



CASE STUDY | Taking Steps to Protect Our Communities

IOWA ACQUATIC CENTER MAKES A SPLASH WITH PERMEABLE PAVERS

After rainstorms in Monona, Iowa, stormwater runoff used to flow off the gravel parking lot and driveway of the Monona Aquatic Center, picking up pollutants as it flowed into a local river tributary. The City of Monona used funds from Iowa's Clean Water State Revolving Fund, a state-wide clean water loan program, to finance a green infrastructure project to replace the lot with permeable pavers to absorb the stormwater runoff. This project helped to improve local water quality, enhance the parking lot, and reduce site maintenance.

BACKGROUND

Originally, the Monona Aquatic Center's driveway and parking lot were made of packed gravel. During rainstorms, stormwater would travel from the parking lot and down the driveway picking up sediment, debris, and oil and chemicals from cars. This contaminated runoff would drain into a local river tributary and then into Silver Creek, which at the time was considered an impaired waterway. During the summer, the heat from the gravel would warm up the stormwater runoff, which would increase the temperature of the local river tributary and disrupt aquatic life.

The parking lot was also unpleasant for guests of the Aquatic Center because it was on a steep hillside. The gravel surface could be hot and uncomfortable for visitors in the summer months. The city wanted to improve the site and use the project to help improve the water quality of nearby streams and rivers. In conjunction with the local Turkey River

IMPAIRED WATERWAYS

are bodies of water that do not meet water quality standards.

AT-A-GLANCE

PROJECT NAME:

Monona Aquatic Center

TIMELINE:

2014

LOCATION:

Monona, Iowa

POPULATION:

1,549

PROJECT FOOTPRINT:

1,835 square yards of permeable pavers

GREEN INFRASTRUCTURE:

Permeable pavers

RESULTS:

Reduced runoff rates during a 100-year storm event from six cubic feet per second to 0.1 cubic feet per second, added 15 parking spots, and improved usability

BENEFITS:

Improved water quality, enhanced aesthetics, reduced maintenance, increased parking



The original gravel parking lot at the Monona Aquatic Center.



The Monona Aquatic Center parking lot after installation of permeable pavers.

Watershed Association, the city began to plan improvements to the Aquatic Center parking lot in 2014.

PLANNING AND FINANCING

To finance the project, the city wanted to take advantage of funds available through Iowa's Clean Water State Revolving Fund. The city already had a loan from this fund to work on a wastewater treatment plant project. Through the loan, the city could add a "sponsored project" for a separate stormwater project. A sponsored project did not add to the overall debt of the original wastewater treatment plant project loan, but was financed through the loan's interest and fees, requiring no additional costs for water utility customers. In 2014, the city completed an application for the Aquatic Center parking lot to be a sponsored project using information from a previously completed environmental assessment of Silver Creek and with support from local stakeholders. The city received a sponsored project loan of \$245,000, which covered most of the construction and engineering costs for installing permeable pavers at the Aquatic Center parking lot.

The city and local engineering firm proposed several potential solutions,

including a stormwater pond near the site and streambank stabilization. However, these options did not address both problems of improving the parking lot and improving water quality. The project team settled on replacing the gravel in the parking lot with permeable pavers. Permeable pavers are interlocking bricks laid over layers of stone or gravel. Stormwater filters down between the pavers and through the stone. This was an innovative solution because permeable pavers are primarily used on flat surfaces. The Aquatic Center parking lot was on a hill, so the engineer redesigned the site to make it less steep and installed permeable pavers. During rainstorms, the space between the pavers allows runoff to soak into layers of gravel placed underneath the pavers. The gravel layers help to create space to filter and store parking lot runoff. After deciding on



The gravel layers installed before the permeable pavers help to create space to filter and store parking lot runoff.

THE CLEAN WATER STATE REVOLVING FUND

is a federal/state partnership managed by EPA to fund water infrastructure projects. EPA provides grants to all 50 states and Puerto Rico. The grants provide funding for projects that improve water quality such as wastewater treatment plant improvements, non-point source pollution control, and green infrastructure projects. To learn more about your state's Clean Water State Revolving Fund, visit <https://epa.gov/cwsrf>.

the best solution, the project team sent the proposal to the Iowa Department of Natural Resources for approval.

PROJECT DETAILS

Once the project and sponsored project loan of \$245,000 were approved, the city hired a contractor to install the permeable pavers in the summer of 2014. Because the Aquatic Center parking lot and driveway were situated on a steep slope, the contractor first had to excavate the original parking lot and driveway to reduce the slope of the site. Next, the contractor added an 18-inch-thick layer of 2- to 3-inch crushed stone to the excavated space to create space for water storage and help to filter stormwater as it travels down the hill. Then the contractor added a 6-inch layer of 1-inch

