Basic Pond Terminology & Construction

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CHAPTER 6

Post Construction

Stormwater Management

Basic Pond Terminology

Pond Configurations

Dry Pond

Dry Pond

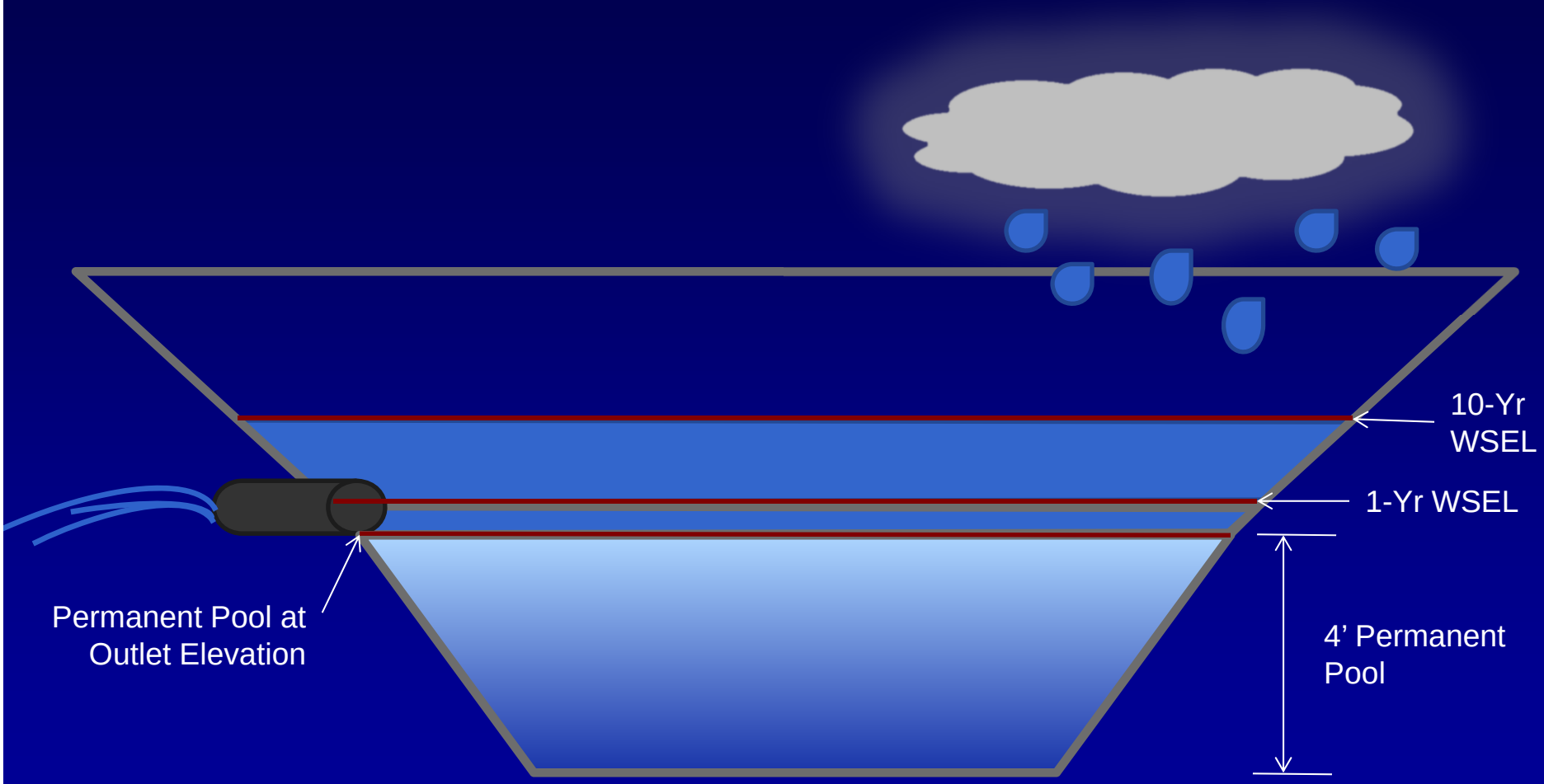
10-Yr
WSEL
1-Yr WSEL
0.5 % Slope to Outlet
Outlet Elevation at
Bottom of Pond
No Permanent Pool

