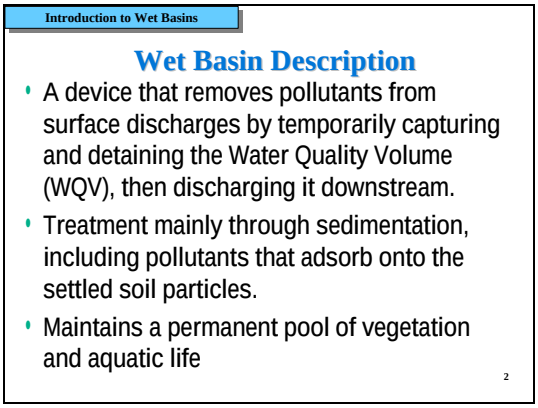
Treatment BMP Training – "Introduction to Wet Basins"
PowerPoint Presentation
Caltrans Headquarters Office of Storm Water Management

Slide 1: This module will present the Caltrans-approved Treatment BMP Wet Basin. A Wet Basin is one of the several recently approved Caltrans Treatment BMPs that can be employed on a project that requires consideration of Treatment BMPs. In addition to the information presented today, Appendix B of the PPDG (Project Planning and Design Guide) has a 7-page section on the Wet Basin.

Please contact your NPDES coordinator if during the design process you have questions that were not answered today, or call the Headquarters Design Office of Storm Water Management.

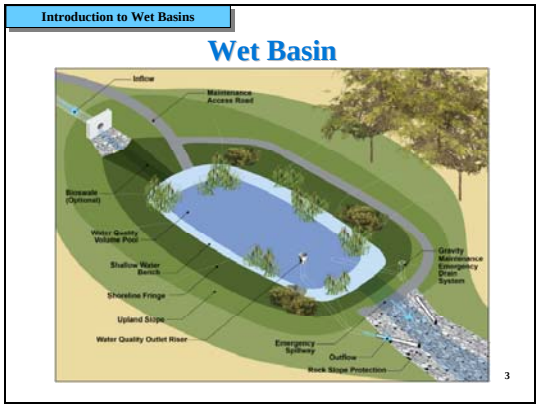
Check also with the NPDES unit to determine if standard detail sheets for appurtenant features are available for the Wet Basin.



Slide 2: Wet Basins were approved by Caltrans as a Treatment Best Management Practice in March 2005, and incorporated into Section 2 of the PPDG in July 2005. Wet Basins were 'piloted' and Districts 7 and 11, and were described in a report entitled BMP Retrofit Pilot Program Final Report, Report ID CTSW - RT - 01 – 050, January 2004, by California Department of Transportation. One wet basin was sited in District 11 as part of this study, at I-5/La Costa, in District 11.

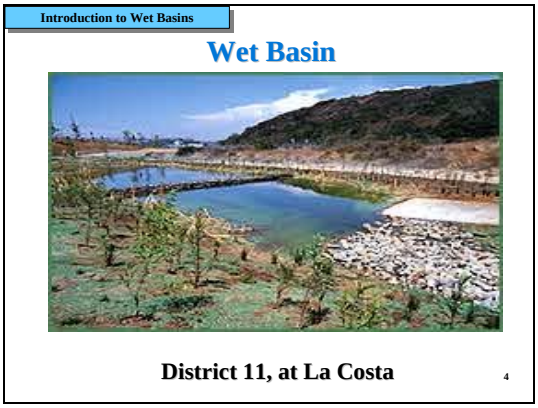
Wet basins are detention systems comprised of a permanent pool of water, a temporary storage volume above the permanent pool, and a shoreline zone planted with aquatic vegetation. Wet basins are placed in locations where naturally occurring wetlands do not exist. Wet basins are designed to remove pollutants from surface discharges by temporarily capturing and detaining the Water Quality Volume (WQV) in order to allow settling and biological uptake to occur. Treatment is provided in part by the mixing action with the permanent pool; since that water has remained in place since the last storm, it has had an even longer hold time that that given to the WQV and is cleaner. Because the incoming WQV is commingled water in the Wet Basin, the outflow, equivalent in volume to the

WQV, leaves the Wet Basin during the design holding period with the pollutant load reduced.



Slide 3: As we have already said, Wet Basins are detention systems comprised of a permanent pool of water, a temporary storage volume above the permanent pool, and a shoreline zone planted with aquatic vegetation. A Wet Basin is an open excavated basin below ground, or an enclosed (bermed) area set on original ground. In addition to the water quality benefits, a Wet Basins can also provides an aesthetic appeal within the right of way. Wet basins are placed in locations where naturally occurring wetlands do not exist.

