CHAPTER 6

STORAGE FACILITIES

6.3 Design Criteria

6.3.1 General Criteria

An analysis of storage facilities should consist of comparing the design flow at a point or points downstream of the proposed storage site with and without storage. In addition to the design flow, other flows in excess of the design flow that might be expected to pass through the storage facility should be included in the analysis (i.e., 100-year flood). The design criteria for storage facilities should include:

- Release rate,
- Storage volume,
- Grading and depth requirements,
- Safety considerations and landscaping,
- Outlet works, and location.

Note: The same hydrologic procedure shall be used to determine pre- and post-development hydrology.

6.3.2 Release Rate

Control structure release rates shall approximate pre-developed peak runoff rates for the 2-year through 25-year storms, with emergency overflow capable of handling the 100-year discharge. Design calculations are required to demonstrate that the facility will limit runoff from the 2-, 5-, 10-, and 25-year developed discharge rates to pre-developed peak discharge rates. Where conditions warrant, the 100-year storm shall also be regulated to the pre-developed rate.

6.3.3 Storage

Storage volume shall be adequate to attenuate the post-development peak discharge rates to pre-developed discharge rates for the 2-year through 25-year storms. Routing calculations must be used to demonstrate that the storage volume is adequate. If sedimentation during construction causes loss of detention volume, design dimensions shall be restored before completion of the project. For detention basins, all detention volume shall be drained within 48 hours.

6.3.4 Grading And Depth

Following is a discussion of the general grading and depth criteria for storage facilities followed by criteria related to detention and retention facilities.

6.3.4.1 General

The construction of storage facilities usually requires excavation or placement of earthen embankments to obtain sufficient storage volume. Vegetated embankments shall be less than 20 feet in height and shall have side slopes no steeper than 3:1 (horizontal to vertical). Riprap protected embankments shall be no steeper than 2:1. Geotechnical slope stability analysis is recommended for embankments greater than 10 feet in height and is mandatory for embankment slopes steeper than those given above. Procedures for performing slope stability evaluations can be found in most soil engineering textbooks, including those by Spangler and Handy (1982) and Sowers and Sowers (1970).

A minimum freeboard of 1.5 feet above the 100-year design storm high water elevation shall be provided for dam heights of less than 20 feet. Dam heights greater than 25 feet or a storage volume greater than 100 acre-feet are subject to the requirements of the Safe Dams Act unless the facility is excavated to this depth. Other considerations when setting depths include flood elevation requirements, public safety, land availability, land value, present and future land use, water table fluctuations, soil characteristics, maintenance requirements, and required freeboard. Aesthetically pleasing features are also important in urbanizing areas.

6.3.4.2 Detention

Area above the normal high water elevations of storage facilities should be sloped at a minimum of 5 percent toward the facilities to allow drainage and to prevent standing water. Careful finish grading is required to avoid creation of upland surface depressions that may retain runoff. The bottom area of storage facilities should be graded toward the outlet to prevent standing water conditions. A minimum 2 percent bottom slope is recommended. A low flow or pilot channel constructed across the facility bottom from the inlet to the outlet is recommended to convey low flows, and prevent standing water conditions. Often a sediment collection forebay is provided with easy maintenance access.

6.3.4.3 Retention

The maximum depth of permanent storage facilities will be determined by site conditions, design constraints, and environmental needs. In general, if the facility provides a permanent pool of water, a depth sufficient to discourage growth of weeds (without creating undue potential for anaerobic bottom conditions) should be considered. A depth of 6 to 8 feet is generally reasonable unless fishery requirements

dictate otherwise. Aeration may be required in permanent pools to prevent anaerobic conditions. Where aquatic habitat is required, wildlife experts should be contacted for site specific criteria relating to such things as depth, habitat, and bottom and shore geometry. In some cases a shallow bench along the perimeter is constructed to encourage emergent vegetation growth to enhance the pollution reduction capabilities or aesthetics of the pond.

6.3.5 Outlet Works

Outlet works selected for storage facilities typically include a principal spillway and an emergency overflow, and must be able to accomplish the design functions of the facility. Outlet works can take the form of combinations of drop inlets, pipes, weirs, and orifices. Slotted riser pipes are discouraged because of clogging problems, but curb openings may be used for parking lot storage. It should be noted that small outlets that will be subject to clogging or be difficult to maintain might not be acceptable to the City. The principal spillway is intended to convey the design storm without allowing flow to enter an emergency outlet. For large storage facilities, selecting a flood magnitude for sizing the emergency outlet should be consistent with the potential threat to downstream life and property if the basin embankment were to fail. The minimum flood to be used to size the emergency outlet is the 100-year flood, using fully developed land use conditions. With the outlet located at or above the 25-year ponding elevation. The sizing of the outlet works shall be based on results of hydrologic routing calculations.

6.3.6 Location

In addition to controlling the peak discharge form the outlet works, storage facilities will change the timing of the entire hydrograph. If several storage facilities are located within a particular basin it is important to determine what effects a particular facility may have on combined hydrographs in downstream locations. The following procedure is recommended to determine downstream effects. For all storage facilities, channel routing calculations should proceed downstream to a confluence point where the drainage area being analyzed represent s ten percent of the total drainage area. At this point the effect of the hydrograph routed through the proposed storage facility on the downstream hydrograph can be assessed and shown not to have detrimental effects on downstream hydrographs.

6.3.7 Safe Dams Act

Under the Dam Safety Act Regulations a dam is an artificial barrier that does or may impound water and that is 25 feet or greater in height or has a maximum storage volume of 100 acre-feet or more. A number of exemptions from the Safe

Dams Act are allowed and any questions concerning a specific design or application should be addressed to the Georgia Department of Natural Resources

END OF SECTION 6.3