Dry Pond

Outlet Elevation at
Bottom of Pond
0.5 % Slope to Outlet
No Permanent Pool

Wet Pond

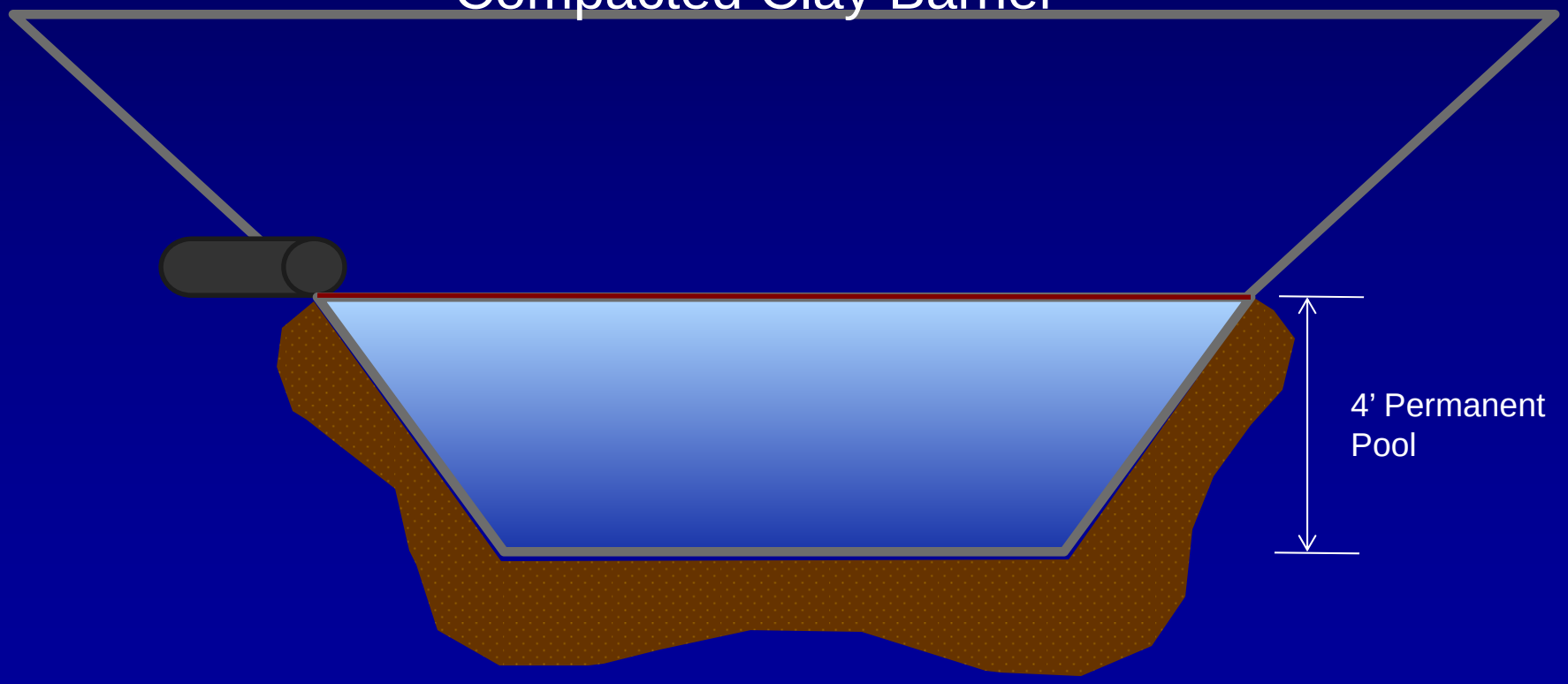
Wet Pond


10-Yr
WSEL
1-Yr WSEL
Permanent Pool at
Outlet Elevation
4' Permanent
Pool

Wet Pond

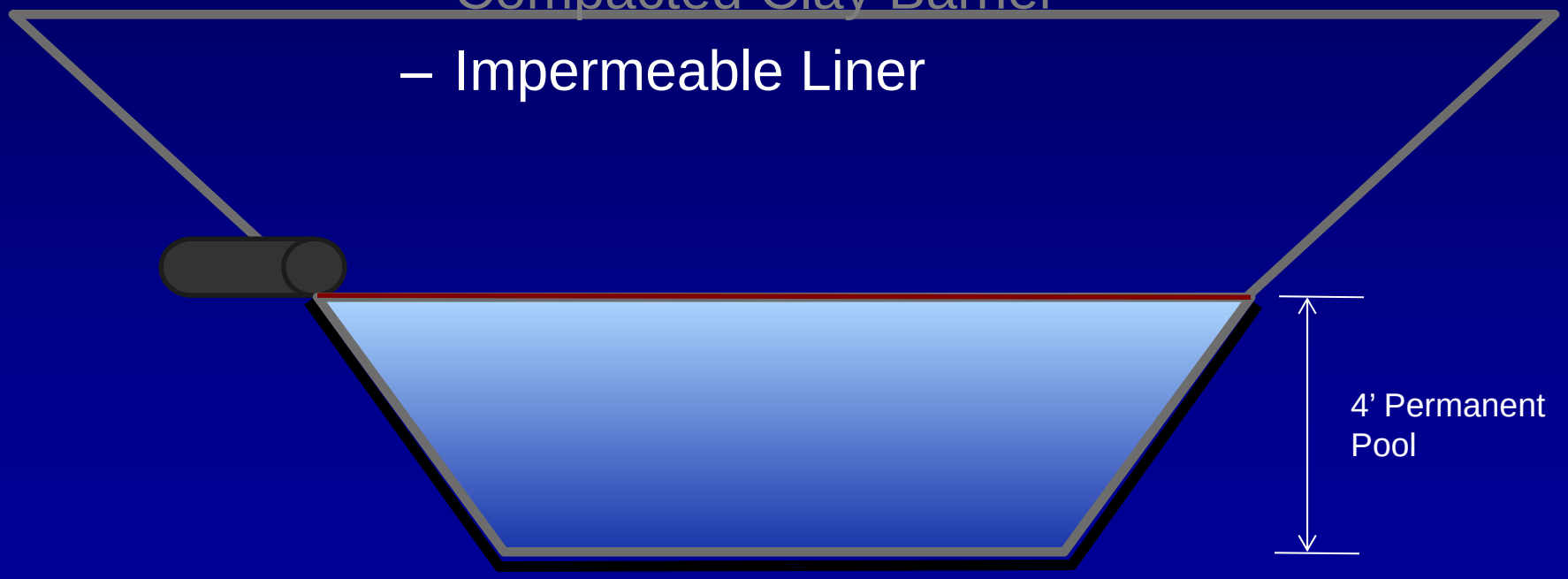
Wet Pond

- Three ways to Maintain a Permanent Pool Elevation:
  - Compacted Clay Barrier



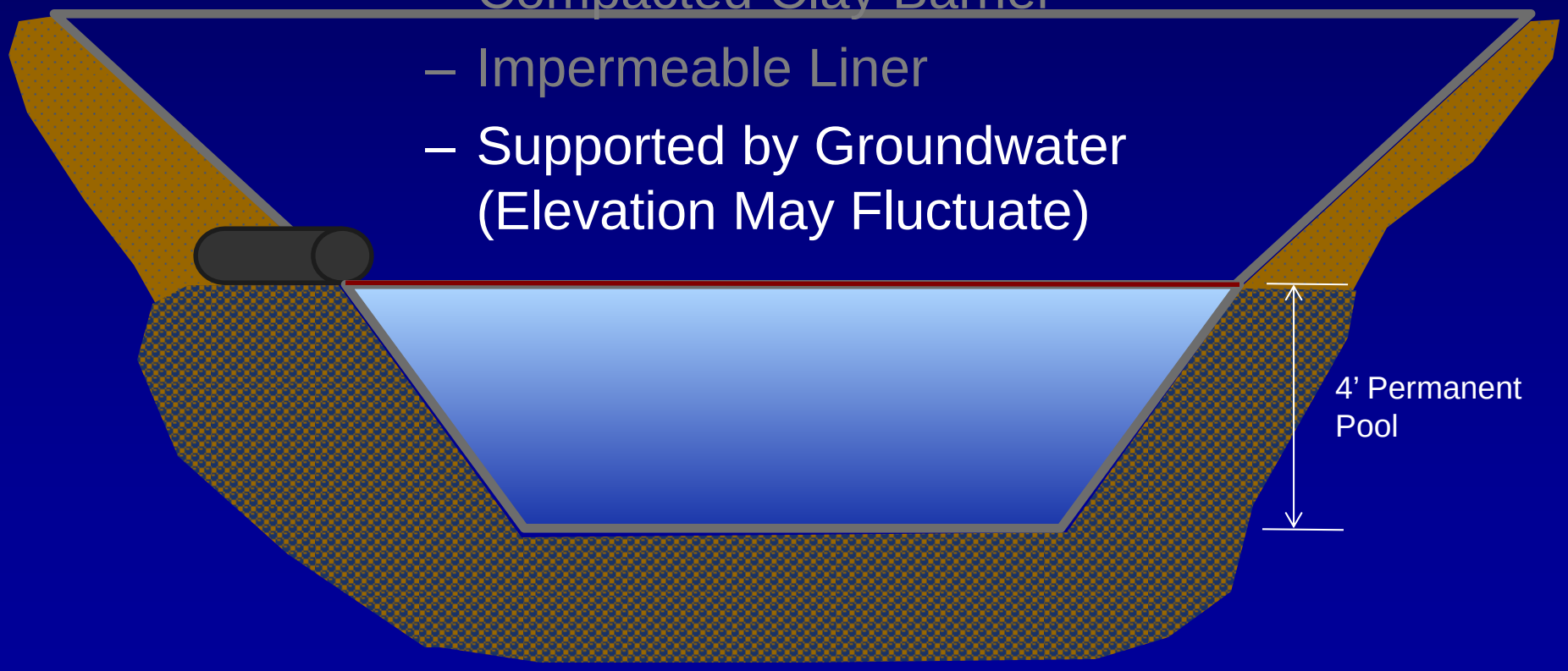
Wet Pond

- Three ways to Maintain a Permanent Pool Elevation:
  - Compacted Clay Barrier
  - Impermeable Liner



Wet Pond

- Three ways to Maintain a Permanent Pool Elevation:
  - Compacted Clay Barrier
  - Impermeable Liner
  - Supported by Groundwater (Elevation May Fluctuate)



NRCS Pond Code 378

USDA, Soil Conservation Service
_____, Delaware
(Field Office)

Technical Guide
Section IV
September 1990

378-1

POND

Code 378

Definition

A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at spillway elevation is 3 ft or more. The depth of water impounded is defined as the difference between the spillway inlet elevation and the channel elevation at the point of discharge.

Purpose

To provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses, and to maintain or improve water quality. This standard also applies to stormwater management ponds that are not within the scope of SCS Technical Release No. 60.

NRCS Pond Code 378 Pond Definition

- A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

Types of Ponds

- Embankment
- Excavated
- Combination embankment/ excavated

Embankment Ponds

Classified as embankment ponds if the depth of water impounded against the embankment at spillway elevation is 3 feet or more.

NRCS Pond Code 378 Components

- Design Specification
- Construction Specification
- Appendix A: Hazard Classification
  (for Dam Failure)
- Appendix B: Urban Stormwater Management Ponds

