afford the opportunity to implement site-specific, ecologically beneficial wetland (enhancement, creation, and restoration) projects on a landscape basis to address water quality and flow regime issues.

**Wetlands and Their Functions**

“Wetlands,” as defined in 40 CFR 232.2(r), are:

“those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.”

Wetlands are often transitional areas between upland and aquatic systems. Wetlands come in all shapes and sizes and go by many names such as marshes, swamps, sedge meadows, etc. (Figure 1). While some wetlands contain standing water for at least part of the year, many rarely or never contain standing water, or contain it for only brief periods each year. Such wetlands must have saturated soils for at least part of the year to be considered wetlands. Most wetlands receive surface water inflow at some time of the year, some are fed by both surface and groundwater, and others are supported solely by groundwater.

Wetlands are key ecosystem components. At the watershed level, an understanding of wetland ecosystems is essential for establishing water quality and quantity priorities and creating management plans. Certain wetlands provide water quality functions that benefit adjacent and downstream waters, while others provide localized benefits that cumulatively have a significant impact downstream.

Wetland functions are well documented (U.S. Fish and Wildlife Service 1984; U.S. Army Corps of Engineers 1986; Conservation Foundation 1985), and include:

- water quality improvement,
- floodwater storage,
- fish and wildlife habitat,
- aesthetics, and
- support of aquatic and terrestrial life.

Protecting these functions is essential for lake home owner associations in the implementation of their lake use and management plans.

A number of lakes’ projects supported through Federal Clean Lakes and Nonpoint Source Programs have demonstrated how wetlands provide water quality benefits by acting as filters and depositional zones for pollutants. Additionally, the ability of wetlands to temporarily store floodwater helps reduce stream discharge velocities that otherwise contribute to stream bank instability and downstream sedimentation (Figure 2).
and protection must be integrated on a watershed basis.

Wetlands that are waters of the U.S. must be protected and restored consistent with the Clean Water Act (33 U.S.C. §1251 et seq. [1972]). For existing wetlands, preference should be given to protecting the existing functions and ensuring that the system is self-sustaining. Planners must understand that impacts on any wetland function can eliminate or diminish wetland benefits. Watershed planning provides an opportunity to be proactive in the protection of existing wetlands. Described below are a few of available tools for protecting wetlands:

- **Section 404 permit**
  Section 404 of the Clean Water Act established a permit program regarding discharges of dredged and fill material.

- **Advance Identification (ADID)**
  ADID, advance identification of disposal areas, is a planning process used to identify wetlands and other waters that are generally suitable or unsuitable for the discharge of dredged and fill material.

- **Section 401 Water Quality Certification and Wetlands**
  States and eligible tribes have authority under Section 401 of the Clean Water Act (CWA) to protect wetlands. Under Section 401, states and tribes can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state or tribal waters, including wetlands. The major federal licenses and permits subject to Section 401 are Section 402 and 404 permits, Federal Energy Regulatory Commission (FERC) hydropower licenses, and Rivers and Harbors Act Section 9 and 10 permits.

Creating or restoring wetlands to reduce pollutant loading to improve water quality utilizes a combination of the following techniques: (1) reestablishing the wetlands hydrology, (2) managing sediment and nutrients affecting the wetlands, and (3) reestablishing native biota. Past Clean Lakes Projects in Minnesota, Florida, Oklahoma, Michigan, and Illinois utilized the watershed scale to emphasize the importance of functional processes, and these projects demonstrated that in wetland restoration, functional processes are more important than the form (Figure 3). Section 319
Nonpoint Source Success Stories, many involving wetlands restoration, are documented at: http://water.epa.gov/polwaste/nps/success319/.

Mitsch and Gosselink (1993) identified four landscape locations for restored/created wetlands: in-stream, riparian, upstream, and terraced wetlands. Wetlands designed as in-stream systems are constructed by adding a control structure within or by impounding a tributary of the stream. In-stream wetlands should be considered only for first or second order streams, and they may provide more water quality than flow regime benefits. Riparian wetlands are designed to capture sediment and associated pollutants to reduce pollutant loading during flood stages and surface runoff. Upstream wetlands are created to temporarily store stormwater runoff and reduce downstream discharges. Terraced wetlands are created wetlands integrated into the landscape’s steeper terrain using terraces to place wetlands on hillsides. They are used to treat runoff and decrease peak discharge.

Creation or restoration of wetlands to stimulate all functions of natural wetlands has additional challenges. For example, created wetlands often must be redesigned on landscapes according to specific engineering and management criteria. A major constraint in the creation of wetlands is providing sufficient hydrology, which often involves considerable planning, design, and engineering and construction expense. In addition, created wetlands may not contain the appropriate wetland soils and are more readily invaded by exotic or invasive plant species.

Building off the Clean Lakes Program successes, a number of nonpoint source projects have enhanced existing degraded wetlands to maximize pollutant loading. Success for any wetlands enhancement effort can be measured by how closely the repair of the damaged or degraded wetland resulted in both its structural and functional attributes attaining pre-disturbance condition. An additional design concern is how resilient a wetland is and how enhancing its functions may impact its resiliency.

Wetland zones situated along lake shorelines can contribute to improved lake water quality and a much richer diversity in aquatic biota. The Chicago Botanic Garden’s Lake Enhancement Program utilized shoreline slope re-grading and installation of over a quarter-million wetland plantings to heal over three miles of eroding lakeshore and add significantly expanded aquatic habitat (Kirschner 2005).

Lake home owner associations can play a vital role in managing lake levels and decreasing residential flooding in their watersheds by working with land owners to use the opportunities natural and constructed wetlands provide to decrease the volume and velocity of stormwater runoff. Numerous studies and projects have shown that watershed hydrologic stability is a factor of the wetlands to watershed ratio. Results of the Illinois State Water Survey studies indicate that in order to maintain hydrologic stability, the wetland-to-watershed ratio should be at least 12 percent (TWI 1997); other studies promote a ratio of open space/wetlands to watershed of at least 18 percent. Delaney (1995) reported if a watershed was comprised of 5-10 percent wetlands, it could provide a 50 percent reduction in peak flood periods compared to watersheds without wetlands.

**Conclusions**

Environmental consequences of not properly managing the wetlands within a watershed create imbalances in flow, increases in pollutant loads, habitat destruction, and loss of biodiversity. The loss of wetland functions is manifested in the downstream lake. Based upon watershed-specific factors, state and local agencies can develop and implement watershed management plans that either prevent or minimize the cumulative impacts of inappropriate land management through a combination of management practices, wetlands, and riparian buffers. The integrated use of wetlands described above has the potential not only to remediate both water quality and quantity problems but to prevent them.
Lake watershed management plans developed for or by homeowners’ associations should address watershed and in-lake problems to support their lake use plans. It is important to note that many local lakes groups lack the capacity (funding, staff, and guidelines) necessary to fully utilize opportunities for protecting, enhancing, and creating wetlands on a watershed basis for lakes. Federal, state and local programs need to provide the capacity local lakes group lack. At a minimum, each lake watershed management plan’s wetlands component should include:

- identification of areas where wetlands need to be protected from nonpoint source pollution and conversion. This section should also include the practices and management measures that are needed to ensure adequate protection;
- identification of areas with the potential to enhance existing degraded wetlands for water quality/quantity purposes; and
- identification of areas with the potential to meet water quality/quantity goals as either restored or created wetlands.

References

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