

STORMWATER FACILITY LOW GROUND PRESSURE MAINTENANCE TECHNIQUES

By Susan Giannantonio, P.E., CPESC, NTM Engineering, Inc.

As stormwater control facility designs have incorporated infiltration and filtration areas, permit plans have incorporated directions to “use low compaction techniques” and “protect the area from compaction” but there has been little clarification on what specific techniques are appropriate for construction and maintenance. Many of these features, formerly BMPs, now recently redefined as Stormwater Control Measures (SCMs) in the draft PA Post Construction Stormwater Management (PCSM) Manual, contain infiltration or filtration (i/f) surfaces that require special compaction (described tech sheet #224: Infiltrating and Filtrating Surfaces in Stormwater Facilities)



Many SCM types have infiltration or filtration surfaces that require special low ground pressure equipment such as the bioretention area pictured here.

Low Ground Pressure (LGP) techniques are a set of construction and maintenance standard procedures and equipment requirements that minimize ground compaction. Minimizing compaction is a critical component to protecting SCMs with infiltration or filtration components.

LGP Equipment Criteria

To be considered LGP equipment, construction and maintenance equipment entering an i/f SCM must meet *weight*, *tire tread*, and *tire pressure* criteria.

The equipment must *weigh* under 5 tons per axle, including all attachments and material weights. Many pieces of equipment have uneven weight distribution between axles. Original manufacturer information can be referenced to confirm the maximum weight on each axle.

Tires should be low *tread* designs such as “Turf Tread” tires (smoother/non-aggressive tread). Note that different tread patterns result in more or less grip on the surface and equipment may handle differently with turf tread tires in comparison to more aggressive tread patterns, particularly on slopes.

Equipment tire *pressure* should be no more than 7 psi with the exception of mowing equipment. While 7 psi max is the recommended maximum tire pressure, mowing equipment that meets these requirements may be cost prohibitive. When mowing equipment meeting the 7 psi maximum tire pressure is not available, mowers must be operated at the lowest psi possible with an absolute maximum of 20 psi tire and 5 psi track. Be aware the less-than-5 ton/axle weight still applies and ideally all mowing equipment will be less than 1,000-pound total weight. Tires must be operated within the recommended operation range from the tire manufacturer; simply lowering the pressure to 7 psi creates a serious safety risk. Some equipment may require dual or triple tire arrangements to safely carry the vehicle loading using low-pressure tires. Track equipment must be configured to maintain a maximum of 5 psi loading. Tracked equipment often apply uneven and high point loads when traversing uneven ground. Consult the manufacturer for equipment loads.



LGP Equipment may use double- or -triple-axle wheel arrangements to carry the equipment load safely using low pressure tires like this Ventrac.

LGP Techniques

Following some fairly simple special procedures during construction and service life maintenance activities will protect i/f SCMs from inadvertent damage. The following techniques are presented in a generally preferred order of implementation. Some of these only apply to construction or rehabilitation, not routine mowing activities as noted.

Dry: No equipment should enter any type of SCM when the surface is not dry. This applies to both SCMs with and i/f surface and those without. Any SCM can be damaged by equipment entering when the surface is moist. Typically, an SCM storage area

is designed to empty within 72 hours after rain. However, the soil in the SCM remains moist for some time thereafter. For the soil to dry, additional time is needed which varies based on temperature, soil type, and other factors. In general, a minimum of 5 to 6 days after the last rain is a good approximation of when an SCM is considered to be dry. The soil should be firm to walk on and a soil probe of the top 5 inches should be dry.

Erosion and sediment protection: I/f surfaces are extremely sensitive to clogging if sediment laden flows enter the area. Although this is not a compaction issues, i/f surface clogging is one of the most common causes of total i/f SCM failure. Throughout construction and service life, whenever earth disturbance occurs within the drainage area of the SCM always install erosion and sediment protection as described by the PADEP Erosion and Sediment Pollution Control Program Manual Publication #363-2134-008 (PADEP E&S Manual).

Work from the outside: Where possible, all work should be performed with equipment operating from the outside of the SCM. Examples include: boom arm mowers may reach from the outside into narrow SCMs; long-reach excavators located outside the SCM may reach in to place materials or remove sediment.



Working from the outside of infiltration/filtration surfaces prevents compaction to the surface. Equipment like this boom arm mower can be used in this fashion.

Use Lightest Equipment Possible: First assess if handheld equipment is adequate to complete the task, then move to smaller powered equipment (meeting LGP Equipment requirements) using handheld tools such as string trimmers in place of larger tractors where the size of the area reasonably allows.