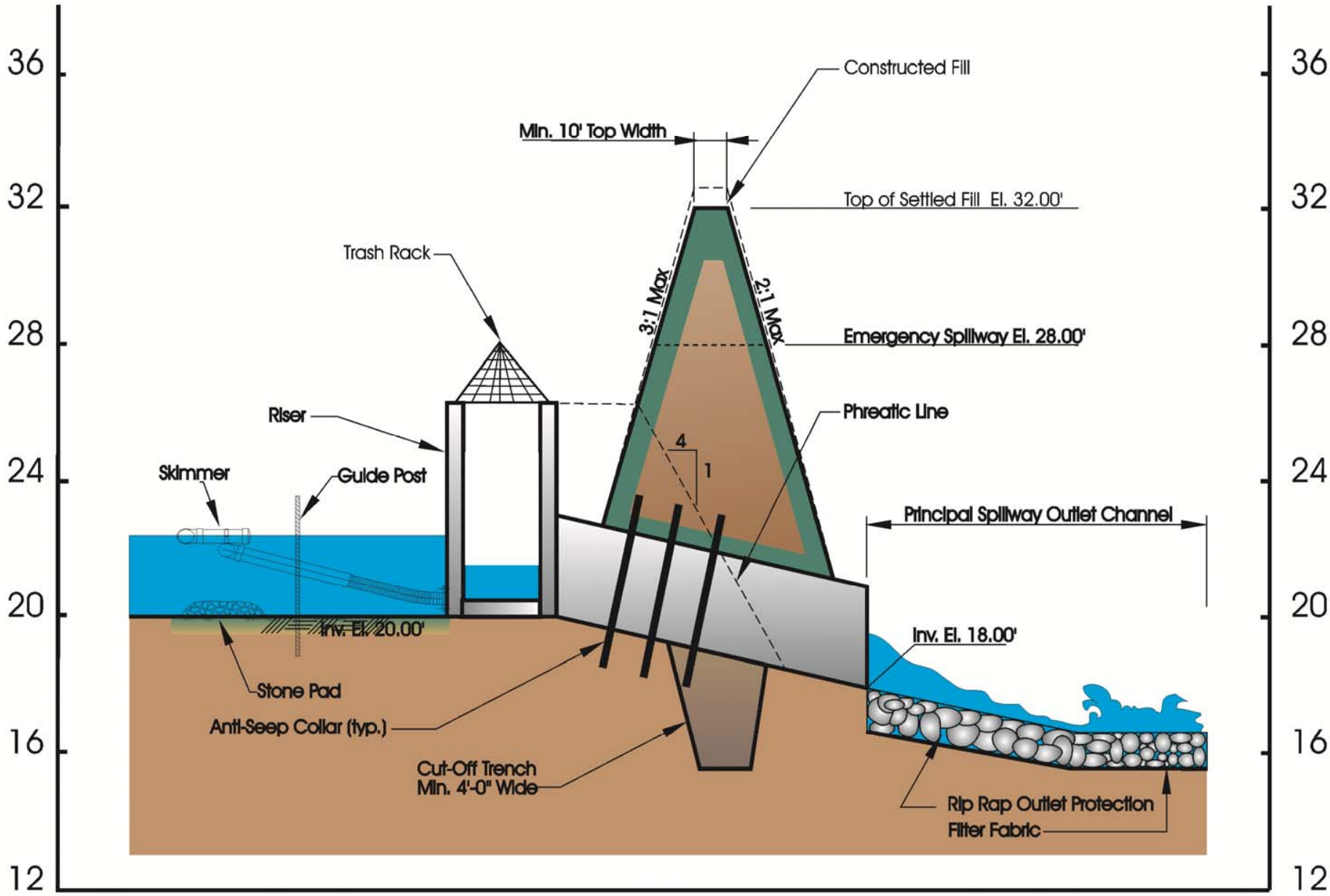
Pond Code 378
Design Specification

- Embankment Design Criteria
- Pond Slopes
  - 3:1 with 10’ Bench 1’ Above and 1’ Below Permanent Pool
  - 4:1 with 10’ Bench 1’ Below Permanent Pool
- Outfall pipe
- Emergency Spillway configuration

Pond Code 378 Construction Specification

- Embankment Construction
  - Foundation Preparation
  - Proper Fill Placement
  - Minimum Compaction Requirements
  - Erosion Protection / Vegetation
- Principal Spillway Construction
- Concrete specifications

Pond Structural Components and Construction

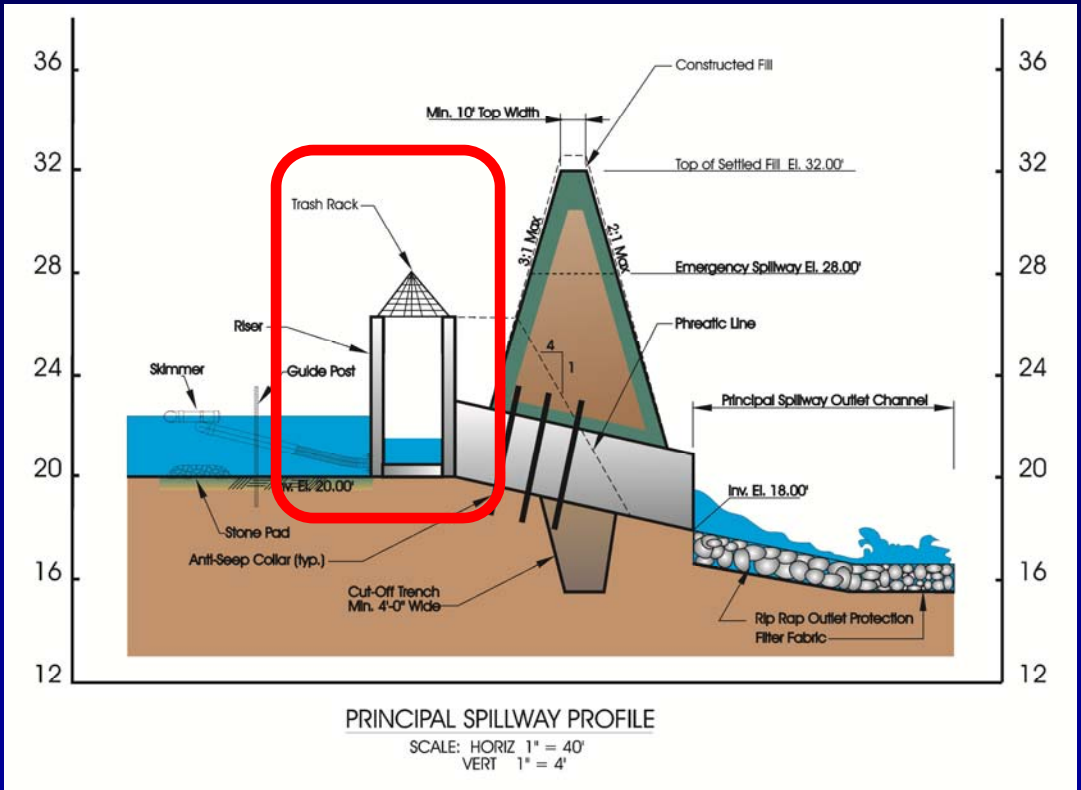


PRINCIPAL SPILLWAY PROFILE

SCALE: HORIZ 1" = 40'
VERT 1" = 4'

Principal Spillway

- Also called “outfall structure” or “outlet structure”
- Pipe Riser Structure
  - CMP Riser
  - Modified Catchbasin (Pre-Cast or Cast in Place)
- Concrete Weir



Principal Spillway

Modified Catchbasin

Corrugated Metal Pipe (CMP) Riser

Principal Spillway

Concrete Weir Structures

Principal Spillway
Pre-Cast

- Dry, stable subgrade
- Spread footer, as needed
- Gasket if more than one section
- Water-tight connection for pipe
- Structure delivered with correct openings!
- Installed to correct elevations

