Chapter 10

Michigan LID Case Studies

This chapter highlights several developments that have incorporated numerous LID best management practices into their designs. These best management practices help communities meet their land use planning goals of protecting public health, safety, and welfare, as well as preserving community character, and making desirable places for people to live and work.

The following case studies showcase the implementation of numerous best management practices working together through integrated systems. Almost all components of the urban environment have the potential to serve as elements of an integrated stormwater management system. This includes using open space, as well as rooftops, streetscapes, parking lots, sidewalks, and medians.

In addition, these case studies represent various size developments as well as a diverse range of land use types and property ownership. LID is a versatile approach that can be applied equally well to new development, urban redevelopment, and in limited space applications such as along transportation corridors.

Pokagonek Edawat Housing Development

The Pokagonek Edawat Housing Development is located in Dowagiac, MI in Cass County. The Dowagiac River Watershed Management Plan was used as the basis for the design principles in this project, which led to integrating LID techniques into the development.

The Pokagon Band of Potawatomi Indians Tribal Development used nine LID BMPs to arrive at an overall strategy that protects and uses natural flow pathways and preserves natural features in overall stormwater planning and design. This development also maximized stormwater infiltration to ground water through:

- Rain gardens and bioswales,
- Sensitive area preservation,
- Cluster development, and
- Porous pavers.

Rain gardens and bioswales

The first phase, or neighborhood, of the development includes 17 homes. Each home has at least one rain garden that accepts roof-top drainage. During the design process, the native topography of the site was retained as much as possible to preserve the natural drainage. Any stormwater runoff generated from the neighborhood is managed by the depressions where infiltration capacities have been augmented by native vegetation to create bioswales.

Bioswale
Source: Pokagon Band of Potawatomi Indians

The rain gardens and bioswales required approximately two growing seasons to become established. The General Land Office survey notes indicate that the development location was a Mixed Oak Savanna circa 1800s. Thus, plant species associated with savanna and prairie settings were selected. Initial maintenance largely included watering and weeding, and infill planting, as needed. Currently, periodic weeding is the main maintenance activity related to this BMP.

For the bioswales, a combination of plug placement and seeding with a warm season grass drill was used, along with an initial fertilizer application. A mixture of warm season grasses and forbs were selected for the bioswale vegetation. Initial maintenance largely included watering and weeding. Weed management during the first year included mowing. Current maintenance activities include prescribed burns and selective mowing. All maintenance is performed by the Pokagon Band Housing Department. Most maintenance costs involve the care of limited turf grass that surrounds each home. Watering of the rain gardens is conducted as needed during prolonged dry spells.

Natural flow path and sensitive area preservation

The site was formerly agricultural fields mixed with woodlots. The woodlots and native topography of the site was retained as much as possible to preserve the natural drainage, and the lots and streets were designed around these depressions. Land between these depressions that is not included as a lot and spared via clustered design is scheduled to remain as open space.

Plant species associated with savanna and prairie settings were selected to mimic the presettlement ecosystem. Native vegetation was established by seeding the open space areas with a warm season grass and forb mixture. This was enhanced with selective placement of plugs.

Turf grass was established in small, select locales within the open space to create social gathering areas. Additionally, groomed walking trails were designed into the open spaces and woodlots. Walking trails will connect to subsequent phases of development to create a walkable community.

Annual maintenance costs are chiefly associated with prescribed burns, followed by lesser costs to maintain the limited areas of turf grass. However, the frequency of prescribed burns may be reduced in the future as the landscape matures.

Cluster development

The housing units have been clustered in loops following the site topography with 17 units in the first phase and 16 units scheduled for the second phase. Clustering reduced development costs by shortening roads and utility runs. Smaller lots have reduced lawn and yard maintenance. Clustering also allows for shared bioswales to be established among the buildings, helping to manage runoff. The footprints of the homes were minimized, through smaller hallway space and eliminating foyers, while still providing for maximum usable space.

Porous pavers

The street design for the first phase of the development is 1,800 linear feet long with approximately 25,000 square feet of interlocking pavers for the primary driv-

Clustering homes
Source: Pokagon Band of Potawatomi Indians

Reduced imperviousness
Source: Pokagon Band of Potawatomi Indians

ing surface. The street's three-foot depth subbase is composed of a bottom layer of road-grade gravel and crushed concrete overlain by coarse grained sand to help facilitate stormwater infiltration. The earth at the bottom of the subbase is graded with a slight slope toward the central bioswale to assist with drainage during very heavy precipitation events.

