6. OTHER DESIGN REQUIREMENTS

6.1 Flood Stages

Low-lift navigation dams are usually designed to the minimum height required to provide project depth over obstructive reaches of the river:

a. At low discharges, the normal pool level is almost horizontal and at an elevation equal to or somewhat above the low-water stage at the head of the pool.

b. At higher discharges, if the pool elevation remains fixed at normal pool level at the dam, velocities, stages, and water-surface slope at the head of the pool will rise and more land will be flooded, Figure 6.1.

c. The additional depth at higher discharges is not required for navigation, and damage due to flooding adjacent lands may be minimized by drawing down (lowering) the pool level at the dam to where the water-surface profile through the pool provides only project depth over controlling obstructions. Such operation is termed a "hinged-pool" operation and is discussed further in Appendix B.3. The amount of permissible drawdown at the dam is determined by the water-surface slope that would produce limiting velocities for navigation in the lower portion of the pool.

6.2 Drainage

The water surface elevation throughout a navigation pool is permanently above natural low-water stage, Figure 6.1, and for relatively high dams, stages at the dam may be permanently above the highest natural flood level. At the head of the pool, stage will fluctuate between normal pool level and flood stage in generally the same manner as under preproject conditions. This increase in stage throughout a pool may:

a. Interfere with the discharge of sewers, culverts, and tributary streams that formerly discharged freely at low river stages.

b. Result in deposition of silts or sludge in the pool that may block sewers or intakes and raise the bed of tributary streams.

c. Cut off natural drainage paths, requiring rerouting drainage systems or pumping for local runoff to enter the waterway.

d. Raise ground water levels, requiring additional agricultural drainage.

Many drainage problems can be minimized or eliminated by selecting dam sites downstream from major drainage outlets and tributaries.

6.3 Water Supply Intakes

Navigation pools provide reliable depth at water supply intakes, and water quality is an important consideration. If a navigation pool is the source of water supply, sewer outlets should be located downstream of the dam. Special measures may be required to ensure that sediment deposition will not block intakes.

6.4 Sewage Contamination

Aeration provided by turbulent flow through spillways aids in maintaining the dissolved oxygen levels required to support fish life and for aerobic decomposition of sewage. However, immediately above a dam, where pools are relatively deep and velocities are low, wastes may settle out resulting in anaerobic conditions.. Accordingly, navigation structures should not be located downstream of major sewage discharge points. Where structures are located in an urban area, consideration should be given to providing interceptor sewers discharging below the dam.

6.5 Vector Control

In some latitudes, stable navigation pool levels provide an ideal environment for mosquito breeding, particularly if floating debris, dead brush, or aquatic vegetation accumulates in shallow marginal areas. Where malaria is endemic, consideration should be given to fluctuating the pool level about one foot each week in the mosquito-breeding period to strand mosquito eggs, larvae, and pupae along the pool margin. A typical example of such an operation is shown in Figure 6.2 for the Wilson Project of the Tennessee Valley Authority. At Wilson, the pool level is drawn down 1.5 ft below normal pool elevation and refilled each week during the May-September mosquito-breeding season.

6.6 Fish and Wildlife

Impoundment of navigation pools may inundate spawning areas, nesting grounds, and habitat, and dams may block the movement of migratory fish. In designing navigation projects, consideration should be given to recommendations of fish and wildlife specialists as to the effects that various pool levels, dam locations, and operating procedures would have on fish and wildlife resources.

If dams block migratory fish movement, mitigation measures, such as the following, may be needed:

a. Fish ladders for fish to pass around dams.
b. Fish hatchery.
c. Management of fish spawning gravels.

Other mitigation and enhancement measures include:

a. Selective withdrawal of water from various depths in the pool to control temperatures of downstream releases from high dams.
b. Reaeration measures to meet or improve dissolved oxygen levels required for fish.
c. Modified spillway release patterns to meet fishery requirements.

Stable pool levels can reduce the stranding of fish during low water periods in rivers of highly varying discharge and can benefit wildlife having nests and dens near the shoreline.

6.7 Recreation

Impoundment of navigation pools often improves the recreational potential of a river and creates new opportunities for recreation development, particularly where projects are located in or near urban areas. Consideration should be given to including recreation areas and facilities in navigation projects. However, it should be noted that there can be conflicts between recreational and commercial boating on a waterway. Commercial tows have slow maneuvering and stopping capabilities and can be a hazard to recreationists.