Principal Spillway
Poured in Place

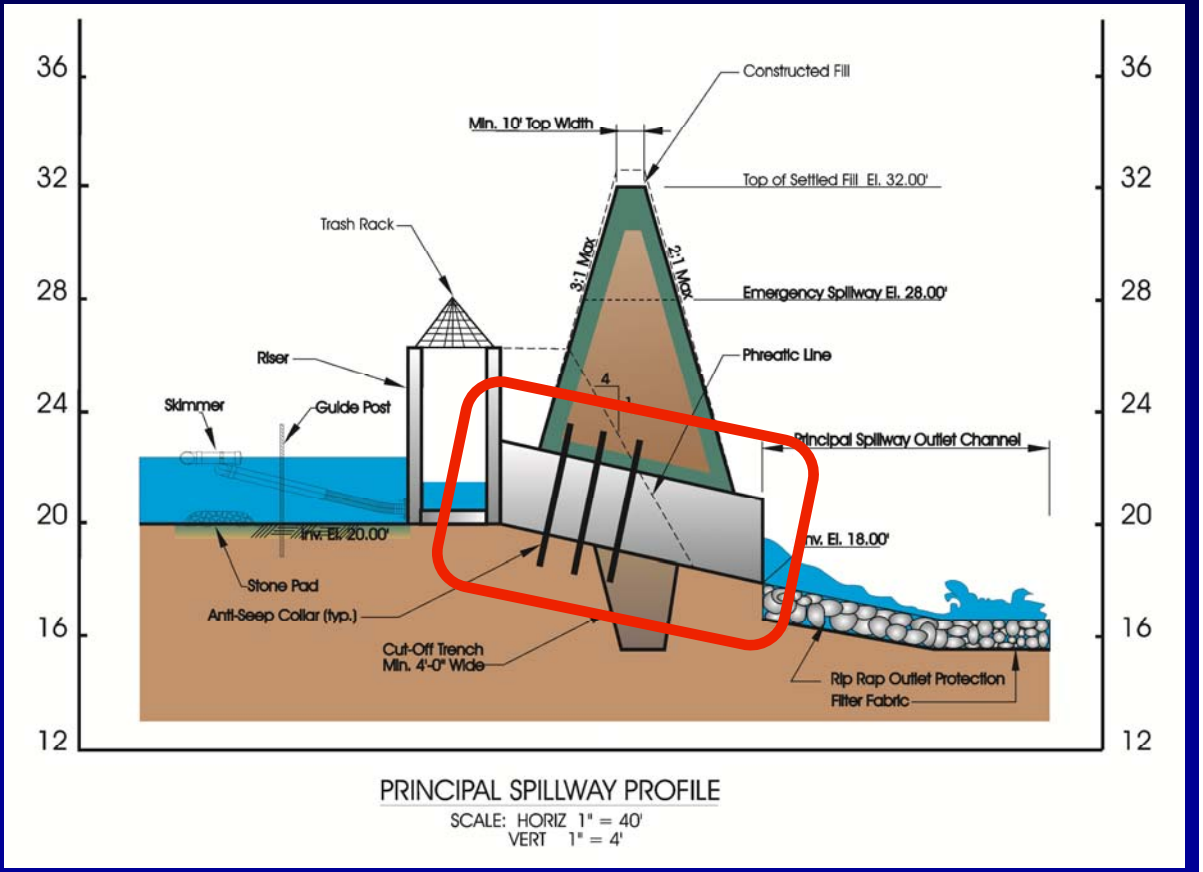
- Footing on dry, stable sub-grade
- Reinforcing steel tied into footing
- Concrete evenly distributed within forms (preferably vibrated)
- Concrete checked for “honeycomb” prior to backfilling, parge if necessary

Principal Spillway
Metal Riser

- Dry, stable subgrade
- Base plate secured in concrete riser base
- Set to correct elevations

Outfall

- Barrel or pipe:
  - Connects pond to discharge location
- Anti-Seep Collars:
  - Prevents water from travelling around outside of pipe, creating a failure point



Outfall Barrel and Anti-Seep Collars

Outfall Barrel and the Anti-Seep Collars are ALWAYS made of the SAME MATERIAL and must have a WATERTIGHT CONNECTION.

Outfall Barrel
Bed Preparation

- Stable, uniform, dry subgrade
- 1:1 sideslopes on trench
- Subgrade at proper elevation & grade
- Excavate full width of anti-seep collars, especially for concrete pipe

Outfall Barrel
Installation

- Start at low point and work upwards
- Check grades often
- ALWAYS install spigot end into bell

Outfall Barrel

Gaskets

- Keep gaskets clean
- Lubricate gasket after installing on pipe
- Both for HDPE and Concrete pipes

Outfall Barrel
Concrete Pipe

- 8” Concrete Cradle Underneath Pipe
- Pipe Supported with Blocks for Pouring of Cradle
- Reinforcing Steel for Anti-Seep Collar
- Monolithic Pour of Cradle and Lower Half of Anti-Seep Collar

Outfall Barrel
Concrete Pipe Block Support

- Two solid 8” blocks per barrel
- Set mid-barrel, not at ends
- Creates 8” lift necessary for cradle
- Blocks set on grade by laser

Outfall Barrel

Concrete Pipe Anti-Seep Collars

- Minimum 1’ wide form
- Minimum 2’ projection
- Hand or mechanical excavation for collar depth below pipe
- Minimum #6 rebar
- Three vertical bars per side with min. 6” spacing
- Two horizontal bars both above and below pipe

Outfall Barrel
Concrete Pipe Cradle

- Recommended 4500psi Hi-Early
- Make sure concrete gets under pipe
- Pour to springline of pipe
  - 9 and 3 position
- Slump of concrete needs to be 2 (stiff)
- Continuous pour
  - have 2nd truck on site when you start pouring

Outfall Barrel

Concrete Pipe, Top of Anti-Seep Collar

- Greased keyway block (4”x4”x2’) set into lower cradle to form keyed connection for top half
- Placed on one side of rebar
- REMOVE block prior to pouring top half of collar

Outfall Barrel

Concrete Pipe, Top of Anti-Seep Collar

- Form adequately braced internally and externally

Outfall Barrel

Concrete Pipe, Top of Anti-Seep Collar

- Rod concrete during pour to make sure it is evenly distributed
- Match concrete strength to cradle

Outfall Barrel
Backfilling

- Hand compaction equipment initially up to barrel springline
  - Especially important for HDPE pipe & around anti-seep collars
- 8”-12” compacted lifts afterwards
- Min. 2’ cover before traversing with heavy equipment

