

## BMP C205: Subsurface Drains

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| <b>Purpose</b>                                | To intercept, collect, and convey ground water to a satisfactory outlet, using a perforated pipe or conduit below the ground surface.<br>Subsurface drains are also known as “french drains.” The perforated pipe provides a dewatering mechanism to drain excessively wet soils, provide a stable base for construction, improve stability of structures with shallow foundations, or to reduce hydrostatic pressure to improve slope stability.  |
| <b>Conditions of Use</b>                      | Use when excessive water must be removed from the soil. The soil permeability, depth to water table and impervious layers are all factors which may govern the use of subsurface drains.   |
| <b>Design and Installation Specifications</b> | <p><b>Relief drains</b> are used either to lower the water table in large, relatively flat areas, improve the growth of vegetation, or to remove surface water.</p> <p>Relief drains are installed along a slope and drain in the direction of the slope.</p> <p>They can be installed in a grid pattern, a herringbone pattern, or a random pattern.</p> <ul style="list-style-type: none"><li>• <b>Interceptor drains</b> are used to remove excess ground water from a slope, stabilize steep slopes, and lower the water table immediately below a slope to prevent the soil from becoming saturated.</li></ul> <p>Interceptor drains are installed perpendicular to a slope and drain to the side of the slope.</p> <p>They usually consist of a single pipe or series of single pipes instead of a patterned layout.</p> <ul style="list-style-type: none"><li>• <b>Depth and spacing of interceptor drains</b> --The depth of an interceptor drain is determined primarily by the depth to which the water table is to be lowered or the depth to a confining layer. For practical reasons, the maximum depth is usually limited to 6 feet, with a minimum cover of 2 feet to protect the conduit.</li><li>• The soil should have depth and sufficient permeability to permit installation of an effective drainage system at a depth of 2 to 6 feet.</li><li>• An adequate outlet for the drainage system must be available either by gravity or by pumping.</li><li>• The quantity and quality of discharge needs to be accounted for in the receiving stream (additional detention may be required).</li><li>• This standard does not apply to subsurface drains for building foundations or deep excavations.</li></ul> |

- The capacity of an interceptor drain is determined by calculating the maximum rate of ground water flow to be intercepted. Therefore, it is good practice to make complete subsurface investigations, including hydraulic conductivity of the soil, before designing a subsurface drainage system.
- **Size of drain**--Size subsurface drains to carry the required capacity without pressure flow. Minimum diameter for a subsurface drain is 4 inches.
- The minimum velocity required to prevent silting is 1.4 ft./sec. The line shall be graded to achieve this velocity at a minimum. The maximum allowable velocity using a sand-gravel filter or envelope is 9 ft/sec.
- Filter material and fabric shall be used around all drains for proper bedding and filtration of fine materials. Envelopes and filters should surround the drain to a minimum of 3-inch thickness.
- The outlet of the subsurface drain shall empty into a sediment pond through a catch basin. If free of sediment, it can then empty into a receiving channel, swale, or stable vegetated area adequately protected from erosion and undermining.
- The trench shall be constructed on a continuous grade with no reverse grades or low spots.
- Soft or yielding soils under the drain shall be stabilized with gravel or other suitable material.
- Backfilling shall be done immediately after placement of the pipe. No sections of pipe shall remain uncovered overnight or during a rainstorm. Backfill material shall be placed in the trench in such a manner that the drain pipe is not displaced or damaged.
- Do not install permanent drains near trees to avoid the tree roots that tend to clog the line. Use solid pipe with watertight connections where it is necessary to pass a subsurface drainage system through a stand of trees.
- **Outlet**--Ensure that the outlet of a drain empties into a channel or other watercourse above the normal water level.
- Secure an animal guard to the outlet end of the pipe to keep out rodents.
- Use outlet pipe of corrugated metal, cast iron, or heavy-duty plastic without perforations and at least 10 feet long. Do not use an envelope or filter material around the outlet pipe, and bury at least two-thirds of the pipe length.
- When outlet velocities exceed those allowable for the receiving stream, outlet protection must be provided.

***Maintenance Standards***

Subsurface drains shall be checked periodically to ensure that they are free-flowing and not clogged with sediment or roots.

- The outlet shall be kept clean and free of debris.
- Surface inlets shall be kept open and free of sediment and other debris.
- Trees located too close to a subsurface drain often clog the system with their roots. If a drain becomes clogged, relocate the drain or remove the trees as a last resort. Drain placement should be planned to minimize this problem.
- Where drains are crossed by heavy vehicles, the line shall be checked to ensure that it is not crushed.