Additionally, the sidewalk was constructed using six inches of reinforced concrete and is actually part of the roadway. It is designed to accommodate the weight of heavier emergency vehicles and allow passage in the presence of street traffic and parked vehicles, if needed. This approach also limits impermeable surfaces through the use of pavers and a narrower streetscape, encouraging slower traffic flow while promoting the walkability of the neighborhood.

Curb and gutters were not used in the street design, since the permeable nature of the pavers and subbase made it unnecessary to collect and divert stormwater. However, a concrete border was constructed to anchor the interlocking pavers into place at the outer edges of the street.

The tribal maintenance department is responsible for maintaining the streets. Placing sand between the pavers is conducted as needed, along with periodic weeding.

Additional information

The pre-existing use of the land was agricultural and covered with large areas of wooded open space. Woodlots were maintained and treated with a tree management plan to open the canopy as well as to remove invasive tree species. Invasive underbrush was removed to assist propagation of remnant native vegetation. Half of the Phase I development was integrated into a wooded portion of the parcel for aesthetics and variation. Soil types within the property range from sandy loams to gravelly sands.

Additionally, the wooded areas have been identified as potential conservation areas in a study conducted by the Michigan Natural Features Inventory for a regional green infrastructure project within Cass, Van Buren, and Berrien Counties. The restoration-based concept for the Pokagonek Edawat development demonstrates that conservation and development can be compatible.

Lawrence Technological University – A. Alfred Taubman Student Services Center

The 42,000 square-foot A. Alfred Taubman Student Services Center, located on the Lawrence Technological University Campus in Southfield, MI, in Oakland County not only meets the requirements of the important student services functions it is designed to house, but is also a "living laboratory" of sustainable design and engineering. Built to U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) specifications, the Taubman Student Services Center addresses the criteria of sustainable site development and construction, recycled materials selection, indoor environmental quality, and water and energy efficiency. Specifically related to stormwater management, the Taubman Student Services Center uses the following best management practices:

- Vegetated roof,
- Bioswale, and
- Soil restoration.

Vegetated roof

The building's 10,000 square-foot living vegetated roof is created with layers of insulation, roof membrane, drainage fabric, and a four-inch granular composition that supports nine different species of sedum ground cover. About nine inches thick, the roof offers more effective insulation than traditional roofs and expands and contracts with seasonal changes. It is expected to last about 40 years, more than twice the lifespan of traditional materials.

The vegetated roof also controls and reduces stormwater runoff. With normal rainfall, about 60 percent of the water will be absorbed by the roof while the remainder drains into a 10,000-gallon underground cistern to be used as "gray" water for flushing toilets and for irrigating the campus quadrangle. The weight of the roof is estimated to be 10 to 12 pounds per square foot with a saturated weight of 15 pounds per square foot.

Vegetated Roof at Lawrence Technological University
Source: Lawrence Technological University

The Hydrotech Garden Roof Assembly is an extensive roof that includes the following vegetation:

- Dianthus plumarius
- Koeleria glauca
- Seven varieties of Sedum:
    - Sedum album
    - Sedum floriferum 'Weihenstephaner Gold'
    - Sedum kamtschaticum
    - Sedum spurium
    - Sedum spurium 'Fuldaglut'
    - Sedum spurium 'Summer Glory
    - Sedum middendorffianum 'Diffusum'

Maintenance activities included a minor amount of watering (permitted by LEED) in the first two years to develop the roots of the sedum plugs. After the two-year establishment period, watering was cut off. Additionally, the first two years required several weedings due to the spacing between the plugs. Now that the roof has fully filled in, the weeding effort is reduced to almost nothing. These intermittent maintenance activities are performed by the Campus Facilities Department.

Bioswale

A circular bioswale, approximately 725 linear feet was installed around the campus quadrangle. The width of the bioswale varies from eight to 15 feet. The preexisting soil consisted of clay with minimal topsoil. A system of weirs, tile fields (composed of material made of volcanic ash), and long-rooted grasses and trees will prevent 60 percent of the rainwater that falls on the adjacent campus quadrangle from running into the Rouge River as part of a regional effort to control stormwater drainage and improve the water quality and biodiversity of this portion of the Rouge watershed. This bioswale of vegetation will naturally purify the water by filtering out pollutants commonly found in snow and rain.

