

**Comments on the Proposed
Natural Gas Development Regulations
Delaware River Basin Commission (DRBC)**

Prepared for:
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1. INTRODUCTION

Demico & Associates, LLC has been retained by the Delaware Riverkeeper Network to provide comments and opinion on the proposed Delaware River Basin Commission's (DRBC) Draft Natural Gas Development Regulations. The first section provides comment on major concepts that we believe either promote excessive water use of Basin resources or are inadequate to promote the protection of the water resource, in particular, the Special Protection Waters. These major sections follow the draft regulations sequentially. Major sections are presented as follows:

- 1 Section 7.1(e)(4) Planning Framework relying on host state requirements
- 2 Section 7.1(f) Relationship to Other Commission Requirements
- 3 Definition – Well Pad
- 4 Approval by Rule (ABR) for Natural Gas Development Projects
- 5 Financial Assurances
- 6 Hydrologic Report Development
- 7 Water Supply Charge
- 8 Pass by Flow Requirements
- 9 Use of Approved Discharge as a Source of Water by ABR
- 10 New Water Sources for Uses Related to Natural Gas Development
- 11 Hydrologic Report Development
- 12 Well pads for Natural Gas Activity
- 13 Wastewater Treatment and Disposal

Other comments are presented in a second section that addresses individual topics, including items such as definitions and editorial comments, and discusses issues that are not included in the draft regulations and recommendations to address these deficiencies.



2. Significant Concepts

2.1 Section 7.1(e)(4) Planning Framework relying on host state requirements

Manifests regulations through a strategic regulatory framework that addresses water withdrawals, well pad siting, wastewater disposal, surface and groundwater monitoring, and water use accounting. **The framework implements standards for well construction and operations primarily by relying on host state review and requirements as specified in Section 7.1 (i).**

Demicco and Associates, LLC does not agree that relying on individual state regulation of well construction and operation is prudent planning. In addition, this section should also reference well decommissioning. These arguments were detailed in the Demicco and Associates, LLC (2010, Attachments 1) comment that provided expert review and opinion on the Delaware River Basin Commission's (DRBC) decision to exclude a number of Pennsylvania state permitted wells from DRBC review of exploratory wells under its June 12, 2010 and July 23, 2010 Supplemental and Amended Supplemental Executive Director Determinations. In that document Demicco and Associates, LLC opined that the existing Pennsylvania Oil and Gas Drilling regulations are inadequate to protect the fresh water aquifers in the Delaware River Basin.

The specific concern is the high pressure of fracing at depths with a thin grout seal surrounding the well casing. The requirements in the Pennsylvania regulations only provide a 1-inch grouted annulus above the top of the Marcellus Shale in a region where the well casing is not perpendicular. Centering the well casing in the borehole is one challenge. Assessing the quality of the grouting job is difficult at these depths. Detailed requirements for grout evaluation and test logging are not included in the regulations. Only several hundred feet of grout is required above the Marcellus Shale and the balance of the borehole is not grouted until the well reaches casings protecting the freshwater aquifers. A large section of the borehole is left ungrouted, which, in my opinion, is a highly questionable and inappropriate practice. Specifically, fugitive gas from ungrouted formations within the borehole can also migrate up to the shallow fresh water zones as described below in reference to methane gas being observed in the Susquehanna River.

Failure of fraced gas wells has been documented, such as in Dimock, Pennsylvania. As evidenced by a Pennsylvania DEP drilling moratorium of 9 square miles from the Cabot



Dimock gas wells (see testimony of J. Scott Roberts, Deputy Secretary for Mineral Resource Management Attachment 2), a wide impact from failure of grout is apparent. Additional research is needed to evaluate this occurrence and if the presence of fracturing fluids have been detected in domestic wells. This specific issue was not researched by this reviewer.

