11.0 Wetland and Stream Environment Zone Treatment

Definition: Treatment areas inundated by water for a sufficient time to support vegetation adapted for life in saturated soil conditions. Some wetland/SEZ treatment structures incorporate small permanent pools while other systems distribute sheet flow across dense wetland/meadow vegetation.

Purpose: Wetland/SEZ treatment systems effectively filter sediment and bioavailable nutrients from runoff waters.

Applicability: Vegetative wetland storm water treatment is applicable in any area where there is sufficient space and hydrologic conditions that support thick hydrophytic vegetation. Any location in need of treatment with access to a densely vegetated area should consider this option. In addition to providing treatment, wetland systems help also control runoff volumes.

Wetland construction or development of existing SEZ resources may require multiple local, state, and federal permits including, but not limited to, 401 water quality certification, 404 wetland permits, waterway disturbance permits, Basin Plan prohibition exemptions, and TRPA land use approvals.

Advantages: Properly designed wetland and SEZ stormwater treatment systems have proven highly effective for removing bioavailable nutrients and fine sediment from urban runoff. Wetland treatment offers pollutant removal by infiltration, sedimentation, physical filtering, and biological uptake and conversion. Wetland and vegetated treatment systems can also be very visually attractive and provide valuable habitat for migratory waterfowl.

Disadvantages: Improper development or excessive pollutant loads can damage natural wetland systems. Sections 401 and 404 of the Clean Water Act place strict regulations on potential impacts to wetland areas. Upsetting the natural nutrient and hydrologic balance of wetland areas by the introduction of storm water may threaten their integrity, reduce water quality benefits, and potentially impair beneficial uses. Some storm water professionals have also raised concerns regarding potential impacts to wildlife attracted to storm water wetlands. Limited nutrient removal capacities during the winter season when vegetation is dormant may be another possible disadvantage. Furthermore, decomposing wetland vegetation may release stored nutrients and other chemicals (such as heavy metals) to surface and groundwater.

Effectiveness: Wetland treatment efficiency is a function of pollutant load, and thus can be highly variable. In general, nutrient removal efficiency drops with decreased nutrient concentrations. Another factor influencing nutrient removal is the seasonal nature of nutrient-laden runoff. Unlike areas on the East Coast of the United States where runoff occurs primarily during the growing season, much of the urban runoff in the Tahoe Basin occurs during the winter and early spring when vegetation is dormant. These issues are discussed in the report entitled *Bioavailable Nutrient Loading into*

Lake Tahoe and Control Opportunities with an Emphasis on Utilizing SEZs to Treat Urban Runoff prepared by HydroScience. The report is an excellent resource for those considering using wetlands and/or SEZs for stormwater treatment. A short summary of this document is available by contacting Robert Larsen at the Lahontan Regional Water Quality Control Board.

Due to the potentially damaging effects urban pollutants can have on native systems, storm water runoff should not be routed to natural wetland areas without pretreatment.

Common wetland/SEZ treatment systems:

- **11.1 - Wet Basins/Constructed Wetlands**
- **11.2 - Existing meadows/SEZs**

References

More detailed construction specifications for wet basins/constructed wetlands can be found in:

Maryland Department of the Environment. 2000. 2000 Maryland Storm Water Design Manual.

EPA 843-B-00-003. *Guiding Principles for Constructed Treatment Wetlands: Providing Water Quality and Wildlife Habitat.* http://www.epa.gov/owow/wetlands/constructed/guide.html

Anyone considering the use of existing wetlands should also review:

HydroScience. 2000. Bioavailable Nutrient Loading into Lake Tahoe and Control Opportunities with and Emphasis on Utilizing SEZs to Treat Urban Runoff.

11.1 Wet Basins/ Constructed Wetlands

Description: Like other treatment basins, wet basins are engineered landscape depressions designed to retain and treat storm water flows. Wet ponds, in contrast to detention basins, maintain a permanent pool of water. They are designed to capture runoff from the design storm and retain it until it is displaced by the next runoff event. Although many wet basins offer nutrient removal by biological uptake and conversion, the primary mechanism for treatment is sedimentation. The permanent pool of water limits resuspension of accumulated sediment during high flow events.

Planning Considerations: To maintain a permanent pool, wet ponds must be located in areas of high groundwater or with a consistent surface inflow and possibly an impermeable liner. The permanent pool volume must be considered when sizing for the design storm. If space permits, wetlands should be designed to capture and retain the greatest possible runoff volume and maximize hydraulic residence time. Like all wetland systems, pretreatment methods should be used to limit coarse sediment loads.