The capacity for the bioswale to capture stormwater runoff was designed for the 10+-year storm event — designed to flood with holding capacity exceeding 10-year event by backing up into the bioswale — essentially a long detention pond. Plants evapotranspiring coupled with free draining soils drain off surface water within 24 to 36 hours. Check dams positioned approximately 30 feet on center through more sloping zones create additional stormwater holding capacity.

Maintenance activities are conducted by the Lawrence Technological University's Campus Facilities Department. Grasses are cut down in the spring to encourage new growth, along with periodic weeding.

Soil restoration

The upper 18 inches of soil within the bioswale is loamy sand amended with sphagnum peat moss for organic content and pH, covered with shredded hardwood bark mulch. All site subgrade soils were decompacted to a depth of 24 inches following construction operations, including in the bioswale, and prior to finishing landscape soil placement. The operation was performed in order to maximize porosity of subsoils for stormwater infiltration and to foster plant and tree health in the bioswale and all general landscape areas.

Bioswale at Taubman Center, LTU Campus
Source: LTU

Mid Towne Village

Mid Towne Village is a mixed-use urban redevelopment project located in Grand Rapids, MI in Kent County, designed to provide a unique setting that contains a walkable community of residential, retail, and office uses (182,000 sq ft.).

The site was previously an older residential neighborhood consisting of 40 homes. Mid Towne Village is unprecedented in the City of Grand Rapids as it is the first project approved under the new Planned Redevelopment District zoning law passed in the fall of 2003 and uses the following LID BMPs:

- Reduce imperviousness,
- Subsurface infiltration, and
- Capture and reuse using a cistern.

Reduce imperviousness

In creating Mid Towne Village, the existing roads and utilities were reconstructed, and an environmentally friendly layout added additional height to the buildings to allow for parking underneath the buildings, construction of subsurface stormwater storage and infiltration, and construction of a cistern to store roof rainwater and reuse it for onsite irrigation purposes.

The Mid Towne Village buildings were built taller to allow for more parking. By incorporating two floors of parking (35,090 sq feet each) into the lower level of the property, exterior impervious surface was reduced resulting in better use of the property.

Cistern and infiltration system

The cistern is located in a park in the middle of the village. The cistern is sized to store 20,000 gallons of roof water from three nearby buildings. The irrigation system of the park area between Union, Dudley, Mid Towne, and Calder streets draws its water from the cistern.

The subsurface infiltration system is sized for the 25-year rain event. The area beneath the park will store 8,950 cubic feet of stormwater; the area along the east side of the site will store 6,774 cubic feet of stormwater. The subsurface stormwater system used the sandy soils and allowed for groundwater recharge, filtration of the stormwater, and eliminated the stormwater connection to the city's storm sewer system. The local rainfall information was reviewed and analyzed to determine the amount of storage necessary to collect adequate supply of rainwater for irrigating the development park area onsite. Using this system, the irrigation system for the development park area was not required to have a separate connection to the city's water system.

Subsurface infiltration system

Source: Dreisinga Associates

Maintenance

An annual budget has been prepared for these systems to be privately maintained. This includes activities such as street sweeping, inspecting and cleaning of sewer sumps, inspecting and cleaning of subsurface storage systems, and inspecting and cleaning of the cistern system.

Longmeadow Development

Longmeadow is 400 acres of rolling land divided by ponds, meadows, clusters of trees, wetlands, and horse paddocks in Niles, MI in Berrien County. The design was dictated by the land topography, resulting in separate areas for a variety of housing types and lot sizes. It preserved 50 acres of open space, providing opportunities for fishing, community gardens, walking trails, and private roads for biking and hiking. The design takes into account the need to preserve habitat for wildlife. This includes eliminating street lighting and maintaining animal corridors.

View of wetland

Source: Longmeadow Development, Owner: Jane Tenney

Sensitive areas — existing wetlands and very hilly areas — were preserved. Hilly areas include a change in topography of 20 feet over the 400-acre site. Existing wetlands are maintained by a buffer of greater than 75 feet of vegetation that is not mowed. This vegetated buffer reduces erosion in these areas by providing infiltration for stormwater runoff.

