

# ENGAGING STAKEHOLDERS IN SMALL PROJECTS FOR BIG IMPACTS IN THE WABASH RIVER WATERSHED

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## ABSTRACT

The Wabash River Enhancement Corporation (WREC), in partnership with Purdue University and the Cities of Lafayette and West Lafayette, implemented a broad-reaching, community-wide stormwater management program. Since 2012, WREC and our partners engaged more than 1,500 individuals to implement a variety of stormwater remediation projects. Cumulatively, these efforts resulted in the storage and infiltration of nearly 5 million gallons of stormwater annually and reducing stormwater impacts on the Wabash River by diverting more than 1,700 lbs. of nitrogen, nearly 1,000 lbs. of phosphorus, and nearly 135 tons of sediment. The projects also engaged 900 community members, 85 partners, and nearly 500 Purdue University students. Through a series of small projects, WREC and their partners are producing **BIG IMPACTS** on the Wabash River.

## INTRODUCTION

Stormwater runoff occurs when precipitation runs off land and naturally drains into waterbodies or settles in low-lying areas where it infiltrates into the ground replenishing groundwater supplies; however, increasing areas of impervious surface cover, such as roads, parking lots, and rooftops, are altering the natural hydrological cycle. In recent years, the area of impervious surface cover in the contiguous United States has increased to over 43,479 square miles, an area nearly equivalent to the size of the state of Ohio (Elvidge, 2004). In Indiana specifically, nearly one million acres of farmland were converted to urban uses between 1992 and 2002 (Thompson and Prokopy, 2009). The consequences of this land use change can have dramatic impacts on human and ecological systems.

At just 10% impervious surface cover, detectable watershed impacts, including the alteration of the shape of stream channels, increased water temperatures, and the movement of urban debris and pollutants into aquatic environments, can lead to reduced numbers and diversity of species in fish and aquatic insects, degradation of wetlands and negative impacts to riparian zones (Beach, 2002). In urban areas, stormwater runoff no longer infiltrates back into the groundwater system, rather it runs off impervious surfaces into drainage ditches, storm drains, and sewer systems and is discharged into nearby waterbodies carrying contaminants with it. These contaminants include sediment, nutrients, chemicals, and other pollutants. Additionally, increased pressures of urban development on aging infrastructure has led to the frequent overloading of combined sewer systems during rain effects resulting in the release of untreated wastewater directly into rivers and streams (USEPA, 2015).

Consequently, management of stormwater has become an increasingly critical problem for communities of all sizes. In addition to federal and state legislation, in recent years, small-scale stormwater best management practices (BMPs) have been identified as a cost-effective way to prevent stormwater from reaching piped stormwater and sewer systems in the first place. These BMPs include rain gardens, rain barrels, bioswales, permeable pavement, and native plantings that can decrease stormwater volumes and reduce water quality impacts (USEPA, 2015). The accessibility of these BMPs provides a unique opportunity to engage urban residents in water quality improvements watershed-wide. It also offers professionals working in stormwater management—watershed management practitioners, governmental entities, and higher education institutions—a challenge to develop education and outreach programs that effectively engage the public in the implementation of such small-scale stormwater management practices.

## AREA OF INTEREST

The Region of the Great Bend of the Wabash covers 478 square miles including portions of Benton, White, Fountain, Montgomery, Tippecanoe, and Warren counties in Indiana, and is primarily agricultural although the majority of the cities of Lafayette and West Lafayette are located within its boundaries. There are about 3,000 acres of impervious surface area covering roughly 1% of the total watershed (Peel, 2011). The Watershed Management Plan for the Wabash documented 107,448 residents in 2011 with nearly 85% of individuals living within Lafayette and West Lafayette's urban boundaries (referred to as the Greater Lafayette area) (Peel, 2011).