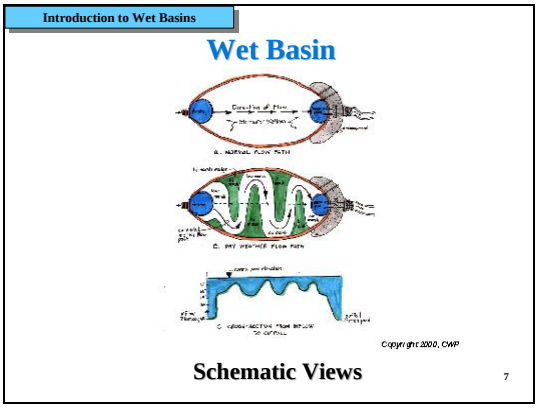
You may sometimes here the term constructed wetlands; constructed wetlands usually have nearly entire water surface planted with emergent vegetation. The Caltrans-approved Wet Basin is not a constructed wetland.



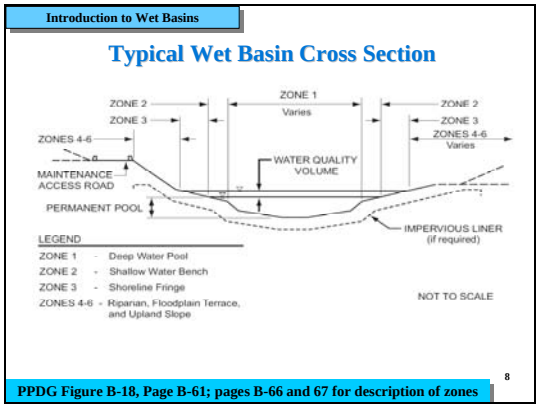
Slide 4: Little or no infiltration is assumed to occur through the basin bottom ("invert") because a permanent pool of water is needed for treatment, and for the survival of the plants and biota in the basin, thus infiltration is not desired from the Wet Basin. The water level of the permanent pool must be maintained year-round to support the plant community in the wet basin; this water level is maintained by connecting the wet basin to a stream channel, by seepage from springs, by placing the invert below the groundwater table, or by water from some other source. Placing below the GW table or use of 'recycled' water requires approval by the REWQCB. Placing below the GW table also increases the difficulty in construction.

Slide 5: This is another view of the same basin. Shown toward the left and in the foreground is a maintenance road; a maintenance road should provided, ideally around the entire basin.
Shown in the foreground on the right side is a emergency valve; we will see a better view on the next slide. This valve would be opened by Maintenance, for example, if access to the invert of the basin were needed, or to do heavy vegetative removal from the Wet Basin. However, Wet Basins have been constructed and operated successfully without this valve; current design guidance recommends that outlet device.

Slide 6: This is again the Wet Basin at La Costa. However, note that all the vegetation has been removed in this view. For reasons we will discuss later, on an annual basis all the 'emergent' vegetation that mimic features of a wetland must be removed, and this can be a costly annual maintenance expenditure.



Slide 7: This is an idealized Wet Basin. The darker blue in the figure represents the water at its various depths in the Wet Basin. A forebay (small detention basin) is often placed at the uppermost segment of a Wet Basin, especially if significant sediment load is expected.
Wet Basins have no specific shape restriction, but flow is recommended to follow a 2:1 length to width path.
A overflow device must be provided to allow runoff above the water quality volume (e.g., the High Design Manual Q_{25} event, or the largest event that can reasonably be expected to enter the device) to be conveyed through the device downstream; it usually consists of an overflow spillway, but if the wet basin is situated in a 'bowl', an overflow riser would be used.
An upstream flow splitter is sometimes used to divert flows greater than the WQV events, but an overflow spillway must still be provided for safe releases from the Wet Basin.