In addition, the site design incorporated the existing long vistas of seeded upland prairie meadows. Most of the trees onsite were preserved, including a very old, large oak tree at the entrance to Longmeadow development. Existing fence rows of trees were also preserved, providing a natural visual separation between housing types.

Bioswales provide infiltration of stormwater runoff from the 24-foot-wide roads and, in some cases, between homes. In a higher density area of homes, flat curbs were installed to maintain road edges, while bioswales direct some stormwater to storm drains surrounded by vegetation. In addition, the fire lanes were constructed with permeable surfaces.

Open space common areas are maintained by the development's homeowners association. Longmeadow was picked by The Conservation Fund as a demonstration project in the State of Michigan for watershed protection.

Quarton Lake Remediation

The Quarton Lake restoration project began in November 2002 in Birmingham, MI in Oakland County. The project included shoreline stabilization using bioengineering techniques, creating fish habitat, an assessment of the tributary stream corridor, and dredging of sediment which accumulated in Quarton Lake during the past 30 years. The stream assessment included a streambank erosion inventory and severity index based on Michigan Department of Environmental Quality procedures to identify areas of erosion and sediment sources.

Aerial view of Quarton Lake
Source: Hubbell Roth & Clark, Inc.

Due to this project's location in a highly urban area, committee meetings were held throughout the design phase soliciting public input and addressing resident concerns. In addition, the project consultant helped the city develop flyers for area residents and articles for neighborhood association newsletters to report project progress throughout construction. This project contains the following LID BMPs:

- Riparian buffer restoration, and
- Native revegetation.

The stabilized buffer area surrounding Quarton Lake has a width of 10 to 50 feet. Invasive plants, including common buckthorn and Japanese barberry were removed from this area for one year. Stabilization activities included installing coir logs on the east and west shorelines and stone terraces on the east and west sides of the lake. A total of 3,500 native plant plugs and 2,000 square yards of fescue and ryegrass seed mix were installed in this area. The native plants included serviceberry, viburnum, common arrowhead, common rush, sedges, and irises.

Quarton Lake initially consisted of over 90 percent carp by weight, creating a monoculture of fish species. To increase fish diversity in the lake, over 700 carp were removed. Gravel substrate was added, along with brush piles, a spawning bay, and a lunker (a man-made fish habitat structure). The lake was stocked with the following fish species: Largemouth bass, Channel catfish, Black crappie, and Flathead minnows.

Dredging of 30,000 cubic yards of soil was performed which was dried in sediment bags and sent to a Type II landfill. In order to gauge the impacts of the dredging, a lake assessment (including monitoring of fish species, fish habitat, dissolved oxygen, and nutrient levels) was performed prior to dredging. The purpose of the dredging was to increase dissolved oxygen levels and improve phosphorus levels found in the lake sediment prior to dredging. Since the lake has been dredged, nutrient levels and dissolved oxygen levels have improved.

The project consultant developed a maintenance plan for the city in 2006, including recommendations for future efforts in Quarton Lake. Dissolved oxygen and temperature levels were monitored in August 2005. Data still showed low dissolved oxygen levels near the stream bed. Temperature levels remain fairly constant from stream bed to the surface. Additional water quality monitoring is recommended for future years. The city maintains the plantings along the lake's 25-foot no-mow buffer. The city participates in an annual goose round-up, to help prevent goose droppings high in phosphorous from entering the lake. To further assist in water quality efforts, the city maintains a stringent street sweeping and catch basin cleaning program to keep sediment out of the lake. To date, there have been no additional costs incurred for maintenance practices, aside from DPW staff labor costs.

Native vegetation for streambank stabilization and runoff infiltration

Source: Hubbell Roth & Clark, Inc.

Riparian education

A workshop to educate the public about the importance of riparian protection was held. It informed riparian homeowners about the purpose and scope of the Quarton Lake project, and educated them on the importance of riparian buffers, restricted activities in the riparian zones (fertilizer use, feeding waterfowl/wildlife, dumping yard wastes, etc.), shoreline stabilization techniques, permitting, and contractor issues and costs.

Towar Rain Garden Drains

The Towar Rain Garden Drains used LID to completely retrofit a rain garden stormwater system in a neighborhood setting. Located in Meridan Township and the City of East Lansing in Ingham County, MI., the system consists of two concurrent drain projects (Towar Snell Drain & Towar Gardens and Branches Drain) that were installed in the Towar Gardens neighborhood in 2006 and 2007. These projects encompass approximately 200 acres and impact over 400 homes.

