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Protection of Surface Waters Associated with Shale Gas Drilling and Related Support Sites
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I. Introduction and Purpose

Shale gas drilling and recovery operations involve industrial and construction-like activities on one or more parcels of land over an extended period of time. In New York, much of this activity will take place on land which is currently undeveloped, and which is exposed to precipitation. Minimizing and mitigating the negative effects of such activity requires management and regulation. Within the context of current management and regulatory practices, the goal of this paper is to outline key issues related to the prevention of storm and surface water pollution at shale gas drilling[1] sites.

II. Technical Background

Shale gas drilling involves the selection and preparation of multi-acre parcels of land, the use and staging of industrial equipment, management of water and chemical resources, and the eventual reclamation of land. In some respects, shale gas drilling activities resemble typical construction activities. Preparation of well pads requires earth moving and grading, compaction of soil, storage and management of materials, and land reclamation. In other respects, shale gas activities resemble industrial operations. Well pads act as storage and handling facilities for equipment, chemicals, and recovered gas. Traditional construction and industrial operations are sequential and separated over time (i.e. a factory is constructed, and then it is operated). Shale gas operations, however, involve a mixture of industrial and construction activities, which can occur at the same site. Furthermore, multiple shale gas operations will be distributed across a region and require a constantly evolving system of pipeline infrastructure and service. Because shale gas wells typically have a limited lifespan (several years to decades[2]), construction and operation of new wells will likely be ongoing.

III. Regulatory Setting

New York, like all states, protects the quality of stormwater runoff through its State Pollutant Discharge Elimination System (SPDES) permitting program. While stormwater protection requirements can be imposed through the issuance of site-specific SPDES permits, it is assumed for the purposes of this paper, consistent with the pending draft Supplemental Generic Impact Statement (Draft SGEIS), that

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1 For the purposes of this paper, the term "shale gas drilling site" includes not only the drilling pads and their immediate vicinity, but all related management and support activities, whether carried out at the actual well site or at a separate parcel.

2 Massachusetts Institute of Technology. (2010). *The Future of Natural Gas*. http://web.mit.edu/mitei/research/studies/naturalgas.html

stormwater falling on most shale gas drilling sites will be protected through an expansion of New York's Stormwater General Permitting Program.

Within New York's Stormwater General Permitting Program, two separate permits exist, one which is designed for a broad range of industrial activities, and another specifically designed for construction activities. As discussed above, shale gas development has characteristics of both industrial and construction operations. As outlined in the Draft SGEIS, the NYSDEC has proposed to deal with this as follows:

- All activities at shale gas drilling sites will (typically) be regulated by a single permit, the State's Multi-Sector General SPDES Permit (MSGP) for stormwater associated with industrial activities (GP-0-06-002).
- Within the MSGP, shale gas operations will be covered under Sector AD (Non-classified Facilities/Stormwater Discharges Designated by the Department as Requiring Permit Coverage). However, the final SGEIS is likely to specify changes to this sector, or create a new "Shale Gas" Sector, which deals more specifically with shale gas operations.
- The new or revised sector of the MSGP will draw from the regulatory language and considerations of the General Permit for construction activities (GP-0-10-001), reflecting the mixed character of shale gas development. However, a separate permit related to construction-like activities will typically not be required.

As a condition of coverage under the MSGP, all shale gas drilling operators must comply with a number of requirements. A list of "General" requirements is included in MSGP Parts I through VII, the main component of which is the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The basic elements of a SWPPP include:

- A map and description of natural and constructed features.
- A description of the activities being conducted.
- The identification and location of potential sources of stormwater contamination.
- Drainage areas and direction of stormwater flow.
- Location(s) of place(s) where stormwater is discharged off-site (outfalls).
- Structural and non-structural Best Management Practices (BMPs) used to treat, divert or contain contaminated stormwater to prevent discharge of pollutants to surface water.
- Applicable monitoring and reporting requirements.
- The identification of individuals or positions responsible for implementation of the SWPPP.

