MARYLAND
DEPARTMENT OF THE ENVIRONMENT

Construction Inspection of SWM BMPs "Best Management Practices"

Why is it critical?

Role of the construction inspector

- Inspector is responsible for making sure that facilities are constructed using the appropriate materials and means and methods.
- Must ensure designers intent as well as standard construction practices are followed.
- Inspector may or may not also be responsible for materials testing and recording, if not, inspector is responsible for ensuring that appropriate personnel are on hand to perform those duties, and are competent at the task.
- Inspectors typically do not perform survey work, but make sure the survey work gets done.

MARYLAND

Consultants

- Depending on the terms of the contract, the project may utilize an engineering consultant to perform the more technically oriented inspections. Soil testing, concrete sampling and testing, inspection of reinforcing steel and formwork, soil bearing capacity, surveying, etc.
- The consultant may also perform the duties of the inspector in some cases.

MARYLAND

Consultants

- In addition to the technical testing and inspection tasks, the consultant may also collect and verify materials and delivery tickets, document and account for material quantities, provide guidance and oversight of site management (ensuring sensitive areas are protected, holding contractor to sequence, etc.)
- The division and scope of responsibilities must be defined prior to project startup. If not defined in the contract documents, the pre-construction meeting is the time to work these details out and get them into the record.

Inspectors/Consultants

- **Scope of authority- typically consultants do not have the authority to "stop work", only to advise and document. However, in some cases the consultant may be assigned this authority. In the case of particularly time sensitive or "limited shelf life" operations (pervious concrete as an example), someone directly involved with the placement needs to have the authority to reject product or stop the pour if things are going wrong.**

MARYLAND

Weather/Environmental Factors

- When dealing with earth and water, weather patterns and events can have a significant influence on the quality and cost of a project.
- Work during cold weather adds challenges such as inability to stabilize disturbed areas, wet work areas (low temps, low sun angle, rain/snow events, seasonally high water table), freezing of materials, and availability of materials (asphalt based permeable pavements, plant and nursery stock), while work during the hot and dry season has challenges such as high temp concrete curing control, sudden summer storms, and plant stock protection.

MARYLAND

Weather/Environmental Factors

- **Inspectors need to be aware of the hazards associated with working with frozen ground/soils and the effect of low and high temps on materials such as concrete and permeable pavement systems.**

Earthen dams/embankments

- The ability of an earthen dam/embankment to resist the forces acting upon it is assured by proper construction methods and materials.
- Ensure that soils used meet the specifications laid out for the project. In Maryland, that is the MD-378 specification for earthen embankment construction. Using the wrong soil type in an embankment is a recipe for infiltration and piping due to permeability, and may not provide the structural integrity required and attained by using the specified materials. This applies to the embankment cut-off trench as well as the impervious core and embankment shell.

