THE BIOENGINEERING GROUP, INC.

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Connecticut Water Purification Facility and Park

Educational Facility and Park Feature Watershed Best Practices
Results Include Increased Biodiversity and Aquatic Habitat On Site and Healthier River Off Site

Project Owner: S**outh Central Connecticut Regional Water Authority**
The Bioengineering Group, Inc.
Sustainable Design Consultant

Background:

A new water purification facility has been designed and constructed with great sensitivity to allow this major project to fit into its setting. Within a residential neighborhood, adjacent to the historically significant Eli Whitney Museum and Barn, adjoining a sensitive tributary to the Long Island Sound Estuary, and highly visible from a cliff top park, the site was an ideal match for green roof as well as other low impact technology. The new facility demonstrates watershed best management practices compatible with recreation, habitat, and educational access.

Role of The Bioengineering Group, Inc:

The Bioengineering Group worked as Sustainable Design Consultant in close collaboration with the project team members including architect, landscape architect, and engineers. The firm's in-house team of ecologists, earth scientists, engineers and landscape architects are trained and experienced at effective interdisciplinary practice and provided linkage between other design firms' roles on the project. The Bioengineering Group identified opportunities and methods to integrate building, landscape, utility, and permitting needs by adopting multi-objective solutions. Through multiple rounds of value engineering, the Sustainable Design elements remained intact because they were shown to be cost-effective and highly functional.

Sustainable Site Design Approach

The project embraced the definition that sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs, balancing ecological, social, and economic factors (World Commission on Environment and Development, Brundtland Commission, 1987). Additionally the project conformed with principles endorsed by the US Green Building Council for specific building and site design parameters. The approach involved re-using a site formerly occupied by an obsolete water treatment plant, and incorporating demolished building materials for re-use in earthworks. All excavated earth and land clearing debris were salvaged and reused on the site and new building materials were selected in keeping with sustainable design. Water treatment processes were selected for efficiency, relying on gravity instead of pumping for flow. Energy systems were based on geothermal loops. Stormwater handling was achieved through use of vegetated swales and treatment wetlands rather than catch basins and pipes. Accordingly off-site impacts of the site such as energy demand, waste handling, and runoff are responsibly addressed.

Watershed Stewardship Demonstration

Most site engineering procedures seek to avoid or minimize new runoff impacts by comparing existing and proposed conditions. For this project, The Bioengineering Group set a goal of watershed restoration based upon achieving runoff behavior and a total annual water budget consistent with a forested, undisturbed ecosystem. Site design elements including best management practices were selected, scaled, and specified in order to achieve the targeted hydrologic functions, and detailed modeling to document results was performed by The Bioengineering Group. In this way, the project demonstrates that well executed projects can have a quantifiable restorative effect that can actually benefit watershed health. Best of all, it proves such measures can be beautiful as well as enjoyable to the public.

The Water Authority wished to design a facility that could handle effective public access of many types, from school tour groups to professional outreach. The administration building orients the public education entrance and the south facing entrance court functions as a staging area for group tours along a tour loop. The entire site serves as a state-of-the-art model for effective watershed stewardship through integration of best management practices such as its green roof, as well as vegetated swales, treatment wetlands, and other measures. The green roof has been designed to accommodate access to allow people to view down into the treatment facility and observe the stages in the purification process. At all levels, the project was a learning event for the entire project team, and can serve as a major outreach tool to promote low impact development approaches within the rapidly growing region of Connecticut known for water quality impairment of the Long Island Sound.

Integrated Stormwater Management System

The entire stormwater collection, conveyance, and treatment system is based on a natural hydrocycle approach. Specifically, the design compares favorably to conventional approaches by reducing runoff, infiltrating runoff close to the source, and keeping water in contact with vegetation and soils in order to promote evapotranspiration and biogeochemical treatment of nutrients and other pollutants commonly carried in stormwater. Much of the park grounds are maintained with tall grass meadow that absorbs water better than turfgrass or other surfaces. Similarly, the green roof is designed to reduce

annual runoff volume by 70%, and to reproduce runoff curves for a meadow for storms up to five inches in magnitude. Vegetated swales throughout the site converge to form a stream channel that leads to the beautifully formed stormwater management pond with wetland borders. The flow of the stream is augmented by water discharged from the deep foundation drain. The site actually releases the same quality and quantity of water to the Mill River as if the entire site were covered in dense forest.

Regulatory Compliance

The Bioengineering Group advised the project team about regulatory issues, attended public hearings and prepared supporting documents, and authored the Stormwater Management Plan for the project. During the design phase, the federal Clean Water Act became more stringent due to implementation of Phase II Stormwater Rules. In order to comply with these requirements, as well as state and local regulations tied to wetland resource impacts, the project needed to coordinate site design elements closely. The site included two areas of existing wetlands, and much of the site had formerly been occupied by fresh and brackish wetlands prior to its original development. Rather than focusing on resource area avoidance, The Bioengineering Group identified opportunities to restore functions and values to existing wetlands through hydrologic improvements and invasive species control, and most significantly to create new wetlands. The project not only harnesses an effective array of stormwater best management practices, it goes further by exceeding all federal, state, and local requirements for performance in terms of runoff mitigation and nutrient, sediment, and pollutant removal, as well as wetland mitigation.

Wetlands Mitigation, Habitat Restoration and Enhancement:

The project minimized site disturbance by preserving existing wetland, forest and other native vegetation. Existing populations of common reed, an invasive non-native plant overrunning the wetlands, were managed through hand cutting. The park design also creates a diverse range of new habitats, linked together to optimize the handling of water while serving as a microcosm sampler of regional habitat conditions. The site is located along a major bird migratory flyway, and the original meadow, wetland, and forest areas on site have been enhanced and incorporated into the final design in order to continue to provide bird resting areas. The project is designed to manage water as a precious natural resource, with water removed from the deep foundation pumped into the vegetated bioretention swales rather than sewer drains as usual. The flushing water for the treatment plan is also directed to the landscape drainage features where it sustains the wetland habitats on site. Stormwater generated from built surfaces is not piped off site, but conserved for the productive supply of aquatic conditions in swales, wetlands, and pond. The bioretention swales feature native wet meadow plantings, while the bordering vegetated wetlands surrounding the pond host emergent wetland plantings and a dense riparian shrub buffer zone. The pond itself is designed to maintain deep areas of standing water that support mosquito-eating fish for natural pest control. The pond features intricate and diverse grading and planting to enhance edge habitat and diverse physical niches for aquatic organisms.

Green Roof Design:

The Bioengineering Group provided engineering design for the built elements of the green roof and selected a plant community to maintain an enjoyable condition for those who view it from the overlooking park or the residences up the hill that also serves as effective meadow habitat for birds, insects (notably butterflies), and small mammals. The planting plan for the green roof was modeled after an alpine meadow and rock outcrop community featuring sedum and flowering perennials. This ecological complex thrives with shallow soils, exposure to wind, and some foot traffic, all without dependency on artificial irrigation or fertilization. The four-inch thick growing medium layer composed of mineral and organic components was carefully specified to deliver the desired hydrologic functions, to be lightweight, and to perform well for plant growth. After the plants fill in, the only maintenance needed will be occasional weeding, leaf removal, and treatment for crabgrass. The green roof is the largest in the State of Connecticut, totaling 28,000 sf. It increases the insulation R value by 3 points, prevents a heat island effect, and reduces stormwater runoff

The Bioengineering Group, Inc is a woman-owned business with 8(a) certification

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