However, looking at the problem simplistically, let's assume the grout above the Marcellus Shale failed or the open borehole encountered gas from a shallower zone and pressurized the entire annular space up to the base of the freshwater casings. The grouted casings at this shallow depth will probably not fail as the grout is not fractured like the adjoining bedrock. The shallow horizontal and vertical fractures that are exposed to deep formation pressures would probably open as the weight of overburden is significantly less at 1,000 feet compared to depths of over 1 mile. The existing rock fractures would open and allow gas migration away from the well, particularly in the direction of regional fractures (north-south). The rock failure would begin roughly 1,000 feet below grade. Horizontal bedding plane fractures would allow movement of gas at least 5 to maybe 10 times faster horizontally than vertically. This is based on the typical horizontal to vertical hydraulic conductivity ratio of 5:1 to 10:1 in bedded sedimentary rocks. Gas could potentially migrate 10,000 feet laterally while moving the 1,000 feet vertically. This distance of gas migration is consistent with the reported gas bubbles in the Susquehanna River reported at a distance of 3 miles from known gas wells. The potential impact area, a 10,000 foot radius, is roughly an 11 square mile area, similar to the area impacted at the Dimock site (see Attachments 2, 3 and 4).

The impact that a single well or small number of failed wells can have on water resources by itself is justification for increasing the stringency of drilling regulations, especially given the 15 million people dependent on drinking water resources of the Basin (see letter by PaDEP Secretary John Hanger, Attachment 3).

Recommendation: Review multiple state drilling regulations, best available technology and practices, and best industry standards and develop the most stringent specifications, including the most up-to-date grout logging/testing technologies.

2.2 Section 7.1(f) Relationship to Other Commission Requirements

This Article also helps implement the Commission's Special Protection Waters (SPW) anti-degradation program where natural gas development projects are located within or affect waters designated by the Commission



as Special Protection Waters or their drainage areas. The SPW regulations require among other things that a project cause no measurable change to existing water quality from point or nonpoint sources at control points identified in the SPW regulations and that the project implement non-point source controls (WQR 3.10.3A.2.b. and e.). An applicant for approval of a natural gas development project located in the drainage area of Special Protection Waters must comply with all SPW regulations in addition to this Article.

The goal of no measurable change to existing water quality from point or nonpoint sources is extremely stringent. It is almost inconceivable that no measurable impact can occur from a single pad development within Special Protection Waters with the limited regulatory history of gas wells in the Basin to date. The reliance on existing host state regulations and the allowance of the use of Approval by Rule (ABR) short cuts in areas draining to Special Protection Waters (SPW) is incompatible with the requirement of no measurable change to existing water quality except toward natural conditions. Additionally, the elimination of a public comment and response process through the ABR procedure removes the ability of the public to have input into the decision making process, a key component of safeguarding SPW.

To date, disputes exist between gas companies and regulatory officials as to the safety and impacts of gas drilling with fracing. This gas resource is projected to provide resources over the next century. Ongoing research and development of horizontal exploration wells will improve over time as lessons are learned from each event. A short duration moratorium on gas drilling over the next decade beneath and next to the most environmentally sensitive areas, the SPW and water resource reservoirs, is needed until a track record of gas drilling environmental issues and resolutions has been developed. Ten years is the selected moratorium minimum duration due to time requirements for investigation and remediation of the existing problems and needed research and data gathering regarding water resources, particularly groundwater, in the Basin. How hydraulic fracturing and horizontal drilling practices will impact the geology of the Basin needs to be fully researched and tested to prevent degradation of water resources. Given the irreplaceable nature of the SPW and reservoirs, a 10-year learning period on pitfalls and human errors of this relatively new technology is a requirement.

Recommendation: Allow no drilling in the Special Protection Waters (SPW) for 10 years until monitoring results from other drilling sites indicate potential impacts and potential mitigation measures that may successfully protect these SPW areas and until essential groundwater and geologic research is completed.



2.3 Definition – Well Pad

The following is the proposed definition of a well pad:

a site constructed, prepared, leveled, or cleared in order to perform the activities and stage the equipment necessary to drill **a** (*emphasis added*) natural gas exploratory or production well.