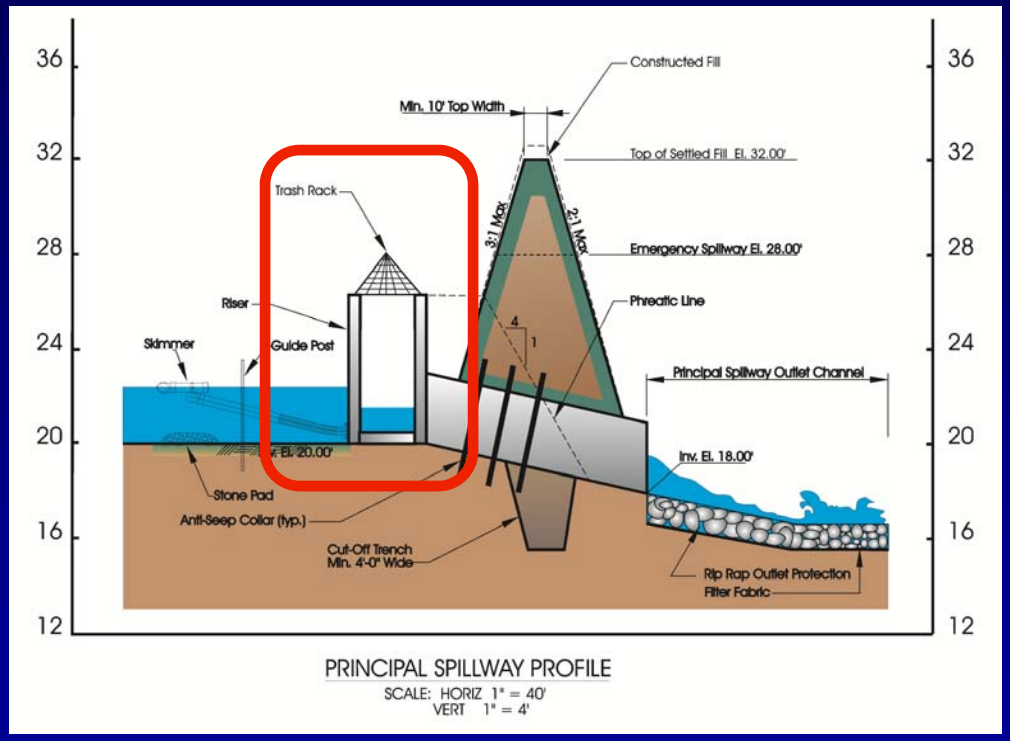
Outfall Barrel

Remember:

- All watertight seals & connections
- Anti-seep collar same material as pipe
- Collar extends min. 2’ into soil
- Soil is properly compacted

Riser Components

- Trash Rack
- Anti-Vortex Device
- Riser Base



Riser Components

Trash Rack

Anti-Vortex Device

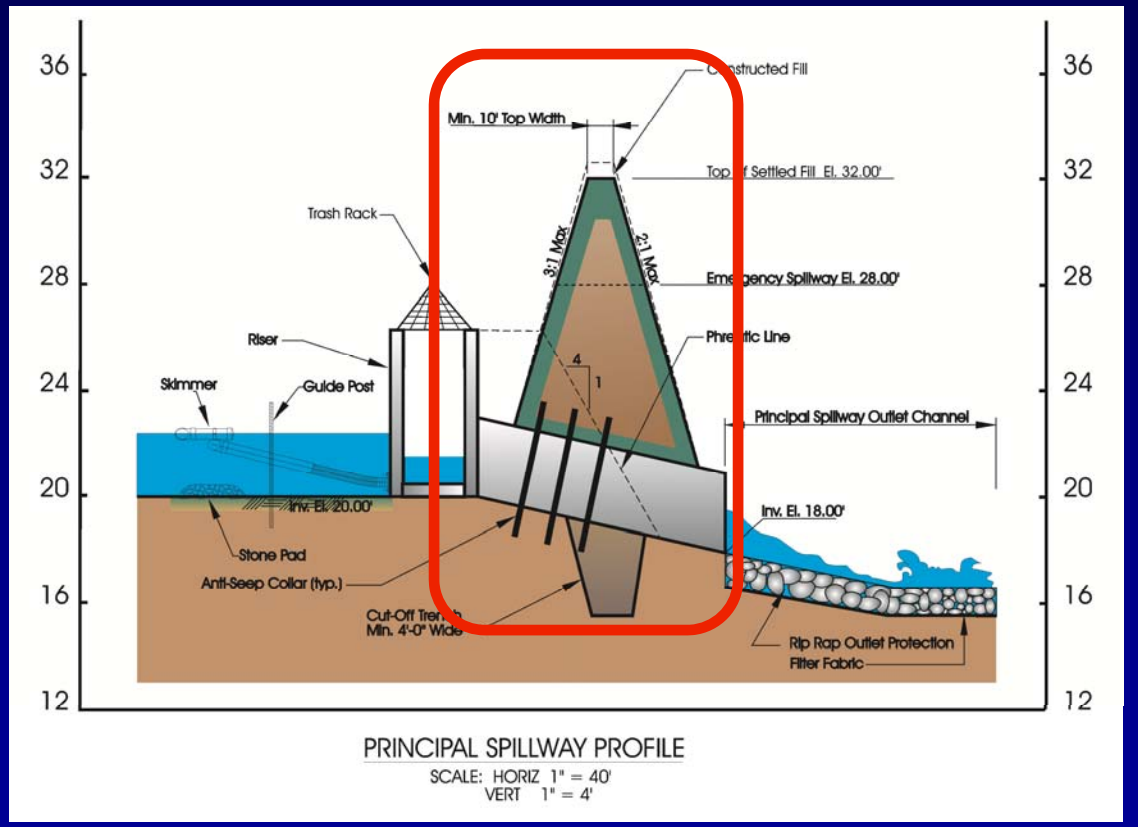
Riser Components

Angled Grate

Embankment

- Cutoff Trench
- Clay Core

(if embankment pond)



Embankment

- Cutoff Trench
  - Excavate down to impermeable layer, or min. 4’ below native soil and 4’ below pipe invert
  - Back fill with clay
  - Compacted in lifts
  - Supervised by Geotechnical Engineer
  - Prevents water from migrating underneath the embankment