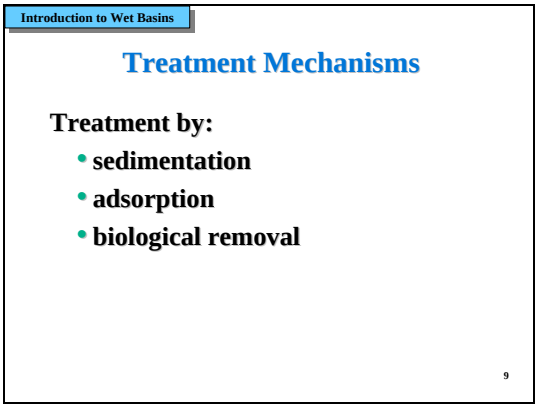


Slide 8: The legend lists the main "hydrologic" zones; each zone has a specific type of vegetation. For example, plant species suitable for temporarily inundated conditions (Zone 2) and plants that can thrive in shallow water depths (Zone 3; these plants are called 'emergent' vegetation) are desired within the permanent pool; those plants provide biological processes that aid in reducing the amount of soluble nutrients and for some dissolved metals. Other zones in the wet basin have vegetation more suited for the expected frequency of inundation (see the Hydrologic Conditions for Vegetation below).

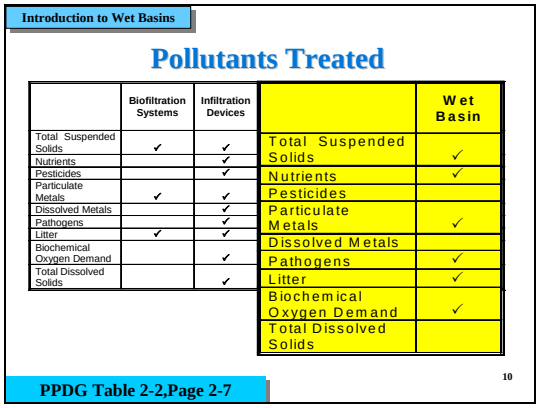
The permanent pool of water (Zone 1) should be deep enough so that it prevents the growth of hydrophytic ("submergent") vegetation; this also has the effect of reducing the plan view of the basin. The District Landscape Architect should be consulted to provide the plant species. Please see PPDG pages B-66 and 67 for more description. Related: within the design constraints the ratio of the area of the shallow water bench to the total surface area of the Wet Basin can vary within a certain range, but the larger the area devoted to the 'shallow water bench' the larger will be the subsequent maintenance costs for periodic vegetation removal.

The invert of the Wet Basin may have a 'micro-topography' (small mounds below or extending above the permanent pool water elevation) to allow some vegetation and habitat in the 'interior' of the wet basin, and provide added visual interest. Our guidance is for about 25 to 50% of the surface area to consist of the shallow zone.

Definitions: Emergent Plants: Water plants with roots and part of the stem submerged below water level, but the rest of the plant is above water; cattails and bulrushes. Emergent plants are desired around the shoreline fringe of the Wet Basin. Emergent plants are in contrast to Submerged Plants: these plants that exist completely below water such as waterweed, and these are not desired in the Wet Basin.

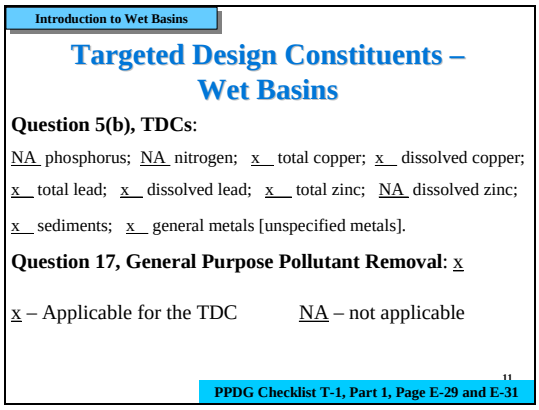


Slide 9: These are the treatment mechanisms of the Wet Basin.



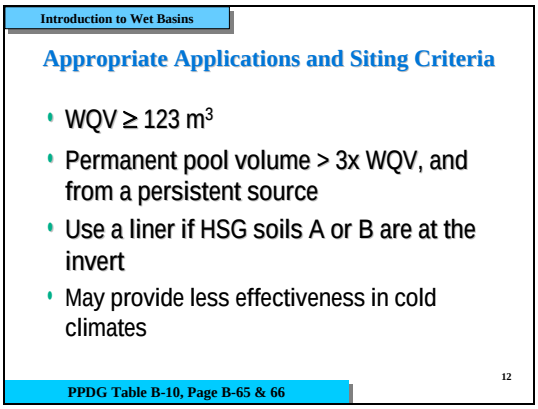
Slide 10: As you can see, the Wet Basin is one of the most effective Treatment BMPs at removing many of the constituents found typically in runoff from roadways.