The Towar neighborhood experienced flooding of yards, roads, and basements for over 80 years prior to this project. The neighborhood is very flat, with only six feet of elevation from the lowest rear yard to the outlet more than a half-mile away. The project used rain gardens and installed them in areas where flooding historically occurred.

All the work was performed under the Michigan Drain Code, with more than 100 easements gathered to install over 5.5-acres of rain gardens along streets and in rear yards. The rain gardens were planted using native species and were constructed with new soil media. More than 110 pounds of native wildflower seed was used to construct the rain gardens and nearly 52,000 plugs were planted. More than eight miles of county drains were constructed during the project.

More than 150 individual rain gardens were constructed throughout the project, ranging from 100 square-feet, to areas larger than 2/3 acre. The main conveyance system consisted of small concrete pipes in the roadways that accepted the stormwater from the ditches and rear yards. This project is believed to be the largest urban retrofit of a stormwater system ever performed in the United States and the largest using rain gardens as the primary function to manage stormwater. It is the largest LID project ever performed under the Drain Code in Michigan. Maintenance costs are variable, since activities will be more intense in the initial years after construction is complete and until native species are fully established. Once established, costs are expected to decrease substantially.

Towar Drain neighborhood

Source: Fitzgerald Henne and Associates, Inc.

The Ingham County Drain Commissioner is responsible for all maintenance activities under the laws of the Drain Code of 1956. Maintenance activities include removing invasive and weed species from the rain gardens, cleaning the perforated pipes from tree roots, and continuing education of the community regarding avoiding mowing and applying herbicide to the native plants.

Rain garden one year after establishment

Source: Fitzgerald Henne and Associates, Inc.

Kresge Foundation Headquarters

The site for Kresge Headquarters is an historic farmstead set within the context of a completely altered landscape on a commercial business site in Troy, MI (Oakland County). The 2.76-acre site is a small oasis within a larger suburban-scale, corporate landscape.

Porous pavers

Source: Conservation Design Forum, Inc.

Site goals

The Kresge site attempts to recreate historical hydrology as an essential component of overall ecological performance, which is a key LID principle. In addition, the site provides habitat for the widest range of plant and animal life given its confined context and location. The site receives all of the rainwater that falls in its 2.76 acres and uses much of it to support a diverse water-based landscape. Any stormwater that is not infiltrated into the existing LID practices is treated onsite in the bioswale system before being released into the city storm drain.

The project objective was to create a workplace that promotes the well-being and productivity of staff and visitors. Because the Kresge Foundation invests in the sustainable development of hundreds of nonprofit facilities each year, sustainable planning of their own construction project was a main goal. As part of this green approach, the overall landscape goals for the Kresge Foundation Headquarters were twofold:

1. To maintain rainwater onsite while using it as a resource, promoting infiltration of surplus stormwater, and
2. To create a healthy, vibrant landscape that could be installed and maintained without use of chemicals, large amounts of supplemental water from municipal sources, and other intensive measures.

The strategy for site ecology was to incorporate LID practices into practically every portion of the site. This project includes the following LID BMPs:

- Minimize total disturbed area,
- Vegetated roof,
- Pervious pavement,
- Native landscaping,
- Bioswales,
- Constructed wetland, and
- Water collection and reuse.

Minimize total disturbed area

The historic farmhouse remains as the cornerstone for the new building. Other historic outbuildings were rearranged to maximize the efficiency of the site. The new building is stacked on two levels and set into the site. The parking lot is tucked on the eastern edge of the site, and has a minimal number of parking spaces. A portion of the building has a vegetated green roof system. The green, or planted, portion of the site is 1.76 acres, or approximately 63.4 percent of the total site area (2.76 acres). More than 63 percent of the site was restored as landscape area and open space.

Vegetated roof

The portion of the roof surface that is at-grade (3,213 square feet) is established with a green roof using a mid-range grass planting mix. Rainwater from the upper portions of the roof is directed into the green roof, where it is cooled and used. Overflow water is then directed to the lower constructed wetland/pond (see below). Surplus rainwater is stored and reused to irrigate the green roof during periods of drought.

Vegetated roof with meadow grass
Source: Conservation Design Forum, Inc.

