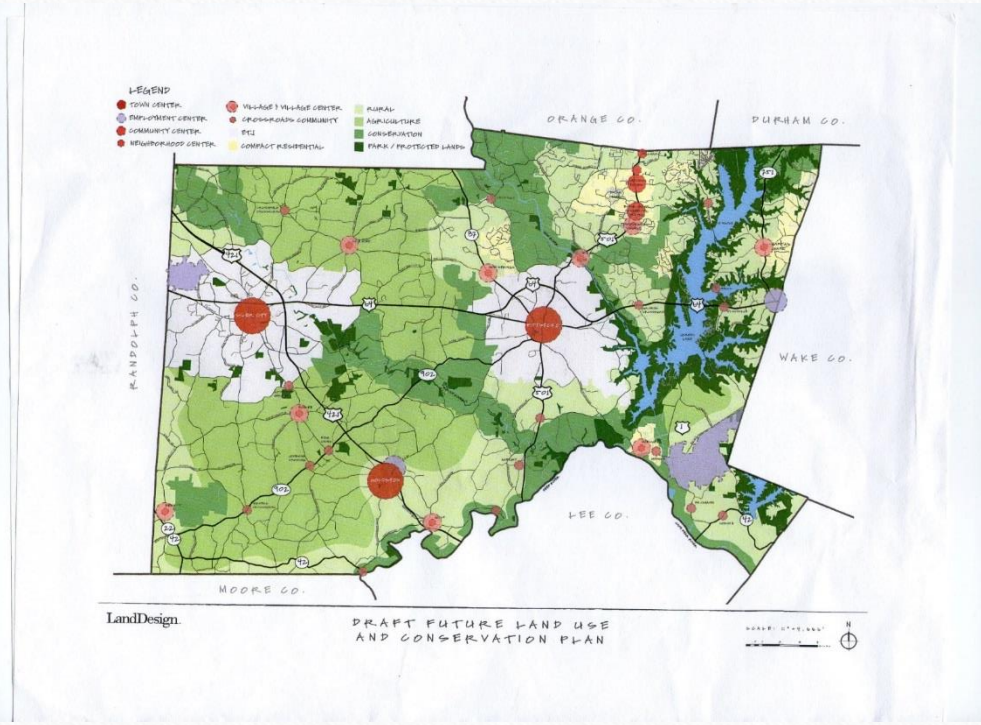
Shallow wells

- Most feasible in areas with deep fracking or existing conventional gas infrastructure in place.
- May be in smaller basins over the large deeper basins.

The Cumnock Region of the County

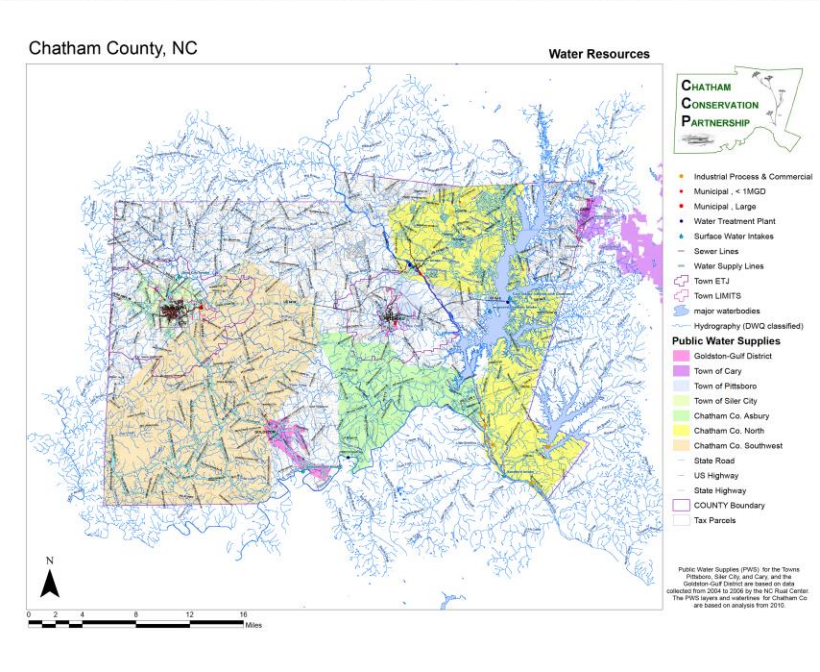
- The Duke Power Station eliminates a significant area for fracking – 5 mile radius around the plant that can be expanded by the NRC.
- Public lands in that portion of the County eliminate much of the area for fracking.
- Landscape values as illustrated in the following maps are of moderate to high importance when compared with much of the county.
- Most Cumnock areas in the county are either outcrop areas (where the shale is at the surface of the ground) or extremely shallow – generally too shallow for the development of hydraulic fracture wells.
- A cursory GIS analysis identified less than 1,000 acres that could be fracked.

