

# Building a Green Roof to promote environmental responsibility

**Edward J. Kalina**, P.E., Engineering Manager, Engineering Solutions Team, Downers Grove, Illinois, and Awards Committee Chair, APWA Chicago Metro Chapter; **Nicholas J. Menninga**, General Manager, Downers Grove Sanitary District, Downers Grove, Illinois

**D**owners Grove, Ill., is located in the center of DuPage County, 25 miles west of the city of Chicago, and immediately southeast of the Interstate 88 and Interstate 355 Interchange.

The Downers Grove Sanitary District (DGSD) is responsible for providing sanitary sewer service for much of the Village of Downers Grove, the portion of the Village of Westmont west of Cass Avenue, and portions of Woodridge, Lisle, Oak Brook, and Darien, Illinois. The District is a separate unit of local government, independent of the municipalities where they provide service. Further, they are not part of the Village of Downers Grove.

DGSD collects sanitary wastewater through over 245 miles of sanitary sewers that they operate and maintain. They also operate and maintain nine wastewater pumping stations located throughout the service area. Sanitary wastewater is collected and treated at the Wastewater Treatment Center (WTC). The effluent is discharged to the East Branch of the DuPage River or St. Joseph's Creek, as permitted by the State of Illinois with authority from the United States Environmental Protection Agency.

DGSD provides service to 20,000 customers, including wastewater generated by more than 60,000 people and a number of commercial, industrial and institutional customers. The WTC has the capacity to treat an average of 11 million gallons per day of sanitary wastewater.

## Fostering a Tight Collection System

The DGSD maintains the separate sanitary sewer system.

The District receives significant amounts of rain and groundwater into the system. During major rain events, flow at the plant can reach as high as several times the dry-weather sanitary flow. Excess flow facilities are in place to treat these flows during major events. High flows during these periods can cause operating problems in the sewer system by taking up the capacity available to transport sanitary flow, contributing to backups and flooding in low-lying areas, and aggravating minor blockages.

Ordinances are in place that strictly prohibit inflow water from entering the sewer system. Significant resources are dedicated to finding and eliminating sources of these excess flows.

It is well understood that a large portion of excess flows come from private property. Buildings in the service area can have flaws in the way the plumbing is configured. Sources like roof drain downspouts and footing drain sump pumps can contribute very large amounts of excess flow into the sanitary sewer if improperly connected to the building sanitary service.

## Green Roofs to Mitigate Inflow and Infiltration

Direct stormwater runoff from building roofs accounts for a significant percentage of the inflow

from the private sector into the District's collection system. The building roofs act as a hard surface where 100% of the stormwater navigates to the building downspouts. This water can make its way to the building sanitary service through numerous pathways, either directly via illegal connection, or indirectly via foundation drains or leaking service pipe joints. A Green Roof absorbs much of this water before it reaches the ground, seriously controlling this major source of Inflow and Infiltration.

## Planning the Green Roof

Planning the Green Roof was an interesting and enjoyable process, mostly because it was a new project for everyone. The first step was to establish the *project priorities* to ensure a successful project. The priorities were as follows:

1. The Digester Building was chosen. The roof of the Digester Building is approximately 1,500 square feet. Not too big to become a major undertaking and not too small to be inconsequential.
2. The existing roof system of the Digester Building is watertight.
3. Structurally the roof of the Digester Building was over-designed. The existing roof structure had the capacity for the additional loading.
4. DGSD retained the services of the Engineering Solutions Team to assist with the design, cost-effective purchasing of materials,



and guidance during the in-house construction process.

### The Project Schedule

The planning and design of the project was initiated on August 5, 2011. It was required that the construction of the Green Roof was to be completed for the annual Treatment Plant Open House scheduled on October 1, 2011. The Open House is the best opportunity to promote Green Roofs to the District's customers.

### Design of the Green Roof

The design for our system generally consisted of a series of well-thought-out decisions.

**The Plan:** We decided on a total roof system vs. a modular system. We felt that we would not better understand the Green Roof concept by just placing modular Green Roof sections. Additionally, we believed that the total roof system would more thoroughly utilize the roof stormwater. We did need to incorporate a couple walks for maintenance of the new Green Roof and the clarifiers which are attached to the Digester Building.