Minimize Entrance Frequency: By minimizing the total number of times equipment of any type enters an i/f SCM, the probability of damage is decreased.

Non mowing activities – Follow same wheel path: Where multiple trips are needed, follow the same wheel tracks to traverse the SCM to minimize the amount of area impacted.

Use Cell Construction: When equipment cannot reach from the outside, construction and rehabilitation activities may use a cell construction approach. In this method, the SCM is divided into

500- to 1,000-square-feet. temporary cells with a 10- to 15-foot wide earth bridge in between each cell. Earthen bridges must be a minimum of 3 feet higher than the SCM i/f surface when non-LGP equipment must be used. The area within each cell is then excavated from the earthen bridges without compacting the final SCM surface. Once all cells are completed, the earthen bridges are removed with equipment working from the inside out such that the equipment never traverses the final SCM surface.

Place Matting: When neither working from the side or cell construction approaches work, matting can be a place for equipment to access the SCM surface. Matting must spread the equipment load to a maximum of 7 psi pressure in contact with the ground surface below. An example that may be suitable for some equipment is the timber or wood matting used for wetland crossings depicted in the PADEP E&S Manual.

Assess infiltration capacity: At the end of construction or repair work that could potentially impact i/f function, the area can be inspected for signs of compaction. This can include a variety of methods. Most simply, visually looking for tire rutting or other signs of damage. Performing a visual inspection 72 hours* after a significant rainfall to confirm the SCM is emptying in this timeframe (*note- confirm SCMs designed time to fully empty; this is typically 72 hours maximum but some may be as long as 7 days per original design). Another alternative is to perform formal infiltration testing such as a double ring infiltration test procedure.

Mowing Specific Techniques

Routine mowing is the most frequent activity for most SCMs throughout their service life and proper performance of this is a critical part of maintaining functionality.

Dry: Mowing should occur when the SCM surface is completely dry. This is approximately 5 to 6 days after the last rain.

Trash Removal: Trash must be removed from the SCM prior to mowing. Small objects like plastic bottles can quickly clog SCM outflow orifices. Mowing trash leaves trash fragments that will still cause serious blockages leading to potential flooding, function, and safety issues.



Trash removal prior to mowing is a critical step in the SCM mowing process.

No-Mow Landscaping: Some SCMs such as bioretention areas, are planted with shrubs, trees and perennials that are not intended to be mowed. Prior to mowing, check for and mark the locations of these to avoid inadvertently mowing them.

Hand-held and Small Equipment: Use the smallest piece of equipment possible. For small SCMs, string trimmers or push mowers are recommended. Larger SCMs may be mowed with small riding mowers (1,000 pounds or less ideally) and have no extra attachments installed while operating on the SCM bottom surface. Equipment must be fitted with LGP tire configurations described above.



The lightest equipment appropriate for the work should be used on infiltration/ filtration surfaces. Hand-helds like string trimmers are a good choice for vegetation maintenance.

Vary wheel path for mowing: Unlike construction and repair activities, mowing occurs on a regular basis. The equipment is much lighter than the types of equipment used during construction and repair activities. The vegetation within the SCM will help heal minor compaction that may occur over time. By varying the mowing pattern, the loading is more evenly spread over time, allowing natural vegetation growth to mitigate the equipment impact to the i/f surface.

Avoid Scalping: Hand-held and mowing equipment can inadvertently cut areas of vegetation too short or to bare ground. Be aware of minor variations in the ground surface that would result in the mower or string trimmer leaving less than three inches of vegetation height.

Avoid wheel/track slippage: Mowers, particularly zero turns, can tear vegetation during turning maneuvers resulting in bare spots and damaged vegetation. Turn slowly, use a wider radius and do not allow wheel slippage to avoid ripping and damaging vegetation.

Grass Clippings: Excessive and clumped grass clippings in SCMs can damage vegetation and clog outlet structures resulting in flooding. Grass should be dry before mowing to allow for proper dispersal of clippings. Any clumps that form should be removed or

thoroughly broken up and dispersed. A properly maintained SCM should not require clippings to be collected. If excessively high vegetation is cut leaving clippings that could smother vegetation or clog outlet structures, clippings should be removed from the SCM. Do not allow grass clippings to enter wet pools.



Zero-turn mowers with low PSI turf tread tires may be used to mow larger SCMs. Avoid maneuvers that damage vegetation like sharp turns and tire slippage.