In 2004, the Wabash River Enhancement Corporation (WREC) was established in partnership with Purdue University, Tippecanoe County, and the cities of Lafayette and West Lafayette. WREC's mission is to improve environmental and economic conditions in the Greater Lafayette Region and the Wabash River Corridor in a sustainable manner. E. coli, sediment, nutrients, and poor quality (low density/low diversity) biotic communities (fish and macroinvertebrate populations) are known impairments in the Wabash (Peel, 2011). Historical water sampling data indicate that nitrogen, phosphorous, E. coli, and suspended solids are an issue throughout the watershed (Peel, 2011). Fish consumption advisories are present along the Wabash River and fish populations are declining (Pyron et al., 2006). There are also problems with erosion, livestock having access to streams, and a lack of adequate buffering between streams and agricultural and urban land (Peel 2011). Urban impacts from combined sewer overflows, buildings, parking lots and other impervious surfaces also negatively impact water quality within the Wabash River.

Clean water in the Wabash River and local tributaries is necessary for not only human and ecosystem health, but economic prosperity in the region. Unfortunately, by the time the river reaches the Greater Lafayette area, the Wabash reflects the runoff and inputs from a quarter of the nearly 40,000 square mile Wabash River watershed, including combined sewer overflows, industrial and municipal wastewater inputs, brownfields, development pressures, and stormwater and agricultural impacts leading the river to be impaired for nutrients, pH, E. coli, dissolved oxygen, and impaired biotic communities. Additionally, a survey by WREC found that among respondents, there was a widespread ignorance about major water impairments and associated practices to address these issues within the urban community (Prokopy et al. 2009). Results of this survey suggest that extensive community education and outreach efforts in urban communities are needed in order to effectively change management behaviors, and ultimately improve water quality (Prokopy et al. 2009).

## ENGAGEMENT & OUTREACH EFFORTS

Since 2012, WREC in partnership with Purdue University and the cities of Lafayette and West Lafayette has implemented a broad-reaching, community-wide stormwater management program that engages a diverse group of stakeholders throughout the community in all facets of project siting, design, implementation, and maintenance. The following discussion will include efforts specifically designed for the residential, commercial and governmental, and higher education sectors.

### Residential Engagement

*Reducing Barriers:* To promote urban green practices, improve local education, and reduce environmental impacts to the Wabash River, the WREC staff and volunteers dedicated thousands of hours towards increasing awareness about installed urban conservation practices, improving access to individuals that installed these practices, and connecting watershed residents to the Wabash River. These efforts are part of WREC's overall campaign to reduce citizens' limitations and address their concerns

with relation to urban conservation practices and engage citizens by encouraging them to reduce their environmental impact on the Wabash River.

The development of a web tool, [TippEcoNow](#), provides a baseline, continuous opportunity to connect Greater Lafayette residents with locally-installed urban conservation practices. Additionally, TippEcoNow connects Greater Lafayette residents with other residents and highlights the practices that they can implement to positively impact the Wabash River from the comfort of their own home. TippEcoNow provides green practice and environmentally friendly program information that is Tippecanoe County-focused. Greater Lafayette resident survey data indicate that a majority of individuals know that their individual lawn care and stormwater decisions impact local water quality. Further, they recognize that good water quality in the Wabash River creates an economically stable community. Additionally, their limited familiarity with urban best management practices limits their ability to make a change that will improve water quality; however, nearly 60% of Greater Lafayette residents indicate a willingness to learn about and implement urban best management practices (Prokopy et al., 2009). WREC and partners developed TippEcoNow to reduce the barriers that Tippecanoe County citizens have with respect to urban best management practices. Specifically, TippEcoNow aims to address the 60% of individuals who feel they have limited knowledge about best management practices and what it takes to install them; the 55% of individuals who want to visibly see installed practices and talk with individuals who have installed practices; and the 31% of individuals who are interested in “keeping up with the Jones” or attempting to make improvements to their property to stay in line with their neighbors and friends.