This definition is the only definition discussed in the major concepts. The proposed definition is woefully inadequate to describe the activities at the well pad. In fact, the definition indicates that only a single well is drilled on a well pad whereas as many as 8 to 10 individual wells may be installed at a well pad (NYSDEC Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program ((DSGEIS), 2009). Does the proposed DRBC definition include the storage lagoons, piping, roads, and staging and parking areas? These facilities represent impervious cover, compacted soil areas, or excavations that drain shallow ground water, all of which reduce recharge to the deep bedrock aquifers.

Recommendation: A more comprehensive definition is required that will include any activity that could affect surface or ground water.

2.4 Approval by Rule (ABR) for Natural Gas Development Projects

The ABR (Section 7.3(c)) is one way the regulations allow for approval of certain defined water supply and well pad activities if prescribed conditions are met. The ABR is issued by the Executive Director. The ABR procedure occurs throughout the regulations and effectively removes the public comment and agency response portion of public review. Given the controversial nature of gas projects and potential harm that can occur, the ABR option should not be allowed, until a track record of industry protection of the environment is established. This track record needs to be at least ten years in duration as discussed above with the SPW and reservoirs. Any new process has a critical learning curve period in an untested geologic environment as all environments will have their differences. Catastrophic and long term adverse impacts can be avoided if rapid pacing of development is prohibited. A goal of pollution prevention requires a slow and measured start up period for any new industrial activity, particularly for this type of high-impact activity in untested environments.



Recommendation: Completely remove the ABR section of the draft regulation and reconsider the ABR after 10 years of regulatory history consistent with the 10 year moratorium on the Special Protection Waters.

2.5 Financial Assurances

Section 7.3(k) provides for financial assurances as follows:

The financial assurance required by this Section must be in the amount of \$125,000 per natural gas well. The financial assurance must cover all wells on a well pad. A single instrument may cover multiple well pads provided that the amount of financial assurance in the aggregate is no less than the sum of the amounts required for each well pad if separate financial assurance instruments were obtained. If the project sponsor receives approval for a natural gas development plan pursuant to Section 7.5(c) of these regulations, the Executive Director may reduce the financial assurance requirement by an amount of up to 25% upon a showing by the project sponsor that the amount of financial assurance remaining will be sufficient to pay for the closure and remediation activities required by Section 7.3(k)(1) and (2) above for the entire area covered by the plan. The Commission may, after public notice and hearing, amend the amount of financial assurance required to adjust for inflation or differing actual costs

The sum total of \$125,000 is woefully inadequate as shown by the current situation in Dimock, Pennsylvania (see PaDEP Secretary Hanger letter – Attachment 3). A standard homeowner's policy typically carries a \$1,000,000 umbrella liability coverage. Small businesses carry \$2,000,000 to \$5,000,000 in coverage. A simple oil spill with soil cleanup and ground-water monitoring will easily cost in excess of \$1,000,000. The water system alone for Dimock was estimated at \$30,000,000.

Section 7.3(k)(15) allows for the reduction of the financial assurance upon successful grouting and after the initial fracing if no further fracing is planned. However, grouting and casing shear can occur over time (add reference). Although additional fracing may be initially planned, a rapid decline in production may require addition fracing over the life of the well. A short time limit for substantial reduction of financial assurance is not practical in the gas industry.

Recommendation: A minimum of \$5,000,000 financial assurance per well and \$25,000,000 per well pad is recommended.



2.6 Water Supply Charge

Section 7.3(l)(7) provides:

The holder of a natural gas well pad approval, whether or not the well pad is part of a NGDP is required to pay a water supply charge for consumptive use as specified in Table 7.3.1. Water supply charges apply to all groundwater and surface water used to support natural gas development projects. One hundred percent (100 %) of water used by a natural gas extraction and development project is considered to be consumptive for the purpose of calculating the water supply charge due to the Commission.