Note that there can be an export of nutrients during wet weather conditions from the Wet Basin, as indicated by a footnote on PPDG page 2-7.



Slide 11: Consideration of a Wet Basin should be done as part of the "TDC process" (Targeted Design Constituent" process) discussed in Appendix E of the PPDG.

This table shows the target pollutants that Wet Basins are effective in removing. They include totals suspended solids, particulate metals, and litter. Wet Basins are included in the TDC process for these constituents, which are given as Questions 9, 10, 11, 12, 13, 15, 16 for specific pollutants, and Question 17 for general pollutants.



Slide 12: The primary function of the wet basin is to create a potentially favorable environment for physical, biological, and chemical processes that reduce pollutants in stormwater runoff.

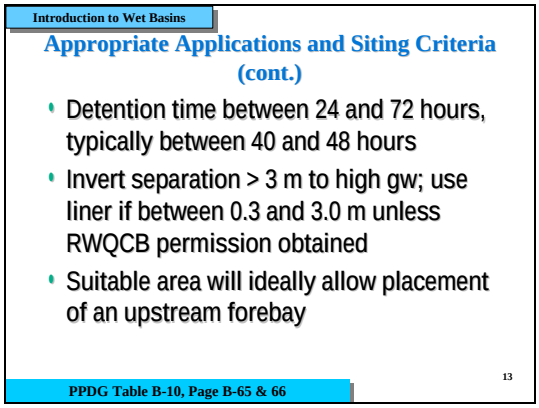
These items are taken from Appendix B and PPDG Checklists T-1, Parts 1 and 10; there are other criteria that will regulate siting that are mentioned that should not be overlooked.

•WQV = 123 m^3 (4,356 ft^3): Note also that if the impounded volume exceeds 18,500 m^3 (15 acre-feet) the wet basin may classify as a jurisdictional dam, and be subject to other requirements; consult with District Hydraulics if the volume below the spillway exceeds this threshold. This is a fairly large volume, and would seldom be achieved on Caltrans' projects unless it was a Wet Basin done in conjunction with a Local Agency.

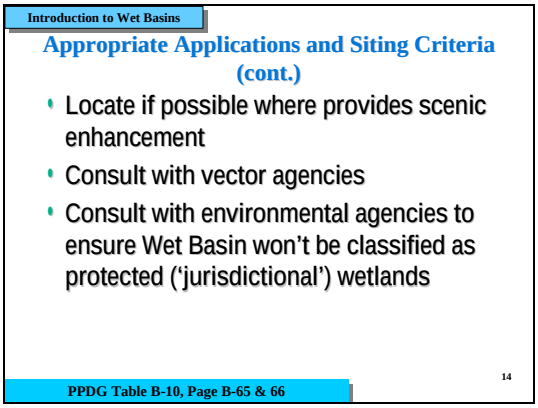
•Permanent pool volume > 3x WQV, and from a persistent source: The use of a liner is required to prevent unacceptable losses of the permanent pool (which could reduce the effectiveness of treatment of the WQV).

• Use a liner if HSG soils A or B are at the invert: The use of a liner is required to prevent unacceptable losses of the

permanent pool (which could reduce the effectiveness of treatment of the WQV).
• May provide less effectiveness in cold climates.

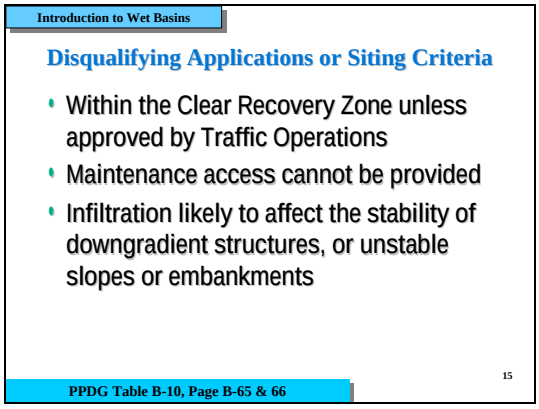


Slide 13:
•Detention time between 24 and 72 hours, typically between 40 and 48 hours: Not surprisingly, the longer the detention time, the more sediment will fall out of the runoff.
•Invert separation > 3 m (10 ft) to high groundwater; use liner if between 0.3 and 3.0 m (1 and 10 ft) unless RWQCB permission obtained: The separation from ground water will help ensure treatment of the water as it infiltrates (if any does), and therefore help protect the quality of the ground water.
•Suitable area will ideally allow placement of an upstream forebay: The forebay will help capture sediment that could reduce the volume of the permanent pool, and therefore the effectiveness of treatment, of the Wet Basin; it is recommended, but not required, for the Wet Basin. The forebay could consist of a grassy depressed area upstream of the Wet Basin, capable of holding about 10 to 25% of the WQV.