TippEcoNow addresses these concerns through a variety of mechanisms. The tool provides general information and regional local resources for: urban best management practices including rain gardens, rain barrels, pervious pavement, native plants and trees; details options for alternative transportation, recycling and solar, wind and geothermal energy options; connects citizens to Clear-Blue-Green businesses and local environmental groups; and promotes recreation and eating local food. The tool includes the option for individuals to calculate their impact to the Wabash River and determine their backyard wildlife habitat value. These items specifically address the limited knowledge issues identified by Greater Lafayette community members. Most importantly, TippEcoNow provides a map and photographs to locate and view these important features in our community allowing individuals to visibly see and visit installed practice locations. Additionally, the map provides opportunities to review projects installed in individual neighborhood cultivating the opportunities for individuals to keep pace with their neighbors. Since 2011, TippEcoNow partners identified, photographed and mapped more than 1,000 individual green practice listings and highlighted an additional 200 alternate transportation and green energy options. WREC and our partners dedicated more than 2,000 hours to developing the web tool and populating the map resulting in more than 400 weekly web hits with 20,000 page views of which 11,490 are unique viewers. These data suggest that visitors return to regularly use the tool. The impact to Greater Lafayette and Tippecanoe County are displayed for all to see on TippEcoNow, which celebrates the efforts made to make Tippecanoe County TippEcoNow.

*Providing Technical Assistance:* Greater Lafayette urban residents identified concerns in implementing a practice incorrectly, not having access to qualified contractors and/or the necessary tools to implement the practices, and not knowing where or how to implement the practice in which they are interested as the biggest barriers to implementing projects (Prokopy et al. 2009). To address these concerns, WREC staff and partners implemented a technical assistance program. This program provides one-on-one technical assistance and site visits to identify specific issues and opportunities to implement urban conservation practices. Since 2012, more than 320 individual site meetings identified more than 750 separate urban conservation practices. These individual consultations resulted in a 50% conversion rate

with more than 165 individuals who participated in one-on-one technical assistance meetings implementing at least one urban conservation practice. Participants identified the site-specific information and the personal connection to the technical assistance provider and potential contractors as the factors that allowed them to take the first step in implementing a project with more confidence and higher success rates.

*Engaging Stakeholders:* Outreach events that specifically targeted urban residents included: pervious concrete demonstration installation; workshops for gardeners and local residents, which highlighted rain garden and rain barrel installations; a native plant workshop series that focused on plant selection, site selection, and maintenance of native plants; multiple green tours, where community members traveled to local residences to speak with homeowners about the water quality practices that they have adopted; a painted rain barrel program, which highlighted the beauty of rain barrels; and educational presentations as part of the local master naturalist training, community library speaker series, League of Women Voters education series, and other public opportunities. Individually, these efforts focused on providing technical information and assistance to participants, highlighted installed urban conservation practices and the associated installation costs, and provided access to individuals who had previously installed or maintained urban conservation practices.

WREC also created and distributed Eco Champion signs to local residents who installed a rain barrel, rain garden, native plants, or pervious pavement. If they had implemented multiple water quality practices, they could add a sticker to their sign for each practice. Individuals recognize the Eco Champion signs as a commitment to maintain their urban conservation practices. 82% of elite rain barrel adopters also installed an Eco Champion sign (Gao et al, in process). Eco Champion signs were present at lower levels (12% and 4%, respectively) for acceptable and unacceptable rain barrel adopters, or individuals that installed but did not maintain or did not install their rain barrels. The individual Eco Champion signs identified rain barrel adopters to their community generating a sense of obligation to continue to use and maintain rain barrels. While adoption and maintenance assessments of rain gardens, native planting areas and pervious pavement have not been completed, Eco Champion signs installed concurrent with urban conservation practice implementation generate public comment and provide opportunities to engage public throughout Greater Lafayette.

