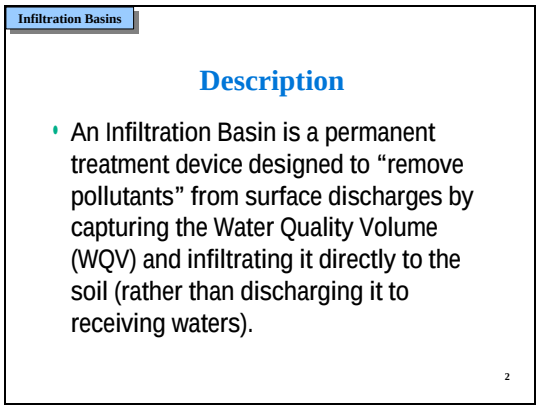
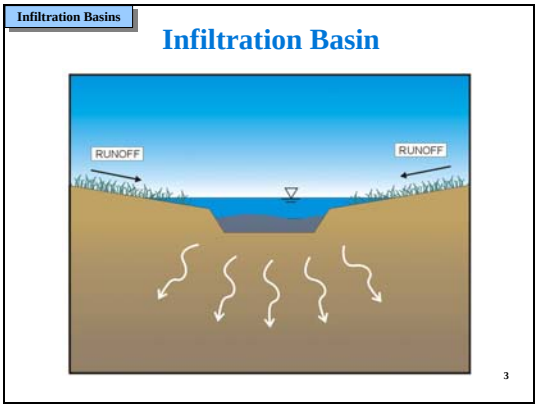
Treatment BMP Training – "Introduction to Infiltration Basins"
PowerPoint Presentation
Caltrans Headquarters Office of Storm Water Management

Slide 1: Infiltration Basins is one of the have been a Caltrans-approved Treatment BMPs for several years. The Infiltration Basin is one of two "Infiltration Devices" approved by Caltrans for use as a Treatment BMP, the other being the Infiltration Trench. In addition to the information presented in these slides, Appendix B of the PPDG (Project Planning and Design Guide) has a 17-page section on the both the Infiltration Basins and Infiltration Trenches. While the designs of each share many similarities, there are sufficient differences such that Infiltration Basins will be discussed separately.
Consult the upcoming revisions to the PPDG for any changes in design guidance for Infiltration Basins.

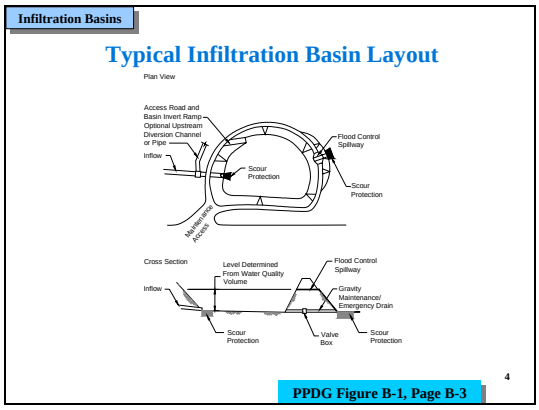


Slide 2: An Infiltration Basin is an open excavated basin, or an enclosed (bermed) area set on original ground. All infiltration is assumed to occur through the basin bottom or invert.

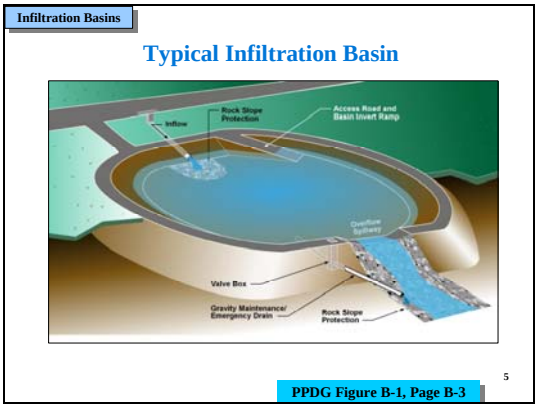


Slide 3: This is an idealized basin. An overflow spillway would be provided to allow runoff above the Water Quality Volume be conveyed through the device downstream, and we will see an overflow spillway on the slide that follows.
While infiltration is shown and does occur through the floor of the Infiltration Basin (the 'invert') and the confining berms, the design formula assumes infiltration only through the invert.
The darker blue in the figure represents sediment that will build up over time – Infiltration Basins will require periodic maintenance, but as we will discuss, they are designed with a Factor of Safety of 2 on the infiltration rate, and if otherwise properly designed (including an upstream forebay or bioswale to capture sediment, should have a reasonable in-service life (say 5 to 10 years) before heavy maintenance is needed. For an Infiltration Basin to function effectively its location must be adequately explored proper to design and construction, and the Division of Engineering Services Geotechnical unit will conduct that exploration; contact them in the PID

