



## EPSC Best Management Practices For Water and Geothermal Well Drilling

### Background and Purpose

Of the many drilling methods available, the main method for drilling wells and holes for geothermal loops in Nashville is air rotary drilling. Any drilling technique involves heavy equipment, water, bentonite clay, cuttings, and related by-products that end up on the ground at the site. Once these by-products become entrained in stormwater, they are referred to as “suspended solids” and are easily transported off-site, into the Municipal Separate Storm Sewer System (MS4) and/or into Waters of the State. The transportation of suspended solids is considered non-point source pollution and may adversely impact wetlands, surface waters, and stormwater culverts. Discharges of this nature are not allowed in Davidson County under Metro Code of Laws §15.64.205 (illicit discharge ordinance [http://www.nashville.gov/stormwater/illicit\\_discharge\\_ordinance.asp](http://www.nashville.gov/stormwater/illicit_discharge_ordinance.asp)). Per this Code, such discharges can receive administrative penalties of \$50 to \$5,000. It is the responsibility of the drilling contractor to manage sediment properly.

The goal of this educational material is to help disseminate information about Best Management Practices for drilling operations. This fact sheet describes the Best Management Practices (BMP's) that are expected in drilling operations in Davidson County unless other suitable BMPs are already on the site (related to ongoing construction site activities). This flyer highlights BMP's that are practical ways to ensure minimal risk to the environment while allowing the drilling operation and/or construction project to continue.

### The Effects of Suspended Solids and Turbidity

- Sediment can clog gravelly areas where fish lay eggs. Turbidity also makes it harder for fish to breathe because it clogs their gills.
- Sediment deposited on primary producers, such as plants and algae, will severely reduce their ability to receive sunlight to photosynthesize. This negatively impacts the food web at the most basic level.
- Increasing turbidity which can inhibit the ability of both the predator and prey to detect each other. This could lead to significant changes in the trophic interactions in the food web of lakes.
- Nutrients such as nitrogen and phosphorus that adhere to sediment particles may end up in water bodies and lead to premature eutrophication of water bodies.

### What is a BMP?

When the drilling process is changed or structures are installed to limit the pollutants escaping off-site, it is called Best Management Practices. Best Management Practices can also be described as structural and non-structural initiatives implemented to prevent erosion and control sediment. It is the driller's responsibility to make sure that BMP's are put in place and maintained during the entire well drilling process. Consideration should be given to terrain, vegetative cover, soil types, and the weather. Clever, on-the-fly, modifications to the best laid BMP's may have to be implemented in order to ensure the sediment stays on-site. Pay attention to your operation as it progresses. The following BMP's are suggestions which can be used alone or in combination to reduce sediment runoff to the Maximum Extent Practicable. Further ideas and guidance can be found in the Metro Nashville Stormwater Management Manual Volume 4, Best Management Practices. Please contact Luke Ewing at the TN Dept. of Environment and Conservation for further assistance at 615-532-0191. You may also contact the NPDES office at Metro at 615-880-2420 if you have questions about designing a system you feel will be effective.

#### Reduce

Consider reducing the size of the drill bit to the smallest size possible for the operation. Choice Mechanical in Nashville found that minimizing the geothermal drill bit to 5 ¼” saved money by reducing grout utilization 20%. They also noticed an equivalent reduction of cuttings.

### **Diversion Device (cost \$2,000-\$5,500):**

Diverters are designed to fit on the well casing or on the rotation head. Diverters contain drill cuttings and divert them through a flow line to a better location. The diverter is designed to prevent the “geyser effect” that results from injecting pressurized air and water into the drill hole. The flow line can be directed into a pond, trench, ring or any device listed below.

### **Containment and Filtration:**

In many low flow operations, the recommended practice is limited detention and filtration or 100% containment and removal off-site.