Slide 14: These items are taken from Appendix B and PPDG Checklists T-1, Parts 1 and 10; there are other criteria that will regulate siting that are mentioned that should not be overlooked.
•Locate if possible where provides scenic enhancement: Locations such as rest stops or vista points would be good selections.
•Consult with vector agencies: So that any vector issues associated with a permanent pool of water can be addressed.
•Consult with environmental agencies to ensure the Wet Basin won't be classified as protected ('jurisdictional') wetland: Since a Wet Basin has the potential to attract and harbor sensitive or endangered species, which may prevent the maintenance activities needed to maintain the proper functioning of the basins and for vector control. Because of the potential for endangered/sensitive species establishment, the Department is required to contact the appropriate state and federal regulatory agencies early in the design phase to discuss the proposed location of every wet basin. Regular maintenance of the Wet Basin will also aid in mainlining the 'non-jurisdictional status, highlighting the importance of maintenance access. If a Wet Basin is not maintained, it may be classified as

jurisdictional wetlands, and might no longer quality as a Treatment BMP, in addition to other requirements being imposed (such as the area being severely restricted for Maintenance activities).

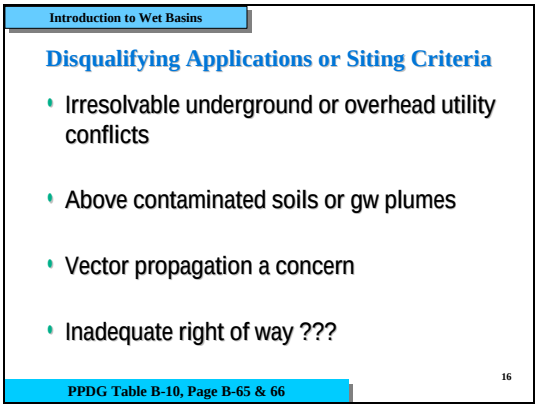


Slide 15: These items are taken from Appendix B and PPDG Checklists T-1, Parts 1 and 10; there are other criteria that will regulate siting that are mentioned that should not be overlooked.

When located with the Clear Recovery Zone, a traffic barrier will likely be required.

Since yearly maintenance is required, Maintenance access is mandatory.

Since some infiltration is likely, even in the least permeable soils, adding subsurface water to unstable areas or to areas supporting structures or embankments is not desired, and these areas should not be considered for placement of a Wet Basin; consult the Geotechnical Services for separation distances if these conditions exist at a proposed Wet Basin site.

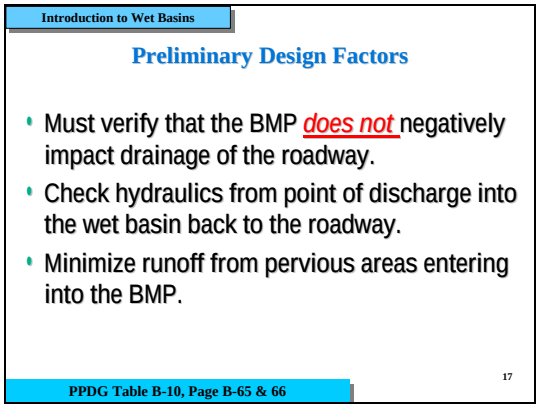


Slide 16: Utility relocation for the construction may not prove possible, or cost-effective. Overhead clearance is more important if vacuum trucks are expected to be used during maintenance.

Since some infiltration is likely, even in the least permeable soils, mobilization of existing contaminants is not desired and above contaminated soils or ground water would be a disqualifying siting condition.

Vector issues may still be a major concern, as indicated.

Right of way: Recall that purchase of additional right of way must be considered for placement of all Treatment BMPs if the existing R/W is insufficient. Also recall that a cooperative agreement with a Local Agency (for joint use) might also include joint building and operation of the device (with both agencies sending runoff to the device).