Tips for Installation:

1. Carefully select wet basin location. Where possible, use natural depressions and native vegetation.
2. Consider the *entire* contributing drainage when sizing; route clean runoff around wet ponds to reserve treatment capacity for polluted runoff.
3. Include a deep water forbay for settling of coarse sediment. In addition to pretreatment, a forbay provides energy dissipation and a means for even distribution across the wetland surface.
4. Design the basin to maximize surface area. As with other treatment basins, a high length to width ratio (~3:1) is recommended.
5. Where possible, limit maximum depth (with design capacity) to 12-18 inches. Shallow wetlands with greater surface area provide longer residence times and greater opportunity for sedimentation.
6. Use an inlet manifold to evenly distribute incoming flow.
7. Construct the basin with maximum separation between the inlet and outlet to prevent "short circuiting."
8. Consider use of an impermeable liner where groundwater contamination is a concern.
9. As with treatment basins, include a high flow bypass to prevent scour and re-suspension of accumulated sediments.
10. Revegetate with hydrophytic vegetation from the TRPA approved species list. Marsh plants around the pond can help remove pollutants, provide habitat, and hide debris.

Maintenance:

- Post-construction maintenance should follow the guidelines outlined in the Revegetation Chapter to ensure the establishment of sustainable vegetation.
- Wetland 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 runoff requiring treatment is bypassing the treatment area and take appropriate corrective action.
- If the storage area of the basin is full, sediment must be manually removed.

Where to Use: Wet basins are best suited to low-lying areas where groundwater is high. Often, naturally wet areas can be converted to wet basins with minimal disturbance. State and Federal regulations protect such areas; consult the appropriate agencies.

Where NOT to Use: Wet basins should not be installed in areas without a sufficient water source. Although a year-round permanent pool is not necessary, basin soils should be saturated long enough to support wetland vegetation. Avoid installation where standing water may be a nuisance or safety hazard.

Field Experience:

- The City of South Lake Tahoe has successfully installed three wet basins as part of the Ski Run Water Quality Improvement Project.
- The Jennings Casino Site Restoration, completed in 1980, was monitored for many years. Forest Service monitoring data of Burke Creek shows effective reductions of both nitrate and

orthosphosphate attributed to the sizable wet basin associated with the restoration.
- Placer County successfully installed a pretreatment detention basin and constructed wetland as part of the Tahoe City Urban Improvement Project. The project is being extensively monitored by the California Tahoe Conservancy and the UC Davis Tahoe Research Group.

11.2 Existing Meadows / SEZs

Definition: Spreading pretreated storm water runoff across established meadows and/or stream environment zones.

Planning Considerations: Using existing meadows, wetlands, and stream environment zones for storm water treatment remains controversial. The possibility of damaging fragile wetland resources may outweigh potential benefits. Constructed wetland systems may be somewhat more predictable than natural systems in terms of pollutant removal efficiencies. Despite these concerns, completed projects where urban storm water routed as sheet flow through existing meadows/SEZs have shown high bioavailable nutrient removal rates (Hydroscience 2000). Filtration through dense meadow vegetation is particularly effective for reducing fine sediment concentrations. It is important to assess the pre-project condition of the meadow or SEZ considered for storm water treatment. Some SEZs may have a natural nutrient export rate exceeding storm water concentrations. If so, the addition of storm water may further flush nutrients from the wetland, resulting in increased nutrient export. While wetland areas may offer improved biological uptake and conversion, uniform shallow flow over dry meadows will enhance sediment removal.

Tips for Installation:
1. Keep disturbance to a minimum; avoid unnecessary alteration of the existing landscape.
2. Focus efforts on achieving uniform storm water distribution.
3. Include an accessible deep-water fore bay for removal of coarse sediment.
4. Install baffles (such as willow wattles or other natural materials) where needed to prevent “short circuiting.”

Maintenance:
- Meadows and SEZs used for stormwater treatment should be inspected after significant storm events and high spring runoff to ensure inlets and outlets are not clogged by debris.
- Visually determine if any runoff is bypassing the treatment area or causing erosion and take appropriate corrective action.

Where to Use: Existing meadows and other SEZs should only be used for stormwater treatment where potential impacts to the natural system have been thoroughly evaluated.

Where NOT to Use: Avoid using meadows and SEZs for stormwater treatment in areas where the natural hydrology, nutrient cycling, and habitat may be adversely affected by the introduction of urban runoff.

Field Experience:

- El Dorado County directed runoff to two meadows as part of the Angora Creek Erosion Control Project. Runoff is directed from a settling basin through a series of baffles to generate uniform sheet flow. Preliminary results from auto samplers installed at the site show excellent removal of fine sediment and bioavailable nutrients.