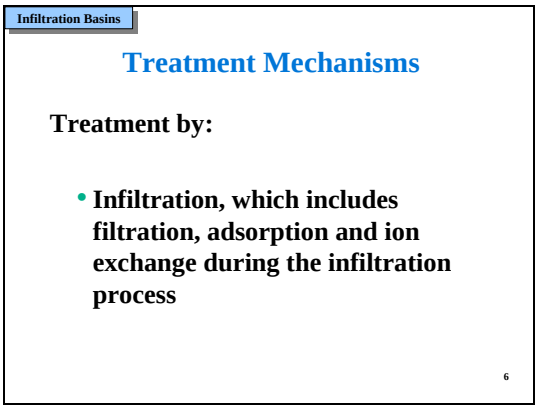
stage of the project if an Infiltration Device is under consideration.



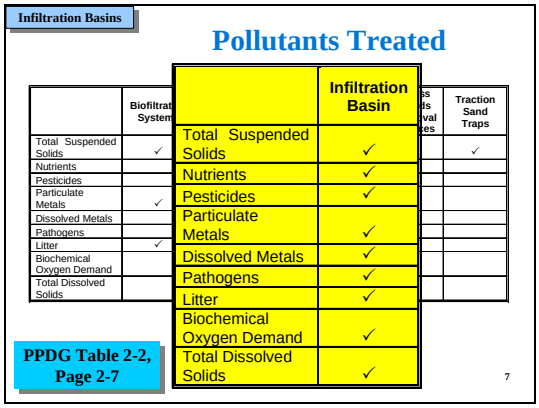
Slide 4: * Let's look at some of the features of an Infiltration Basin. First note that a maintenance road is provided around the basin. At some sites, space may not be available for a road around the basin. Provide a road that to allow access to the basin for maintenance. Also, note on the figure the emergency valve. If possible, provide this valve, and provide access to operate the emergency valve by Maintenance. The valve must be operated in the event that the basin has not emptied within the time allowed to prevent vector growth. Generally, the valve provided is a slide gate valve and the operator is supported from the slope. If the valve is installed as shown, water would remain in the pipe between the basin and the valve for several days or weeks. However, Infiltration Basins have been constructed and operated successfully without this valve. A forebay (small depression, usually grass-lined, holding about 10% of the Water Quality Volume) is often placed at the uppermost segment of an Infiltration Basin, if significant sediment load is expected. Infiltration Basins have no shape restriction.



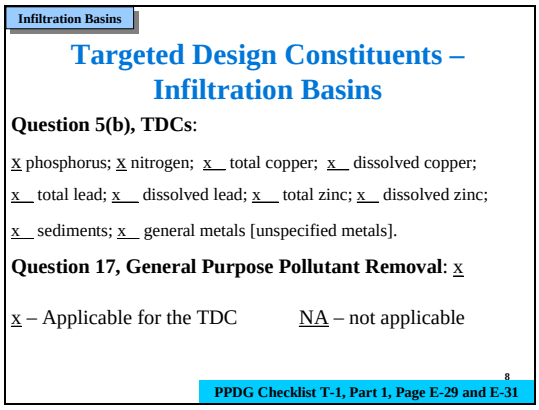
Slide 5: This is an oblique view of an Infiltration Basin. The overflow spillway that will allow larger rainfall events to pass through the Infiltration Basin is shown on the lower right of this slide.



Slide 6: These are the treatment mechanisms employed by an Infiltration Basin, but some of these occur below ground, and often simply 'infiltration is stated as the treatment mechanism.