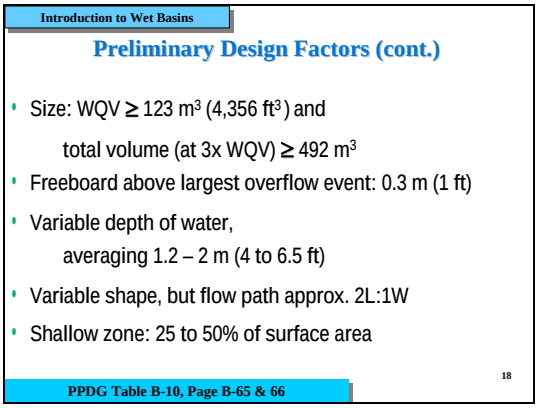
Slide 17: These three bullets are true for every Treatment BMP.

•Must verify that the BMP *does not* negatively impact drainage of the roadway: Consult with District Hydraulics to ensure that the design will not compromise the roadway drainage.

•Check hydraulics from point of discharge into the wet basin back to the roadway: This bullet is related to the first.

•Minimize runoff from pervious areas entering into the BMP. Regarding the 3rd bullet: while it is true that it is goal to only treat runoff from the impervious areas (I. E., the roadway surface), if the runoff from those surfaces cannot be routed around the treatment device, then this additional area must be considered when determining the design volume for the treatment device, and treated if possible; if it is neither possible to prevent commingling nor to provide a larger Treatment BMP device to handle the commingled volume, attempt to treat the WQV determined from the impervious area.

Note that 'flood routing' is not considered in the design process for water quality purposes; if the Wet Basin is placed for purposes of complying with local agency requirements about detaining/minimizing runoff into the downstream body, an inflow/outflow hydrograph must be developed; this would usually be done by District Hydraulics, and is beyond the scope of this presentation. .



Slide 18:

•Size: minimum WQV = 123 m^3 (4,356 ft^3) and total volume = 3x WQV (but consult with District NPDES Design Coordinator if even 80% of that value can be captured in a favorable location)

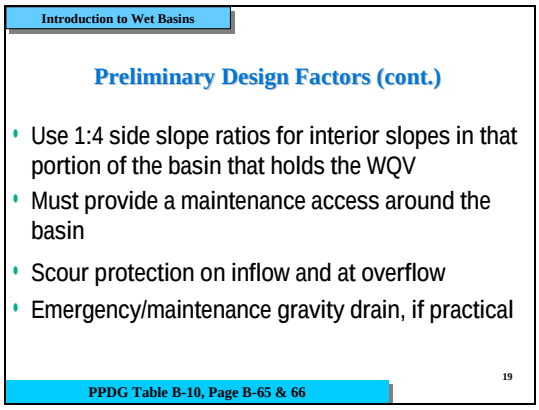
•Freeboard above largest overflow event: 0.3 m (1 ft)

•Variable depth of water, averaging 1.2 to 2 m (4 to 6.5 ft): Because of the depth of the water, and the fact that there is a permanent pool, consider also fencing around the wet basin given these water depths, and pedestrian access to wet basins will likely not allowed for safety reasons. One purpose of the variable depth: the presence of deeper zones will limit the growth of the 'emergent' vegetation, which should only occur in the shallow zones adjacent to the shoreline.

•Variable shape, but flow path approximately 2:1 L:W

•Shallow zone: 25 to 50% of surface area: The shallow zone relates to the design: this will be a wet basin, not a constructed wetland, and for treatment

the emergent vegetation will grow in the shallow zones.



Slide 19: Because the amount of vegetation can be more than is needed for water quality purposes, it is desirable to have shallow water zones where "emergent" vegetation would grow and deeper water zones where vegetation would be limited. One means to accomplish this is by using different slope ratios on the invert of the Wet Basin: for the shallow zone, which will hold the WQV, a slope of 1V:4H is preferred, which is also consistent with safety considerations; the zone which holds the permanent pool may have a steeper slope, up to 1V:3H. Because there are two different side slopes, the Wet Basin in cross section can be thought of as two trapezoids, one atop the other, with the top of the lower one, holding the permanent pool, forming the base of the upper one, the WQV zone. Total volume is the summation of both trapezoids.

Slide 20: Please contact your NPDES coordinator if, later in the design process, you have questions that were not answered today, or call the Headquarters Design Office of Storm Water Management.

If no more questions, we will begin some design examples.

Check also with the NPDES unit to determine if standard detail sheets for appurtenant features are available for the Wet Basin.