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Technology That Separates

## STORM BULLETIN 14

# SIZING GUIDELINES AND TSS MONITORING

- **CZARA Guidance (EPA 840-B-92-002, Chapter 4, Section 2:** states in part "The purpose of this management measure is to protect or improve surface water quality by the development and implementation of watershed management programs that pursue the following objectives:

  1. Reduce surface water runoff pollution loadings from areas where development has already occurred;

  2. Limit surface water runoff volumes in order to minimize sediment loadings resulting from the erosion of stream banks and other natural conveyance systems; and

  3. Preserve, enhance, or establish buffers that provide water quality benefits along water bodies and their tributaries.

  80% Total Suspended Solids (TSS) reduction is determined on an average annual basis to help achieve the above. This reduction is often achieved using a treatment train consisting of a pretreatment chamber (less than three minutes of treatment time) and a detention system (several hours of treatment time). Gravity separation is commonly used for pretreatment and detention systems. In some cases filtration is used to filter the effluent from the detention system.

- **The key criteria for sizing gravity separation systems** are particle size and specific gravity. This well established science of gravity separation has been used for decades in municipal wastewater treatment plants. Gravity separation science is based on particle size and density. Professional judgment and accepted guidelines must be used to provide a sizing scenario because of the unpredictable nature of the particles in the stormwater wash-off process.
  - Removal efficiency will improve as residence time is increased. As a comparison, residence time in a septic tank is generally 24 hours while in a stormwater pretreatment chamber it's 10-40 seconds.
  - Increased water surface area results in increased residence time and removal efficiency.
    - A 250 $ft^2$ detention swale containing a water depth of 4.0 ft can provide 4.0 hours of treatment time and is capable of efficient removal of fine silt and coarser sediment.
    - A pretreatment chamber with 13 $ft^2$ of water surface area and 36 seconds of treatment time is capable of efficient removal of fine sand and coarser sediment.
    - Swales and pretreatment chambers are most effective when the water is quiescent, turbulence will reduce the efficiency for removing sediment.

- **The required treatment before bypassing** is the flow rate to be treated before bypassing a pretreatment chamber. Premature bypassing is undesirable because visible floatables may not be trapped in the pretreatment chamber.
- **A reasonable pretreatment chamber sizing guideline**, for efficient removal of sand and coarser sediment, would be to provide at least 10-20 $ft^2$ of water surface area per impervious acre. More turbulent chambers would require larger water surface areas for equivalent removal efficiency. This sizing guideline could be presumed to provide 10-15% removal of "EPA Total Suspended Solids (TSS)". Oil sheen is typically seen in well designed pretreatment chambers and the typical sediment analysis is 10-15% clay/silt and 85-90% sand/grit. Site Engineers need to ensure that a pretreatment chamber meets minimum guidelines for water surface area.

- **TSS monitoring does not provide an adequate measure of performance and** monitoring stormwater pretreatment chambers for TSS removal is of limited value for several reasons:
  - There is a limited need to measure TSS removal in pretreatment chambers. The presumption of 10-15% TSS removal is adequate for BMP purposes. Based on the EPA National Pollutant Removal Performance Database issued in 2000, BMP treatment of "EPA TSS" requires several hours of detention and in some cases effluent filtration.
  - In most pretreatment chamber monitoring programs the TSS is not evaluated for gradation and composition (mineral and organic). There is usually no effort made to determine if the monitored TSS is representative of "EPA TSS".
  - In most cases there is no attempt to relate the test data to sedimentation science and sizing methodology.
  - In some cases the event was a "drizzle" that provided increased residence time and used dilution for treatment. There is no reliable way to relate this to the treatment process at stronger flow events.
  - There is not an evaluation in any of the cases of the ability to retain sediment during high flow events.