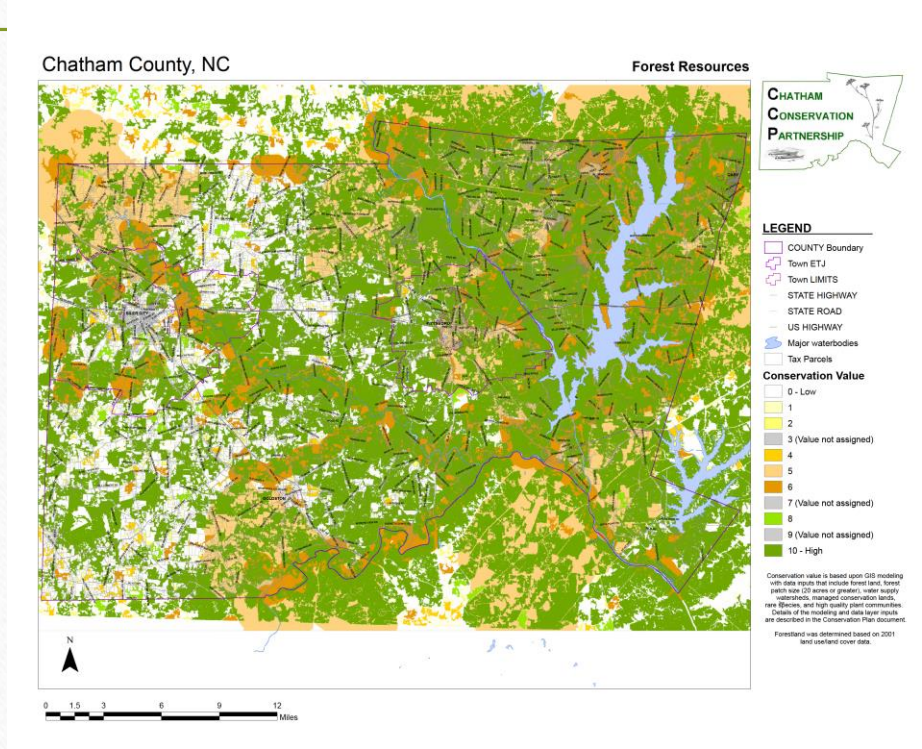
The County has had and is in the midst of comprehensive planning efforts



- From the comprehensive planning effort – the Cumnock region in the southern portion of the County is being planned as conservation, industrial, and mixed rural and agriculture.