One question that should be considered is the 100 percent consumptive use requirement for the water supply charge. In fact, water use by gas fracing can be much more than 100 percent consumptive if additional water is needed to dilute the brines down from their high chloride and other chemical component concentrations for specific discharges. Brine total dissolved solid concentrations are in the order of 150,000 mg/l, almost 5 times the concentration of sea water and almost 1000 times the concentration of shallow aquifer-zone ground water and surface waters.

Recommendation: The consumptive use fee should be based strictly on the treatment and discharge option proposed for the individual well pad application and the location of the discharge within or outside of the Basin For example, any saline discharge within fresh waters of the Delaware River Basin without treatment for total dissolved solids should be charged a 1000 time surcharge on the volume of water used. This would effectively discourage discharge to Public Owned Treatment Plants which do not treat the total dissolved solids of the discharge other than dilution and will provide incentive for pretreatment of salinity before wastewater removal to a treatment facility.

2.7 Use of Previously Approved Sources



Section 7.4(c)(3) discusses ABR of existing allocated sources within the Basin for gas well supply. Existing water allocation permits were approved based on justification of water supply needs as well as the ability of the water source to produce the water without negative environmental impacts. Using previously approved sources of water for gas exploration represents a change of use for a variety of affected populations without public hearing and should not be allowed. The volume of available water between actual use and permitted use should not be particularly large if the original application justification of water need was accurate. In addition, gas exploration water use is 100 percent consumptive and the original permit may not represent 100 percent consumptive use. This is particularly true for drinking water allocations. Drinking water supplies usually return up to 80-90 percent of the water either through septic system recharge or discharge through a treatment plant. Section 7.4(d)(1)(vi) allows ABR if the applicant demonstrates that no adverse affects will occur. Public comment on potential adverse impacts should be presented in a public meeting setting that provides the opportunity for public input into the decision making process. The use of existing water allocation permits (essentially a reallocation of the use of the waters controlled by those permits) for gas drilling, should not be approved as an ABR due to the complex nature of water resource impacts and the broad range of populations and water uses that could be affected. I do not know of any state water use regulation where the potential use of a resource is changed without major permit modifications including advertisement for public hearing and including a public participation process. The DRBC should be at least as restrictive as state requirements.

In addition, the proposed use of waste water under the ABR also should not be used as again a potentially non-consumptive discharge of water is becoming a 100 percent consumptive use, without public hearing. Again, the proposed regulations allow ABR if the applicant demonstrates that no adverse affects will occur. The complexity of potential impacts and the broad range of potentially affected populations should be presented in a public meeting setting with the opportunity for public input into the



decision making process with the views of multiple affected parties presented, and not be approved as an ABR.

Section 7.4(c)(3) allows for ABR for new water sources within a Natural Gas Development Plan (NGDP). The NGDP does require evaluation of impacts from surface water and ground water withdrawal. However, ABR is also allowed for these water sources as part of the NGDP. Any new water withdrawal project should require a Docket and public hearing as per 7.4(c)(4), giving the public an opportunity to review the data and applicant's reports and providing the opportunity for public input into the decision making process. This is typical of the allocation process in states where a public hearing is a key component of the approved water use.

Recommendation: ABR should not be used to change the condition of use for previously approved allocations or any other permit requirement.

2.8 Pass by Flow Requirements

The (Section 7.4(d)(1)(xi)) and 7.4(e)(3)(ii) pass by flow requirements of Q7-10 is the passing flow that occurs during significant drought. Water needed for fracing can be collected and stored over a significant time period in preparation for fracing. Given the ability to plan and estimate the time fracing will occur, allowing pass by flow to be diminished to Q7-10 is simply encouraging poor planning on the part of the gas well operator. No justification is provided for the Q7-10 in the regulations. In fact, high flow skimming of stream flows from rainfall runoff should be used under prescribed conditions, not a stream at or near groundwater base flow. High flow skimming removes the environmental impact of any low flow removal of stream water. In calculating minimum flows, ecological needs and strict flow regime protection should be applied given the time frame for frac preparation. In calculating protective low flows, a mean low flow of several days on a two or three year reoccurrence interval is far more



appropriate and should be combined with the implementation of a modeled flow regime mimicking natural flows that does not adversely impact stream ecosystems and habitats as well as instream and downstream conditions and uses.

