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Rethinking the lake system

A new approach in Chicago creates an environment conducive to healthy aquatic life, and increases the site's value to visitors

One of the most significant features of the Chicago Botanic Garden (CBG) is its constructed 24 ha (59 acre) lake system created in 1967. Since its construction, active bank erosion has resulted in a shoreline that lacks visual appeal and is devoid of aquatic habitat. In fact, the 10.3 km (6.5 mi) of eroded shoreline has lead to the loss of over 0.8 ha (2 acres) of land in the past 30 years. Responding to this concern, the CBG adopted and began to implement "The Aquatic Initiative" with the goal of creating a preeminent water garden.

The lagoons and shoreline would host beautiful gardens and a healthy aquatic ecosystem. The major objectives of the shoreline restoration initiative were to:

- arrest future shoreline erosion
- enhance the aesthetic appeal of the lakes
- create educational plant opportunities
- improve water quality
- enhance habitat

Since the program's implementation in 2000, CBG has rehabilitated four different shoreline garden segments - nearly 3,962 m (13,000 ft.) of shoreline and adjacent gardens. Funding assistance has been provided by the Illinois Environmental Protection Agency (EPA) and the United States Army Corps of Engineers.

A multi-disciplined plan

The projects were designed and implemented by a multi-disciplinary team consisting of CBG staff, civil engineers, landscape architects and ecologists. Perhaps one of the most interesting dynamics was how the disciplines worked in a somewhat unconventional, cross-discipline manner. Engineers and ecologists provided landscape design input, while landscape architects and ecologists provided shoreline stabilization ideas. Two of the gardens were opened to the public in 2002, while the third was completed and unveiled in 2003.

The original shoreline was sloped at 3H: 1V with vegetated turf. This arrangement greatly limited the aquatic habitat and water quality benefits. As the shoreline receded over the years, it had been a source of significant sediment load to the lake system As noted earlier, nearly 0.8 ha of land had eroded around the shoreline - an estimated 6,370 metric tons of sediment.

The shoreline reconstruction has arrested that erosion within the project area, and in the process has created nearly 1 ha of aquatic habitat.

Draining the lake, shoreline treatments

The intent was to create broad aquatic shelves where none had existed. It was determined that the most effective method of creating shelves would be to drain the lake so that conventional earth moving equipment could be used. Temporary sheet pile coffer dams were used to isolate portions of the lake system prior to draining those sections. Other areas of the lake could not be drained without causing significant damage to other shoreline areas. Shelves in those areas had to be created in-the-wet. It was determined that a shelf could be slowly created by placing large rock along the shoreline. After drawing the lake down several feet to below the elevation of the shelf, the rock was placed along with a layer of soil spread to provide a growing medium for aquatic plants. Excavation through the test shelf revealed that the rock penetrated the bottom sediments and was locking-up, ensuring a stable shelf over time.

With the dual goal of providing technically sound shoreline repair along with beautiful garden spaces, the designers developed and implemented a range of shoreline treatments. These treatments produced extensive garden spaces that treat the shoreline as a living system. Underwater sheet pile was used in a

Photo 1. Once lacking in visual appeal and devoid of aquatic habitat , four Chicago Botanic Garden shorelines were restored.

By Thomas Price, P.E., Matthew J. Tucker, and Andrea B. Cooper

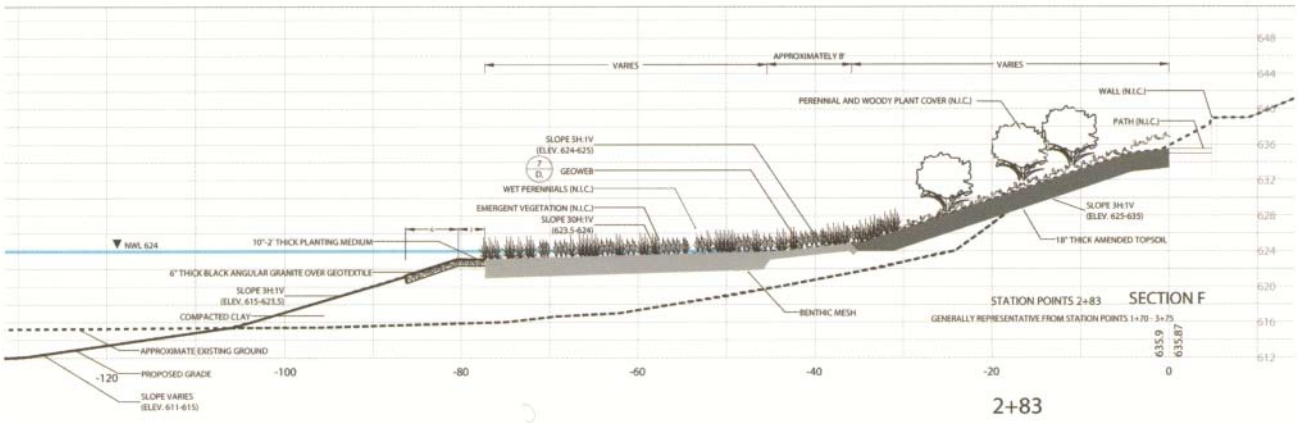

Figure 1. Cross section of shoreline. With the dual goal of repairing and beautifying the lake system, the designer developed a range of shoreline treatments: geotextiles for soil separation, geocellular reinforcement.

number of areas to create shallow aquatic shelves. Large boulders were interplanted with emergent vegetation to improve habitat, water quality and aesthetics.

Geotextiles were also used to provide soil separation while still allowing vegetation to grow. A benthic mesh (an open plastic weave geotextile with 25.4 mm openings) was used to provide support for maintenance workers in the soft, wet sediment, and to enhance aquatic plant survival. This material was customized by the manufacturer according to project design specifications so as to provide larger openings for better plant growth. Increased specific weight ensured that the material would not float. Also, the material was supplied in a color that blended more successfully with the lake substrates. A geocellular system was used to protect the shorelines above the aquatic shelf. Geocells are often used as soil-confinement solutions to increase the load bearing capacity or to create retaining walls.

Photo 2. Geocellular systems are effective counters to shoreline erosion.

However, in this case it serves to prevent excessive shoreline recession as well as a visual indicator of shoreline erosion.

Additional treatments include the creation of aquatic shelves along the shoreline planted with native plants that collectively create beautiful gardens and at the same time absorb wave energy and stabilize shoreline soils. In addition, back slopes were regraded and engineered soils and materials were introduced to maximize shoreline stability without disturbing the CBG's plant collections located up-slope. Finally, select aquatic species filter runoff and improve the aesthetic character while also accommodating aquatic research and education. **GRF**

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Project information

Client: City of Chicago, Dept. of Parks and Recreation

Landscape Architects: Conservation Design Forum; Thomas Price, Matthew Tucker, Andrea Cooper, project team

Geocell: Geoweb® from Presto Geosystems