Pervious pavement

The parking lot is constructed with interlocking concrete pavers that have gaps filled with crushed stone and underlain with open-graded gravel. This porous paving system allows the water falling on its surface to be cooled, filtered, and infiltrated into the ground. Overflow water is directed to the bioswale systems.

Native landscaping

The entire site was planted with a range of native and adapted grasses and flowering perennials (primarily prairie species) that thrive without supplemental water once established. The landscape was organized into ornamental edges, panels, and zones to address views, programming, and the suburban and historic context of the site. The landscape is managed as a natural system and, where feasible, existing trees were retained. Since controlled burning is not permitted in this area, the landscape was designed with a hybrid native/adapted plant mix that will thrive with minimal input once fully established. Invasive species removal and annual removal of the dormant material through mowing are the primary stewardship activities. As the root systems of the native plants, especially the grasses, become fully established, invasive species will be crowded out and be less of an issue. More importantly, the landscape will become progressively better at receiving rainwater sustainably, and returning it to the ground without any runoff.

Native landscaping prairie mix
Source: Conservation Design Forum, Inc.

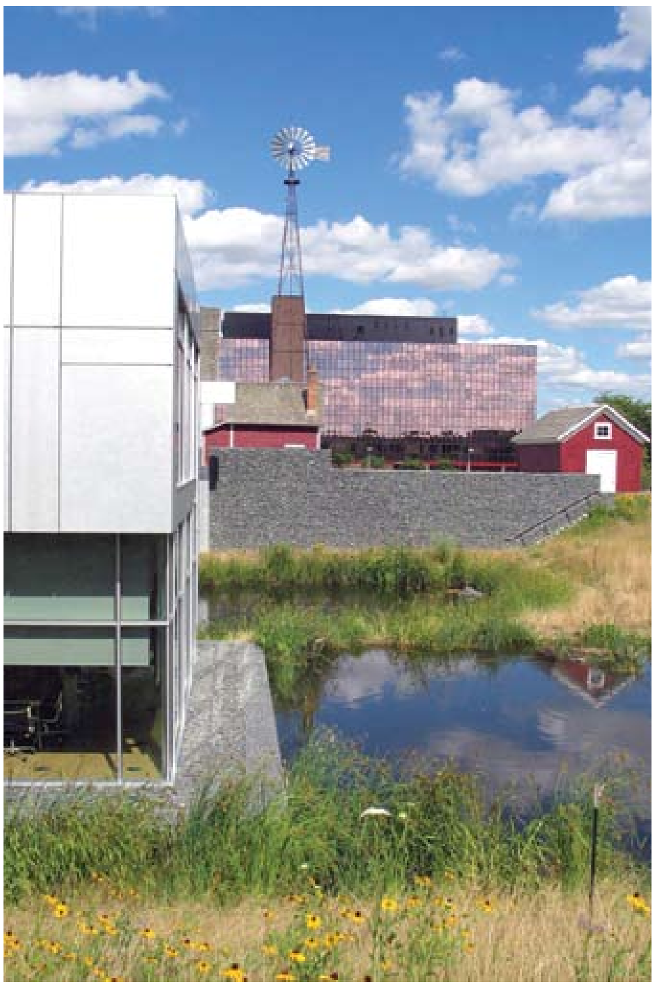
Bioswales

Surplus rainwater is directed to a bioswale system. The bioswale is constructed with amended topsoil, underlain with stone, and planted with deep-rooted grasses. The bioswale slows and further cleanses and cools the rainwater, allowing more of it to return to the atmosphere in the form of evapotranspiration. The bioswale system then overflows into the city storm drain only in the heaviest rain events and when the ground is saturated.

Bioswale along parking lot
Source: Conservation Design Forum, Inc.

Constructed wetland

The lowest portion of the site was developed as a constructed wetland pond. It is a lined basin meant to have a permanent water surface, with a planted wetland fringe mimicking a native system. Rainwater that overflows from the roof and portions of the site are directed to this pond. If the water level rises more than six inches, surplus water is drawn into the cistern for future reuse. If the water level draws down during dry periods by more than six inches, water from the cistern is allowed to flow back in. This keeps a fairly constant water level to maintain a high quality wetland habitat and also allows the pond to be part of the stormwater management system.



Wetland along building
Source: Conservation Design Forum, Inc.