#### Commercial and Governmental

*Connecting Large-scale Projects to the Community:* To engage commercial and governmental sectors in increasing the health of the Wabash River, since 2012, WREC partnered with commercial, municipal, and educational entities to install urban conservation practices. In total, 35 commercial, municipal, and educational facilities implemented projects installing 40 rain gardens, 8 acres of pervious pavement, 2 bioswales, 1 green roof, 0.5 miles of streambank stabilization and 2.2 acres of turf to prairie conversion. Cumulatively, these projects generate the largest water quality impact on the Wabash River resulting in reductions as follows: 1500 lbs. nitrogen, 500 lbs. phosphorus and 130 tons sediment annually. Project partners identified a need to create a positive impact on local water quality, improve aesthetic and environmental conditions for their residents, and address long-term infrastructure issues as the predominant motivation for implementing practices. These large scale, highly visible projects have the ability to improve water quality through their function while influencing everyday users to implement practices at their own residence. While the movement of these practices is still being tracked, several local, large-scale projects, including the City of Lafayette North Street pervious pavement and rain garden project, the City Bus transfer terminal rain garden, and the Alcoa parking lot conversion, were mentioned as an influence for individuals to adopt a practice at their own home (Babin 2014). Additionally, these projects provide opportunities to engage the local community with their maintenance and connect their community to one another. WREC works with partner agencies to coordinate

volunteer-based maintenance events at many of these large-scale installations. In each case, individuals who live, work, or recreate in these areas partner with community volunteers to understand how the practice functions, improve its condition and implement long-term management and maintenance plans. These maintenance events create a sense of community and improve the likelihood that volunteering will translate into a personal commitment to make a change on behalf of the Wabash River.

### Higher Education

Since 2006, WREC has fostered deep, meaningful relationships with Purdue University among faculty, students, and staff. These partnerships, not only enhanced student learning, but also leveraged expertise of faculty members in addressing the issues surrounding the health of the Wabash River. To date, 12 courses have been offered in partnership with WREC, nearly 1,000 students engaged, and 7 faculty members contributed expertise.

*Authentic Learning for Students:* Over 265 students have participated in semester long service-learning courses offered in partnership with WREC across multiple departments (Agronomy; Environmental and Ecological Engineering; EPICS; Forestry and Natural Resources; and Horticulture and Landscape Architecture). A total of 12 unique courses have been developed since 2006 around topics, such as developing study designs for the Lafayette-West Lafayette urban core; developing natural resource management plans for the Wabash River corridor; planning and executing public meetings; creating a web tool which connects the public to ecological opportunities throughout Tippecanoe County; and co-designing stormwater remediation projects with additional community partners. Virtually all of these courses involved high levels of interactions with stakeholders and presentation of findings to the public giving the students the opportunity not only to work on a real-world projects that meet a direct community need, but also the opportunity to interact with concerned citizens, stakeholders, and community organizations, as well as develop civic leadership skills (Bringle and Hatcher, 2009; Bringle and Hatcher, 2002).

One specific course, Urban Water Projects, was formed after WREC partnered with a Purdue graduate student to receive a national \$50,000 Ford College Community Challenge (C3) grant to lead the implementation of small-scale stormwater management projects, including rain barrels, rain gardens, bioswales, and native plants at three additional partner sites. The success of this course and grant effort lead to an additional \$18,000 from the Alcoa foundation and another iteration of the course. To date this course has been conducted three times linking students to 7 community partners (Cary Home for Children, Christ United Methodist Church, Fire Station #8, Food Finders Food Bank, Imagination Station, Oakland High School, and Tecumseh Middle School) and the installation of 28 stormwater management projects that also serve as educational demonstration sites for the public. WREC has also provided support for student clubs in designing and funding on-the-ground implementation of projects that positively impact the Wabash River, including funding a rain garden designed and installed by the Boiler Green Initiative (2012 and 2016) and rain gardens and a bioswale designed by the Engineers for a Sustainable World (2015-2016).

*Creating Citizen Scientists & Civic Leaders:* WREC has provided countless opportunities for students to work in the community through committee participation, as citizen scientists, and as support staff for education and outreach events affording them the opportunity to becoming engaged citizens, and directly contribute to addressing a local sustainability issue. Since 2009, Purdue students served on the following WREC committees: education and outreach (12 students), monitoring (6), signage (3), targeting of practices (2), messaging (3), and photography (8). With student support of these committees have produced 6 large and 9 small Eco-Champion signs to promote best management practices, discussed and identified monitoring needs and options, developed a newsletter for WREC, and worked

to document existing and identify future potential urban practice locations throughout the community. WREC has also trained 66 undergraduate student leaders to install rain barrels at residential homes and to participate in Hoosier Riverwatch monitoring.

