CASE STUDY | Taking Steps to Protect Our Communities

SANTA FE UNDERPASS BLAZES A FLOOD PREVENTION TRAIL WITH GREEN INFRASTRUCTURE

When it came time to build a new pedestrian and biking underpass at one of the busiest intersections in the metropolitan area, the City of Santa Fe, New Mexico, included green infrastructure innovations to ensure water from occasional heavy storms would not pool on the newly constructed trail. Proactively incorporating green infrastructure such as stormwater infiltration ponds, infiltration trenches, and bioswales of native plants in this community project helped mitigate flooding on the trail, reduced required maintenance at the site, saved water, and improved the local ecosystem.

BACKGROUND

Given the dry, desert environment of New Mexico, stormwater management might not be the first consideration for construction project teams in the region. The Santa Fe metropolitan area receives only 14 inches of rain per year, much less than the annual U.S. average of 38 inches. However, most of this rainfall occurs during intense storms in July and August, referred to as "monsoon season." The high-desert and mountain scrub ecosystem is not able to naturally stop the flow of stormwater or reduce nutrient loading during major weather events. Without proper management, runoff can cause erosion of the local landscape and carry pollution into the Santa Fe River, enough for the river to be classified as impaired due to high levels of sediment, nutrients, bacteria, and thermal pollution. This stormwater should be treated before it reaches the Santa Fe River watershed.

Additonally, uncontrolled stormwater runoff during the monsoon season can damage private and public property. Streets and sidewalks can be covered in sand and gravel from runoff, trees and power lines could fall down in bad storms, and low-lying dwellings may become flooded.

AT-A-GLANCE

PROJECT NAME:
The Acequia Trail Pedestrian and Bicycle Underpass

COMPLETED:
2017

LOCATION:
Santa Fe, New Mexico

POPULATION:
84,683

PROJECT FOOTPRINT:
Nearly 100,000 square feet

GREEN INFRASTRUCTURE:
Bioswales, infiltration trenches, infiltration ponds

RESULTS:
The site can collect up to 437,000 gallons of stormwater per year and holds water from a 100-year storm event

BENEFITS:
Local watershed protection, reduced maintenance, improved safety and aesthetics

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Arial image of St. Francis Drive Intersection before the project. *Courtesy Serquis + Associates*

Finished trail and underpass. *Courtesy Serquis + Associates*

Based on its unique climate and associated challenges, the City of Santa Fe developed a proactive stormwater strategy to maintain a sustainable ecosystem and quality of life by seeing stormwater as a "resource with unrealized opportunities."[1] The city's strategy highlights the importance of incorporating stormwater management into local development projects such as the Acequia Trail Pedestrian and Bicycle Underpass.

The Acequia Trail Pedestrian and Bicycle Underpass project was developed to safely link two popular trails under a busy intersection, allowing continuous access to the popular retail and community spaces such as parks, plazas, and playgrounds in southwest Santa Fe. Before the underpass was built, the five-way intersection on St. Francis Drive posed safety and accessibility challenges for pedestrians and cyclists trying to reach the Santa Fe Railyard. The Railyard development, a 50-acre site that was completed in 2008, had incorporated green infrastructure and served as a source of inspiration for the underpass site design.

PLANNING AND FINANCING

A diverse group of stakeholders contributed input throughout the process, including: the Santa Fe Railyard, which owned the land for the project; the Santa Fe School for the Deaf, which has a campus adjacent to the site; the City of Santa Fe Bicycle Technical Advisory Committee; and the Santa Fe Arts Commission. During the initial design discussions, the project team recommended incorporating green infrastructure features to address the stormwater runoff that would collect and flood the usable areas of the trail during "monsoon" season.

Because the trail is located near a historic irrigation canal, the team conducted a study of the surface and groundwater of the proposed site for the underpass. After discussing several options to divert water from the trail and prevent flooding, the team decided to capture and filter water on site.

MONSOON SEASON

The annual North American Monsoon System impacts New Mexico and other areas of the Southwest. From mid-June through the end of September, exceptionally hot days are accompanied by an increase in thunderstorms and flash flooding.

[1] City of Santa Fe Stormwater Management Strategic Plan: https://www.santafenm.gov/document_center/document/9530

UNDERPASS BIOSWALES

The underpass used some of the same green infrastructure features as the Railyard, which include bioswales, native plants, infiltration ponds, and underground storage to capture and treat stormwater. Bioswales are shallow and sunken vegetated channels that slow, direct, treat, and filter pollutants from stormwater runoff and direct stormwater into infiltration ponds.