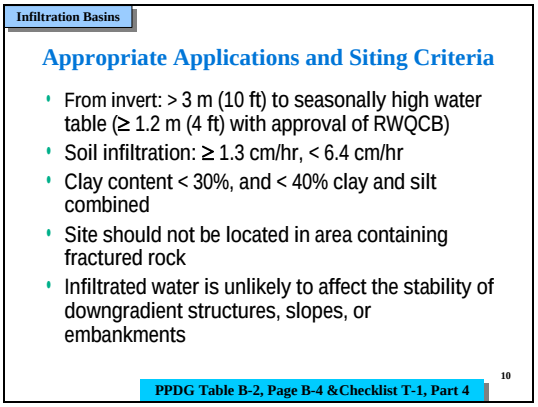
Slide 7: • Note that this table indicates the Infiltration Basin is effective on all pollutants of concern. For this reason, consider an Infiltration Basin (or Infiltration Trench) whenever feasible, as the 1st choice for treatment.



Slide 8: This table shows the target pollutants that Infiltration Basins are effective in removing. They include totals suspended solids, particulate metals, and litter, although litter removal is not a primary function. Infiltration Devices are the 1st choice devices in the TDC process for these constituents, and will the first device listed (as Infiltration Devices) for Questions 7 through 17 on Checklist T-1, Part 1.

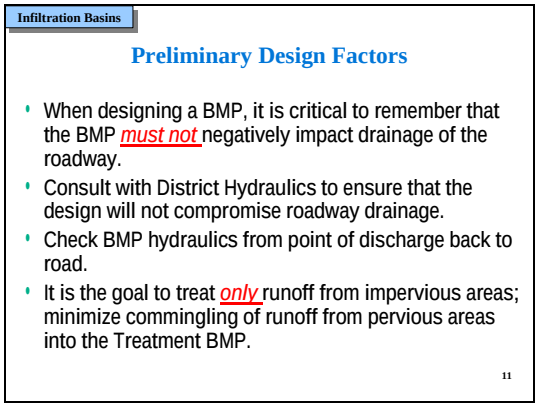
Slide 9: Here is a constructed Infiltration Basin from District 7, I605/Rt91, shown after drainage from the preceding storm is nearly complete. Although this is a square basin, the geometry is of little importance in an Infiltration Basin. A circular or irregularly shaped basin would work as well and may be easier to site and more aesthetic. Also note that the vegetation in the basin is similar to the surrounding area. Vegetation promotes and helps maintain good infiltration characteristics. Consider

aesthetics when designing the basin. Aesthetics could include providing landscape screening.

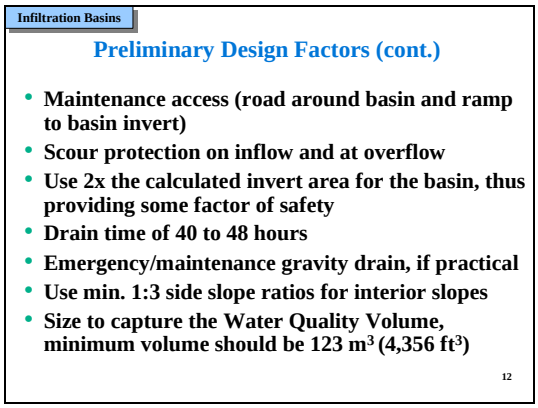


Slide 10: Here are some applications and siting criteria, taken from the PPDG Appendix B; see that Table for a complete list of items. Also, when the Project Engineer is completing PPDG Checklists T-1, Parts 1 and 4 there are other criteria that will regulate siting