The Cumnock regional context





Chatham County, NC

Biodiversity/Wildlife Habitat Resources

CHATHAM CONSERVATION PARTNERSHIP

LEGEND

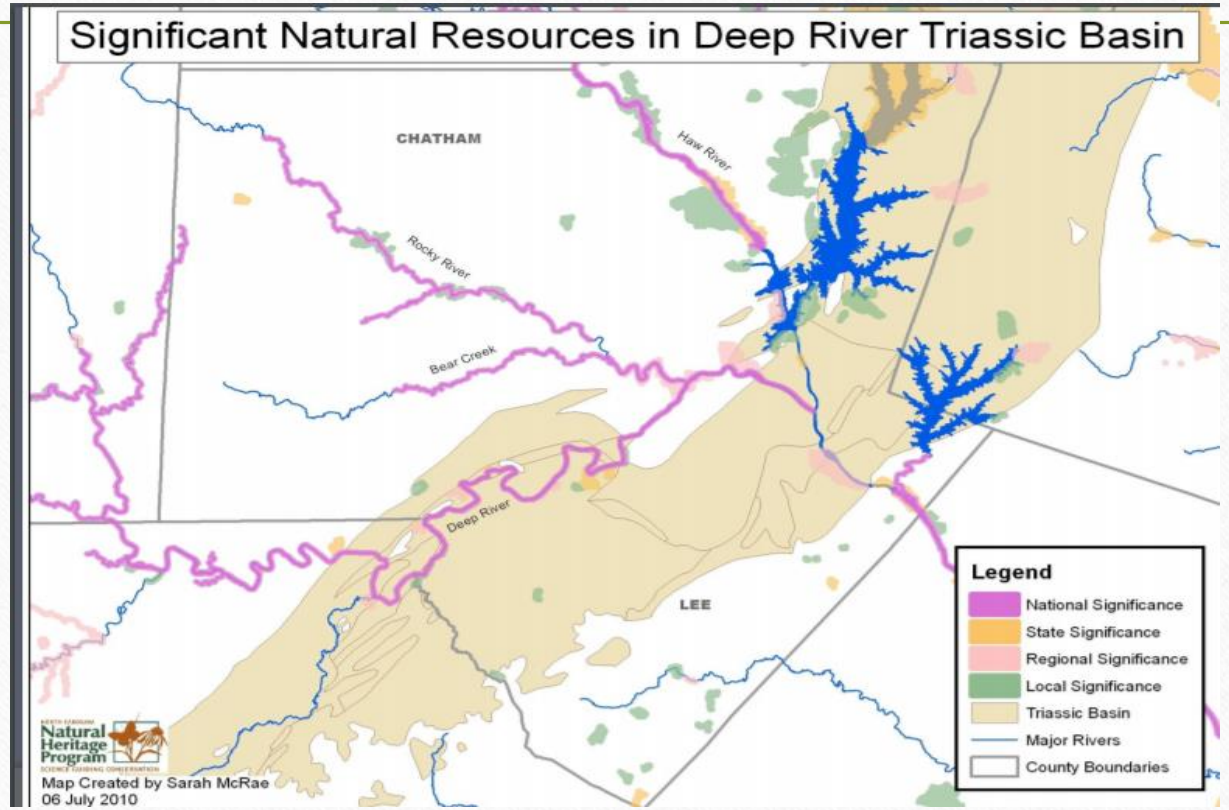
- COUNTY Boundary
- Town ETJ
- Town LIMITS
- STATE HIGHWAY
- STATE ROAD
- US HIGHWAY
- Major waterbodies
- Tax Parcels

