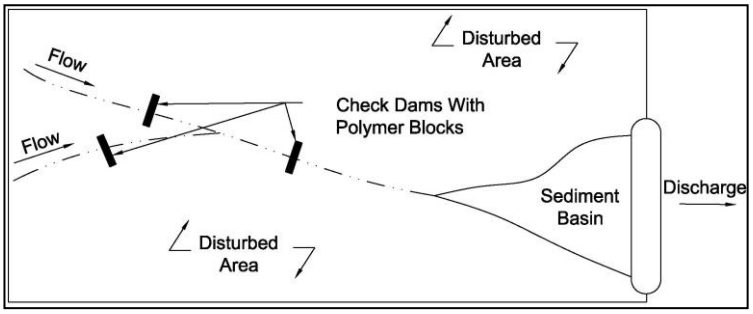
3.7 Passive Treatment System (PTS)

Sediment Control



Description: Passive Treatment Systems (PTS) consist of adding polymers to traditional sediment controls. The polymers act as a coagulant to cause flocculation of fine silts and clay soil particles that are not typically removed by the traditional controls. PTS devices include polymer gel socks, floc blocks, floc logs, and surface applications of powder or liquid polymers.

KEY CONSIDERATIONS

DESIGN CRITERIA:

- Install in flowing water upstream of sediment barriers
- Do not install at perimeter controls
- Select polymers based on soil type
- Closely monitor performance after storm events and adjust based on results

ADVANTAGES / BENEFITS:

- Less expensive and easier to operate than an ATS
- Capable of producing discharges with turbidity less than 280 NTU when applied and managed properly
- Improves removal of fine silt and clay particles from stormwater
- Reduces size requirements for a sediment basin
- May be used with dewatering devices

DISADVANTAGES / LIMITATIONS:

- Does not produce a predictable level of sediment removal
- Unknown levels of residual chemicals may be in discharges
- Trial and error often required to achieve high removal rates without off-site impacts

MAINTENANCE REQUIREMENTS:

- Inspect after every storm event
- Reapply and/or adjust locations after each storm event

TARGETED POLLUTANTS

- ● Sediment
- ○ Nutrients & Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

APPLICATIONS

Perimeter Control

Slope Protection

Sediment Barrier

Channel Protection

Temporary Stabilization

Final Stabilization

Waste Management

Housekeeping Practices

Fe=0.85

IMPLEMENTATION CONSIDERATIONS

- ◒ Capital Costs
- ● Maintenance
- ◒ Training
- ◒ Suitability for Slopes > 5%

Other Considerations:

- *Potential off-site impacts of over dosing*

3.7.1 Primary Use

Passive treatment systems (PTS) are used to remove fine silt and clay soil particles, for which traditional sediment controls are the least effective. These fine particles are small enough to pass through the pores or void spaces of sediment barriers. They are also not removed by sediment basins, because their settling velocities require a detention time of days or weeks, not hours.

3.7.2 Applications

Passive treatment systems are applicable on construction sites that have a large percentage of fine silt and clay soils. The site must have an internal system of berms, swales and control devices where the PTS can be applied.

A PTS functions similarly to an active treatment system (ATS); however, it trades lower cost for less consistency in removal rates. PTSs are applicable on sites where variability in the effluent characteristics is acceptable, such as where the discharge from the PTS will flow through a vegetated area before leaving the site, instead of directly to receiving waters. A PTS may also be a viable alternative to an ATS when the concentration of suspended solids in runoff is relatively low due to soil type or good erosion control measures on the site.

The systems are also applicable where discharge criteria are established for a construction site or discharges from a disturbed area have the potential to impact special aquatic sites or sensitive receiving waters. Examples of sensitive receiving waters include wetlands regulated under Section 404 of the Clean Water Act, spring-fed water bodies, water bodies with species protected under the Federal Endangered Species Act or the State of Texas Threatened and Endangered Species Regulations, or water bodies closely monitored by citizen groups.

3.7.3 Design Criteria

The passive use of polymers to enhance sediment removal is a relatively new and rapidly evolving science. The pace of new product development is expected to accelerate due to the demand that is being driven by the Effluent Limitation Guidelines and Standards for the Construction and Development Point Source Category, issued by the EPA on December 1, 2009. The following criteria are general guidelines. It is essential that the designer of controls for a construction activity develop the PTS specifications based on consultation with technical experts at the company supplying the polymer.