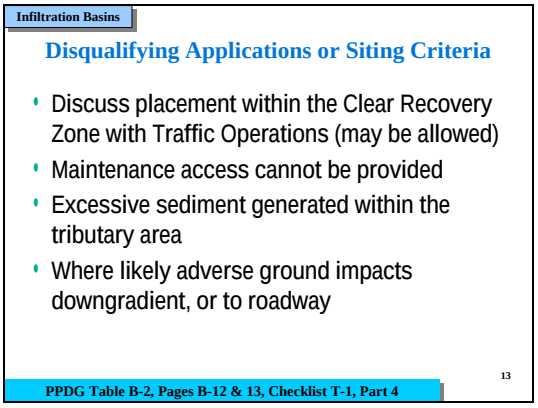
(e.g., presence of pollutant plumes under the proposed basin site).
•Separation from the Infiltration Basin invert of > 3 m to seasonally high water table (³ 1.2 m with approval of RWQCB)
•Soil infiltration characteristics: ³ 1.3 cm/hr, < 6.4 cm/hr (unless RWQCB approval is obtained)
•Clay content < 30%, and < 40% clay and silt combined: this requirement was also developed to ensure that good permeability will be obtained at the site, and these criteria are especially useful in the PID phase to evaluate a proposed Infiltration Basin location.
•Site should not be located in area containing fractured rock within 3 m (10 ft) of the Infiltration Basin invert, as the soils below the invert provide treatment to the percolating water (flow through fractured rock is likely to be very fast with little time provided for treatment)
•Infiltrated water is unlikely to affect the stability of downgradient structures, slopes, or embankments
Some of these requirements are reproduced in the Workshop Handout



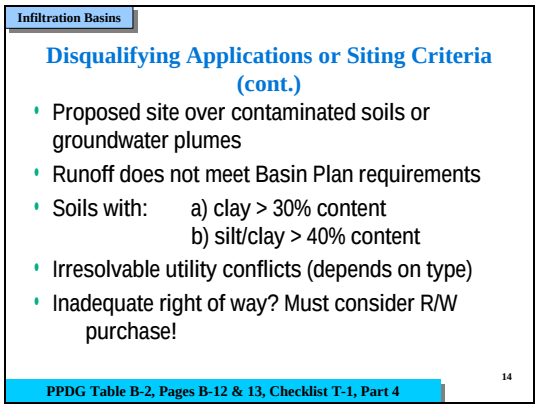
Slide 11: Some of the Preliminary Design Factors from Table B-2 are provided here; see the PPDG Appendix B for a complete listing.
•When designing a BMP, it is critical to remember that the BMP must not negatively impact drainage of the roadway.
•Consult with District Hydraulics to ensure that the design will not compromise roadway drainage.
•Check BMP hydraulics from point of discharge back to road.
•It is the goal to treat only runoff from impervious areas; minimize commingling of runoff from pervious areas into the Treatment BMP: the goal is to treat runoff from the impervious areas (i. e., the roadway surface), and runoff from pervious areas should bypass the Infiltration Basin if possible. However, if the runoff pervious surfaces cannot be routed around the treatment device, then this additional volume should be considered for the Infiltration Basin.



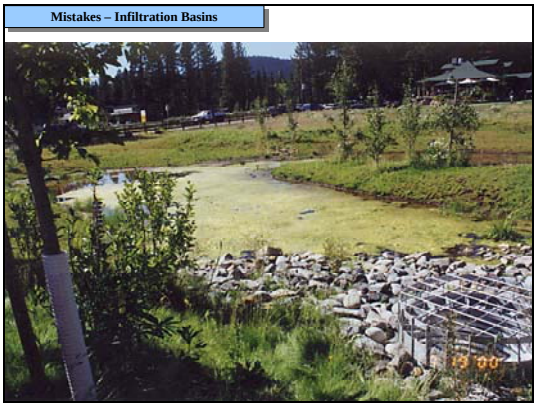
Slide 12: Some of the Preliminary Design Factors from Table B-2 are provided here; see the PPDG Appendix B for a complete listing.
•Maintenance access (road around basin and ramp to basin invert)
•Scour protection on inflow and at overflow
•Use 2x the calculated invert area for the basin, thus providing some factor of safety: A factor of safety is provided directly in the formula provided in the PPDG and used later in this training to estimate the invert of an Infiltration Basin. This provides some factor of safety on the accuracy of the permeability, and contributes to longer intervals between maintenance cleanout.
•Drain time of 40 to 48 hours
•Emergency/maintenance gravity drain, if practical
•Use min. 1:3 side slope ratios for interior slopes
•Size to capture the Water Quality Volume, minimum volume should be 123 m3 (4,356 ft3)
Not listed as a Design Factor, but consider the need for fencing around the basin no matter what the depth of water at the design WQV elevation is.