Recommendation: Use of a Q3-3, a 3 consecutive day low flow on a 3 year reoccurrence interval should be applied in addition to a modeled flow that preserves the ecological flow regime protective of instream ecology and habitats as well as instream and downstream conditions and uses.

2.9 Use of Approved Discharge as a Source of Water by ABR

Section 7.4(d)(2) discusses approved discharges of waste water or non-contact cooling water as a source for water for gas well fracing. The statement “If the project sponsor meets the set forth below” is a fragment and needs to be clarified. The complexity of potential impacts and the broad range of potentially affected populations should be presented in a public meeting setting with the opportunity for public input into the decision making process with the views of multiple affected parties presented, and not approved as an ABR. ABR should not be allowed in these regulations as previous granting of permits did not include water use for gas development as a possible occurrence and likely did not include a 100 percent consumptive (or more) use of the water in the considerations that informed and resulted in the final decision making.

Further, the discharge permit pollution limits and Total Maximum Daily Loads (TMDLs) were set for particular constituents of the waste water and the water to which the discharge occurs. The redistribution of that water, potentially to a much smaller basin, will require reevaluation, especially for limits such as coliform, phosphates and nitrates. Public input and hearings are required to understand the full impact to the environment, explore all options to meet demonstrated needs, and allow the public the opportunity to meaningfully participate in the decision making process.



Recommendation: ABR should not be used to change the condition of use for previously approved discharges. Protective water quality standards should be set by the DRBC and applied to all water sources for natural gas extraction and development processes.

2.10 New Water Sources for Uses Related to Natural Gas Development

Section 7.4(e)(1) discusses the requirement for developing a new water source. Again, the use of a NGDP allows for the ABR of these water sources. The ABR requires the reporting for a new water source, but does not allow for public review and hearing. Further comment on testing for new sources is below.

Recommendation: ABR should not be used to change the condition of use for previously approved allocations.

2.11 Hydrologic Report Development

As part of the approval process for new ground water sources, a hydrologic report has to be developed as per Section 7.4(e)(4)(i). However, a far more effective process is to require an Aquifer Test Plan prior to conducting the required 48-hour test. The Aquifer Test Plan must include the following sections.

1. Detailed background geologic studies including a fracture trace study and field verification of fracture orientation to determine and project anisotropic effects within the aquifer. Based on the orientation of fractures, specific wells



can be prioritized for monitoring in the direction parallel to and perpendicular to the suspected direction of anisotropy.

2. The Aquifer Test Plan should also detail conditions for stopping the drawdown test with pass/fail criteria. In a fracture rock aquifer, increasing rates of drawdown as the test continues indicates dewatering of the fracture network. The test should be run for a full 72 hours and until the rate of drawdown over the last 6 two-hour intervals of the test show a decreasing rate of drawdown. The extended length of the test to 72 hours is needed to evaluate dewatering effects within fractured rock aquifers. If a stabilized rate of drawdown cannot be established, the well has limited value and additional evolution and testing of the water resource requested is needed. This could include additional wells, which would also be subject to aquifer testing.
3. The Aquifer Test Plan should also detail conditions for recovery with pass/fail criteria. Recovery from pumping is extremely important in evaluation of recharge to the aquifer. Recovery to a full 90 percent of the amount of drawdown must be required. If the well fails to reach either a stabilized rate of drawdown or does recover to 90 percent of the total drawdown within 96 hours, the well has failed to illustrate sustainable production.

An aquifer test conducted with the above analysis of anisotropy will provide reviewing hydrogeologists with reliable data to evaluate interference effects that will occur with operation of the well. Interference effects are simply the drawdown caused in any well from the ground water withdrawal in another well. Specific wells most vulnerable to interference effects will be identified based not only on lateral distance but based on vertical depth. Well variability both horizontally and vertically requires that aquifer test monitoring not be limited to one well in one particular compass direction, but encompass as many wells as available. Further, varying water quality related to periods of extreme rainfall can occur in fractured rock wells. Given the availability of water level recording instruments, the well(s) identified in the aquifer



test as most vulnerable to interference should be equipped with water level and specific conductivity recording instruments.

