## Step 2 Specific Criteria

The last three categories in the Structural Control Screening matrix (Table 2.1.3-1) provides an overview of various specific design criteria and specifications, or exclusions for a structural control that may be present due to a site's general physiographic character, soils, or location in a watershed with special water resources considerations.

Physiographic Factors

Three key factors to consider are low-relief, high-relief, and karst terrain. In the North Central Texas, low relief (very flat) areas are primarily located east of the Dallas metropolitan area. High relief (steep and hilly) areas are primarily located west of the Fort Worth metropolitan area. Karst and major carbonaceous rock areas are limited to portions of Palo Pinto, Erath, Hood, Johnson, and Somerveil counties. Special geotechnical testing requirements may be needed in karst areas. The local reviewing authority should be consulted to determine if a project is subject to terrain constraints.

Low relief areas need special consideration because many structural controls require a hydraulic head to move stormwater runoff through the facility.

High relief may limit the use of some structural controls that need flat or gently sloping areas to settle out sediment or to reduce velocities. In other cases, high relief may impact dam heights to the point that a structural control becomes infeasible.

Karst terrain can limit the use of some structural controls as the infiltration of polluted waters directly into underground streams found in karst areas may be prohibited. In addition, ponding areas may not reliably hold water in karst areas.

Soils

The key evaluation factors are based on an initial investigation of the NRCS hydrologic soils groups at the site. Note that more detailed geotechnical tests are usually required for infiltration feasibility and during design to confirm permeability and other factors.

Special Watershed or Stream Considerations

The design of structural stormwater controls is fundamentally influenced by the nature of the downstream water body that will be receiving the stormwater discharge. In addition, the designer should consult with the appropriate review authority to determine if their development project is subject to additional structural control criteria as a result of an adopted local watershed plan or special provision.

In some cases, higher pollutant removal or environmental performance is needed to fully protect aquatic resources and/or human health and safety within a particular watershed or receiving water. Therefore, special design criteria for a particular structural control or the exclusion of one or more controls may need to be considered within these watersheds or areas. Examples of important watershed factors to consider include:

*High Quality Streams* (Streams with a watershed impervious cover less than approximately 15%). These streams may also possess high quality cool water or warm water aquatic resources or endangered species. The design objectives are to maintain habitat quality through the same techniques used for cold-water streams, with the exception that stream warming is not as severe of a design constraint. These streams may also be specially designated by local authorities.

*Wellhead Protection.* Areas that recharge existing public water supply wells present a unique management challenge. The key design constraint is to prevent possible groundwater contamination by preventing infiltration of hotspot runoff. At the same time, recharge of unpolluted stormwater is encouraged to maintain flow in streams and wells during dry weather.

*Reservoir or Drinking Water Protection.* Watersheds that deliver surface runoff to a public water supply reservoir or impoundment are a special concern. Depending on the treatment available, it may be necessary to achieve a greater level of pollutant removal for the pollutants of concern, such as bacteria pathogens, nutrients, sediment, or metals. One particular management concern for reservoirs is ensuring stormwater hotspots are adequately treated so they do not contaminate drinking water.

### Step 3 Location and Permitting Considerations

In the last step, a site designer assesses the physical and environmental features at the site to determine the optimal location for the selected structural control or group of controls. The checklist below (Table 2.1.3-2) provides a condensed summary of current restrictions as they relate to common site features that may be regulated under local, state, or federal law. These restrictions fall into one of three general categories:

Locating a structural control within an area when expressly prohibited by law.

Locating a structural control within an area that is strongly discouraged, and is only allowed on a case by case basis. Local, state, and/or federal permits shall be obtained, and the applicant will need to supply additional documentation to justify locating the stormwater control within the regulated area.

Structural stormwater controls must be setback a fixed distance from a site feature.

This checklist is only intended as a general guide to location and permitting requirements as they relate to siting of stormwater structural controls. Consultation with the appropriate regulatory agency is the best strategy.