In addition to the MSGP's general requirements of Parts I through VII, including development and implementation of a SWPPP, Part VIII describes specific industrial "Sectors", each of which includes sector-specific BMPs and considerations. We strongly support the creation of a specific Sector dedicated to unconventional shale gas operations. This "Shale Gas" Sector, therefore, would contain the regulatory language and BMP requirements needed to address stormwater and surface water protection at shale gas drilling sites. This raises the critical question: **What does a protective and enforceable Shale Gas Sector look like?**

To put such a question into context, it is helpful to review existing regulations, and the extent to which they might address at least some aspects of shale gas operations:

- MSGP - The Multi-Sector General SPDES Permit contains a variety of general requirements associated with protection of surface waters during industrial activities
    - Sector I - Within the MSGP, the specific industrial "Sector I" applies to traditional activities associated with "Oil and Gas Extraction and Refining" and can be used as a frame of reference for understanding how gas extraction activities have been regulated previously. To be clear, shale gas operations will not fall within Sector I. However, it is useful for identifying issues in need of more adequate coverage given the unique characteristics of modern shale gas extraction techniques.
    - Sector AD - MSGP Sector AD also specifies certain industrial best management practices. Although Sector AD is a generic sector, and likely will not ultimately apply to shale gas operations, it too is useful for illustrating the scope of existing regulations.
- CSGP - The Construction Stormwater General SPDES Permit (CSGP) contains a variety of general requirements associated with protection of surface waters during construction activities.

Crafting an effective Shale Gas Sector requires both an understanding of the characteristics of shale gas operations themselves, and some knowledge of how regulations in New York currently work to influence industry and individuals to protect surface waters. Below, we discuss a few aspects of an effective Shale Gas Sector. In some cases, elements of existing regulations may be combined to provide adequate surface water protection. In other cases, the unique challenges associated with modern shale gas operations may require new, more stringent rules and considerations.

IV. Key Issues

This section discusses how shale gas operations fit within existing regulations related to stormwater pollution prevention and the storage and handling of fluids and chemicals on well pads in New York State. It also provides NYWEA's recommendations intended to facilitate the discussion and establishment of final state regulations in the form of a Shale Gas Sector within the MSGP, in accordance with the language of the Draft SGEIS.

Site definition

Well pads represent a significant portion of the land disturbed by shale gas operations. These well pads are similar in some respects to conventional well pads, which are covered in the MSGP Sector I. Shale gas operations, however, involve more intense construction-like activities relative to conventional gas wells, and are more appropriately covered by regulations set forth in the CSGP. Protective requirements of the CSGP go beyond those stipulated by the MSGP, and include identification of existing and final slopes, locations of different soil types and their identification by Hydrologic Soil Group, and a construction phasing plan. In addition to well pad activities, a Shale Gas Sector must also consider support sites that may not be located at the well site, but which nevertheless result in land disturbance. Sites for water withdrawals, centralized wastewater storage and handling facilities, and associated road and pipeline construction all deserve attention and coverage under new regulations.

Storage of hazardous materials

High volume hydraulic fracturing operations require significant quantities of chemicals to be stored and handled on site. A preliminary analysis of violations in PA indicates that minor spills and leaks of chemicals and waste fluids constitute a significant fraction of problems discovered on well pads (NYSWRI unpublished). Contamination of stormwater effluent is best minimized by spill prevention and secondary containment of hazardous substances, thereby preventing their release to soils and water. Requiring secondary containment of hazardous chemicals and diesel in storage and mixing areas should be a priority.