- **Sediment Filter Bag:** (cost \$65-\$200) Can be applied to the end of the diverter flow line. The bag traps sediment and allows clean water to flow through. The sediment filter bag can be deposited in a landfill or allowed to dry, slit open, and the sediment spread on vegetated land or it can be used later as backfill. The bag can be set up in an empty dumpster, utilized, and left in place to be thrown out with the rest of the construction debris when the dumpster gets full.
- **Trench:** A trench 10-15 feet long can be excavated immediately down gradient of the well. The downstream edge of the trench should be level to allow water to spill out uniformly over the entire length of the trench. A semi-circle of silt fence or straw bales should be installed downgrade of the trench for further sediment removal. From the trench, the water should be directed as sheet flow across a thickly vegetated area.
- **Sediment pond:** A temporary pond can be constructed down-gradient of the well to catch the slurry. On some construction sites a detention pond already exists and can be utilized. Clear water can be released from the pond after the sediment settles. The water can be allowed to fully evaporate and the sediment can be left on site and used later, hauled away, or spread uniformly over a vegetated area as fertilizer. The pond should have the capacity to prevent overflow or by-pass. If not, overflow material will have to be removed offsite, contained in a vessel, or effectively filtered.
- **Ring:** A circle of material can be constructed that captures the slurry product and filters it. For example, a ring of silt fence, hay bales, or size 57 stone can be constructed into which the slurry is directed. The straw bales or rock ring will stop the sediment, but let clean water through. If the sediment is contained on-site, it can be left in the ring for future use as backfill or fertilizer. The ring should have the capacity to prevent overflow or by-pass. If not, overflow material will have to be removed offsite, contained in a dumpster, or effectively filtered.
- **Portable Sediment Tank:** Can be constructed with steel drums, sturdy wood or other material. The tank should be strong enough to enable transfer off-site under fully loaded conditions. A stable path should be provided for a removal vehicle. Details in section CP-02 of Metro Stormwater Management Manual, Vol. 4. [http://www.nashville.gov/stormwater/docs/SWMM/vol4/swmanual03\\_vol4\\_cp02.pdf](http://www.nashville.gov/stormwater/docs/SWMM/vol4/swmanual03_vol4_cp02.pdf)
- **Filter Box:** Elevated box constructed with steel drums or sturdy wood material with a stone filter at the bottom to trap slurry and filter water. Details in section CP-02 of Metro Stormwater Management Manual, Vol. 4. [http://www.nashville.gov/stormwater/docs/SWMM/vol4/swmanual03\\_vol4\\_cp02.pdf](http://www.nashville.gov/stormwater/docs/SWMM/vol4/swmanual03_vol4_cp02.pdf)
- **Frac tank:** Slurry and cuttings can be directed into a fully enclosed metal box. Frac tanks have a large capacity, up to 21,000 gallons. They can easily be transported off-site by a tractor with a winch and a fifth wheel. They can be rented from various environmental supply companies.
- **Dewatering containers:** Similar to frac tanks, but serve to separate the water from the sludge that settles to the bottom of the container. The liquid phase can then be released and the rest of the container removed and contents disposed of in a landfill. They can be rented from various environmental supply companies.

### **Slurry Removal:**

Uncontrolled slurry allowed to freely flow on the site can always be shoveled, scooped, skid loaded, and deposited in a dump truck for removal and off-site disposal in a landfill or other appropriate location.

### **Turbidity Reduction Treatments:**

The purpose of turbidity reduction treatments is to remove TSS through technology.

- **Mud cleaner:** A mud cleaner is a combination of hydrocyclones, vibratory screen and desanders that provide liquid/solid separation at a high flow rate. The weighted mud flows to the inlet head section of the desander and/or desilter entering the hydrocyclones for separation of particles. Mud leaving the underflow is further screened with fine mesh to separate larger particles allowing only barite size particles to pass through the screen returning and recovering the clean mud.



