

Sinkhole Maintenance, Inspection and Repair Plan:

- PCSM design considerations for karst areas were taken into account when designing PCSM facilities on this project. Initial site assessments, buffer zones, minimizing earth disturbance, and stormwater management BMP considerations for karst topography was utilized in areas of known surface depressions, sinkholes, and underlying carbonate rock. BMP considerations include the use of a 3:1 ratio of impervious area to infiltration area, the design of multiple stormwater BMP's which utilize broad and shallow flow dispersion techniques to reduce concentrating flow, and managing and maintaining a hydrologic water balance within karst areas.
- In areas of known karst terrain, stormwater BMPs shall be inspected at regular intervals of at least once every quarter for the first two years following installation and then at regular periods thereafter. Inspections shall also be made after every storm event greater than 1 inch during the establishment period. Inspections shall consist of an examination of any noticeable subsidence, surface depressions, or sinkholes. Inspections shall include an evaluation of all inlet and outlet structures and document any areas to be cleaned, maintained, or repaired.
- Maintenance of the stormwater BMP includes cleaning inlet and outlet structures and piping, removal of trash and debris, mowing, planting, pruning and removal of vegetation. Pay specific attention to the integrity of piping of all types. Evidence of a pipe leakage or sagging should be immediately repaired. When performing maintenance and cleaning activities, minimize all earth disturbance to the greatest extent practicable.
- **If a sinkhole develops within a stormwater BMP, the following measures must be taken into account immediately:**
 1. Report the occurrence to the appropriate Pennsylvania DEP District Office and additional plan approving authorities upon discovery.
 2. Secure the sinkhole area and direct surface water away from the sinkhole area, if possible to a suitable storm drainage system.
 3. Communicate proposed remediation plan to the plan approving authorities.
 4. Determine the depth and size of the sinkhole and determine whether the sides and bottom are stable. The type of repair chosen for any sinkhole depends on its location, the extent and size of the void, and the type of infrastructure planned for the sinkhole area. All sinkhole remediation activities should be done under the direct supervision of a geologist, or geotechnical engineer within experience in limestone/carbonate rock investigations and remediation practices.
 5. Use geophysical testing, field determinations, and site evaluations, and geotechnical borings to determine whether the area is stable and whether there is potential for additional ground subsidence or instability.
 6. For very small, stable sinkholes:
 - a. Fill sinkhole with soil and restore ground cover
 7. For larger sinkholes:
 - a. Investigate and evaluate the sinkhole to determine the most effective repair approach.
 - b. Large sinkholes will require a filling operation. Excavation down to stable rock may be necessary. Fill with layers of rock, gravel, grout (if deemed appropriate), soil, and restore ground cover.

8. In some instances, it may be necessary to remove, relocate, or redesign the stormwater management structure to prevent further karst losses. Any revisions or repairs that may alter the stormwater management structure must be approved by the PA DEP and/or additional plan approving authorities.

TYPICAL KARST REPAIR DETAIL