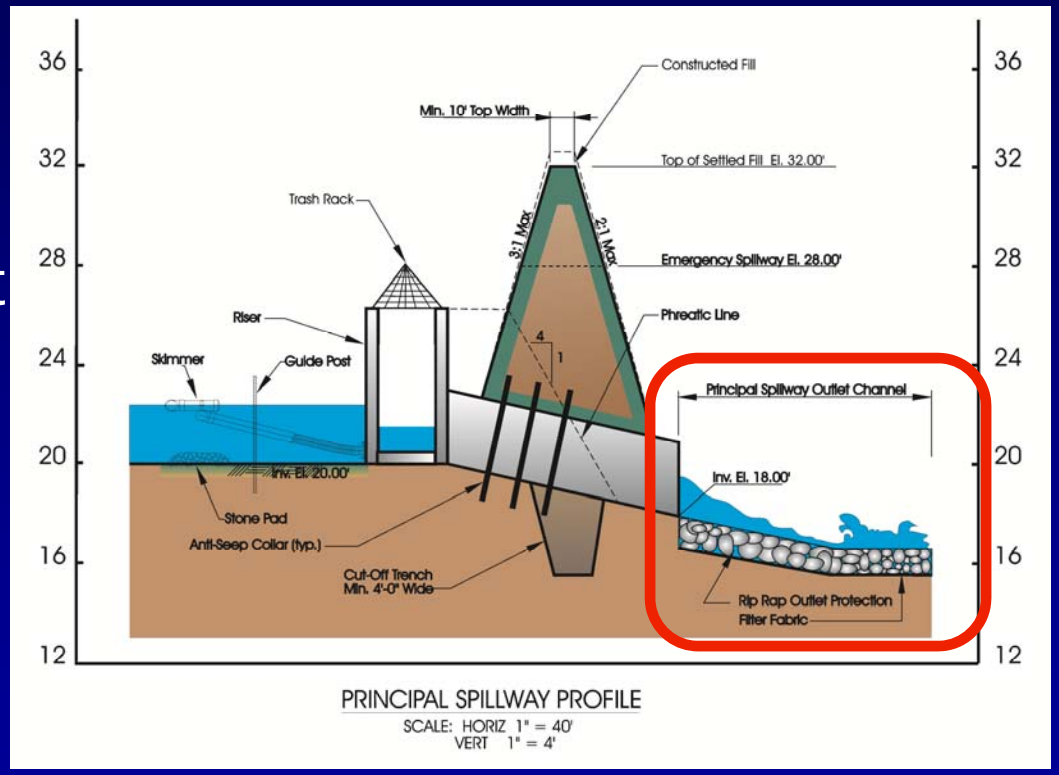
Embankment

- Clay Core
  - Continue Backfilling with Clay and Compacting in 8”-12” Lifts
  - Supervised by Geotechnical Engineer
  - Prevents Water from Migrating through the Embankment
  - Allowance for 10% Settling (Built High)

Inflow and Outflow Protection

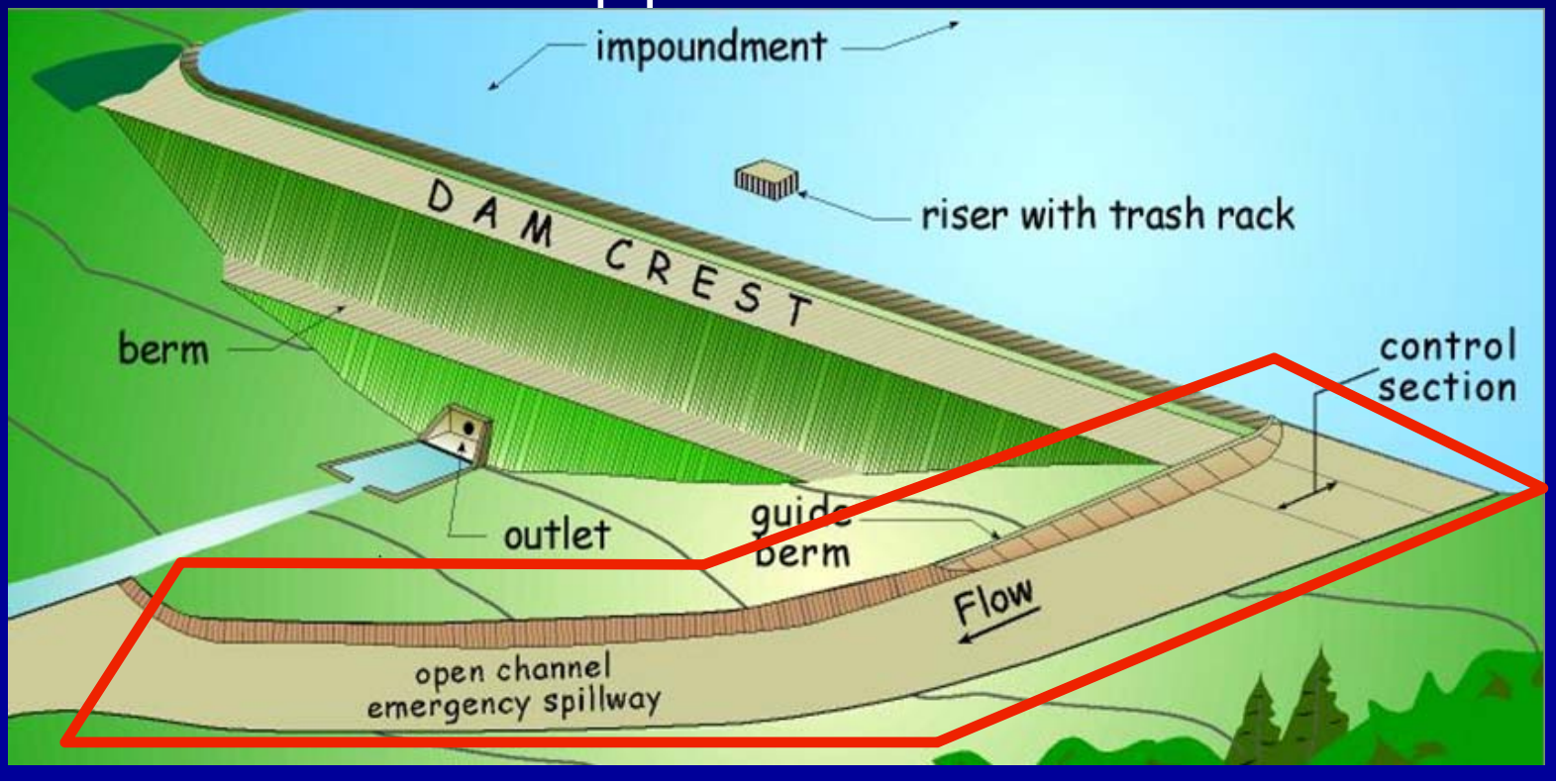
Riprap Outlet Protection

- Transition to Non-Erosive Outlet
- Correct Size Rock
- Geotextile Underlayment or #57 stone (prevents settling of riprap)