Aspects of current regulations are reasonably protective and preventative. The MSGP §III(L)(3) discusses special requirements for SWPPPs dealing with storage and handling of hazardous materials and references NY regulations 6 NYCRR 595-599, 612-614, and 370-373. These regulations describe the procedures that must be followed to ensure that spills and leaks resulting from activities such as loading and unloading fluids from trucks do not lead to contamination of stormwater effluent. In particular, §599.8 through 599.11 offer thorough guidelines with respect to secondary containment measures and the maintenance and monitoring of containment systems. Additionally, §599.13 and 599.14 describe measures that apply to construction and maintenance of gathering pipelines.

Concern remains, however, as to whether or not a shale gas well pad will be treated as a hazardous substance "storage facility" and thus whether or not regulations set forth in 6 NYCRR 596 and 599 will apply. As mentioned above, these regulations deal specifically with hazardous substance containment, and therefore are critically important for the prevention of spills. A "storage facility" is defined in §596.1 as having a capacity of 185 gallons or greater. However, various liquid chemicals may be present on a well pad that may be hazardous but not of individual volumes of 185 gallons. While individual volumes may not be large, the sum total volume of hazardous chemicals held in storage and mixing areas is often considerable. We recommend that the total volume of liquid hazardous chemicals stored on a well pad be used in defining such a well pad as a "storage facility." Thus, if the sum of various small volumes is 185 gallons or greater, secondary containment requirements as outlined in 6 NYCRR 596 and 599 would be applied. Storage of non-liquid hazardous chemicals should be treated in a similar manner so as to prevent contact with precipitation and/or run-on/off. Temporary storage or use of chemicals (e.g. for less than 24 hours) could be allowed as specified in this rule.

Such an approach should also be used for storage and handling of petroleum liquids on well pads, as diesel is often used as a fuel for compressors and drilling rigs. A petroleum "storage facility," defined by a volume >1,100 gallons, is regulated separately under 6 NYCRR §614.8 through 614.13. With respect to contamination of surface waters, however, diesel can be hazardous even at low volumes. We recommend that a lower, more protective volume (185 gallons or greater) be used to define a shale gas well pad as a petroleum "storage facility." This would ensure that secondary containment requirements within 6 NYCRR §614 were triggered at well pads where a significant amount of diesel is stored.

Specific BMPs

BMPs should primarily focus on prevention and containment of spills and sediments, and need to be appropriate for the phase of activity occurring at any given time on site. Many of the concerns regarding hazardous materials, including how they should be situated on a well pad, inspection and maintenance routines and reporting procedures can be effectively dealt with by ensuring that regulations included within 6 NYCRR listed above apply to chemicals on site. Concerns about sediments in stormwater

runoff can best be addressed by requiring prudent BMPs, and emphasizing their use via inspection and site monitoring.

The MSGP §III(6)(b) discusses a variety of structural and non-structural BMPs to prevent stormwater pollution. However, the language of the permit states that these BMPs are "to be considered" and thus does not guarantee that proper management will occur. The CSGP contains stronger language and a more rigorous set of "required" guidelines based on the NYS Standards and Specs for Erosion & Sediment Control. In the CSGP §III (B)(2), and based on Table 2 of Appendix B, the idea of a "post-construction" SWPPP is also discussed. Aspects of these regulations could be modified to apply to specific phases of well pad development, such as partial site reclamation after initial completion and temporary abandonment of wells. The CSGP is more protective than the MSGP with respect to stormwater pollution, and should serve as the primary reference for new guidelines. In reality, prudent usage of stormwater pollution controls depends largely on the attention they receive from inspectors, and the weight of potential consequences for non-compliance. It is worthwhile to stress the need for regular inspections as a method for ensuring that adequate protection is achieved.

Benchmark monitoring requirements

Monitoring for water contamination is no substitute for effective prevention practices that focus on safety and containment. However, monitoring can be important in providing stakeholders assurance that negative environmental impacts are kept to a minimum. An effective framework for monitoring shale gas sites must address when, where, and what to monitor.

The Delaware River Basin Commission (DRBC) recently released draft regulations covering shale gas activities within its jurisdiction. Included within these draft regulations (§7.5(h)(2)(i)[3]) are progressive requirements for the location and timing of groundwater and surface water monitoring. Elements of these regulations could be included in a new Shale Gas Sector of the MSGP. For example, DRBC draft regulations call for surface water monitoring both upstream and downstream of proposed drilling sites, and prescribe a schedule for taking such measurements. Additionally, the DRBC requires that drilling companies assess water quality in nearby private water wells (similar to the Draft SGEIS), but go further to say that groundwater monitoring wells must be installed at operator expense in the absence of suitable private wells.

Choosing what constituents to monitor for will be the subject of some debate, as it is difficult to know what chemicals an operator will choose to use, and therefore what potential stormwater contaminants may be. The ideal approach would be to maintain flexibility over what parameters to test for at any given well pad; required parameters could be chosen based on what chemicals are identified as being in use by the operator, by local surface and geological conditions, and by proximity to sensitive environments, such as wetlands or public drinking water supplies. The drawback to such an approach is that it requires careful review of each site and significant staff attention during the permitting process.

[3] Article 7 is a proposed supplement the Groundwater – Basin-wide regulations set forth in Section 3.40 of the Commission's Administrative Manual - Part III Water Quality 6 Regulations (WQR), 18 C.F.R. Section 410. Information on the DRBC proposal, which is extensive, is provided by way of an example. Its inclusion does not indicate a NYWEA position on these proposed DRBC regulations.

Alternatively, required parameters could be specified and monitored at all sites. This is already done in some cases. Sector I of the MSGP requires benchmark testing of stormwater discharges for Total Suspended Solids (TSS), Chloride, and pH (Table VIII-I-1 of the MSGP). Sector AD of the MSGP calls for additional benchmark testing of Chemical Oxygen Demand (COD), Oil and Grease, Total Nitrogen (TN), Total Recoverable Iron, and Total Recoverable Zinc (Table VIII-AD-1 of the MSGP). Given the potentially large volume of hazardous chemicals stored on site, large area of disturbance, and long time frame of shale gas operations, additional benchmark testing parameters should be considered. Consideration should be given to the following: Barium (as an indication of mishandling of drilling muds), Specific Conductivity and /or Total Dissolved Solids (TDS) (as an indication of flowback and produced water leakage), Total Organic Carbon (as an indication of chemical spills), and Gross Alpha Radioactivity (as an indication of increased naturally occurring radioactive materials).

As with stormwater pollution prevention BMPs, thorough inspection and enforcement systems are necessary for preventing negative impacts. Current regulations do not have adequate enforcement and penalty structures to ensure they will be followed diligently. For example, the MSGP §IV(A)(c) states that exceedance of established benchmark levels does not constitute a permit violation, and suggests only that "continued exceedance" of benchmarks "may identify" sites for individual SPDES permit requirements. Given the potential for distributed and cumulative negative impacts as a possible result of widespread shale gas activities, penalties for non-compliance need to be increased accordingly. Exceedances of benchmark levels should be flagged by the State's automated compliance tracking system, and should incur immediate regulatory scrutiny. Subsequent exceedance of the same parameters should require a documented review by the Department with the goal of determining whether coverage by the General Permit, with its benchmark levels, should be withdrawn and replaced by an individual SPDES permit with enforceable effluent limits.

Clear distinction of operational phases

The timing of drilling activities at shale gas well pads creates a unique challenge for the regulatory community. Once well pads are established, wells may be drilled and completed at various times, sometimes months to years apart. For the regulation of stormwater pollution, this means that rules need to account for the significantly different activities associated with each phase, and potentially long periods of temporary inactivity and abandonment. In some cases, it may be prudent to apply different sets of rules at different times.