Recommendation: Add the requirement for an Aquifer Test Plan to evaluate aquifer anisotropic features, run the test for 72 hours to evaluate dewatering effects, and add pass fail criteria to the aquifer test results.

2.12 Well pads for Natural Gas Activity

2.12.1 Natural Gas Development Plans

The Natural Gas Development Plans (NGDP) (Section 7.5) appear to be an attempt to quantify future gas development plans. However, there does not appear to be any goal or process by which cumulative effects of the thousands of gas wells will be assessed, quantified or mitigated. Only the Suspension of the Rules of Practice and Procedure (RPP) illustrates the DBRC concern with small cumulative use of water resources. Individual pads will increase runoff and diminish ground water recharge by a certain amount, while staging areas, roads, driveways, and other construction and production activities will compact soil. Storage lagoons also diminish recharge to the site aquifer. Buried gas lines can provide preferential pathways for shallow ground-water drainage and contaminant migration, potentially resulting in the dewatering of shallow ground-water systems. Despite these impacts, however, the cumulative effects from all the well pads on water resources are not directly addressed through the regulation. The NGDP plans will inventory resources but fail to ensure action to avoid degradation to SPW, which includes requiring protection of recharge to groundwater and the healthy base flow of streams.

However, Section 7.5 (c): DRBC's Proposed Regulations establish development rules for natural gas drilling projects at a high review threshold (3,200 acres or 5 well pads), meaning that single exploration wells or operators that drill wells and develop



facilities under the 3,200 acres or 5 well pads will receive little scrutiny. This is inconsistent with the suspension of the RPP rules.

Recommendation: Resource inventories should be followed by a proposed plan from the applicant on resource conservation and a plan for how pollution and degradation of resources will be avoided. Such plan must be subject to approval by the DRBC, which itself must review each plan in the context of basin-wide cumulative impacts and with the benefit of thorough public review and comment.

2.12.2 NGDP Minimum Setbacks

The draft regulations, Section 7.5(a)(4), establish minimum setbacks. In general, these regulations need a “Basis and Background Document” providing scientific justification for setback requirements. The failure in Dimock and the widespread nature of gas migration illustrate that well failure is a vitally important consideration in determining setback requirements and is a consideration not taken into account by the apparent generic setbacks proposed in these regulations. The setbacks proposed in the regulations seem to only attempt to address threats proposed from simple surface contamination, surface runoff problems and shallow ground water contamination. The proposed setbacks are not adequate to meet that goal and certainly are not adequate to meet a goal of protection of water resources from subsurface sources of pollution that accompany natural gas extraction practices.

The setbacks proposed to address simple shallow ground water and surface water issues in these regulations and the setbacks needed to prevent threats presented by deep grout failure differ by orders of magnitude. This illustrates the critical importance of well construction, grouting, maintenance, and closure to the protection of Basin resources and underscores the importance of DRBC adaptation of stringent well drilling regulation in concert with member states.



The NGDP indicates only an inventory of a minimum number of surficial geological features in 7.5(c)(3)(ii)(E). Bedrock geologic mapping and site specific bedrock fracture and fault data on the geology of each pad area should be required along with an inventory of surficial geology and soils. Such data would provide information indicating reasonable minimum setbacks. In addition, detailed geologic information will be needed for the development of the monitoring plan referenced in 7.5(c)(3)(v) as well as the Aquifer Test Plan discussed above.

Recommendation: Provide a basis and background document with justification on setback selections instead of adopting potentially inadequate and non-uniform state regulations. Develop setbacks based on soils, surficial geology, bedrock geology and other data, as well as the unique activities and potential failures associated with gas drilling, so as to prevent pollution and avoid degradation.