Emergency Spillway

- Conveys flows greater than 10-year storm
- Located in native soil (NOT in fill unless structural)
- Typically one foot above riser crest
- If principal spillway acts as emergency spillway than minimum 24” outlet pipe

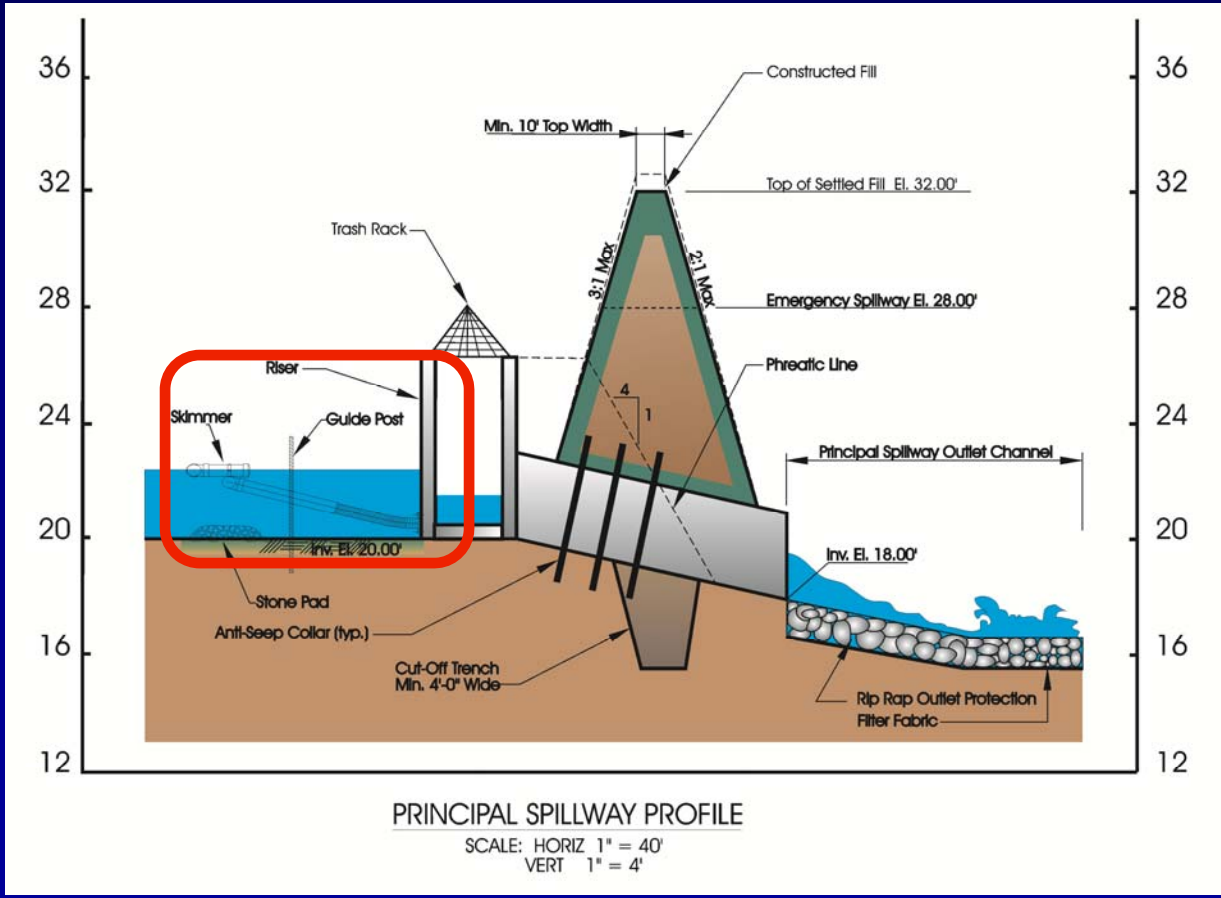


Emergency Spillway

- Designed for Erosive Forces
  - Earthen (vegetated)
  - Reinforced
    - Riprap
    - Concrete
    - TRM (Turf Reinforcement Matting)

Dewatering Device

- Temporary / During Construction
  - Floating Skimmer
  - ~~Vertical Riser~~



Vertical Riser

Floating Skimmer

Incorrect – No Stone Base

Floating Skimmer

Correct – Stone Base with
Guide Rods to Aid in Floatation

Converting Sediment Basins to Ponds

- Remove Accumulated Sediment from the Basin

Converting Sediment Basins to Ponds

- Regrade the Basin to the Final Pond Grades and Slopes

  (sediment basin may not be the same size or depth as the pond)

Converting Sediment Basins to Ponds

- Permanently Stabilize the Newly Disturbed Areas ***&*** any Temporary Stabilized Areas

Converting Sediment Basins to Ponds

- Convert the Outfall Structure to Final Design
  - Remove Floating Skimmer and Any Temporary Orifice Coverings

Converting Sediment Basins to Ponds

- Conduct an Asbuilt Survey that's submitted to the Delegated Agency as part of the Operation and Maintenance Plan

Remember - All Ponds:

- **CONFORM TO PLAN**
- Follow construction sequence
- Be watertight!!
- Have safety measures, such as proper slopes and benches
- Establish vegetation & provide E&SC measures to reduce erosion & sediment discharge

So they look like this…

…and not this!!

Questions?