Water collection and reuse

The entire landscape thrives without the use of potable water. Rainwater is harvested, treated, and stored in a cistern to provide water for the constructed wetland and supplemental water for the green roof system. In order to optimize this system, a water budget was developed and used as a design tool. The amount of water potentially generated from rainwater (supply) was compared with water needs (demand). An analysis of the water budget throughout the year led to refinement of the design and sizing of the water landscapes and storage elements.

The green roof systems contain a permanent irrigation system and the created wetland on the south side of the building is topped off when the water level drops below a prescribed depth. Water for green roof irrigation and refilling of the pond is supplied by collected rainwater from the new building roofs, the barn, the utility corridor, the landscape, and water that falls within the courtyard and the created wetland. The runoff water drains by gravity to the aquatic wetland and is then pumped to the 18,000 gallon cistern for later reuse. The water is reused on the four intensive green roofs that are vegetated with a native grass mix, and also to replace evaporated water from the created wetland. The average monthly volume of collected rainwater exceeds the average monthly demand by more than 50 percent. The cistern is of sufficient size to provide more than three weeks of water demand to average out monthly variability and extended periods without rain.

Irrigation water is applied to the green roof drainage layer using a trickle system. Irrigation water is held with the drainage layer using "ridges" two inches in height, at sufficient spacing to cause an average ponding depth of 1.25 inches, which equates to an irrigation volume of 0.5 inches over the roof area (40 percent pore space within the drainage layer media). If the lowest irrigation ridge is not full at the sensor, it will call for the pump to operate and for the drip box water supply valve to open. When the sensor indicates that the system is full of water at that bottom edge of the roof, it signals the valve to shut. Once all the systems are full of water, the pump shuts off. When the cistern is empty, the system does not operate. The maximum irrigation interval is once every other week. The water discharge module consists of drip box, water discharge with shut-off and flow control valves, and a distribution pipe. The discharge module discharges irrigation water consistently along the top roof edge.

When the water level in the created wetland drops two inches below normal water level, the pond is refilled to the normal water level using water in the cistern. The required volume to refill the two-inch drawdown is approximately 6,600 gallons. The 18,000 gallon cistern has sufficient volume to refill the drawdown more than 2.5 times. The average monthly water supply exceeds the average monthly water demand by more than 50 percent. The cistern has sufficient volume to supply more than three weeks of irrigation and refill the created wetland water feature.

Decentralized stormwater management

The integrated stormwater management design treats water as a resource, and allows water to flow over land, thus allowing ample opportunity to infiltrate back into the ground. Water is also collected and conveyed underground in the bioswale zones. The stormwater harvesting cistern is above ground, and serves as an icon and part of the Kresge Foundation image. The 18,000-gallon cistern is reminiscent of the "historic farm aesthetic," and is visible from Big Beaver Road, making a dramatic statement about Kresge's commitment to water conservation and natural resource preservation. The green roof landscape systems are permanently irrigated by a cistern system that collects and reuses rainwater in a drip fashion. A typical Midwestern office campus with turf vegetation would require irrigation at a rate of one inch per week (Source: Purdue University, State of Indiana and U.S. Department of Agriculture Cooperative). The native landscape established at the Kresge Foundation Headquarters requires no irrigation.

Cistern at Kresge Foundation

Source: Conservation Design Forum, Inc.

Lessons learned

The City of Troy was interested in having BMPs and LID tools implemented within their city. They were a very helpful partner in bringing innovation to this project, approving the design, and were involved from the early stages reviewing design documents and providing feedback.

It is critical to work closely with the contractor, and for the designer to be onsite regularly overseeing construction and stewardship. It was also advantageous to have well written specifications that require submittals and approvals for various products. This kept the landscape architect in the conversation, and required review of issues before they were installed. While onsite during one field visit, the porous paver parking lot was being constructed using a sand setting bed, rather than the aggregate material from the detail. The construction was halted immediately, and testing was completed to document the infiltration capacity. The owner agreed to a warranty period extension, allowing the rest of the parking lot to be constructed using the specified material. To date, there has been no sign of a lack of infiltration.

It is important to communicate the establishment process and aesthetic considerations very clearly to the client (and all occupants of a particular project), so that all expectations are clear and resolved. Construction schedule impacts also need to be clearly understood throughout the implementation process.