Conservation Value

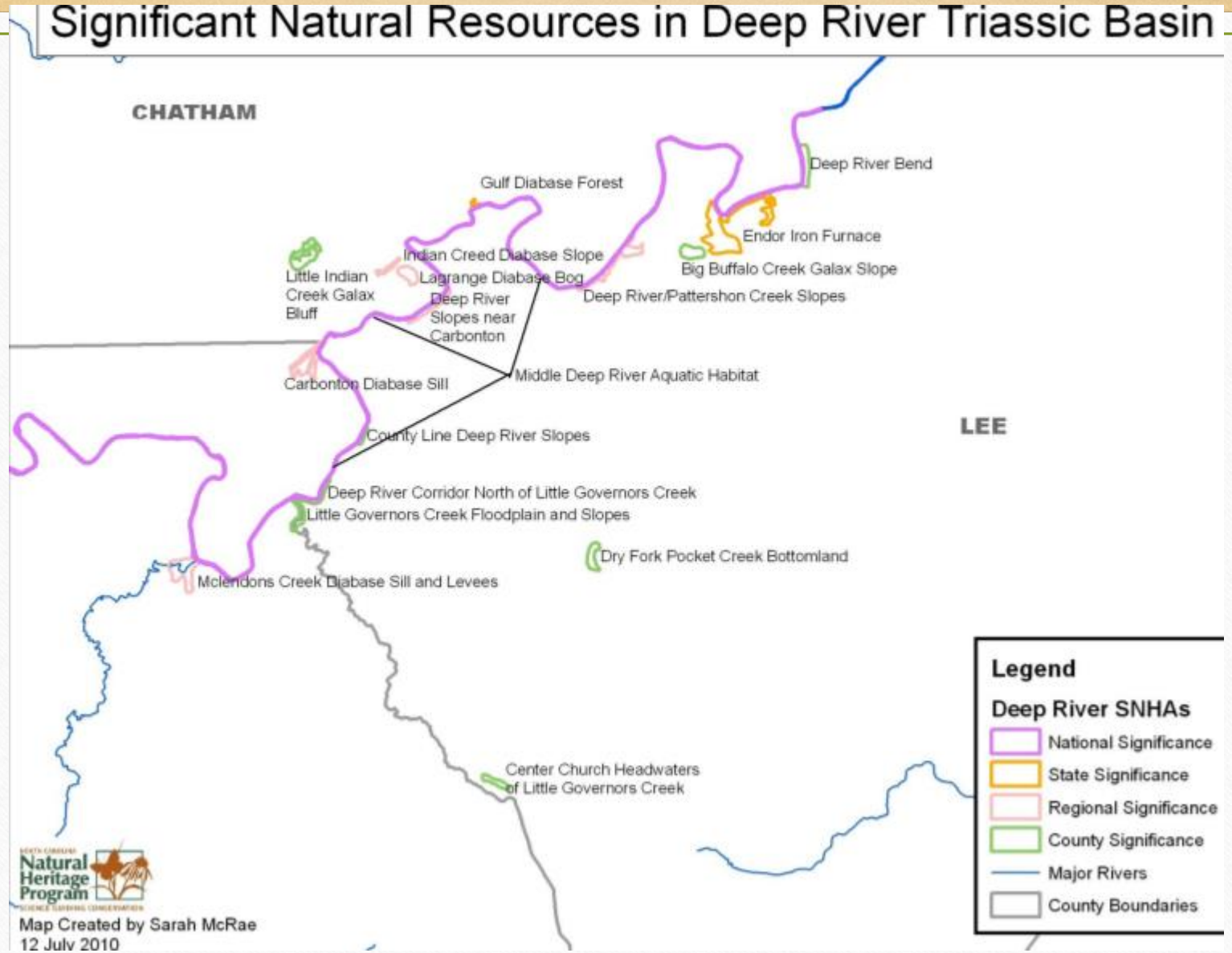
- 0 - Low
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 - High
- -1 - Impervious surfaces

Conservation value is based upon GIS modeling with data inputs that include rare species, high-quality plant communities, high-quality aquatic habitats, and contiguous hardwood forests. Details of the modeling and data layer inputs are described in the Conservation Plan document.

North Carolina State Heritage Program identified significant environmental resources in the Basin



Significant Natural Resources in Deep River Triassic Basin



A brief summary

- Fracking in Chatham County is unlikely but possible in a very small area of the County – probably less than 1,000 acres – acres are spread over a number of non-contiguous areas so fracking feasibility is extremely low based on shale depth and surface ownership and conditions. A more detailed spatial analysis could be completed with the available geologic data, available Lidar data, updated land use, and exclusion zones such as the power station buffer.
- The Cumnock deepens while maintaining formation thickness clearly making Lee County more attractive for development. Due to the infrastructure requirements of the fracking process it would be conceivable that small portions of Chatham County could be developed from infrastructure developed in Lee County.

Recommendations

- Formation of a multi-county working group focusing on larger geographic issues of unconventional shale development.
- Develop voluntary guidelines for shale gas development in the County similar to those developed by the working group in the Marcellus region.

For more reading – I would suggest the following references

- Physicians for Social Responsibility. Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking Unconventional Gas and Oil Extraction. November 2016.
- United States Environmental Protection Agency. Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources n the United States. December 2016.
- Any readings on shallow fracking.
- Chatham County Geologic Map – May 2017.

A special thanks

- Walt Haven and the NC Geologic Survey for providing up to date geologic mapping and data as well as personal observations.

Summary and questions

- Final comprehensive report with responses to questions /comments will be prepared
- Questions

Chatham County, NC

Text File

File Number: 17-2191

Agenda Date: 6/13/2017 **Version:** 1 **Status:** Board Priorities

In Control: Board of Commissioners **File Type:** Agenda Item

Input from invited Advisory Boards and Committees

Chatham County, NC

Text File

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Public Input