Students also serve as citizen scientists during the Wabash River Sampling Blitz hosted by WREC. From 2009 to present, 984 volunteers have sampled 2,784 stream sites to create twice annual snapshots of water quality. Purdue University students comprise more than 45% of the total participants. This experience provided hands-on opportunities for students to connect with the Wabash River, while equipping them with necessary tools to make significant changes in their behavior and actions. Additionally, since 2012, WREC offered nearly 425 volunteer hours for over 100 students representing multiple student organizations (Boiler Green Initiative, Engineers for a Sustainable World, Environmental Science Club, BoilerOUT, and MANNRS) to support WREC's ongoing education and outreach activities, including 4-H fair booth staffing, Riverfest booth staffing, canoe trip planning, urban practice design and maintenance, and fishing derby.

*Engaged Research:* Lastly, WREC developed multiple relationships with Purdue faculty and graduate students to support programmatic efforts. Through community-based, engaged research faculty provided expertise in the development of social indicator surveys; upstream and downstream monitoring of nutrients and E. coli; biological monitoring of fish, macroinvertebrates, and habitat; GIS inventory and analysis; and urban corridor master planning. Eleven graduate and undergraduate students from the following departments also contributed research time and skills: Agricultural and Biological Engineering; Agronomy; Earth Atmospheric and Planetary Sciences; Forestry and Natural Resources; and Honors.

## FUNDING

To complement the education and outreach programs, as well as partnership efforts, in 2011, WREC developed a targeted cost-share program identifying specific practices focused on improving water quality from both urban and agricultural portions of our watershed. To show a marked change in the Wabash River, the plan identifies \$14.3 million in agricultural and urban project need in the first five years of implementation (2012-2015). To date, \$5.1 million has been spent throughout the community to improve water quality conditions in the river. Nearly \$1.1 million in USEPA Section 319 funds provide the foundation for urban conservation practice implementation throughout the Greater Lafayette area. Local funding, (\$40,000) from TippMont REMC and (\$7,500) the Purdue University Service-Learning Community Service program; state funding (\$80,000) from the Indiana DNR Lake and River Enhancement Program; and corporate funding from The Nature Conservancy (\$10,000), Alcoa (\$18,000), and the National Ford College Community Challenge (\$50,000) provided additional program funding. Partner efforts provided the other \$4 million in urban conservation practice implementation funds.

## CUMULATIVE PROGRAM IMPACTS

*Residential:* In total, 166 residential projects have been implemented to date. These projects include 32 rain barrels, 22 rain gardens, 7 bioswales, 2 urban retrofits, and 7 acres of turf to prairie conversion. An additional 1,449 rain barrels, 26 rain gardens, 15 bioswales, 13 acres of pervious pavement, and 10 acres of turf to prairie conversion occurred using partner or personal funds. These projects resulted in nearly 122 lbs. less nitrogen, 407 lbs. less phosphorus and nearly 4800 lbs. less sediment entering the Wabash River annually. A 2014-2015 assessment of installed rain barrels indicate that nearly 80% remain in place two and three years after initial purchase (Gao et al, in process). Survey data indicate that the majority of residences where a rain barrel is no longer installed is due to the initial landowner moving from their residence (16%) or the rain barrel maintenance being too much work for the resident (4%).

*Commercial and Governmental:* In total, 35 projects have been implemented resulting in the installation of 40 rain gardens, 8 acres of pervious pavement, 2 bioswales, 1 green roof, and 2.2 acres of turf to prairie conversion. These large-scale projects are generally privately funded and result in highly visible projects with long-term community improvements and relatively short-term payoffs. The positive impact of these projects on the Wabash River far outweighs privately installed, small scale projects, as well as the highly visible, student-designed projects. In total, commercial and governmental projects account for 98% of the cumulative load reductions achieved by implementing urban conservation projects resulting in 1,500 lbs. less nitrogen, 500 lbs. less phosphorus and 130 tons less sediment entering the river annually.