2.12.3 NGDP High Volume Frac Well Monitoring

Section 7.5(h)(2)(i) establishes requirements for pre-development and post-development groundwater and surface water monitoring reports for high volume frac wells. The groundwater monitoring includes available wells within 1,000 to 2,000 feet of high volume fraced wells. The site geologic conditions and depths of the available wells must also be considered, especially the depths to which the wells are completed. At least one moderately deep (300 foot) properly cased rock well must be available for permanent monitoring before, during and after fracing, preferably within 1,000 feet of the well being fraced.

The draft regulations fail to establish adequate monitoring requirements for water levels, before, during, and after fracing. Recording water level transducers are accurate enough to register responses up to a few hundredths of a foot. Any change in pressure in the rock mass above a fraced zone will be observed as a water level change



within the overlying rock mass. If pressure escapes into the well bore annulus, a response in water levels certainly could be observed in a moderately deep rock water supply well. This is based on personal observation of low pressure water supply fracing where measurable responses were observed in wells 1,000 feet away from the pressurized well where only several thousand psi were applied, not the 15,000 psi or more used in deep well fracing.

Recommendation: Water level pressure monitoring must be included within the regulations in the deepest available rock well within 1,000 feet of the gas well being fraced during the part of the pre and post development well testing. Monitoring farther outwards from the fraced area is also recommended based on bedrock geologic conditions.

2.13 Wastewater Treatment and Disposal

Sections 7.6(a) and (b) address wastewater generation at well pads and the treatability studies required for operations that accept non-domestic gas wastewaters. The waste treatability studies have to be consistent with the intent of Section 3.10.3.B.2. of the Commission's Water Quality Regulations (WQRs). The requirement of these regulations is that there is "no measurable change to existing water quality." The wastewater treatment and disposal section of the proposed gas regulations do not demonstrate that the "no measurable change" standard is achievable and appear to partially fall back on the notion that "dilution is the solution to pollution." Further, there are no standards for the quality of gas drilling wastewater that would be re-used or "recycled" in subsequent hydraulic fracturing operations. This provides a potential pollution source during repumping and handling previously contaminated frac water. Also, certain pollutants may concentrate in the re-used material or go through chemical reactions that produce dangerous by-products.



Recommendation: Pretreatment standards for the reuse of frac fluids at the gas pad are not developed within the regulation and need to be a critical addition to the regulations (see Tinto and Solomon, Attachment 5).

3.0 Other comments

Sections 7.1(a) and (c), Purpose and Scope, only discuss the construction and operation of gas development, but not the decommissioning of the operations. The statement must also address the decommissioning of the operation, specifically well decommissioning, long term monitoring of any contaminated material left behind and site restoration.

Section 7.1(e) The Commission concludes that management of natural gas development projects should promote use and development of the Basin's water resources in a sustainable manner and should (replace with must) be conducted pursuant to rules and regulations that avoid pollution of or injury to the water resources of the Basin.

Section 7.1(i) again only mentions construction and operation of natural gas wells without any mention of the critical decommissioning step.

Definitions:

Artificial penetration – a human-made excavation, opening, or void beneath the ground surface that may provide a pathway for the upward migration of any potential contaminant existing or injected below the ground surface. This may include any type of well, mine, mine shafts, or tunnels.

This definition should either be expanded to include shallow subsurface excavations, such as lagoons and underground piping and utilities, which also create pathways of contaminant migration, or a separate definition, should be established for shallow excavation.

The definitions for disturbed area and earth disturbance activity are not consistent as earth disturbance activity includes agricultural plowing but disturbed areas do not include any reference to agriculture.



The definition of mine drainage water is not clear as active or inactive quarries or mines may or may not be included. A definition for mine would help to clarify this issue.

The definition of NGDP should be changed:

Natural gas development plan (NGDP) - a project sponsor's overall plan for siting and accessing natural gas development projects in all its leasehold areas.

The financial assurances sections require a per well bond or letter or credit as multiple wells can be drilled per well pad. This multiple well per pad comment is not consistent with the definition of a well pad which implies each pad has "a" well.