**Table 2.1.3-2 Location and Permitting Checklist**

| Site Feature | Location and Permitting Guidance |
|---|---|
| **Jurisdictional Wetland** (Waters of the U.S) U.S. Army Corps of Engineers Regulattory Permit | • Jurisdictional wetlands should be delineated prior to siting structural control. • Use of natural wetlands for stormwater quality treatment is contrary to the goals of the Clean Water Act and should be avoided. • Stormwater should be treated prior to discharge into a natural wetland. • Structural controls may also be *restricted* in local buffer zones. Buffer zones may be utilized as a non-structural filter strip (i.e., accept sheet flow). • Should justify that no practical upland treatment alternatives exist. • Where practical, excess stormwater flows should be conveyed away from jurisdictional wetlands. |
| **Stream Channel** (Waters of the U.S) U.S. Army Corps of Engineers Section 404 Permit | • All Waters of the U.S. (streams, ponds, lakes, etc.) should be delineated prior to design. • Use of any Waters of the U.S. for stormwater quality treatment is contrary to the goals of the Clean Water Act and should be avoided. • Stormwater should be treated prior to discharge into Waters of the U.S. • In-stream ponds for stormwater quality treatment are highly discouraged. • Must justify that no practical upland treatment alternatives exist. • Temporary runoff storage preferred over permanent pools. • Implement measures that reduce downstream warming. |

| Table 2.1.3-2 Location and Permitting Checklist | |
|---|---|
| Site Feature | Location and Permitting Guidance |
| **Tennessee Department of Environment & Conservation (TDEC)** Aquatic Resource Alteration Permit (ARAP) | • Specific stream and reservoir buffer requirements. • TDEC provides ARAP permitting – in conjunction with 404 permit • Mitigation may be required for impacts to existing aquatic and terrestrial habitat. |
| **100 Year Floodplain** – City of Murfreesboro Planning & Engineering Dept. | • Grading and fill for structural control construction is generally discouraged within the 100 year floodplain, as delineated by FEMA flood insurance rate maps, FEMA flood boundary • No fill within the limits of the floodway as delineated on the referenced maps. |
| Stream Buffer (Water Quality Protection Area) Murfreesboro Water & Sewer Dept. (MWSD) | • 50' stream buffer (WQPA) on mapped streams (Zone 1 – 35' undisturbed; Zone 2 – 15' limited management), and 35' stream buffer (WQPA) on unmapped streams (Zone 1 – 20' undisturbed; Zone 2 – 15' limited management) |
| **Utilities** Local Review Authority | • Call appropriate agency to locate existing utilities prior to design. • Note the location of proposed utilities to serve development. • Structural controls are discouraged within utility easements or rights of way for public or private utilities. |
| **Roads** TDOT, City of Murfreesboro or Rutherford County | • Consult City of Murfreesboro Planning & Engineering and Rutherford County Planning for any setback requirement from local roads. • Consult TDOT for setbacks from State maintained roads. • Approval must also be obtained for any stormwater discharges to a local or state-owned conveyance or channel. |
| **Structures** – City of Murfreesboro Water & Sewer Department | •Required setbacks for each structural control group are provided in the performance criteria in this manual. |
| **Septic Drain fields** – Rutherford County Health Department | • Consult Rutherford County Health Department for minimum setbacks from a drain field edge or drip area. |
| **Water Wells** - Rutherford County Health Department | • Consult Rutherford County Health Department for minimum setbacks for stormwater infiltration or other structural controls. |

## 2.1.3.2 Example Application

A 20-acre institutional area (e.g., church and associated buildings) is being constructed in an urban area within the Murfreesboro area. The impervious coverage of the site is 40%. The site drains to an urban stream that is highly impacted from hydrologic alterations (accelerated channel erosion). The stream channel is deeply incised; consequently, flooding is not a problem. The channel drains to an urban river that is tributary to a phosphorus limited drinking water reservoir. Low permeability soils limit infiltration practices.