The underpass was excavated to resemble a canyon and the local landscape. *Courtesy Serquis + Associates*

The project team used highway funds available for the underpass to improve the project and prevent flooding. The city had received $4.2 million in funding from the Federal Highway Administration's (FHWA) Congestion Mitigation and Air Quality (CMAQ) Improvement Program, which focuses on traffic calming and air quality projects. Though the funding program does not explicitly require stormwater infrastructure aspects, the project was allowed to include green infrastructure components to control erosion and provide flood protection.

PROJECT DETAILS

Once funding and site design were approved, project construction took nine months to complete. For the first three months, the project team built the structure of the underpass walkway. After the structural elements of the underpass were complete, a drainage system modeled after a traditional irrigation ditch was added to both sides of the underpass. This served to direct water from the paved underpass trail to the green infrastructure elements.

Following the initial stages, the adjacent trail areas were formed to resemble a canyon, and trenches and bioswales were added to direct stormwater to areas for storage and treatment without interfering with trail usability. Stormwater is stored in two infiltration ponds—one upper pond and one lower pond—that collect and filter stormwater before it reaches groundwater. When the higher pond fills up, water flows into the lower

A semi-circular infiltration pond and the 15,000-gallon cistern prevents flooding and standing water on the trail when it rains. *Courtesy Serquis + Associates and the City of Santa Fe*

A bioswale constructed from gravel and repurposed concrete reduces erosion and directs stormwater flow. *Courtesy Serquis + Associates*

pond, where it will filter back into the ground. When there is too much water in the ponds, stormwater overflow is collected in a 15,000-gallon cistern and slowly discharged to the aquifer to prevent flooding. The drainage system and green infrastructure features were designed and built to manage the runoff from a 100-year storm event, which is a storm that has a 1 percent chance of occurring in any given year; in the Santa Fe area, that type of storm can generate 2 inches of rainfall in one hour.[2] Given arid climate and compact ground conditions, that rate of rainfall could lead to significant flooding in low-lying areas without stormwater practices.

Various types of ground covers were used along the sides of the trail to slow and direct the flow of water. For example, concrete material from the demolition phase was crushed and repurposed throughout the site, which both reduced construction waste and minimized erosion. This intentional design created a landscape where runoff flows directly to areas where it will be treated and filtered back into the groundwater system.

The project incorporated native trees and shrubs that reduce the need for additional irrigation, since the plants are accustomed to the local climate. Vegetated areas also help control erosion while improving the aesthetics of the site.

RESULTS

This project's green infrastructure can capture and treat up to 437,000 gallons of stormwater per year. By reducing the likelihood of flooding during monsoon season, it also provides the following benefits to the community:

HEALTHIER WATERSHED:

By capturing precipitation before it beccomes runoff or causes flooding, these stormwater management features protect nearby waterways from pollution, improving water quality and the local ecosystem.

[2] National Weather Service, Precipitation Frequency Data Server: https://hdsc.nws.noaa.gov/hdsc/pfds/

MORE BEAUTIFUL LANDSCAPE: Adding native plants along with pavers and stones enhanced the look of the site and made it a more pleasant pathway to encourage cyclists and pedestrians to use alternate forms of transportation to reach the Railyard development.

IMPROVED SAFETY: In addition to making it safer to walk or bike through this busy intersection, capturing stormwater on this pathway reduced the effects of flooding.

REDUCED MAINTENANCE: Using native plants and preventing flooding and erosion mean less work for city crews to maintain the trail and irrigate the landscape during drier months.

LESSONS LEARNED

The community learned the following strategies for designing and building a successful project:

- **Piggyback on existing project funds.** The City of Santa Fe accessed federal transportation funding to build the underpass.
- **Incorporate stormwater management concepts early.** By incorporating green infrastructure elements into the initial design of the project, the project team ensured these components met the goals of stakeholders and would be covered by the transportation funding.
- **Get inspired.** Seeing that stormwater management technologies were successful in the nearby Railyard development inspired the project designers and ensured consistency in the area.
- **Know your local weather conditions.** Careful planning and local site considerations prevented problems from arising after the project was complete. Given the prevalence of intense rain events, the project team considered the flooding potential of the underpass and designed solutions to prevent it.

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