MARYLAND

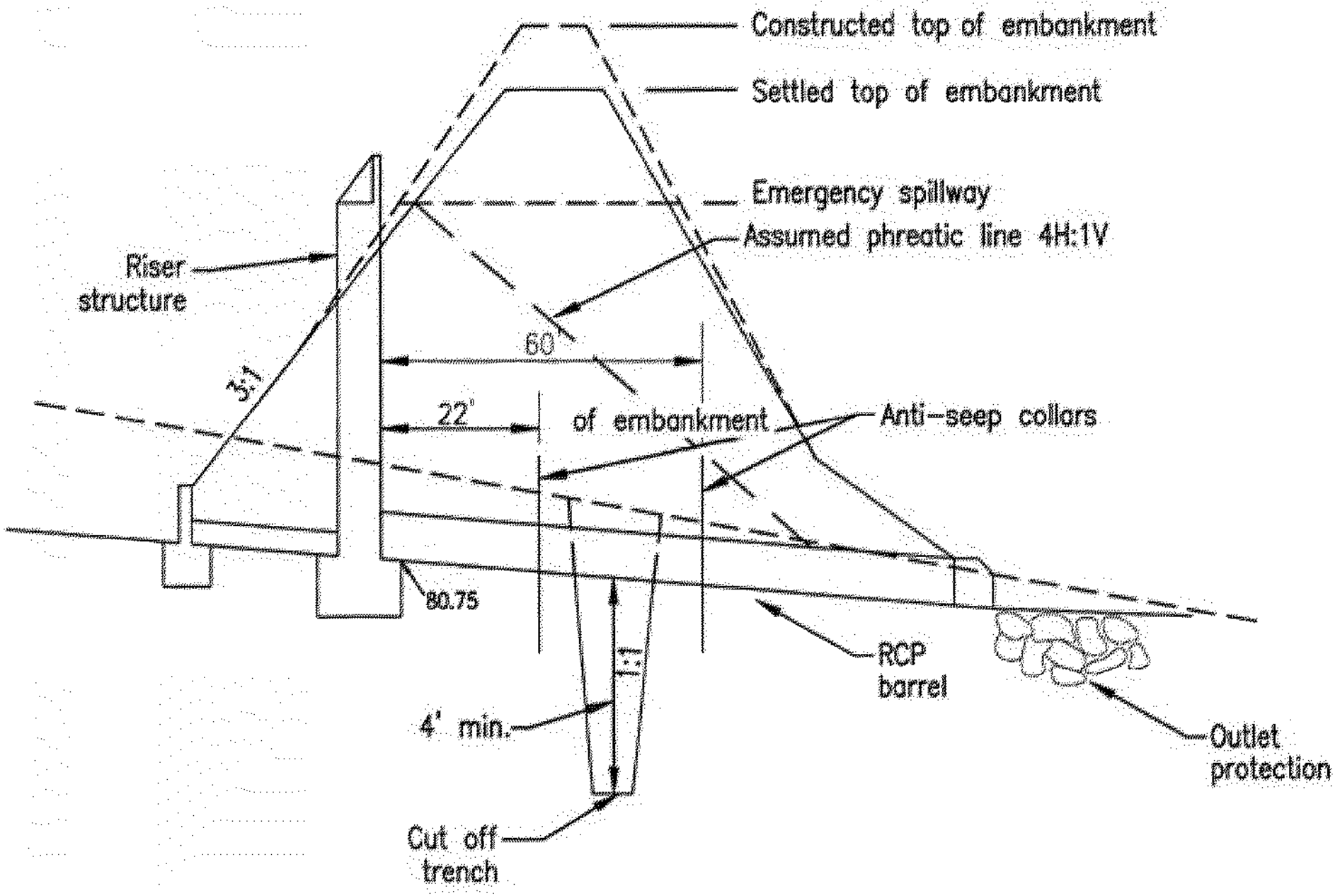
Piping Failure

Cutoff Failure

- Failure of cut-off trench to intercept in-place impervious soils. The cut-off trench is an impervious barrier intended to stop water from flowing under the constructed embankment. It should extend from the existing ground level down a minimum of 4' OR to where it intercepts an impervious soil layer. If water can find a path under the constructed embankment, the embankment foundation can become unstable as it becomes saturated. If the water path leads to daylight downstream of the embankment, loss of material carried by this flow can result in voids under the embankment leading to failure.

MARYLAND

Typical Embankment Profile



Spillway Construction

- **Post embankment construction spillway installation- it used to be common practice to construct the embankment, then come back and cut through it to install the spillway pipe. This is a poor practice that is specifically prohibited by the MD-378 spec, as it results in a non-contiguous embankment, and will create a weak area relative to the rest of the embankment, and a potential failure area. However, it is still seen on rare occasions when specifically planned and designed for, typically to replace a principal spillway pipe.**

MARYLAND

Spillway Repair

- **This is only permitted under the direct supervision of a geo-technical engineer due to the inherent risks of the practice. But some contractors may try it if proper oversight is not provided.**

MARYLAND

Failure to verify bearing capacity

- **Verify control structure footing bearing capacity**

Filtering Practices (LID/ESD)

- Practices intended to filter runoff from small drainage areas (less than 1 acre)
- Use is intended to mimic natural runoff distribution.
- Practices may utilize infiltration to recharge groundwater, or underdrain conveyance if soils do not support infiltration.
- Practices include submerged gravel wetlands, landscape infiltration, micro-bioretention, dry wells, rain gardens, infiltration berms, swales, enhanced filters, and permeable surfaces.

MARYLAND

Failure Modes

Why Do They Fail???

- Infiltration practice construction problems

1. Soils are not compatible with infiltration (verify in-situ soils match design requirements)
2. Soils within BMP have been compacted by traffic/equipment (document isolation of BMP footprint/protected from traffic)
3. Water table is higher than anticipated (presence of water at facility invert)
4. Soils within BMP have clogged with fines (verify that runoff is directed around excavation)
5. Construction practices “seal” in-situ soils

MARYLAND

Why Do They Fail???

- Filtering practice construction problems

1. Use of geotextiles on facility invert or between layers. Practice has been abandoned.
2. Use of unwashed aggregates- fines in aggregate lead to clogging.
3. Use of inappropriate/incorrect aggregates (manufactured sand for example)
4. Planting media does not meet specification (slow to de-water)
5. Filter media contaminated by sediment laden runoff during or after construction.

MARYLAND

Bad Stuff


Fix 1: Geotextile as separation, only on top*
* - note the return up the sides; this was not intended

Bad Stuff


Failure 2: Flat geotextile created 'perched water table'
07/10/2013 10:43

Bad Stuff

MARYLAND

Bad Stuff

Bad Stuff

Bad Stuff

MARYLAND

Bad Stuff

Structural Bad Stuff

Structural Bad Stuff

MARYLAND

Structural Bad Stuff