*Objective:* Avoid additional disruptions to receiving channel and reduce pollutant loads for sediment and phosphorus to receiving waters.

*Target Removals:* Provide stormwater management to mitigate for accelerated channel incision and reduce loadings of key pollutants by the following:

- Sediment: 70% to 80%
- Phosphorus: 40%

*Activity/Runoff Characteristics:* The proposed site is to have large areas of impervious surface in the form of parking and structures. However, there will be a large contiguous portion of turf grass proposed for the front of the parcel that will have a relatively steep slope (approximately 10%) and will drain to the storm drain system associated with the entrance drive. Stormwater runoff from the site is expected to exhibit fairly high sediment levels and seasonally high phosphorus levels (due to turf grass management).

Table 2.1.3-3 lists the results of the selection analysis using the screening matrix described previously. The highlighted rows indicate the controls selected for this example. The **X**'s indicate inadequacies in the control for this site. The ☜'s indicate adequate control capabilities for this site.

While there is a downstream reservoir to consider, there are no special watershed factors or physiographic factors to preclude the use of any of the practices from the structural control list. However, due to the size of the drainage area, most stormwater ponds and wetlands are removed from consideration. In addition, the site's impermeable soils remove an infiltration trench from being considered. Due to the need to provide flood control as well as streambank protection storage, an extended detention micropool pond will likely be needed, unless some downstream regional storage is available to control flood waters.

To provide additional pollutant removal capabilities in an attempt to better meet the target removals, bioretention, surface sand filters, and/or perimeter sand filters can be used to treat the parking lot and driveway runoff. The bioretention will provide some removal of phosphorus while improving the aesthetics of the site. Surface sand filters provide higher phosphorus removal at a comparable unit cost to bioretention, but are not as aesthetically pleasing. The perimeter sand filter, is a flexible, easy to access practice (but at higher cost) that provides good phosphorus removal and additionally high oil and grease trapping ability.

The site drainage system can be designed so the bioretention and/or sand filters drain to the extended detention micropool pond for redundant treatment. Vegetated dry swales could also be used to convey runoff to the pond, which would provide pretreatment. Pocket wetlands and wet swales were eliminated from consideration due to potential for nuisance conditions. Underground sand filters could also be used at the site; however, cost and aesthetic considerations were significant enough to eliminate from consideration.

**Table 2.1.3-3 Sample Structural Control Selection Matrix**

| Structural Control Alternative | Stormwater Treatment Suitability | Site Applicability | Implementation Considerations | Physiographic Factors/Soils | Special Watershed Considerations | Other Issues |
|---|---|---|---|---|---|---|
| Bioretention | ☑1 | ☑2 | ☑ | ☑ | none | |
| Dry Swale | ☑1 | ☑2 | ☑ | ☑ | none | |
| Wet Swale | ☑1 | ☑2 | ☑ | ☑ | none | Odor / mosquitoes |
| Perimeter Sand Filter | ☑1 | ☑2 | ☑ | ☑ | none | Higher cost |
| Surface Sand Filter | ☑1 | ☑2 | ☑ | ☑ | none | Aesthetics |
| Infiltration Trench | ☑1 | ☑ | ☑ | X | | |
| Extended Detention Micropool Pond | ☑ | ☑ | ☑ | ☑ | none | |
| Multiple Ponds | ☑ | X | | | | |
| Wet Extended Detention Pond | ☑ | X | | | | |
| Wet Pond | ☑ | X | | | | |
| Extended Detention Shallow Wetland | ☑ | X | | | | |
| Pocket Wetland | ☑ | ☑ | ☑ | ☑ | none | Odor / mosquitoes |
| Shallow Wetland | ☑ | X | | | | |

Notes:
1 Only when used with another structural control that provides water quantity control
2 Can treat a portion of the site