6.8 Hydropower

The feasibility of hydropower development should be considered at all navigation dams. Leakage through the locks and dam, evaporation and other water losses in the pool, and water required for lockages must be subtracted from total streamflow to determine the water available for power production. Except in the case of high-lift structures, the most suitable type of power installation is a "run-of-river" plant that utilizes natural streamflow with essentially no modification by storage.

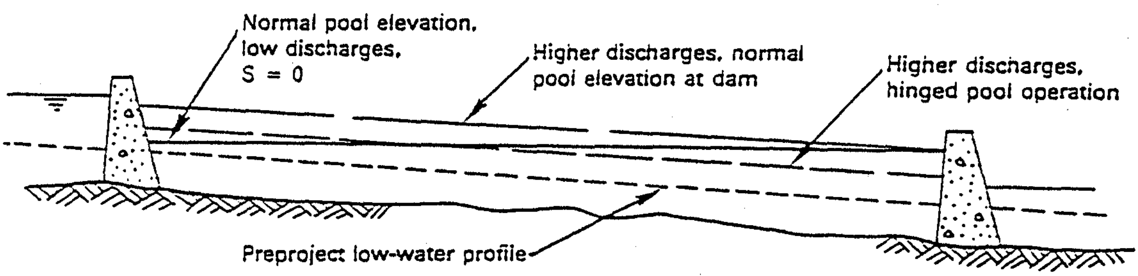

Figure 6.1 Effect of pool operation on water surface elevations.

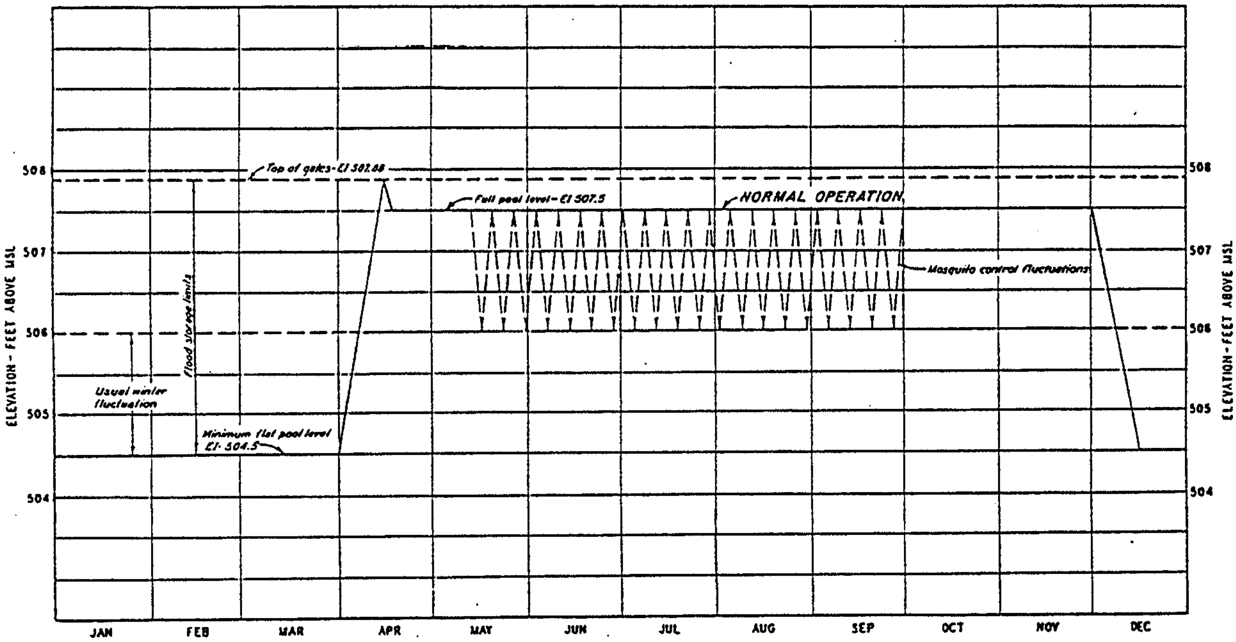

Figure 6.2. Multiple-Purpose Reservoir Operation for Vector Control, Wilson Project, Tennessee Valley Authority. (TVA Monograph 55, Engineering Data, TVA Water Control Projects, 1980).