**The Typical Section:** The Typical Sections to choose from are generally called the extensive or the intensive sections. We chose the extensive section. Our logic for choosing the extensive section was the following:

- The extensive section is simpler and more lightweight.
- The extensive section requires less maintenance.
- Additionally, we chose to use the sedum tiles because of their cost-effectiveness and their durability.

**The Mood:** The attitude of the staff around the plant was quite upbeat. The team was genuinely interested in tackling a new challenge. Everyone



The team installs the root stop, the root stop tape and the edging

was volunteering to be placed on the Green Roof construction unit.

**The Purchase of Supplies:** The plan was complete and consensus was reached on the typical section. The required items were formulated and the summary of quantities was calculated.

Research was conducted to identify several firms who met our criteria for materials. Based on the information provided by several firms we were in a position to develop our initial budget.

DGSD intended to perform the installation of the Green Roof with its in-house labor. The District wanted to pick up the materials at local warehouses but this was possible for only limited items. Our initial cost-projection was \$10/square foot, or \$15,000. Senior management approved the concept and the budget; therefore, we were moving forward and our completion deadline was the end of September.

**The Supplier:** American Hydrotech, Inc. was selected to be the roofing

supplier for the Green Roof. The supplier was selected for the following reasons:

- The company has successfully been in the business for over 30 years.
- The company is a local firm with the ability to provide good service.
- The company has developed a national and international presence.
- The company has been building Green Roofs for over 10 years.
- The company promised to provide onsite guidance during the construction process.
- The company could provide the materials at a competitive price.

### Construction of the Green Roof

Prior to installation of the Green Roof, the existing roof needs to be swept well.

Once you commit to beginning the construction of the Green Roof, you should build diligently through





**Installation of the sedum tiles**

the installation of all topsoil. The partially completed roof is very sensitive to windy conditions.

Installation was initiated on Tuesday, September 12.

Installation sequence is as follows:

1. Lay the heavy plastic root barrier. Generally provide a 12" overlap at all seams and at all edges. Tape all the seams.
2. Install edgings for walkways. Install the drainage covers for all existing inlets.
3. Install the special Green Roof plastic garden support drain system. This system is to be placed edge to edge.
4. Lay the root system filter fabric over the plastic garden support drain system. A 12" overlap is recommended, taping is not necessary.
5. Place 4" of the special "LITE TOPSOIL" over all the plastic garden support drain system.

6. Place the sedum tiles on the topsoil. Placing the sedum tiles is very similar to placing sod.

7. The sedum tiles should be watered probably three times a week for the first month after installation. Watering depends on the weather. The watering is to promote healthy germination of the sedum plants.

Installation was completed on Thursday, September 22.

The Open House was held on Saturday, October 1. The Green Roof was one of the focal points of the tour.

### **Final Construction Costs**

The final construction costs for all the roofing supplies came in at approximately \$17,500.00 for the 1,500-square-foot roof.

Also included in that final cost were several hundred square feet of extra sedum plantings. These extra sedums were planted on the grounds around the WTC and are being utilized as an ad-hoc nursery in the event that

areas of the roof may require being replanted.

The cost of the in-house labor was not figured into the cost of the project.

### **The Advantages of the DGSD Green Roof**

#### **Economic Benefits:**

- Energy efficiency – reducing heating and cooling costs for building.
- Prolonged roof membrane durability and longevity – protecting the membrane.
- Fire prevention.
- The installation became a solid team building exercise.

#### **Environmental Benefits:**

- Creation of preservation of habitat and increasing biodiversity.
- Temperature regulation.
- Improve air quality.
- Stormwater management.
- Water filtration.
- Improved aesthetics.
- Noise reduction.

### **Conclusion**

The Green Roof is currently growing well and looking good. The flows through the downspouts have been reduced. The District intends to construct another Green Roof in the same fashion in the near future.

*Edward J. Kalina can be reached at (630) 698-6696 or [edkalina@hotmail.com](mailto:edkalina@hotmail.com); Nicholas Menninga can be reached at (630) 969-0664 or [nmenninga@dgsd.org](mailto:nmenninga@dgsd.org).*