*Higher Education:* In total, 32 community partner projects have been implemented to date by Purdue students enhancing student learning and addressing stormwater management challenges. These projects include 13 rain barrels, 8 rain gardens, 7 native savannas, 3 bioswales, and 1 edible garden. These projects resulted in nearly 18 lbs. less nitrogen, nearly 15 lbs. less phosphorus and nearly 1,600 lbs. less sediment entering the Wabash River annually. While the project impacts are minimal compared to the commercial and governmental projects, of the 45 students that have participated in the 3 courses that installed these projects 75% state that this experience has redirected their future career path toward a more socially responsible choice (Payne, 2016).

*Cumulative Impact:* In total, WREC and our partners engaged more than 1,500 individuals to implement a variety of stormwater remediation projects. Cumulatively, these efforts resulted in the storage and infiltration of nearly 5 million gallons of stormwater annually and reducing stormwater impacts on the Wabash River by diverting more than 1,700 lbs. of nitrogen, nearly 1,000 lbs. of phosphorus, and nearly 135 tons of sediment. The projects also engaged 900 community members, 85 partners, and nearly 500 Purdue University students.

## RECOMMENDATIONS & CONCLUSIONS

While stormwater management has become an increasingly critical problem for communities of all sizes, water quality improvements can be achieved through small-scale water management projects implemented watershed-wide. This narrative provided the effective ways in which WREC and partners developed education and outreach programs to engage the public in the implementation of such projects, and ultimately lasting water quality improvements within the Wabash River. It should be noted that one of the most integral aspects of these efforts is the inclusion of a diverse groups of individuals throughout the community integrated into all facets of conservation—project siting, design, implementation, maintenance, and education. Without these broad-reaching partnerships and intentional inclusion of individuals across sectors and ages, it is highly likely the project impacts would not have been as successful. In spite of these efforts, there are additional targeted efforts needed in order to increase urban conservation practice implementation in the Greater Lafayette area, including:

- Improved access to the necessary equipment and contractors that can assist with urban conservation practice installation. In 2016, an equipment sharing option will be reviewed with community partners and needs and opportunities for promoting the use of this equipment will be identified.
- Increase awareness of installed practices and individuals that installed the practice. While many individuals are aware of installed urban conservation practices, additional promotion of these practices and access to individuals, especially residents, who implemented the projects need to occur. Installed urban BMPs will be promoted via weekly social media posts, installer's experience with urban BMPs will be promoted with monthly blog posts and highlighted in

monthly newsletters, and additional opportunities for individual landowners to host tours and events to promote their urban BMP will be identified.

- Education event participants already feel an affinity for the Wabash River. This affinity needs to be cultivated and opportunities to convert Detrash the Wabash, Wabash Sampling Blitz, Wabash Riverfest and other volunteers into urban conservation practice adopters will be identified, prioritized and implemented. Research indicates that individuals that volunteer are interested in the Wabash River and its water quality, thus should be candidates for urban BMP adoption.
- More than 50% of individuals that take advantage of individual technical assistance opportunities implement an urban conservation practice. Promotion of and access to individual one-on-one conservation-based technical assistance.
- Strategically promote the use of rain barrels to gardeners and those that are interested in reducing the cost of water spent watering flowers and vegetables. Survey results indicate that most rain barrel purchasers installed their rain barrel to reduce the volume and cost of water used in their yard.
- Continue general promotion of rain barrels, native plants and trees as low cost options for increasing property values, improving water quality, and reducing negative impacts on the Wabash River. Specifically, unique uses for these practices, proof that they provide a water quality benefit, identification of ways that all properties support these types of practices.
- Promote the economic benefits of installing urban BMPs through social and traditional media as economic motivators such as water costs and property values are the highest motivators for early adopters.
- Research and evaluation of projects, including residential, commercial, and student-led design.

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