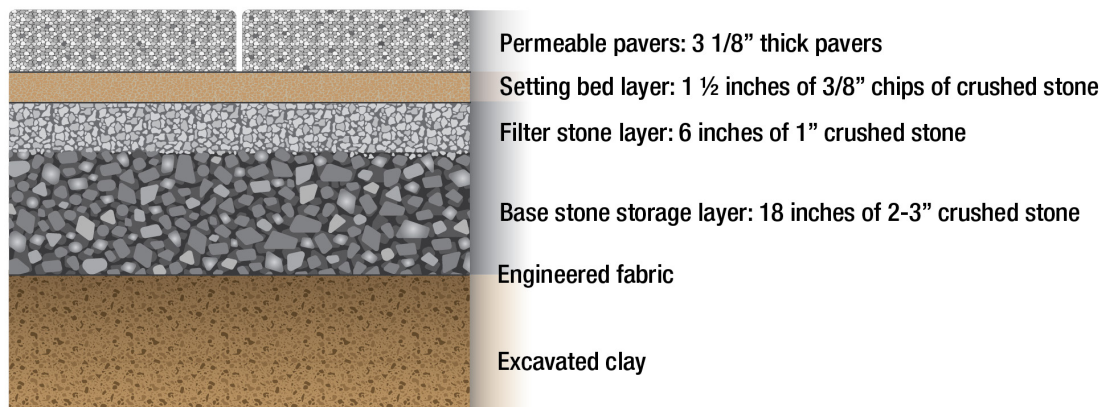
crushed stone over the entire parking lot and driveway space. After this layer of stone, the contractor built concrete curbs to contain the stone. Following the installation of the curbs, the contractor placed a thin layer of small stone called the setting bed over the previous layers of stone. This layer was screened to create a flat surface to lay the pavers.



The contractor lays permeable pavers over layers of crushed stone.

To complete the parking lot, the contractor used a special piece of machinery to place 4-foot square pallets of pavers in the parking lot and driveway areas. The contractor used white pavers to create parking lines and black pavers to indicate where not to park. The different colored pavers reduce maintenance from painting. Finally, the contractor compacted small stone chips into the spaces between pavers. This prevents dirt and debris from clogging the drainage system while allowing runoff to soak into the gravel layers below the pavers.

During construction of the parking lot,



the contractor added additional features to help control runoff rates on the site. Because of the site's slope and underlying clay layer that prevents infiltration below the gravel layers, the contractor dug a 5 to 6-foot deep storage trench on the downhill side of the parking lot to collect extra stormwater runoff that did not soak into the pavers. In the trench, the contractor added a pipe that connects to the storm sewer system. In the storage trench, a 6-foot layer of the crushed stone was added. After runoff filters through the gravel layers, it flows to the storage trench at the bottom of the parking lot and is slowly released through this pipe.

Additionally, sidewalk permeable pavers were placed over the area outside the concrete curbs to connect the parking lot to the Aquatic Center and to create an area to place a bicycle rack.

RESULTS

The new parking lot and driveway greatly reduced the rate at which stormwater runoff leaves the site, added more parking space without increasing the site's footprint, and improved aesthetics for Monona Aquatic Center patrons.

HEALTHIER WATERSHED: The permeable pavers and layers of crushed stone filter and store stormwater, allowing it to slowly drain off the site over a span of four days. Previously, the gravel parking lot did not store stormwater, and any rain that fell on the site would run off within minutes. This new, extended drainage time helps to reduce erosion as the water is released as a small trickle over several days. The site can now manage the runoff from a 100 year storm event, which has a one percent chance of occurring in any given year and generates approximately 7 inches of rainfall in a 24-hour period¹. The additional time the water filters through



A demonstration of the permeable pavers capturing water.

the crushed stone beds under the pavers also helps to filter the stormwater of sediment and other debris.

The city did not evaluate the water quality of the nearby river tributary before and after the project. However, the project engineer noted that oil and grease from the parking lot no longer reach the creek, and the water appears cleaner now that most of the stormwater from the site is filtered by the new design.

IMPROVED AESTHETICS:

The parking lot is easier for Monona Aquatic Center patrons to access and use, as it is no longer on such a steep slope. The new pavers also reduced dust and debris. Before the project, the parking lot looked unfinished, but with the new pavers the parking lot appears to be in much better condition.



REDUCED MAINTENANCE:

The use of different color pavers reduces parking lot maintenance for city staff, since they do not need to repaint parking space lines every year.



LESSONS LEARNED

Thorough planning and preparation helped the project team avoid major problems or roadblocks; following are some of the tips and strategies they learned along the way:

¹https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ia

- **Be flexible.** The steep slope of the site or the underlying clay layer could have been a roadblock, but the team developed a creative solution.
- **Evaluate the needs of the site before deciding on a solution.** Careful planning can help you solve multiple problems with one project.
- **Piggyback off other projects or funding.** Using an existing financing system helped fund the project without cost or burden on citizens.
- **Small projects can inspire larger projects.** Though this site was small, it was the starting point for Monona to complete larger projects. Following the successful completion of this project, the city renovated a 560-foot road next to the Monona Aquatic Center with permeable pavers.

- **Find local partners.** Partnering with local groups such as watershed associations or local River Keepers can help garner support for projects and provide valuable insight from local experts.

The City of Monona used green infrastructure to solve multiple problems at the Aquatic Center. By using existing funding mechanisms, the city was able to improve the parking lot, driveway, and local water quality in a short amount of time at minimal cost to the city. Additionally, this smaller project inspired the City of Monona to implement additional green infrastructure projects.

ACKNOWLEDGEMENTS

Jon Biederman of Fehr Graham, the local engineering firm hired for this project, provided information and photos for this case study.



Permeable pavers were installed on a steep slope.