Requirements associated with each SWPPP should clearly differentiate between exploration, drilling, and completion phases. BMPs and monitoring will be needed in each phase, but there are unique characteristics of each that ought to be addressed in the SWPPP. Completion activities, for example, often require that higher volumes of hazardous materials be stored on site. This may also be a time when contractor or service company activity is high, and where maintenance and safety responsibilities are potentially shared among multiple individuals. SWPPPs that acknowledge the characteristics of each phase could reduce the risk of complacency during intense operations, while avoiding unnecessary precautions during times of relative quiescence.

Temporary inactivity and partial site reclamation and abandonment also represent phases which may be poorly addressed in current regulations. The MSGP allows for essentially complete suspension of responsibility with respect to inspection and maintenance at "inactive and unstaffed sites". Sector I of the MSGP increases the level of oversight marginally by requiring facility inspections "at least

annually" at such sites. It is unreasonable, however, to think that sites remain environmentally benign simply because they are inactive and unstaffed. On the other hand, the CSGP is perhaps too stringent for shale gas purposes. It stipulates within §IV (C)(2)(c) that visits by a qualified inspector are still required "at least once every 30 days" at inactive sites. A new Shale Gas Sector will need to carefully strike a balance between these two approaches, and more specifically define what constitutes "inactivity" and "partial reclamation".

Oversight capacity

While there is currently no single set of adequate regulations for stormwater and spill pollution protection at shale gas well pads in NY, elements of the MSGP and CSGP, combined with additional measures discussed above, provide a foundation for reasonable regulation going forward. It is clear, however, that good regulations are only useful in the context of thorough and regular inspections coupled with an appropriately scaled penalty structure. Major concern remains as to whether NYS has an adequate number of inspectors to cover such a rapidly expanding and widely distributed industry, especially in regions 7 and 8 where activity is likely to be highest. A preliminary analysis of violations issued in PA found that improper erosion/SWPPP control, combined with spills and leaks (many preventable with secondary containment) made up a significant proportion of total violations, suggesting these as critical focus areas for inspectors in NY. Increasing the number of inspectors, along with proper training in these critical areas, should be considered, especially in regions anticipating significant drilling activity. A fee system by which a group of operators in a region are charged to maintain a NYSDEC or USEPA inspector (Site Monitor) may be the best possible way to ensure appropriate oversight commensurate with the scale and pace of local drilling activity. NYSDEC has authority to impose any permit condition that is rationally related to protecting the environment[4] and hence it can, and often times should, make the funding of a Site Monitor a standard permit condition in a shale gas drilling permit. A single Site Monitor could cover multiple well pads, serving as a "circuit rider" with the freedom and authority to inspect any one of their sites at any time.

Recommendation Summary

- New regulations, General Stormwater SPDES permit requirements and/or other enforceable requirements must account for the unique phasing and layout of shale gas operations. This may be best accomplished by establishing a new Sector within the New York Multi-Sector Industrial Stormwater permit, with explicit requirements based on the needs and activities of each phase at the various site and support locations.
- Containment and reduction of potential contaminants at their source should be highlighted as an effective and inexpensive approach for reducing water contamination.
- Monitoring is necessary in order to evaluate the effectiveness of practices and regulations. It is important to monitor the right things at the right times, in the right locations. This is likely best done on a site-by-site basis. Use of real-time screening instrumentation should be encouraged.
- Regulations are only as good as the inspectors that enforce them. It is critical that a cost-effective and reliable system be established to ensure compliance. Either an annual permit fee and/or a Site Monitor system in which financial support to pay part of the cost of a NYSDEC employee/contractor

[4] *See*, ECL 1-0101, 3-0301; 6 NYCRR 360-4.1 [a]; .*Flacke v Onondaga Landfill Sys.*, 69 NY2d 355, 362 and *C.I.D. Landfill, Inc. v. New York State Department of Environmental Conservation*, 167 A.D.2d 827; 561 N.Y.S.2d 936; 1990 N.Y. App. Div. LEXIS 14362)

is stipulated as a condition of the permit is likely the most efficient and publically acceptable approach to doing this.