General

- Polymers are used for PTS function by altering the charge of soil particles to allow them to floc, or “clump” together. The flocs are then trapped as a soil mass by a traditional sediment control, instead of passing through pores or voids of the control as a suspended particle. This effect will more quickly clog the sediment barrier and require more frequent cleaning.
- Polymers are available in anionic (negatively charged), non-ionic (no charge), and cationic (positively charged) forms. The charged state of the soil to be treated should be known to specify the proper polymer. Clay soils are typically anionic.
- Numerous types of polymers are commercially available; however, polyacrylamide (PAM) and chitosan are effective and non-toxic in a wide range of applications. They are the safest for use in systems that are not being continuously monitored.
- Polymers are available in numerous formulations that will have varying rates of effectiveness depending on the soil type being treated. Jar tests may be used to determine the effectiveness of a particular formulation or to evaluate different formulations if the one being used is not producing the desired results. Jar tests should be conducted in accordance with ASTM D2035 Standard Practice for Coagulation-Flocculation Jar Test of Water.

- PTSs may produce fluctuating and unpredictable levels of residual polymer in stormwater discharged from the site. Either residual testing or the use of an ATS is advisable when an endangered, threatened, or other sensitive species is present in the receiving water.
- Areas downstream of the PTS shall be monitored for floc accumulation. Design is partially trial and error. The goal is to provide sufficient polymer to produce onsite settling of soil flocs while not providing excess polymer that results in a chemical residual being discharged to receiving waters.

Floc Blocks, Floc Logs and Gel Socks

- Floc blocks and logs contain a solid form of polyacrylamide (PAM), a polymer that acts as a flocculating agent.
- Gel socks are a soft powder form of chitosan, a polymer that acts as a flocculating agent, contained within a fabric sock.
- The PTS should only be used in flowing water that is concentrated in swales or pipes. The turbulence of flowing water is necessary for mixing the polymer with the suspended soil.
- Swales and channels, upstream of a sediment basin, stone outlet sediment trap, check dam or other detention structure are effective locations for the PTS. This location gives the polymer time to mix before velocities are slowed by the sediment control, where the newly formed flocs can be settled or filtered.
- Removal rates increase proportionally with the distance the PTS is installed upstream of the sediment barrier. Longer distances correlate to higher removal rates.
- The PTS should be secured in a non-biodegradable mesh bag or galvanized wire cage, which in turn is securely anchored in a swale, channel, or pipe.
- The PTS should be installed in a manner that elevates above the ground at least six inches to minimize the potential for it to be in standing water a prolonged period of time.
- During long periods (weeks) of no precipitation, the floc blocks or logs that contain PAM may degrade from exposure to air and sunlight. In these situations, the blocks or logs should be replaced before the next predicted storm event. Alternatively, they may be removed during drought conditions to prevent their degradation, and then re-installed at the first forecast of precipitation.

Powder or Liquid Polymer

- Powder or liquid polymer can be sprayed onto check dams, silt fences, organic filter tubes, and other permeable barriers. Polymer can also be sprayed onto filter fabric or erosion control blankets lining a swale. The polymer will mix with stormwater as it filters through of flows over the control.
- Polymer shall not be applied to perimeter controls, as this will result in flocs forming after the stormwater has been discharged from the site. Liquid polymer shall only be applied to sediment controls that are located within the disturbed areas and have a perimeter control or other sediment trap down slope to catch the flocs.
- Polymer should be re-applied after each storm event. If a long period passes between storm events, the polymer will break-down and should be re-applied.
- Liquid polymer may be injected into concentrated stormwater (swales, channels, etc.) upstream of sediment basins to improve the removal efficiency of the basin. The polymer is typically injected using a small metering pump that is calibrated for a pre-established dose based on the design flow for the temporary control design storm (2-year, 24-hour).
- Liquid polymer may also be injected into the pump intake of dewatering systems to provide a higher sediment removal rate for fine silt and clay soil particles. Criteria for dewatering are in *Section 3.3 Dewatering*.

3.7.4 Design Guidance and Specifications

No specification for construction of this item is currently available in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments.

3.7.5 Inspection and Maintenance Requirements

Passive treatment systems should be inspected regularly (at least as often as required by the TPDES Construction General Permit).

Floc blocks, floc logs, and gel socks should be checked after every storm event that produces stormwater runoff. Replace the PTS before it is completely dissolved. If the PTS is found to be submerged in standing water, it should be removed and re-installed at a new location where it will only be in contact with flowing stormwater.

The site's discharge points and downstream drainage infrastructure and water bodies should be inspected for accumulations of soil flocs. If flocs are found off the construction site, the PTS is not being implemented at a point where there is sufficient flow distance and time for polymer mixing and floc removal, or too much polymer is being used. The off-site floc accumulation must be removed if doing so will not negatively impact the receiving water. Then, the location or application of the PTS should be modified to provide additional mixing, more time for removal, or a lower dose, as applicable. If modifying the PTS is not possible, then an ATS may be needed to meet the discharge conditions for which a PTS was being used.