## Water Quality Standards

Many Federal, State and Local regulations – originating from the Clean Water Act - apply to protecting our streams and rivers from pollutant sources. Illicit discharges of sediment, slurry, etc. to the MS4 and/or to “Waters of the State” represent violations to Metro Stormwater Regulations (§15.64.205) and/or to the State Water Quality Standards (Chapter 1200-4-3)

### **Metro Illicit Discharge Ordinance Title 15 WATER, SEWERS AND OTHER PUBLIC SERVICES - Chapter 15.64 STORMWATER MANAGEMENT 15.64.205 Non-stormwater discharges states:**

- Except as hereinafter provided, all non-stormwater discharges into community waters, into the waters of the state, or into the municipal separate storm sewer system of the metropolitan government are prohibited and are declared to be unlawful.

### **TDEC 2007 GENERAL WATER QUALITY CRITERIA Chapter 1200-4-3 includes some pertinent sections:**

- Turbidity, Total Suspended Solids, or Color - There shall be no turbidity, total suspended solids, or color in such amounts or of such character that will materially affect fish and aquatic life. In wadeable streams, suspended solid levels over time should not be substantially different than conditions found in reference streams.
- Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life
- Nutrients - The waters shall not contain nutrients in concentrations that stimulate aquatic plant and/or algae growth to the extent that aquatic habitat is substantially reduced and/or the biological integrity fails to meet regional goals. Additionally, the quality of downstream waters shall not be detrimentally affected.
- Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.

The ideas listed in this Guidance Document are not the only ways to obtain compliance on your drilling site. As a contractor, you have the responsibility and duty to think of ways that are cost effective for you and do not violate the Metro illicit discharge ordinance or the TDEC General Water Quality Criteria while drilling. Please perform your duties in Metro Nashville/Davidson County in a responsible manner.

Thank you very much for recognizing the importance of our streams as a valuable natural resource and your help in the protection and improvement of the streams within Metro Nashville/Davidson County.

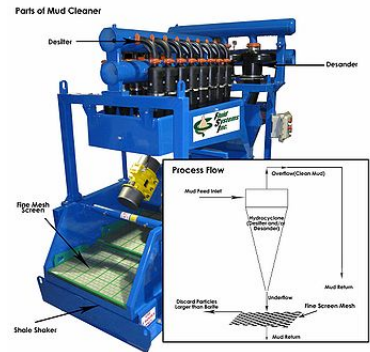
This publication is a public service of:  
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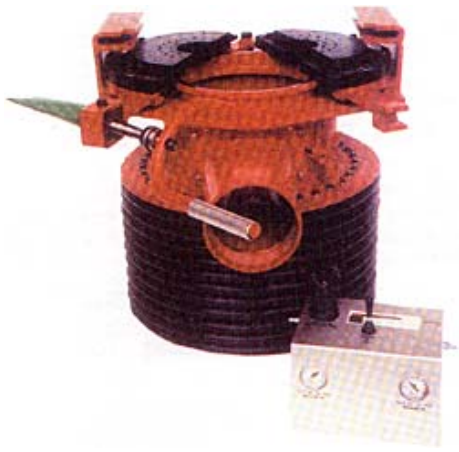
Metro Water Services is in the process of complying with all appropriate Americans with Disabilities Act Guidelines. For additional information contact Joseph A. Estes, Sr., 1600 2<sup>nd</sup> Avenue North, Nashville, TN 37208-2206; telephone 615-862-4862.



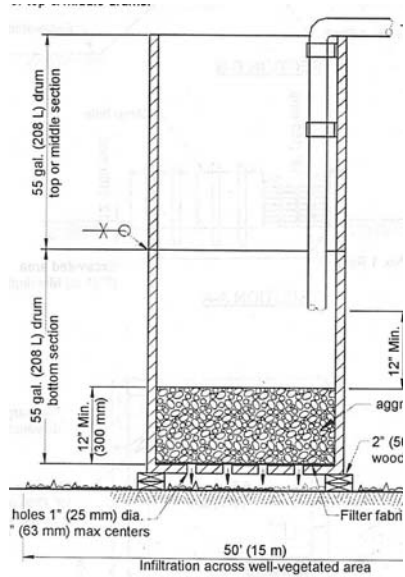
Sediment Filter Bag



Mud Cleaner



Diversion device



Filter Box



Frac Tank