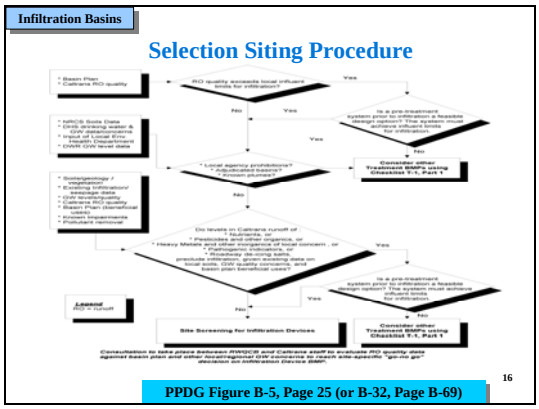
Slide 13 Other requirements, some of which are disqualifying:
*When located with the Clear Recovery Zone, a traffic barrier may be required, although the curbing used to limit vehicle entry is fairly low.
*Since maintenance is required, Maintenance access is mandatory.
*Infiltration likely to affect the stability of downgradient structures, or lead to unstable ground conditions; geotechnical considerations, apart from permeability, that may restrict usage; examples include: location in seismic impact zones; unstable areas such as landslides and Karst terrain, soil liquefaction or differential settlement potential; or highly expansive/collapsible soils.
*Infiltration Basins should not adversely affect the roadway pavement, such as by leading to a saturated subgrade; they should be installed down-gradient from the highway structural section, and should not be placed closer horizontally than the trench depth to the roadway if in a location subject to frost.
Please see PPDG Table B-2 for a complete listing of criteria.



Slide 14: Other disqualifying conditions:
•Proposed site over contaminated soils or groundwater plumes *Infiltration devices should not be sited in locations over previously identified soil or contaminated groundwater plumes; setback distance should be determined in coordination with the RWQCB.
•Runoff does not meet Basin Plan requirements * Runoff from roadways does certain constituents at some contamination levels; information on these can be found from the DEA website. Runoff proposed for infiltration must not the of poorer quality than allowed by Basin Plans, but usually requirements for infiltration are much less restrictive than for surface water disposal.
•Soils with: a) clay > 30% content b) silt/clay > 40% content * These soil parameters a) clay > 30% content and b) silt/clay > 40% content relate to permeability and may be found during the Pre-Screening for the Infiltration Devices; these soils will not have a high permeability.
•Irresolvable utility conflicts (depends on type) * Utility relocation for the construction and operation may not prove possible.
•Inadequate right of way? Must consider R/W purchase! * 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).
Please see PPDG Table B-2 for a complete listing of criteria.



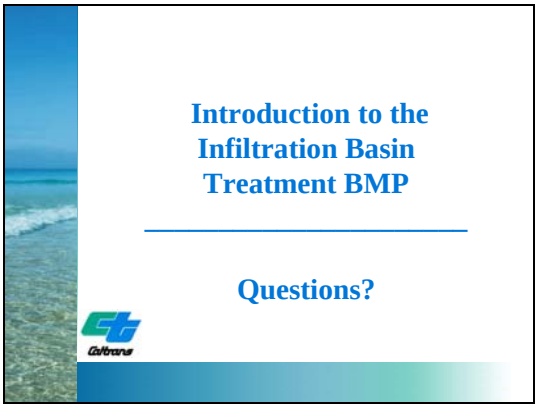
Slide 15: This site was constructed as an Infiltration Basin, but it clearly does not infiltrate at the rate required to drain the basin in a period that does not promote algal and vector growth.
Also note the rocks surrounding the emergency overflow.



Slide 16: We will not go over this chart except to note that it is in the PPDG on the page noted. This flowchart, "BMP Siting Procedure for Infiltration Devices," is shown on this slide for information only. The decision tree checklist is found in the PPDG on page B-25. District 7 should follow the procedure found on Page B-69, but in general there are the same.

Many of these questions are incorporated into the Checklists T-1, Parts 1 and 4.

You will note that there are questions on this flowchart revolve around the quality of the water that will be infiltrated, and the existence of regulatory limits (such as found in a "Basin Plan") for the project area; if you do not have that information, consult the District/Regional Environmental Unit, or the NPDES coordinator.



Slide 17: End of the presentation. 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.