10.0 Treatment Basins

Definition: Storm water treatment basins are engineered landscape depressions designed to intercept and treat a specific volume of runoff (i.e. the design storm).

Purpose: Treatment basins serve to intercept large volumes of runoff and trap and retain sediment to protect receiving water. Some treatment basins (infiltration basins) are intended to infiltrate the design storm, effectively removing fine sediments and nutrients while providing groundwater recharge, while others (detention basins) are designed to attenuate peak flows to prevent downstream erosion. Many basins serve both purposes, offering some degree of infiltration and storm water attenuation.

Applicability: Basins have been the principal method for storm water treatment in the Tahoe Basin for many years. Basins are generally applicable for storm water treatment in any area where land availability and site conditions permit. Constraints on basin location include anticipated sediment loading, soil type, percolation rates, depth to groundwater, and available maintenance access.

Advantages: If properly designed and maintained, treatment basins can effectively trap sediment and, in some cases, remove bioavailable nutrients (primarily dissolved phosphorus). As mentioned, basins also offer a degree of flood protection and help prevent stream bank erosion by attenuating peak flows. Basins serve as effective secondary treatment to treat runoff from impervious surfaces that has been adequately conveyed and passed through a pretreatment system.

Disadvantages: If not properly designed and maintained, captured sediment may be resuspended and discharged during high flow events. Improper sizing may limit hydraulic residence times, negatively impacting treatment potential. If not properly revegetated, basins may be unattractive and susceptible to erosion. In areas where grease and oil accumulate, extensive pretreatment may be necessary to prevent sediment and groundwater contamination. Basins may also present a potential safety hazard, especially for young children. Standing water can also provide habitat for insect pests.

10.1 – Infiltration Basins
10.2 – Detention Basins

References

More detailed construction specifications can be found in:

CalTrans. 2000. Statewide Storm Water Quality Practice Guidelines.

Goldman, et al. 1986. Erosion and Sediment Control Handbook. McGraw Hill.

10.1 Infiltration Basins

Please read section 10.0 for important information applicable to all treatment basins.

Description: Infiltration basins are landscape depressions designed to capture runoff and infiltrate it directly into the soil. Pollutant removal is achieved by sedimentation, physical filtration through soil surface horizons, and vegetative uptake.

Planning Considerations: Since infiltration is the primary goal, soil percolation rates are the principle consideration when planning infiltration basins. A qualified soil scientist familiar with Lake Tahoe soil conditions should be consulted to ensure soil conditions are adequate for infiltration. Consider the depth to the seasonal water table and the presence of any restrictive soil layers. Current regulations require basins be sized to treat runoff from the 20-year, 1 hour design storm. A common mistake in determining the treatment volume is to neglect runoff sources other than impervious surfaces. Often, additional flows from outside the project area may reach the basin, which can overwhelm the treatment capacity. It is important to consider the entire watershed of the basin, and plan accordingly. In areas where large volumes of natural runoff may reach treatment basins, bypass structures must be installed to prevent mixing with project runoff. Such clean water bypasses are essential for meeting treatment goals. Without them, runoff volumes will likely exceed the design volume and treatment capacity will be diminished.

Effectiveness:

◎ *Dissolved Nutrients*
● *Fine Particulates*
● *Flow attenuation*

Where:
○ = Not effective
◎ = Somewhat effective
● = Very effective

Tips for Installation:

1. Carefully select the basin location. Use natural depressions and established native vegetation whenever possible.
2. Determine depth to groundwater. There should be at least four feet of separation between the basin invert and the seasonal high water table (or restrictive layer). If groundwater or an impervious layer is less than four feet from the soil surface, consider installing an impermeable liner or designing a wet basin (see Section 11.0).
3. Infiltration basins should be designed to maximize surface area; wide shallow basins allow for enhanced settling and improved infiltration. A length to width ratio of 3:1 is recommended. Increased surface area has been shown to improve removal efficiencies of bioavailable nutrients (Hydroscience, 2000).
4. Where feasible, a maximum depth of 12-18 inches is recommended to allow for improved settling of suspended sediment and maintain adequate vegetation.
5. The design should provide for maximum separation of the inlet and outlet to prevent “short circuiting.”
6. A deep-water forebay should be included to trap heavy sediment and allow for convenient maintenance.

7. Consider the use of a permeable, sorptive liner to improve orthophosphate removal (Hydroscience, 2000).
8. Install appropriate overflow protection structures.
9. Install a high flow bypass to prevent scouring of basin sediments and re-suspension of collected materials.
10. Consider installing a drainage system for manual dewatering between storms.
11. After construction, revegetate the basin with appropriate native and adapted wet site species (TRPA approved) to prevent scour.
12. Include maintenance access as part of the initial design.

Maintenance:

- Post construction maintenance should follow the guidelines outlined in the Revegetation Chapter to ensure the establishment of sustainable vegetation.
- Basins should be inspected after significant storm events and high spring runoff to ensure inlets and outlets are not clogged by debris.
- Visually determine if project runoff is bypassing the basin – take appropriate corrective action.
- Check to see if basins are draining between storms.
- If the storage area of the basin is full, sediment must be manually removed.
- Trash should be removed from the basin on a regular basis.

Field Experience:

10.2 Detention Basins

Description: Detention basins are landscape depressions designed to temporarily impound storm water runoff to allow for attenuation of peak flows. Pollutant removal exclusively occurs via sedimentation.

Planning Considerations: Detention basins offer limited capacity for pollutant removal. They are generally effective for coarse sediment removal only. Some detention basins may offer a degree of infiltration, depending on soil conditions. As with infiltration basins, consider all runoff sources when sizing and separate "clean" from "dirty" water when possible. Appropriate discharge facilities must be included in the design to prevent basin erosion.

Effectiveness:

○ *Dissolved Nutrients*
○ *Fine Particulates*
● *Flow attenuation*

Where:
○ = Not effective
◎ = Somewhat effective
● = Very effective

Tips for Installation:

1. Ensure sufficient hydraulic head to prevent stored water from backing up into inflow conveyances.
2. Determine depth to groundwater. There should be at least four feet of separation between the basin invert and the

seasonal high water table (or restrictive layer).
3. A minimum flow-path to width ratio of 2:1 is recommended to provide for enhanced settling.
4. Install appropriate overflow and outlet protection structures.
5. Install a high flow bypass to prevent scouring of basin sediments and re-suspension of collected materials.
6. Include maintenance access as part of the initial design.

Maintenance:

- Post construction maintenance should follow the guidelines outlined in the Revegetation Chapter to ensure the establishment of sustainable vegetation.
- Basins should be inspected after significant storm events and high spring runoff to ensure inlets and outlets are not clogged by debris.
- Visually determine if project runoff is bypassing the basin – take appropriate corrective action.
- Check to see if basins are draining between storms.
- If the storage area of the basin is full, sediment must be manually removed.
- Trash should be removed from the basin on a regular basis.

Field Experience: