MEMO

TO: City Management

FROM: Rebecca Ybarra, Director of Destination Services

DATE: October 4, 2024

RE: Alleys Without Names Working Group

Working Group Members

Alleys Without Names working group included Anita Collins (Main Street Board/Hays County/Film Maker/Screenwriter), Vic Patel (CVB/Hotel owner), Linda Coker (CVB/Heritage), Jennifer Rogers (GSMP/Historic Commission), Josie Falletta (Staff), Jared Stratemann (Staff), and Rebecca Ybarra (Staff).

Background

- First meeting was held March 2023.
- City of San Marcos does not have a process to name alleys.
    - Researched area city's processes of alley naming.
    - Next steps collaboration with Planning and Development to create a mechanism.
- Researched list of movies and television productions filmed in San Marcos – 75 plus titles.
    - Considered movies and television productions with iconic scenes in downtown or downtown alleys.
- Worked with Sarah Simpson, who prepared the Green Alleys Initiative Project toolkit (attached)
    - Pages 14 and 15 include a map of existing downtown alleys – assigned letters and descriptives. Sixteen alleys included in the project.
    - Two have names officially approved by City Council:
        - Alley E - Kissing Alley (2017)
        - Alley O – Boyhood Alley* (2023) (*this was named after the tool kit was prepared)
    - Four alleys have widely used names but are not official:
        - Alley F – Jack's Alley (Jack the dog of the City downtown fire station who died on December 27, 1922. The sign remains today at what is now TXST's Fire Station Studio on Guadalupe St.)
        - Alley I – Feltner Alley North (there are City Street signs on this alley)
        - Alley M – Feltner Alley South (there are City Street signs on this alley)
        - Alley N – Telephone Alley (alley adjacent to former CenturyLink telephone company building)
    - She suggested the public is allowed to suggest names.
- Considered numerous ideas of names or how to go about naming alleys

Selection of Names

- Naming after a movie with an iconic scene filmed in downtown. This alley is located within the same block as the iconic bank robbery scene of the 1972 movie *The Getaway*.
    - **Alley D** – "The Getaway Alley"
- Officially naming the three alleys with widely used names.
    - **Alley F** – Jack's Alley
    - **Alley I** – Feltner Alley North
    - **Alley M** – Feltner Alley South
- Naming an alley recognizing two telephone company buildings. 1.the first San Marcos Telephone Company building recently demolished and 2. The former San Marcos Telephone Company/Centurytel/CenturyLink building cater-corner from the alley.
    - **Alley J** instead of Alley N – naming it "Old Telephone Alley"
- Naming an alley to acknowledge our Texas Music Friendly Certified Community designation.
    - **Alley K** –over the years, hundreds of musical acts have performed in a multitude of cafes, restaurants and bars located on this section of LBJ Drive adjacent to this alley – The Coffee Bar, Café on the Square/Café de Corte, Mayloo's/Rocky LaRue's, Green Parrot, Hill Country Humidor/Cigar Vault, and Valentino's. Six of ten buildings on this block.
- Since 2014, With permission, a group of artists/muralists paint the walls of multiple buildings along **Alley P** and an adjacent private drive. The private drive was commonly known as Imagine Alley. Since it is a private drive, the committee decided to recognize Alley P as Imagine Alley.

Attachment: The San Marcos Green Alley Initiative

THE SAN MARCOS GREEN ALLEY INITIATIVE

A Framework + Toolkit for Resilient, Green Infrastructure in Downtown San Marcos, Texas

Created for the Community of San Marcos, Texas

Prepared by:
Colorspace Architecture & Urban Design
Tristan Roger, Planning Intern + Sarah Simpson, Architect, Urban Designer, LEED GA

In collaboration with:
Elizabeth Arceneaux, PE, Environmental Engineer

The Meadows Center for Water and the Environment
Aspen Navarro, Program Coordinator, Watershed Services + Allyson Schlandt, Grant Technician II, Watershed Services

With review and additional assistance by:
Jon Dienst, P.E., Civil Engineer II, City of Dubuque, Iowa
Tom Hegemier, P.E., D.WRE, CFM, Senior Project Manager, Doucet & Associates
Melani Howard, Habitat Conservation Plan Manager, City of San Marcos Engineering & Capital Improvements

And endorsed by the following partners:

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FOREWORD

GREEN ALLEYS FOR A SUSTAINABLE FUTURE

Downtown San Marcos falls within the boundary of the Upper San Marcos River Watershed, a body of water highly valued by both permanent residents, students, and tourists alike. This portion of the San Marcos River (the River) is the most urbanized area in the watershed, where the River and its tributaries run through the city, providing a source of drinking water, recreational opportunities, and habitat for endangered and threatened species. As San Marcos continues to experience growth, implementing resilient green infrastructure strategies - like Green Alleys - becomes important to not only reduce stormwater runoff and pollutants in the River but also to ensure the vitality of San Marcos' urban areas.

In addition to addressing environmental impact, Green Alleys are a mechanism to improve existing infrastructure while bolstering the local economy. Improved alleys act as gathering spaces for a multitude of different events, as already seen in the utilization of Kissing Alley by the City and local businesses. Alley improvements will increase connectivity throughout downtown, increase the space available for hosting community events, and make access to businesses more feasible to foot and bike traffic by providing safe alternative routes to main streets and sidewalks. Rather than highlighting just one alley, building a network will promote downtown as a whole, and provide a platform for businesses to work together to best utilize alleys for economic vitality.

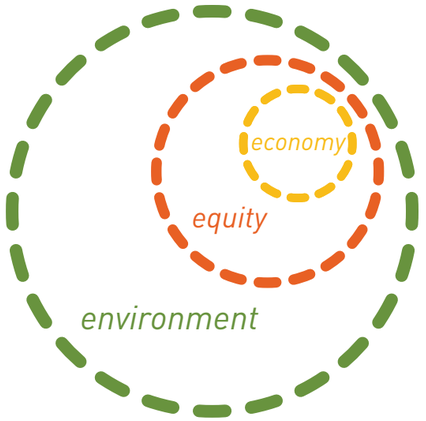


Fig. 1 The Improved Three E's

Green Alleys also have the potential to improve the lives of all community members. Involving citizens in their reconstruction from the beginning will provide a sense of ownership and pride over these revamped and environmentally conscious spaces. As they are completed, the hope is to provide aesthetically pleasing multi-use spaces accessible to all citizens and community members, as well as education about the importance of protecting the natural resources around them through the implementation of green infrastructure projects.

A Green Alley Initiative will enhance and improve the environment, economics, and equity for the city and its citizens. Placing an equal value on all three of these elements is vital to the long-term success of reconstruction efforts, and ensures that the goals of Green Alleys and the vibrancy of San Marcos' downtown will be sustained well into the future.

- Aspen Navarro,
Program Coordinator, Watershed Services
The Meadows Center for Water and the Environment

Fig. 2 Alley Transformations

EXECUTIVE SUMMARY

FINDINGS OF THE GREEN ALLEY INITIATIVE

Often overlooked, alleys are resilient pieces of infrastructure, readily adapting over centuries to meet the needs of the current day. Today, North American cities of all sizes are increasingly converting gray alleys to green infrastructure. Inspired by such alley greening precedents, as well as the local efforts behind Kissing Alley, recent San Marcos city council initiatives prioritizing Downtown Vitality and Stormwater Management, and City of San Marcos downtown alley reconstruction plans, local advocates in San Marcos have come together to support a comprehensive 21st century vision for Green Alleys in San Marcos. Thus, the Green Alley Initiative was formed.

With a pristine river ecosystem just east of downtown, growing demands for more liveable, walkable environments, and increasing climate and social crises, community ideas for alleys have naturally started to surface. Through the investigations of the Green Alley Initiative, downtown alleys in San Marcos have been revealed to be powerful stormwater tools - with the capacity to capture nearly half a million gallons of stormwater and filter over 10,720 pounds of total suspended solids a year if converted to green reconstructions! This potential is further augmented by the social and economic benefits that would result from the quality of improved public space.

With this information in hand, the purpose of the Green Alley Initiative is to inspire greater use of urban alleys and make the case for their use as green infrastructure, social space, and economic stimulus in downtown. More specifically, this document:

- Provides a high-level overview of alleys in today's general urban context alongside best practices for realizing their full capacity to contribute to both practical everyday needs of a city, as well as the pressing environmental and social issues of our time;
- Captures a current snapshot of San Marcos' downtown alley network within an ecological and infrastructural context, while assessing current conditions and potential for enhancement;
- Envisions and illustrates how a performative Green Alley network can increase resilience and deliver ecological, social, and economic services to downtown San Marcos; and,
- Provides a strategic toolkit of green infrastructure practices, public space improvements, and other features that can be flexibly deployed to activate an alley, deliver ecosystem services, and vitalize downtown San Marcos.

SHORT-TERM GOALS

The ideas, case studies, and solutions in this document are presented as an indication of collective community desire and recommendation for more performative public urban space in the city.

In the last century, urban zones have been seen as separate from the natural landscape and are too often dominated by the automobile. But citizens, environmentalists, urbanists, scientists, and planners alike understand that there is a greener, more integrated way forward.

Thus, the short term goals of this document are:

- To implement a first phase, pilot alley project and demonstrate the multitude of ecological benefits, social possibilities, and economic benefits possible in downtown San Marcos, particularly when considered collectively as a network; and,
- To encourage the integration of green infrastructure best practices for both public and private investment throughout San Marcos and the Central Texas region.

LONG-TERM OBJECTIVES + BENEFITS

The long-term objectives and benefits of the Green Alley Initiative include:

- Protection and improvement of water quality in the Upper San Marcos River Watershed and lessened localized flooding;
- Enhanced air quality, mitigation of the urban heat island effect, and increased urban biodiversity in downtown San Marcos;
- Community education and expanded awareness of the social and ecological impacts of the green alley network;
- Increased economic vitality for local businesses by improved service, functionality, and aesthetics of downtown alleys;
- Encouraged walking and biking into and through downtown San Marcos via friendly, safe, and accessible connectivity; and,
- Creation of a human scale network that fosters a sense of discovery and exploration and cultivates unique cultural uses by businesses, visitors, and residents alike.

GREEN ALLEY RECOMMENDATIONS

To accomplish these goals and objectives, the Green Alley Initiative recommends the following for San Marcos' downtown alleys:

- Reassess all current and future City of San Marcos Capital Improvement Plan (CIP) projects that pertain to downtown alleys for inclusion in a new city-led effort for Green Alleys;
- Create a Green Alley framework, which would assess all currently planned and future alley projects systematically across downtown San Marcos for their collective ecological, social, and economic services potential;
- Adopt a toolkit of green infrastructure and public space components, as well as scope requirements, for all alley improvements across downtown, including at a minimum:
    - Use of permeable pavers in alley surface reconstructions to infiltrate and filter stormwater on-site, while enhancing aesthetics and visitor experience in the heart of San Marcos;
    - Naming and providing physical identification of alleys through a public ideas process; and,
    - Incentivized participation of adjacent properties / businesses in green alley improvements, such as depaving, waste enclosures, rainwater harvesting, and more
- Support knowledge building amongst the community and City of San Marcos staff through trainings and collaborative research to ensure widespread familiarity with and acceptance of green infrastructure concepts required for successful deployment
- Work in cooperation with downtown businesses and local organizations / non-profits to help guide and support the Green Alley Initiative as an exemplary urban infrastructure project that benefits the local economy, environment, and community
- Invest in the creation of a Green Stormwater Maintenance Department to develop long-term GSI maintenance protocols
- Actively pursue grants applicable to Green Alleys and GSI to increase their feasibility; and dedicate a revenue stream for their maintenance to ensure both opportunity and long-term success

1 / INTRODUCTION

CREATING A VISION FOR ALLEYS IN SAN MARCOS

INSPIRATION

Several years ago, Main Street San Marcos undertook a placemaking effort to put a downtown alley on the map. One parklet, a wedding, and many concerts later, Kissing Alley was officially dedicated as such in 2017 and has become a celebrated community gathering space.

This wonderful act of creation has since spurred a larger dialogue about alleys generally in San Marcos - where alleys exist, how alleys function, who alleys serve today and in the future, and what could be altered or added to them so that they support not only downtown businesses but also other city-wide needs and systems.

Unlike primary roads running through San Marcos' downtown owned by TXDOT, all alleys are City-owned and maintained, and, with lower levels of traffic, lend themselves to less conventional treatment. Inspired by alley greening precedents, as well as the local efforts behind Kissing Alley, recent San Marcos city council initiatives prioritizing Downtown Vitality and Stormwater Management, and City of San Marcos downtown alley reconstruction plans, local advocates in San Marcos have come together to support a comprehensive 21st century vision for Green Alleys in San Marcos. Thus, the Green Alley Initiative was formed.

A RESPONSE TO PRESSING ISSUES

The recommendations in this document acknowledge the many local, regional, and global issues we face in 2020, as well as the existing efforts to address them, and strives to support and act in response to these forces, including:

- Anthropogenic impacts on local / global environments that have led to today's climate crisis, solutions to which require more compact, connected, and multi-functional urban environments;
- The National Weather Service's 2018 rainfall study Atlas14, which demonstrates considerable rain volume increases and necessitates resilient stormwater infrastructure, particularly for already flood-prone zones including the central Texas towns of "Flash Flood Alley" along the Balcones Escarpment;
- The long-time presence of threatened and endangered species in the Upper San Marcos River ecosystems, requiring pollutant capture and compliance with the Edwards Aquifer Habitat Conservation Plan (EAHCP);
- San Marcos City Council's recent Strategic Initiatives focusing on Stormwater Management and Downtown Vitality, as well as efforts to implement a city-wide sustainability plan; and,
- Main Street's ongoing efforts to ensure the continued relevance and success of San Marcos' downtown - amidst a time of increasing physical separation, social isolation, and economic instability.

In spite of these many challenges and goals, a disconnect exists between growing needs and implementation. Local street standards can be improved to encourage enhancement of alleys beyond impermeable surfaces. Similarly, while the San Marcos CIP Plan has taken small encouraging steps to consider more green infrastructure, a systematic commitment to it has not yet been made.

The City has indicated that all downtown alleys are planned for reconstruction within the coming decade (by 2027). Thus, it is the aim of this document to demonstrate both possibilities and community support for a network of multifunctional urban alleys so as to not lose an opportunity for impactful change downtown.

Although the challenges ahead of San Marcos, the Central Texas region, and the planet as a whole are daunting, the Green Alley Initiative understands that community commitment and focused projects are key to social and ecological progress. As demonstrated on the following pages, we believe Green Alleys are one such project in a wider web of positive environmental and social action.

> "You can't solve a problem at the same level it was created. You have to rise above it to the next level."
>
> - ALBERT EINSTEIN

2 / ALLEYS IN THE CITY

LEVERAGING HISTORIC SUPPORT FOR A RESILIENT DOWNTOWN

ALLEYS OVER TIME

Trash collection. Pedestrian pathway. Utility line route. Outdoor play area. Delivery zone. Informal gathering space. Car parking. Shop storefront. Such is the versatile realm of alleys.

For over two millennia dating back to Greek civilizations, alleys have been a vital component of functional urban places (Wolch et al, 2010). Typically designed as a secondary grid of circulation at the rear of lots, alleys have historically provided service for pedestrians and utilitarian functions and were integral to the urban design of many North American settlements founded in and prior to the 19th century.

Yet, alleys commonly go unnamed and overlooked as meaningful infrastructure. Synonymous with "city" and the urban condition, alleys fell into disfavor in the 20th century. Described in popular narratives as dark, dangerous spaces in dark, dangerous cities, alleys were effectively banned by federal housing policy by 1930 (Newell et al, 2012). Later, as the civil rights movement of the 1960s was met with white flight and highway building, planning policies shifted away from compact cities where alleys originated. Instead, the nation adopted and heavily subsidized suburban, auto-oriented patterns where private rear lawns pushed vehicles and services to the primary street grid.

Today, many alleys have all but vanished due to 20th century urban renewal projects that cleared large portions of American urban fabric. However, a sea-change is underway to reverse this trajectory and redefine the 21st century role of alleys - this time as green infrastructure and public space, as explored in the following pages.

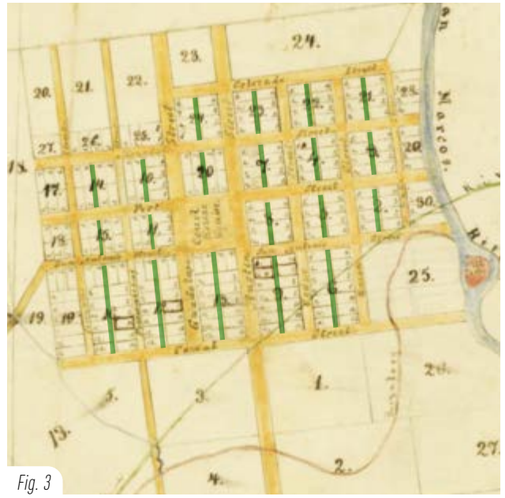
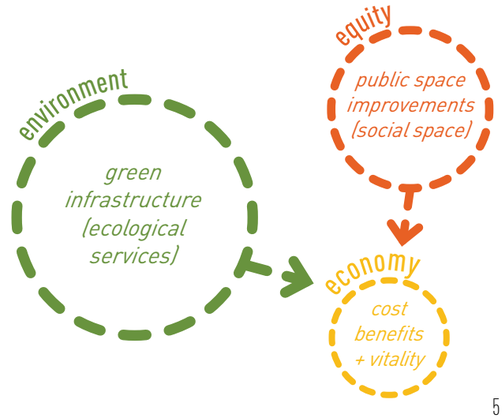


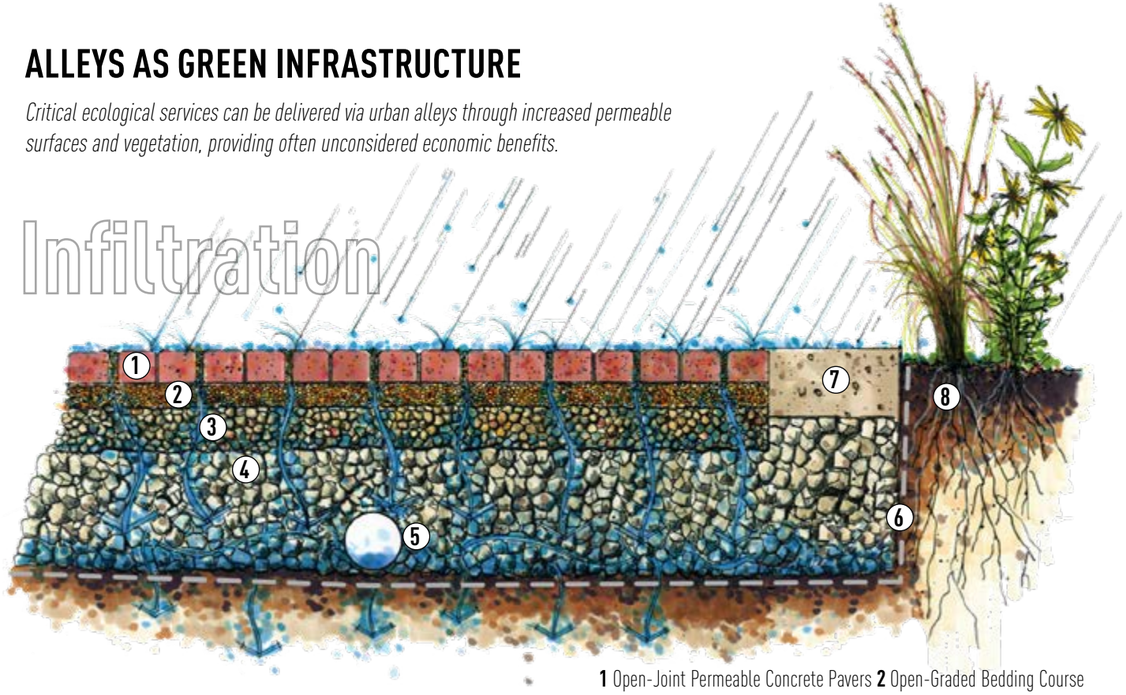
Fig. 3

Integral to San Marcos' downtown center as conceived in 1851 is a network of alleys that deliver necessary services to the rear of each lot, as shown on the town plat above from 1881 in green. Many of these original alleys remain intact today and continue to ensure reliable services to downtown businesses and residences. By upgrading alleys with green infrastructure and public space improvements, this historic network can deliver critical benefits relevant to the 21st century, including ecological services, equitable social space, and economic vitality.



ALLEYS AS GREEN INFRASTRUCTURE

Critical ecological services can be delivered via urban alleys through increased permeable surfaces and vegetation, providing often unconsidered economic benefits.



1 Open-Joint Permeable Concrete Pavers **2** Open-Graded Bedding Course
3 Open-Graded Base Reservoir **4** Open-Graded Subbase Reservoir
5 Underdrain (as required) **6** Geotextile Fabric, Waterproof Liner (as required)
7 Concrete Collar **8** Permeable Biofilter / Planter / Rain Garden

IMPROVED STORMWATER QUALITY + REDUCED LOCALIZED FLOODING

Permeable surfaces and Green Stormwater Infrastructure (GSI) practices, such as the use of permeable pavers and rain gardens, are increasingly replacing traditional gray hardscapes in urban settings, helping to create a distributed network of stormwater filtration in urban spaces. Permeable hard surfaces work particularly well in alleys due to their ability to capture and clean stormwater, lessen flooding, and slow runoff while also supporting vehicular loading.

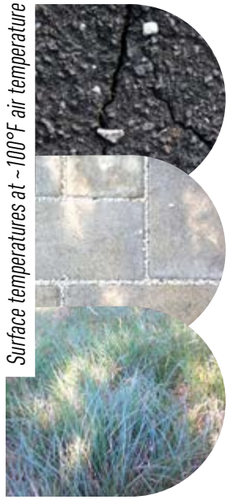
The typical cross section of permeable interlocking concrete pavers, above demonstrates how this durable surface, with a strength of over 8,000 pounds per square inch, allows stormwater to infiltrate.

- The joints between interlocking pavers allow a high infiltration rate of up to 500 to 800 inches per hour. Compared to sand at 30 to 200 inches per hour, these paver systems are extremely permeable yet function as an effective replacement to impervious cover such as asphalt and concrete.
- Water that passes between the pavers into the open graded base (gravel and stone having a porosity of 30 to 40%) is slowed down, filtered, and cooled much like in an underground aquifer.
- Water stored in the open void spaces slowly infiltrates into the underlying soils. Even in tight clay soils with an infiltration rate of 0.5 inches per hour, a 12 inch stored layer of water can infiltrate over a 24 to 48 hour time.
- Permeable pavers for green alleys can be designed to detain a 25-year 24-hour storm and achieve an 89% -93% reduction in suspended solids and over 40% reduction in the total nutrients, including phosphorus and nitrogen (RG-348, City of San Marcos Technical Stormwater Manual and WERF SELECT model, 2013).

GSI practices' ability to infiltrate, treat, and detain runoff is an advantage over conventional gray infrastructure systems that simply direct runoff directly toward waterways without treatment. The impact of high velocity and high pollutant load runoff is detrimental to stream ecosystems and has long term environmental and economic effects. By reducing impervious cover in urban right-of-ways, we can reverse these effects and create more livable spaces.

cost benefits + economic vitality:
• avoided costs for upgraded storm pipe, improved aesthetics that stimulate downtown visits

> Underlying these techniques is a change in philosophy for handling stormwater. Previous methods were often based on getting water off of the land as quickly as possible...By contrast, LID uses various solutions often spread across the site to capture as much water as possible.
>
> - CHRISTINE MIDDLETON, THE WIMBERLEY VIEW



AIR QUALITY + URBAN HEAT ISLAND MITIGATION

The urban heat island effect and poor air pollution are common issues that plague urban environments due to large amounts of hot, hard surfaces and car exhaust. Finding opportunities to introduce cooler surfaces, however, can help create cooler spaces with improved air quality.

Introducing more native trees and groundcover can help clean the air, reduce CO2, and provide shade. Use of permeable hard surfaces with high albedo in alleys also reduces ambient temperatures through solar reflectance and evapotranspiration. Up to two times cooler than asphalt, high albedo pavement also helps to reduce the temperature of runoff to the river, which reduces negative impacts to aquatic life in receiving waters (EPA, 2014).

• reduced energy costs, cleaner air, increased human health + pedestrian activity, stimulated business

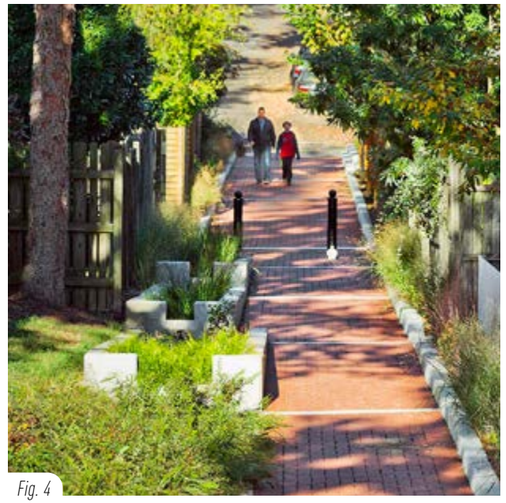


Fig. 4

INCREASED URBAN BIODIVERSITY + QUALITY OF LIFE

Cities have too commonly been viewed and constructed as gray, sacrificial zones where natural ecologies and systems are suppressed or broken. However, efforts like the Biophilic City (Beatley, 2010) project are working to repair this rift by bolstering and celebrating the unique qualities and strengths of urban ecosystems while improving quality of life for all human and non-human residents.

The innate flexibility and lower traffic levels of alleys can help cultivate biophilic space and increase urban biodiversity by providing spatial networks for native groundcover, shrubs, and trees. This increased vegetation helps absorb stormwater runoff, build wildlife habitat for pollinators and avian populations, and contribute to overall ecosystem health.

Support for local wildlife can be further cultivated with the strategic insertion and maintenance of nesting boxes. Species well-suited for green alley habitat include hummingbirds, House Finches, Western Kingbirds, and other species common to urbanized areas.

• avoided costs for upgraded storm pipe, improved aesthetics, increased human health + pedestrian activity, stimulated business

ALLEYS AS EQUITABLE PUBLIC SPACE

Important social services can be cultivated by creating a functional, supportive, and educational urban alley network that also helps boost downtown business.

> While alleys vary in width, material, use, and even go by different names in other countries, one thing is certain: alleys not only provide important space for services but also invaluable public space.
>
> - SEATTLE INTEGRATED ALLEY HANDBOOK, FIALKO, HAMPTON, + GEHL PARTNERS

Fig. 5

Fig. 6

Fig. 7

IMPROVED SERVICE SUPPORT + ALLEY FUNCTION

Central to their design, alleys provide a valuable service network for utilities, deliveries, waste services, and general back-of-house access. This service functionality should remain a priority for all alleys, particularly those with intended vehicular access, and opportunities to improve service for property and business owners should be prioritized.

Areas of common use can often be streamlined and the pedestrian experience improved through the use of trash enclosures or combined trash facilities. Overhead utility lines can be buried for electric line protection and enhanced aesthetics. In instances where right-of-way is limited, traffic can be simplified by moving to one-way travel. Water drainage can also be improved through the use of permeable surfaces, as previously described, to ensure year-round functionality.

HUMAN SCALE DISCOVERY + CULTURAL USE

Humans are naturally drawn to enclosed spaces that reflect and compliment our scale. Thus, it is no surprise that the more personal scale of alleyways tend to attract and leave a memorable impression on many. At typical widths of 16' - 20', current downtown alleys provide a more intimate way to explore cities for residents and visitors alike when made safe, interesting, and welcoming.

Encouraging business and residential uses to provide access off of alleys can help provide more regular surveillance. Beyond pure utility, alleys can also provide vibrant, informal public space for the many cultural activities of a city's inhabitants. Efforts to bring arts programming, impromptu gatherings, and organized events into alley space have been heralded world wide and should be embraced where initiated. Community art programs also create reasons for exploration and contribute to a hidden yet discoverable, or off-the-beaten-path, experience for a city's inhabitants.

WALKABLE, BIKEABLE ACCESS + CONNECTIVITY

Nothing deters pedestrians or cyclists from hitting the streets like hostile vehicular traffic, a lack of sidewalk continuity, or little shade and few places to sit and rest in hot climates. Primary street grids often take on these characteristics - but, conversely, alleys can serve as a safer, quieter, and cooler network for walking and cycling.

By ensuring that an alley network is accessible, connected, and advertised as such through the strategic placement of benches and bike racks, healthy, low-carbon active transportation can be boosted considerably via a functioning secondary alley grid.

Safety must always remain a priority and special consideration should be given to the intersections of alleys and primary streets to minimize conflict between varying environments and speeds.

EDUCATION + COMMUNITY AWARENESS

Through informative wayfinding and interpretive signs, the many benefits and services rendered by alleys described herein should be communicated to help educate residents and visitors. Awareness of alleyway histories and the environmental connectivity of urban areas to waterways can be increased with illustrated signage and maps. Educational tours that integrate informative talks with walking or cycling activities can impart positive memories and leave a lasting impact on participants.

cost benefits + economic vitality:

- *streamlined + consistent business function, improved aesthetics*
- *improved business access + visibility*
- *improved downtown access, increased pedestrian + bike activity which produces higher rates of business patronage*
- *increased destination presence of downtown San Marcos*

GREEN ALLEY PRECEDENTS: A NATION-WIDE MOVEMENT

As previously explored, Green Alleys can help deliver needed urban infrastructure. Many US cities have initiated different types of alley programs over the last decade in an attempt to reinvigorate these forgotten spaces, and Green Alleys in particular are gaining momentum not only in large cities but also in small and mid-sized towns like San Marcos due to the lived benefits. The following case studies of best practice alley programs provide a high-level overview of successes and inspiration for an improved future for San Marcos' downtown and the River.

> Green alleys use pervious pavements and effective drainage to create an inviting public space for people to walk, play, and interact.
>
> - NATIONAL ASSOCIATION OF CITY TRANSPORTATION OFFICIALS (NACTO)

Fig. 8

Fig. 9

DUBUQUE, IOWA

POPULATION (2019): 58,000

2012 - Present Bee Branch Watershed Flood Mitigation Project • 240 planned alleys

Investment Costs: $200,000,000 in 12 Phases

As a Mississippi River town prone to flash floods, the City of Dubuque, Iowa initiated the ambitious Bee Branch Watershed Flood Mitigation Project in the early 2000s after experiencing devastating and reoccurring flooding disasters. The flood mitigation project takes a multi-faceted approach but focuses heavily on the reduction of impervious surfaces through the installation of permeable pavers on 240 alleys across the watershed. Abutting property owners are assessed a portion of the cost (typically 15%) based on frontage. With 80 green alleys completed to date, city engineers have already seen success from their efforts to curb the flow of pollutant-laden runoff into the river, and the treatment plant observed a reduction of 60% in total suspended solids (TSS). The program was named Public Works Project Of The Year in 2015 by the Iowa Chapter of the APWA.

ROSWELL, GEORGIA

POPULATION (2019): 78,000

2015 East-West Alley Master Plan • Seven alleys

Investment Costs: $1,700,000

Roswell, Georgia launched the East-West Alley Master Plan in 2015 after gathering public input during a full-day design charrette with city staff, business owners, heritage professionals, and other stakeholders. The plan focused on the ecological and economical activation of seven alleys located in the downtown commercial area with enhanced pedestrian access, permeable pavers, enlarged landscaped areas, widened sidewalks, string lighting, flexible social space, and outdoor dining. Owners and local businesses received this project as an amazing addition to the character of the historic district as well as a much needed improvement in local stormwater management.

GREAT ALLEY TRENDS

- **Identification**: Naming alleys is essential to giving them identity and starting the activation process.
- **Community Art Programs**: Mural and arts programs are a good way to show an alley is safe, cared for, and occupied.
- **Open Facades**: Doors and windows opening onto alleys are welcoming and increase the rates of pedestrian traffic.
- **Permeable Surfaces**: Alleys present opportunities to insert permeable surfaces that can help capture and clean stormwater.
- **Urban Landscapes:** Native vegetation in alleys can contribute to a city's biodiversity and larger environmental strategies.
- **Placemaking + Exploration**: With thoughtful design, alleys can encourage locals and tourists to explore urban centers.

Fig. 10

Fig. 11

LONGMONT, COLORADO

POPULATION (2019): 94,000

2010 - 2017 Alleyscape Development Project • Three alleys

Investment Costs: Unknown with $200,000 Private Improvement 25% Matching Grants allocated in two Phases

The City of Longmont, Colorado's Alleyscape Development Project resulted from a collaborative effort between the city's Public Works and Natural Resources department and the Longmont Downtown Development Authority (LDDA). After reoccurring floods caused extensive infrastructural damage, efforts to reduce impervious cover downtown called for the installation of permeable paving systems on alleyways with underground piping to adjacent street storm drain systems. Public space enhancements were also made in parallel, including the completion of underground utilities, consolidated trash, lighting, public art, and facade improvements. During reconstruction, businesses were incentivized to make additional private improvements with 25% matching alley LDDA grants of up to $10,000 each. The alleys are now more functional, inviting to the public, and able to fully contain up to 10-year storm events.

SOUTH PARK, CALIFORNIA

POPULATION (2008): 32,850

2015 Avalon Project• Six planned alleys

Investment Costs: $400,000

Located in the heart of South Los Angeles, the neighborhood of South Park led a collaborative effort for a green alley pilot project. In partnership with the City of Los Angeles and the Trust for Public Land, the Avalon Project was regarded as a framework for the systematic revitalization of alleys located throughout South Los Angeles. The plan had many goals and aimed at improving community health and fitness, safety, and water quality, as well as providing neighborhood connections and reducing urban heat island effects. Plants, bioswales, permeable pavers, street lights, and signage were used and installed over a one year construction period. The program relied heavily on public input, and the population is now requesting its expansion to other neighborhoods in the city,

3 / DOWNTOWN ALLEYS TODAY

BIOREGIONAL CONTEXT, INVENTORY, & EXISTING CONDITIONS

DOWNTOWN SAN MARCOS + THE SAN MARCOS RIVER

Situated at the edge of the Edwards Plateau / Balcones Escarpment and primarily within the Blackland Prairies ecoregion, downtown San Marcos is a well-known gateway to the Texas Hill Country. One of the oldest inhabited sites in the Americas, it has been home to Clovis Indians 12,000+ years ago and, more recently, Texas settlers from the 1840s to today, all of whom have been drawn to the flowing waters of the River - a pristine habitat for many unique and endangered species found no where else on earth.

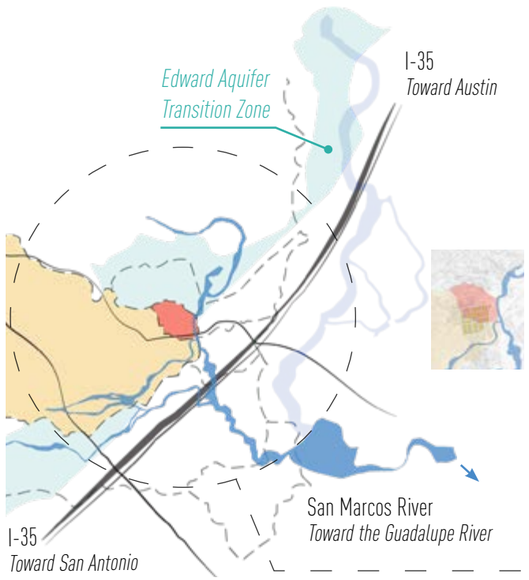


FIG. 12 UPPER SAN MARCOS RIVER WATERSHEDS

NOT TO SCALE

Downtown Watershed

Purgatory Creek Watershed

Downtown San Marcos contributes both directly and indirectly to the Upper San Marcos River Watershed. The Downtown Watershed collects runoff from the northeast portion of downtown, as well as a sizable portion of Texas State University's main campus, and flows directly into the San Marcos River. The Purgatory Creek Watershed, a sub-watershed of the Upper San Marcos River Watershed, collects runoff from the remaining southwest portion of downtown and flows into Purgatory Creek before flowing to the San Marcos River (The Meadows Center for Water and the Environment, 2014).

Following the tenets of Smart Growth, Downtown San Marcos is a designated Intensity Zone per the 2013 San Marcos Comprehensive Plan, which encourages mixed-use development patterns and increased residential units per acre to help reduce urban sprawl. Development can occur at 100% impervious cover per lot and associated stormwater impact fees are paid into a downtown Stormwater Management District, which helps fund more effective district-wide stormwater capture and filtration improvements.

Some of the benefits of urban development downtown include more environmentally responsible use of land regionally, reduced impervious cover and stormwater runoff *per capita*, and the potential for holistic stormwater controls (vs. piecemeal, lot by lot strategies). But with the adjacency to the River, finding opportunities to expand the network of district-wide stormwater controls is key to protecting this ecosystem from the negative impacts of urban runoff, typically polluted with oil and debris from automobiles, as well as dirt, chemicals, and fertilizers. Developing a green alley network can help build a healthier relationship between San Marcos' center and the Upper San Marcos River Watershed, with downtown alleys acting as an important pollutant-filtering mechanism.

Downtown San Marcos is located within the larger context of the Upper San Marcos River Watershed, which connects more immediately to the Blanco River Watershed before merging into the Guadalupe River and eventually flowing to the Gulf of Mexico.

FIG. 13 DOWNTOWN SAN MARCOS

UPPER SAN MARCOS RIVER WATERSHEDS

1:750

MAJOR WATERSHEDS
- Downtown
- Purgatory Creek

ALLEYS
- Existing
- Vacated

MUNICIPAL BOUNDARIES
- Stormwater Management District

EXISTING DOWNTOWN ALLEYS

Of the original 20 platted downtown San Marcos alleys, 14 remain in use today along with Jack's Alley, the only alley that has been added since the original town was designed. These currently provide vital service access to the rear of most commercial lots and the businesses / residences that occupy them. For the purpose of this document, alleys without formalized names have been assigned alphabetic identification as noted below.

ALLEY A
Connecting University Dr & Hutchison St,
between Guadalupe St & LBJ Dr
- Adjacent to N LBJ & University Square Shop Center

ALLEY B
Connecting University Dr & Hutchison St,
between LBJ Dr & Edward Gary St
- Adjacent to N LBJ & Nelson Shop Center

ALLEY C
Connecting University Dr & Hutchison St,
between Edward Gary St & Moon St
- Adjacent to University Plaza & Colloquium Books

ALLEY D
Connecting Hutchison St & Hopkins St,
between Fredericksburg St & Guadalupe St
- Adjacent to First United Methodist Church

ALLEY E (KISSING ALLEY)
Connecting Hutchison St & Hopkins St,
between Guadalupe St & LBJ Dr
- Adjacent to Central Fire Station

ALLEY F (JACK'S ALLEY)
Connecting Guadalupe St & N LBJ Dr,
between Hutchison St & Hopkins St
- Adjacent to original San Marcos City Hall

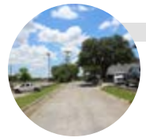
ALLEY G
Connecting Hutchison St & Hopkins St,
between LBJ Dr & Edward Gary St
- Adjacent to the Mobility Hub

ALLEY H
Connecting Hutchison St & Hopkins St,
between Edward Gary St & CM Allen Pkwy
- Adjacent to The Local Downtown

ALLEY I (FELTNER ALLEY NORTH)
Connecting Hopkins St & San Antonio St,
between Comanche St & Fredericksburg St
- Adjacent to The Price Center

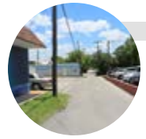
ALLEY J
Connecting Hopkins St & San Antonio St,
between Fredericksburg St & Guadalupe St
- Adjacent to the LBJ Museum

ALLEY K
Connecting Hopkins St & San Antonio St,
between LBJ Dr & Edward Gary St
- Adjacent to the Hays Co Annex Bldg & Wells Fargo



ALLEY L
Connecting Hopkins St & San Antonio St,
between Edward Gary St & CM Allen Pkwy
- Adjacent to Bank of America

ALLEY M (FELTNER ALLEY SOUTH)
Connecting San Antonio St & Martin Luther King Dr,
between Comanche St & Fredericksburg St
- Adjacent to the Calaboose Museum



ALLEY N (TELEPHONE ALLEY)
Connecting San Antonio St & Martin Luther King Dr,
between Fredericksburg St & Guadalupe St
- Adjacent to Century Link

ALLEY O (RAILROAD ALLEY)
Connecting San Antonio St & Martin Luther King Dr,
between Guadalupe St & LBJ Dr
- Adjacent to Aquabrew, facing South Courthouse

ALLEY P
Connecting San Antonio St & Martin Luther King Dr,
between LBJ Dr & Edward Gary St
- Adjacent Lindsey Lofts and private Imagine Alley

FIG. 14 DOWNTOWN SAN MARCOS
ALLEY INVENTORY

1:375

ALLEYS
Existing
Travel direction

MAIN STREET DOWNTOWN LIMITS
University Dr
Moon St
Hutchison St
Edward Gary St
Hopkins St
LBJ Dr
courthouse
San Antonio St
Guadalupe St
RAILROAD
CM Allen Pkwy
MLK Dr
Comanche St
Fredericksburg St
San Marcos River
Purgatory Creek
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

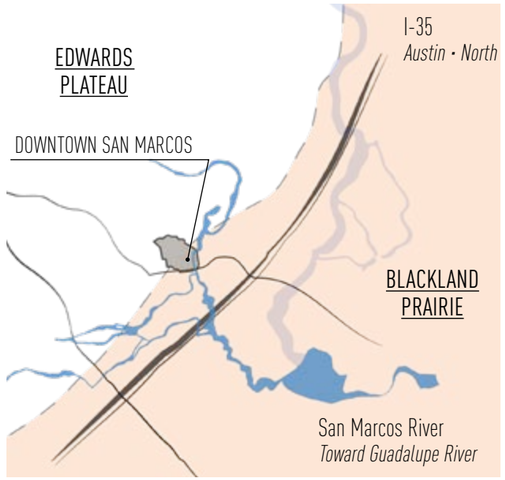


FIG. 15 CENTRAL TEXAS ECOREGIONS

NOT TO SCALE

FIG. 16 DOWNTOWN SAN MARCOS SOIL TYPES

NOT TO SCALE

Soil Type (Infiltration Rate)

- Clay (Very Low Infiltration)
- Clay Loam (Low Infiltration)
- Sand (Very High Infiltration)
- Sandy Loam (High Infiltration)

DOWNTOWN SOILS + STORMWATER INFRASTRUCTURE

Most of the land below downtown San Marcos is part of the Blackland Prairie ecoregion, characterized by dark, heavy clay soils with low permeability (Texas Parks and Wildlife Department, 2019). While not conducive to high rates of on-site infiltration, downtown's existing alley network has the capacity to temporarily detain and filter stormwater runoff before it connects to the stormwater system and flows into the River.

The existing stormwater sewer system, which captures runoff from downtown right-of-way and properties, already provides considerable potential connectivity with downtown alleys and is undergoing continual upgrades as part of the City of San Marcos Capital Improvement Projects (CIP) Program. Drainage improvements in the LBJ Dr and Hutchison St areas of downtown were completed in the last ten years and storm drain upgrades along CM Allen Parkway are underway at the time of writing. Future projects The determined by the City of San Marcos Stormwater Drainage Department and CIP Program will continue to address older and missing sections of the drainage system, improving potential for alley connectivity.

The City of San Marcos has plans to reconstruct all downtown alleys by 2025 / 2027 with the reconstruction of Kissing Alley from Hopkins Street to University Drive first on the horizon (Alleys A and E) to be completed by 2022. As these plans come to fruition, planning for the accommodation of green infrastructure in the alley network - such as permeable pavers, biofiltration, and increased native vegetation - is critical to expanding district-wide stormwater controls.

The low permeability of downtown soils and the presence of many existing buildings makes it necessary to collect and eventually transport most captured rainwater into the stormwater sewer system. As alleys are reconstructed, planning for the incorporation of underdrains that tie into existing storm drains, as well as the infill of gaps in the primary storm drain system, will help facilitate the flow of cleaner stormwater throughout downtown.

FIG. 17 DOWNTOWN SAN MARCOS

STORMWATER FLOW MAP

1:375

SURFACE FLOW
- Streets
- Alleys

EXISTING INFRASTRUCTURE
- Storm Sewer
- Bioretention Pond

CONNECTIVITY - ALLEYS TO STORM DRAIN
- Connection Opportunity
- Minor Extension Required
- Considerable Extension Required

stormflow to creeks + rivers

storm drain present

alley stormflow

storm drain not present

WATERSHED RIDGELINE

University Dr

Hutchison St

Hopkins St

San Antonio St

MLK Dr

courthouse

Moon St

Ed Gary St

LBJ Dr

Comanche St

Fredericksburg St

Guadalupe St

CM Allen Pkwy

San Marcos River

Purgatory Creek

A B C D E F G H I J K L M N O P

DOWNTOWN GROUNDWATER

In addition to soil conditions and stormwater systems, the proximity of Downtown San Marcos to the River requires consideration of the local groundwater table, or the underground boundary between unsaturated and saturated soil zones as subsurface water flows toward surface water features.

The topography of the Downtown area is characterized by a gradual slope towards the River on the east and Purgatory Creek towards the south, and running below this land surface is a map of groundwater levels at varying depths from the surface and with varying saturation depths, depending on proximity to these adjacent surface water features. Seasonal fluctuations between dry summer and wet spring and autumn conditions also result in changing water depths for single locations depending on the time of year.

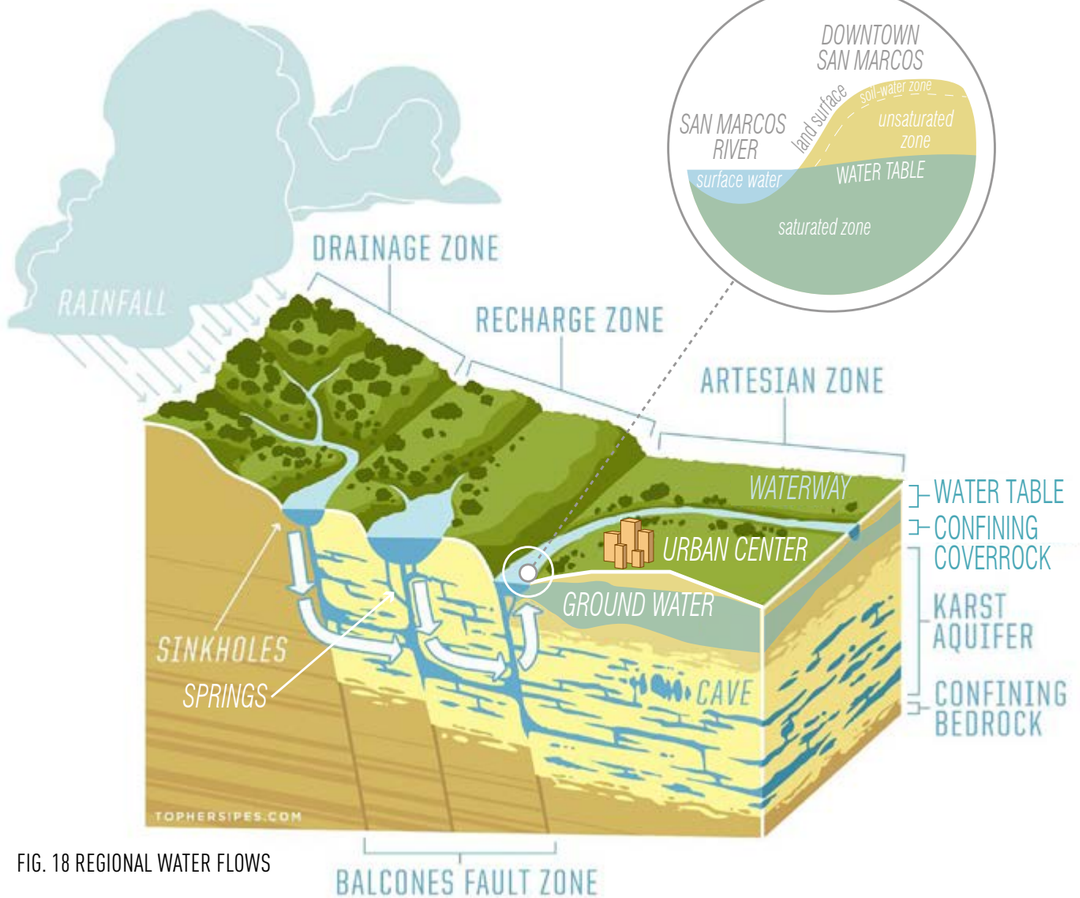
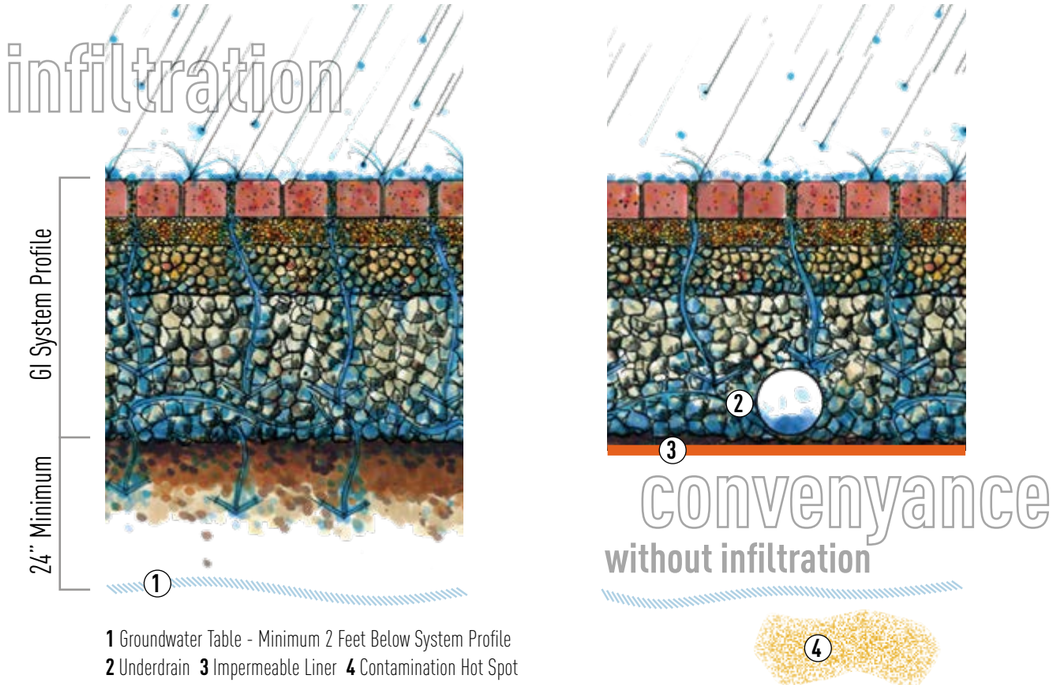


FIG. 18 REGIONAL WATER FLOWS

For distributed green infrastructure systems that aim to collect rainwater in a decentralized network, often below the improved surface as is the case for permeable pavers and biofiltration features, there are different ways to design the system to address on-site conditions. As shown in the infiltration graphic (opposite page), groundwater levels should be located at least 2 feet below the bottom of the system profile to ensure minimal disruption to these flows (ICPI, 2018). This is particularly important in urban areas where contamination from business operations (dry cleaners, gas stations) is often present and disturbance of plumes is to be avoided. If known contamination hot spots are present, then an impermeable liner should also be utilized to prevent infiltration and plume disturbance (ICPI, 2018; City of San Marcos, 2019).

The height of the water table can be determined through water level measurements at installed piezometers, many of which are already located throughout downtown on both public and private property. Readings collected at 50 locations in 2020 show that the saturated zone being studied appears to be an unconfined system with seasonal variability. The water levels vary from 4 to 20 feet below ground with an average depth of 9.2 feet below ground observed. These depths are acceptable to provide the desired clearance demonstrated in the Infiltration graphic below.

Generally the height of the groundwater column appears to be much deeper closer to Purgatory Creek and the San Marcos River, with thinner water layers at higher land surface elevations, such as near the Courthouse Square. However, in order to better understand annual average levels across the entire Downtown, the GAI recommends that these locations be measured at least quarterly and a ground water contour map of the levels plotted to show ground water presence and subsurface flow in this area. Collaborative use of all downwtown piezometers could provide a better data set to make informed decisions for green infrastructure.



1 Groundwater Table - Minimum 2 Feet Below System Profile
2 Underdrain **3** Impermeable Liner **4** Contamination Hot Spot

UNLINED GREEN INFRASTRUCTURE FEATURE

Allows collected runoff to infiltrate into existing soils where appropriate permeability is present and known contamination hot spots are not present

LINED GREEN INFRASTRUCTURE FEATURE

Directs collected runoff to integrated underdrain tied into stormwater network where existing soils are not adequately permeable and known contamination hot spots are present

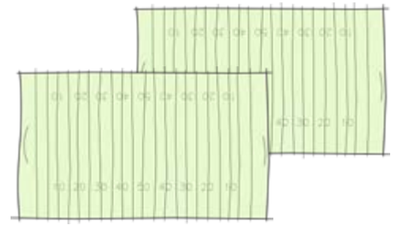
EXISTING ALLEY CONDITIONS

Based on a thorough inventory process and observations of current use and conditions, the alleys in downtown San Marcos were determined to fall into three existing categories: Vacated, Programmed, and Underperforming.

> “...alleys should be seen as opportunities for initiating complete street renovations in creation of beneficial networks of connected public spaces, including streets, alleys, and sidewalks.
>
> - TRUST FOR PUBLIC LAND, ALLEYS AMPLIFIED

2.5 acres

The approximate area covered by downtown alleys, **equivalent to the area of almost two football fields!**



Vacated alley in HEB parking lot

Kissing Alley

Alley behind the Nelson Center

Feltner Alley

VACATED

Vacated alleys are pieces of public right-of-way that existed in the original town plat of San Marcos but are today either absorbed by other uses or non-existent. When analyzing historic maps of the city and comparing them to existing property lines, six partially or fully vacated alleys have been identified in Downtown San Marcos, as demonstrated in the map on page 13. Two were previously located in the middle of blocks now characterized by parking lots (HEB and the former Broadway Bank), while others were never built and were instead absorbed into parkland.

PROGRAMMED

Kissing Alley is the only alley in Downtown San Marcos that has experienced any activation of note. Using thoughtful programming, art, and lighting, San Marcos' Main Street program was able to turn what would otherwise be considered an underperforming alley into the beloved location it has now become. Despite the current lack of green infrastructure, Kissing Alley provides a local example of how alleys can serve as important public space.

Kissing Alley is planned to be reconstructed by 2021; however, at the time of writing, no green infrastructure elements are yet confirmed in its design.

UNDERPERFORMING

Underperforming alleys are characterized by their sole dedication to access, prioritizing functionality for utilities, car parking, and waste service. Underperforming alleys feature impervious asphaltic ground surfaces that generate untreated runoff, little to no invitation for social interaction, poor lighting, an abundance of garbage containers, and often little plant life. These alleys can be placed into the following two subcategories based on the surrounding built form:

ENCLOSED / UNDERPERFORMING

Enclosed / undeperforming alleys are situated in a mixed-use urban environment, and typically occur in close proximity to the historic courthouse square and within blocks that are more fully occupied by building footprints. Their central location generates natural pedestrian traffic, making these alleys suitable for both green infrastructure and public space amenities.

UNENCLOSED / UNDERPERFORMING

Unenclosed / underperforming alleys are situated in less urban conditions. They often separate private residential backyards, provide cross-block connectivity, or serve as parking lot driveways. Typically larger and more vegetated than others, these alleys are well-suited for green infrastructure but their location makes them less suitable for public space activation.

Refer to map on page 13

E (Kissing Alley)

A, B, C, D, F (Jack's Alley), G , I (Feltner Alley N), K, O (Railroad Alley), P

H, J, L, M (Feltner Alley S), N

BENEFICIAL CHARACTERISTICS

Analysis of downtown San Marcos' alleys focused on an observational inventory of existing elements that lend them either positive or negative character today. The presence of identification, lighting, plants, art, or building access demonstrates a public desire to use or improve the alley as inhabitable space and was observed on many alleys as shown on the following Table 1. Most of the existing beneficial characteristics are improvements to public space, and do not currently contribute to meaningful green infrastructure.

● *Public Space Consideration* ● *Green Infrastructure Consideration*

● *Alley Identification*

Naming alleys is essential to giving them identity and recognition in the community. A few alleys in San Marcos already have names and identification initiatives could be expanded across downtown to elevate these areas of Right-of-Way as vital components of San Marcos' city grid.

● *Lighting*

Lighting is important to encourage safe nighttime pedestrian use and lends ambiance to an alley. Building-mounted lights exist on most downtown alleys, and a few have street lighting, making them safe and inviting. Kissing Alley's string lighting creates atmosphere and a sense of place.

● *Proximity to the Square*

Due to the concentration of businesses near the historic square and the pedestrian traffic this generates, the alleys closest to the courthouse are good candidates for early pilot public space activation and prioritization.

● *Art / Murals*

Art and community programs help show that alleys are safe, cared for, and occupied. Almost half of San Marcos' downtown alleys already have notable art, murals, or public landmarks.

●● *Existing Vegetation*

Native plants can make an alley inviting, provide micro-climatic shade, bird and insect habitat, and better air quality. Most of the alleys in San Marcos have some level of vegetation, ranging from volunteer grasses and shrubs to small trees and climbing wall vines.

● *Building Access*

Transparency and access at building walls adjacent to alleys can help increase pedestrian traffic within them. A few downtown alleys currently provide direct public access to shops, bars, and restaurants and generally see greater pedestrian use as a result.

CHALLENGES + OPPORTUNITIES

A number of common functional and visual issues were observed throughout the existing alley network, including: disorganized and redundant waste collection locations as well as lack of recycling and compost collection; visual clutter of overhead electric lines and poles; excessive curb cuts between alley and private property boundaries; large amounts of unnecessary pavement within the alley corridors and at adjacent property boundaries; and, poor surface drainage conditions. An overall lack of meaningful vegetation, as well as places to sit or park a bike, were noted as deterrents to alley foot traffic.

Alley width and traffic flow are additional considerations for any future interventions. It is also important to ensure that local development requirements are modified to allow and support Green Alley solutions.

These more challenging characteristics demonstrate the need for improvements that enhance and continue delivery of basic services.

● *Waste Collection*

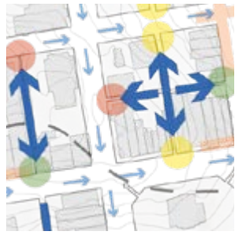
Waste containers, when prolific or poorly maintained, can discourage pedestrian use, so it is important that green alleys offer solutions for better waste collection. Half of San Marcos' downtown alleys currently contain waste containers, with most of them located in more commercial areas and unenclosed.

● *Existence of Utilities*

While necessary, utility and building service equipment do have a visual and spatial impact on alleys that must be taken into consideration. Buried electric lines, screens, and paint can help enhance their appearance but they must remain safe and accessible for shop owners.

●● *Pavement Condition*

The pavement in most downtown San Marcos alleys is in poor condition, and asphalt has been used systematically, making the alleys impermeable and prone to stormwater runoff. New surface treatments can have both positive ecological and aesthetic impacts. Alleys with particularly poor existing road conditions are good candidates for reconstruction.

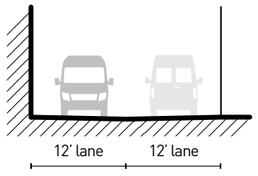


● *Storm Drain Connectivity*

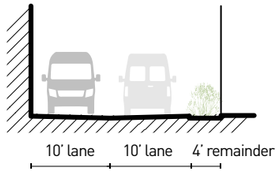
Due to clay-heavy soils, drainage improvements to help capture and filter stormwater in alleys will likely require some level of stormdrain connectivity. A majority of alleys currently have proximity and good connectivity potential to the existing underground stormdrain system, while some will require extension of the existing storm drain system or other means of stormwater infiltration.

●● *Vehicular Travel*

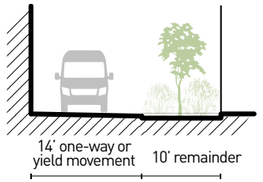
Many existing alleys are approx. 16' -20' wide and rely on yield movement, which keeps traffic flow slow and safe. Redeveloped alleys are required to have pavement width of 24' for alleys to accommodate two 12' lanes - but moving to 10' lanes, maintaining yield movement, or adopting an alley grid of alternating one-way traffic flow can all reduce pavement width and create more flexibility for other improvements.



Current standards: Two-Way, Highway Standard Lanes
no space granted for other improvements



Suggested option: Two-Way, Right-Sized Lanes
some space granted for other improvements



→ **Preferred option: One-Way or Yield Movement, Right-Sized Lanes + Slow Speeds**
most space granted for other improvements

ASSESSED ALLEY CONDITIONS + POTENTIALS

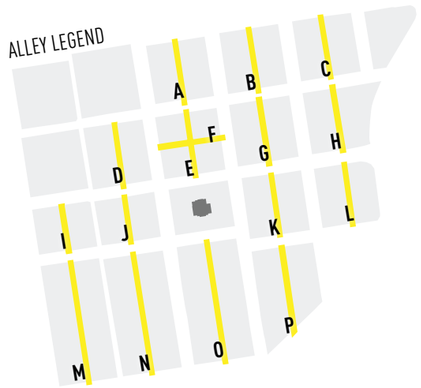
TABLE 1 : Observations and characteristics of all downtown alleys made in the summer of 2019 were integrated into Table 1 to collectively analyze their current potential for both public space and green infrastructure activation. While many alleys are unlikely candidates for public space activation, all alleys can contribute to a green infrastructure network.

ALLEY CONDITIONS

- ○ *Observed*
- ○○ *Notable*

NEAR TERM POTENTIAL FOR ACTIVATION

- \- *No potential*
- ◎ *Low*
- ◎◎ *Moderate*
- ◎◎◎ *Outstanding*



> "Alleys represent unrealized community assets that could be transformed...to simultaneously offer multiple ecological, economic, and social benefits...
>
> - WOLCH ET AL, THE FORGOTTEN AND THE FUTURE: RECLAIMING BACK ALLEYS FOR A SUSTAINABLE CITY

ID	Alley Name	Alley Dimensions *(Approximate)*	Adjacent Building Form	Vehicular Travel	Proximity to the Square	Waste Collection	Public Utilities	Lighting	Building Access	Art / Murals	Vegetation	Pavement Condition	Existing Storm Drain Connectivity	NEAR TERM POTENTIAL FOR PUBLIC SPACE ACTIVATION	NEAR TERM POTENTIAL FOR GREEN INFRASTRUCTURE ACTIVATION
A		16 ft. x 340 ft. • 5,440 ft ²	Enclosed	Two way	1 block	○	○	Building			○	Fair		-	○
B		16 ft. x 345 ft. • 5,520 ft ²	Enclosed	Two way	2 blocks	○	○	None		○	○	Fair	○	◎◎	○○○
C		16 ft. x 345 ft. • 5,520 ft ²	Enclosed	Two way	3 blocks		○	None			○○	Poor	○	◎	○○○
D		16 ft. x 350 ft. • 5,600 ft ²	Enclosed	One way	1 block	○	○	None		○	○	Fair		◎	○
E	KISSING ALLEY	16 ft. x 340 ft. • 5,440 ft ²	Enclosed	One way	0 blocks		○	Street	○	○		Poor		◎◎◎	○○
F	JACK'S ALLEY	(16 ft.+20 ft.) x 175 ft. • 6,300 ft ²	Enclosed	One way	1 block	○	○	Street		○	○	Poor	○	◎	○○○
G		20 ft. x 350 ft. • 7,000 ft ²	Enclosed	Two way	1 block	○	○	Street	○○			Fair	○	◎◎	○○
H		20 ft. x 350 ft. • 7,000 ft ²	Unenclosed	Two way	2 blocks	○	○	None			○	Good	○	-	○○
I	NORTH FELTNER ALLEY	20 ft. x 260 ft • 5,200 ft ²	Enclosed	Two way	2 blocks		○	Building			○○	Fair	○	-	○○
J		16 ft. x 260 ft. • 4,160 ft ²	Unenclosed	One way	1 block		○	Street				Fair	○	◎	○○
K		16 ft. x 345 ft. • 5,520 ft ²	Enclosed	Two way	1 block	○	○	Street	○		○	Fair	○	◎	○○
L		16 ft. x 340 ft. • 5,540 ft ²	Unenclosed	Two way	2 blocks		○	Building			○○	Fair	○	-	○○
M	SOUTH FELTNER ALLEY	16 ft. x 690 ft. • 11,040 ft ²	Unenclosed	Two way	2 blocks		○	None				Poor	○	-	○○○
N		16 ft. x 670 ft. • 10,720 ft ²	Unenclosed	Two way	1 block		○	Street		○	○○	Good	○	-	○○
O	RAILROAD ALLEY	16 ft. x 680 ft. • 10,880 ft ²	Enclosed	Two way	0 blocks	○	○	Street	○○	○	○	Poor		◎◎◎	○○
P		20 ft. x 460 ft. • 9,200 ft ²	Enclosed	Two way	1 block	○	○	Street		○○	○	Fair		◎	○

SERVICE REQUIREMENTS

PUBLIC SPACE CRITERIA

GREEN INFRASTRUCTURE CRITERIA

4 / GREEN ALLEYS OF TOMORROW

ACTIVATING GREEN INFRASTRUCTURE & PUBLIC SPACE DOWNTOWN

CONCEPTUALIZING A GREEN ALLEY NETWORK

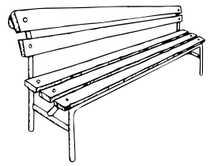
Most of San Marcos' existing downtown alleys are not particularly well cared for today. But the emergence of Kissing Alley, as well as the recent spread of alley murals in San Marcos, demonstrates general community desire to realize greater potential of this important network of public right-of-way. Similarly, the long, outstanding commitment of river-oriented organizations reveals a deep concern and care for the local environment. These indications of community desire, combined with a review of the existing alley conditions and their potential for delivering green infrastructure and enhanced public space, provides reason and value for the initiation of a green alley network to deliver integrated urban solutions to downtown San Marcos.

As demonstrated by previous case studies and the visuals presented herein, green alleys can take many forms, ranging from a simple permeable strip of pavers to a verdant rear oasis fully outfitted with human-scaled seating, art, and more. The following pages put forth a vision to help demonstrate local possibilities, using an assembled toolkit for green infrastructure and public space components - both for city-led improvements as well as adjacent property owner contributions.

While the possibilities are many, the Green Alley Initiative envisions alley reconstruction in downtown San Marcos to start with a permeable ground surface, like permeable pavers, and alley identification as an infrastructural baseline. Utility enhancements, such as the burying of electric or cable lines, should also be completed as feasible. Additional green infrastructure components or public space enhancements can then be layered on top of this permeable ground surface based on deemed potential, as demonstrated in Figure 20. Adjacent property owners should then be incentivized to complete simultaneous improvements with streamlined processes and/or matching grant opportunities.

Adjacent property enhancements

+



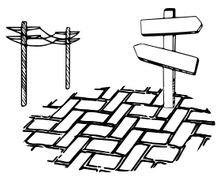
Public space amenities

+

Enhanced green infrastructure

+

MINIMUM GREEN ALLEY BASELINE



Permeable ground surface, alley identification, utility enhancements

$3.3 million

The approximate cost to install

permeable pavers across all downtown alleys

High-end estimate with contingency, refer to Appendix B for full cost estimates

FIG. 20 DOWNTOWN SAN MARCOS

ALLEY ACTIVATION POTENTIAL

1:300

GREEN INFRASTRUCTURE NEAR-TERM POTENTIAL
- Low ( )
- Moderate ( )
- Outstanding ( )

PUBLIC SPACE NEAR-TERM POTENTIAL
- Low ( )
- Moderate ( )
- Outstanding ( )

FIG. 21 DOWNTOWN SAN MARCOS

A GREEN ALLEY CATALYST

1:150

The centrally located Hays County Courthouse Square serves not only as the primary organizing space of downtown but also as a green heart with its heritage Pecan trees and considerable open space. Starting here at this existing vegetated center and weaving a connected green alley network outwards lays the foundation for ecological micro-corridors throughout downtown that can have meaningful impacts for the community and the Upper San Marcos River Watershed.

The following plans and images are intended to illustrate a vision for how a green alley framework could turn what are currently underperforming impervious rear alleys into a transformative and multi-functional ecological network in downtown San Marcos.

1 **FIRE STATION NO. 1 GOES GREEN**

The downtown fire station, a publicly-owned city asset, and the adjacent alley (Alley E) can help showcase many green infrastructure elements.

2 **KISSING + JACK'S ALLEY IN FULL BLOOM**

San Marcos' premier downtown alleys (Alley E, F) are the perfect space to invite visitors to learn about small but mighty green alleys.

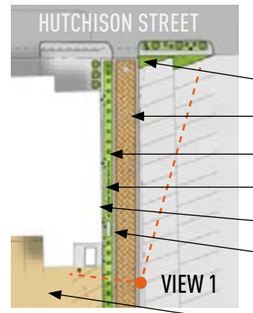
3 **LIGHTING UP A SISTER ALLEY**

The alley south of the Courthouse Square (Alley O) extends both public space amenities and integrated stormwater controls to the south end of downtown.

4 **DEPAVE + DEFINE THE MIDBLOCK**

Southward on Alley O at MLK Drive, defining rear lots through the removal of unnecessary impermeable cover reveals many greening opportunities that are common in downtown.

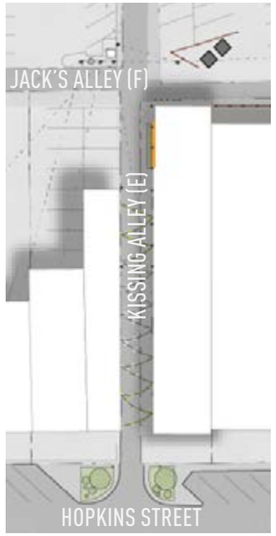
Adjacent Long-term Hardscape Areas suitable for **Simultaneous Green Alley Improvements**



1 **FIRE STATION NO. 1 GOES GREEN**

- **Depaved Asphalt** for **Native Plants**
- **A** **High Albedo Permeable Pavers** with underdrain
- **B** **Biofiltration Planter** with native plants
- **C** **Freestanding Green Vine Wall**
- **D** **Urban Bird Nesting Boxes**
- **E** **Slimline Rain Barrel** connected to existing downspout, serving biofiltration planter
- **Adjacent Hardscape Improvement Areas**

2 KISSING + JACK'S ALLEY IN FULL BLOOM



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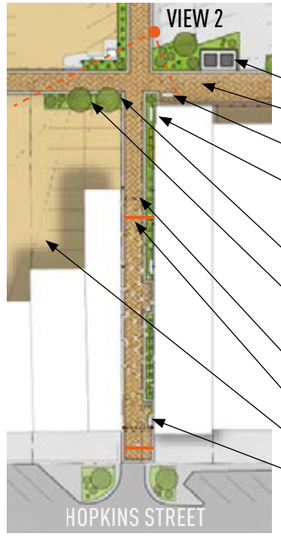
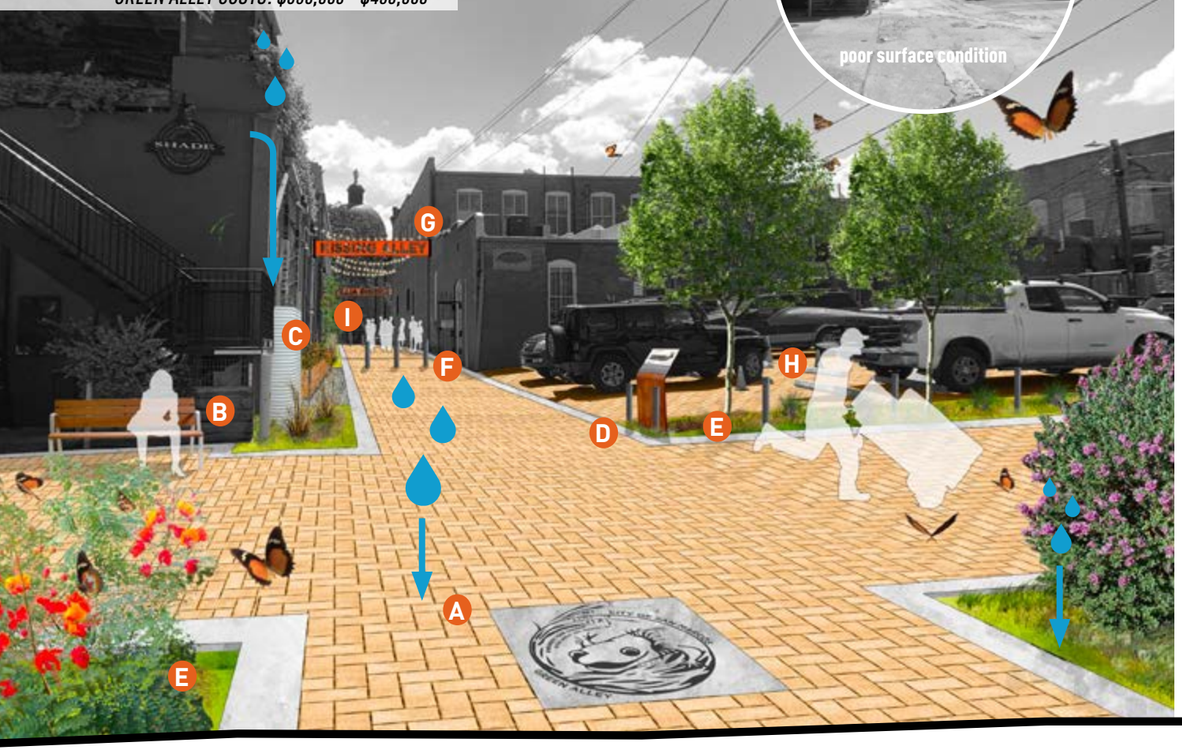


AFTER

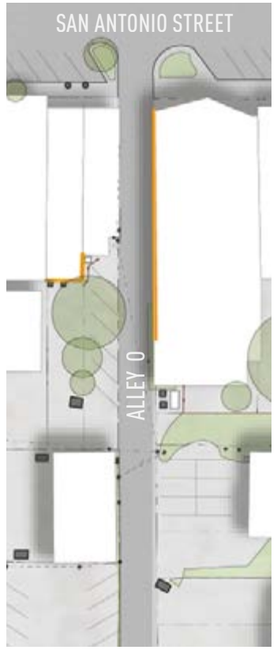
- New Waste Enclosure
- A High Albedo Permeable Pavers with Green Alley Marker
- B Public Bench
- C Slimline Rain Barrel connected to existing downspout, serving Raised Pollinator Planters
- D Interpretive Signage
- E Depaved Asphalt for new Stormwater Tree Wells and Native Plants
- F Street Closure Bollards
- G Overhead Alley ID Signage
- H Adjacent Hardscape Improvement Areas
- I Event Backdrop with Green Vine Wall

GREEN ALLEY VISION // VIEW 2

ESTIMATED KISSING + JACK'S ALLEY (E, F)
GREEN ALLEY COSTS: $350,000 - $450,000



3 LIGHTING UP A SISTER ALLEY



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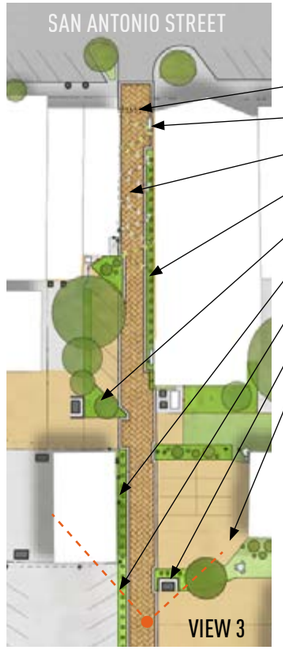
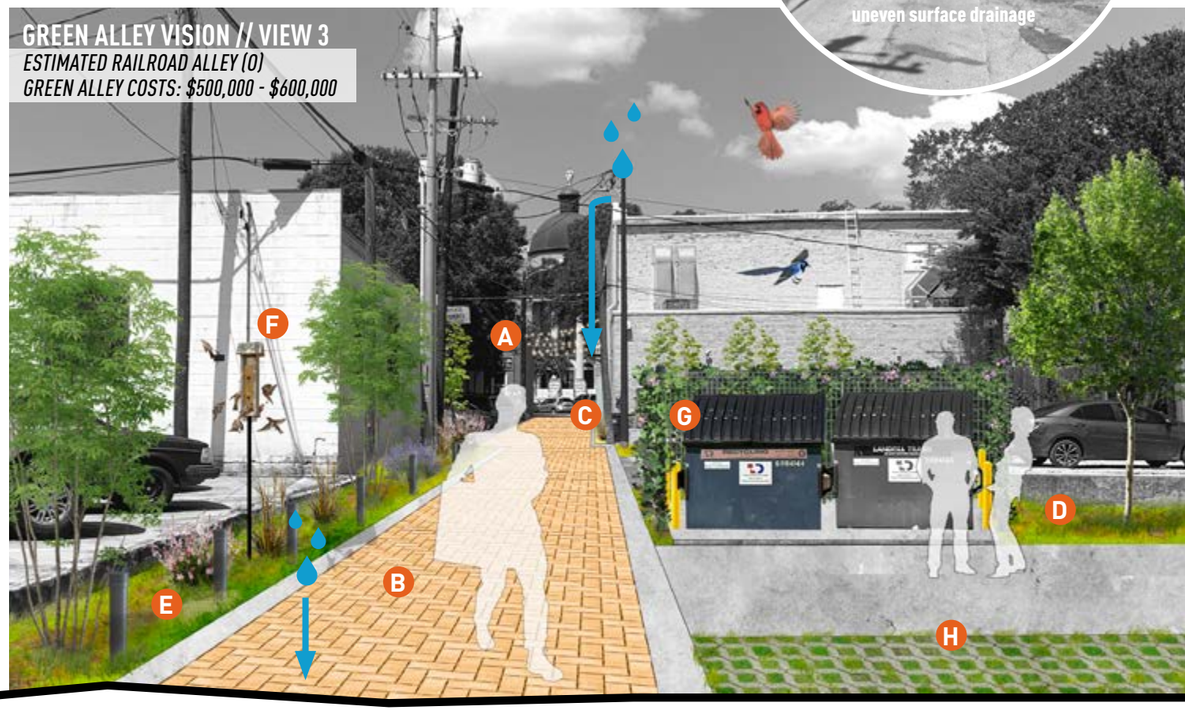


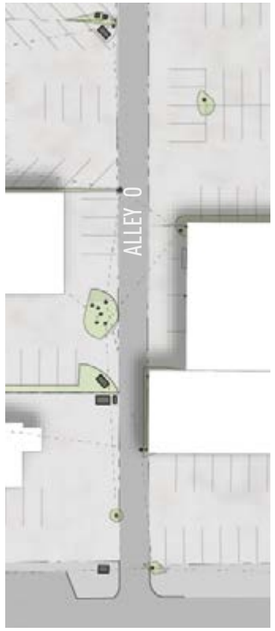
AFTER

- A New Alley Identification with LED Lighting
- Public Bench
- B High Albedo Permeable Pavers with underdrain
- C Biofiltration Planter with Rainwater Capture
- D Depaved Asphalt with Native Trees
- E Native Plant Bed with protective bollards
- F Urban Bird Feeder
- G Waste Enclosure with Native Vines
- H Adjacent Hardscape Improvement Areas

GREEN ALLEY VISION // VIEW 3

ESTIMATED RAILROAD ALLEY (0)
GREEN ALLEY COSTS: $500,000 - $600,000





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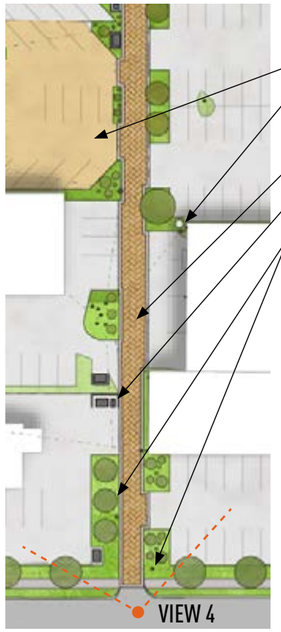


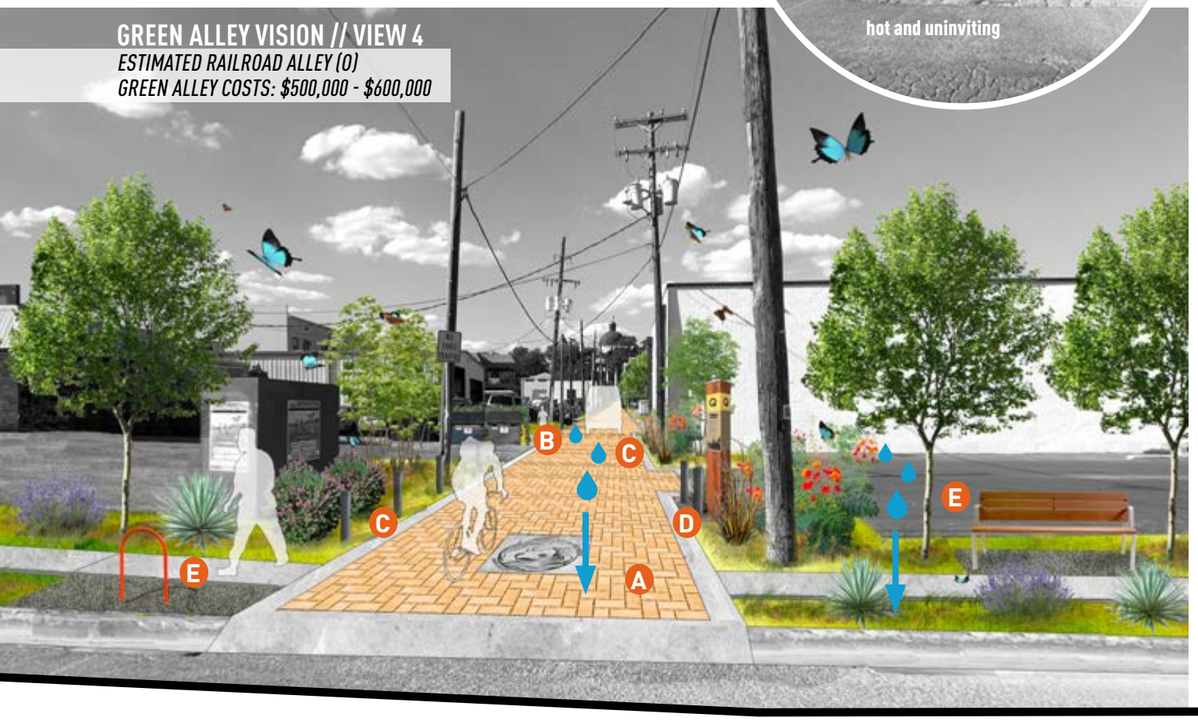
AFTER

4 DEPAVE + DEFINE THE MIDBLOCK

- Adjacent Hardscape Improvement Areas
- **Rain Barrel** connected to existing downspout, serving **Rain Garden with Native Tree and Plants**
- A **High Albedo Permeable Pavers** with underdrain
- B **New Waste Enclosures**
- C **Depaved Asphalt and Native Planters**
- D **Interpretive and Wayfinding Signage**
- E **Street Furniture** including Bike Rack + Bench

GREEN ALLEY VISION // VIEW 4

ESTIMATED RAILROAD ALLEY (0)
GREEN ALLEY COSTS: $500,000 - $600,000



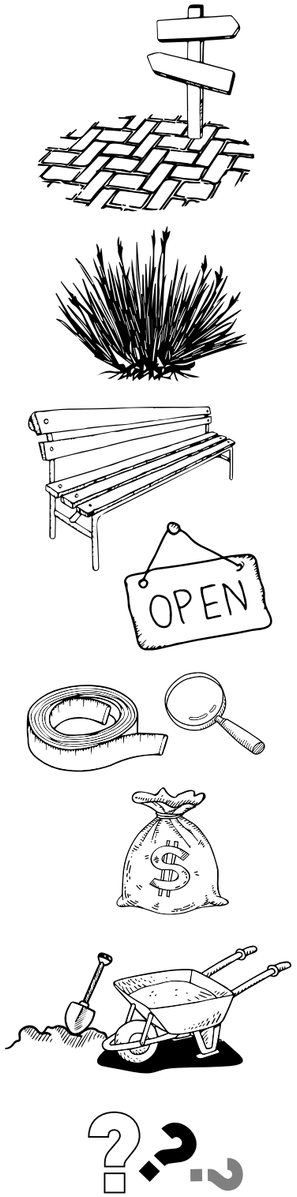
5 / GREEN ALLEY TOOLKIT

RESOURCES FOR IMPLEMENTING GREEN ALLEYS IN SAN MARCOS

BUILDING A TOOLKIT

So how do we get from today to tomorrow? To help make the previous visualizations a reality, Green Alleys must incorporate a system-wide layering of elements both in the right-of-way and on adjacent properties. Supplemental funding such as grants will also likely be required, as will a demonstration of benefits and outcomes to help make the case for such an undertaking. The following pages contain recommendations for components in the categories of Green Infrastructure, Public Space, and Adjacent Properties, along with helpful information on metrics, funding resources, relevant industry contacts. A collection of Frequently Asked Questions has also been included for reference.

- GREEN INFRASTRUCTURE TOOLKIT
- PUBLIC SPACE TOOLKIT
- ADJACENT PROPERTIES TOOLKIT
- METRICS + OUTCOMES
- POTENTIAL FUNDING SOURCES
- INDUSTRY CONTACTS + RESOURCES
- FREQUENTLY ASKED QUESTIONS



GREEN INFRASTRUCTURE TOOLKIT

As already noted, all alleys can contribute to positive environmental outcomes for Downtown San Marcos, and at a minimum, can help provide cleaner stormwater, reduce runoff flow to the River, and boost economic activity downtown. **System-wide integration of permeable ground surfaces, like permeable pavers, should be standard for all alley reconstructions with other components being integrated as viable and desired.**

Each component noted here can be utilized singularly or combined with other components to create more sophisticated water flows, urban ecosystems, and enhanced aesthetics.

For further information, see the following resources:

- For suggested native and adapted plants suitable for the Central Texas climate, as well as wet/dry conditions common to GSI, refer to the City of San Marcos' published Preferred Plant List and the City of San Marcos Technical Stormwater Manual.
- For grants related to green infrastructure, refer to the Potential Funding Sources section.
- For a list of relevant manufacturers and knowledge sources, refer to the Industry Contacts section.

GREEN ALLEY INITIATIVE OBJECTIVES SUPPORTED BY GREEN INFRASTRUCTURE

IMPROVED STORMWATER QUALITY + REDUCED FLOODING

AIR QUALITY + URBAN HEAT ISLAND MITIGATION

INCREASED URBAN BIODIVERSITY + QUALITY OF LIFE

Fig. 24

HIGH ALBEDO PERMEABLE PAVERS

DESCRIPTION

ALLEYS • PARKING LOTS • SIDEWALKS • PATIOS

Permeable pavers reduce stormwater runoff, filter pollutant loads, enable groundwater recharge, and provide a durable, attractive ground surface that helps to reduce the urban heat island effect and localized flooding. Full system installs include pavers over open base with underdrain and liners as required.

COST/MAINTENANCE

$16 - $30 / SF INSTALLED (FULL SYSTEM)

Monthly sweeping and seasonal vacuuming. Impermeable liner and underdrain required when adjacent to building foundations.

Fig. 25

NATIVE PLANTS

DESCRIPTION

GRASSES + SHRUBS + PERENNIALS

Native plants adapted to the climate require minimal water, help to lessen the urban heat island effect, improve urban aesthetics, and support urban wildlife, including birds and pollinators.

COST/MAINTENANCE

$3 - $50 PER PLANT

Once established, typical native plant care.

Fig. 26

GREEN SCREENS + WALLS

DESCRIPTION

FREESTANDING • WALL-MOUNTED

Green walls are comprised of native vines or vertically-mounted planters that provide unique aesthetic and ecological value, attract pedestrians, reduce air and noise pollution, and help insulate buildings from heat / cold.

COST/MAINTENANCE

LOW COST DIY - $200 / VERT. SF PREFAB

Once established, typical native plant care. Plants can be supported directly on a wall or on an independently supported screen.

Fig. 27

NATIVE TREES

DESCRIPTION

STORMWATER WELL • TREE CELLS • POROUS PAVE

Native trees provide shade, CO2 sequestration, and air/noise pollution reduction. Trees in biofiltration wells can capture / filter sizable volumes of stormwater on-site. Products like tree cells (Silva Cells) and porous pavement (Porous Pave) can help protect roots and reduce maintenance.

COST/MAINTENANCE

$500 DIY INSTALL - $15,000 TREE WELL

Once established, typical native tree care. Impermeable liner and underdrain required when adjacent to building foundations.

Fig. 28

RAINWATER HARVESTING

DESCRIPTION

CISTERNS • SLIMLINE TANKS • RAIN CHAINS, ETC.

Rain barrels store rainfall from adjacent roofs, providing peak flow mitigation by delaying runoff. This helps to conserve water resources by using gray water for irrigation and when paired with nearby planters can also provide runoff filtration.

COST/MAINTENANCE

$100 - $3,500 PER CISTERN

Annual downspout debris removal and vector prevention.

Fig. 29

RAISED PLANTERS

DESCRIPTION

FIXED + MOBILE BEDS • COMMUNITY GARDENS

Raised planters with native or edible species can support biodiversity, contribute to pollinator corridors, enhance aesthetics and provide recreational and educational opportunities. They can also be used to block vehicle access during events.

COST/MAINTENANCE

$50 - $100 / LF INSTALLED

Once plants are established, typical raised bed care.

Fig. 30

WILDLIFE SUPPORT

DESCRIPTION

BIRD + POLLINATOR SHELTERS • FEEDERS

Nesting boxes, wildlife feeders, and water sources in alleys can help supplement urban habitat for local species of birds and pollinators that help to control disease-transmitting vectors and support human food systems.

COST/MAINTENANCE

$20 - $200 PER SHELTER OR FEEDER

Annual / seasonal nesting box cleaning; regular feeder and shelter maintenance.

Fig. 31

BIOFILTRATION PLANTERS

DESCRIPTION

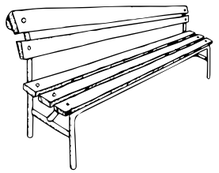
LINEAR DRAINAGE BEDS

Biofiltration planters offer high capacity stormwater water quality treatment and peak flow rate reduction in areas of impervious cover, while also introducing native plants and greenscape in urban areas.

COST/MAINTENANCE

$25 - $50 / SF

Once established, typical native plant care with periodic debris clearing. Impermeable liner and underdrain required when adjacent to building foundations.



PUBLIC SPACE TOOLKIT

Not all alleys are destined to become active spaces for community engagement (see Table 1 and Figure 20), but they should all at least be given identity and recognized for any integration of sustainable features to help educate residents and visitors about their role in the city. Depending on an alley's proximity to the square, commercial activity, and existing public space, some alleys may integrate additional toolkit components to support enhanced public gatherings and alternative transportation.

Public input should be sought for the incorporation of any public art or amenities. **In particular, the San Marcos community should be engaged in a process to name all downtown alleys as they are reconstructed as Green Alleys to help build awareness and support.**

For further information, see the following resources:

- For grants related to public space infrastructure, refer to the Potential Funding Sources section.
- For a list of relevant manufacturers and knowledge sources, refer to the Industry Contacts section.

GREEN ALLEY INITIATIVE OBJECTIVES SUPPORTED BY PUBLIC SPACE IMPROVEMENTS

SUPPORTED SERVICES + CULTURAL ACTIVITIES

HUMAN SCALE DISCOVERY + EXPLORATION

WALKABLE, BIKEABLE ACCESS + CONNECTIVITY

EDUCATION + AWARENESS

Fig. 32

INTERPRETIVE SIGNAGE

DESCRIPTION

EDUCATIONAL DISPLAYS + MARKERS

Educational signage, displays, and markers help spread awareness of green alleys for both visitors and residents alike. Integrating references to existing campaigns like Sally the Salamander are important to connect the impacts of downtown to the River.

COST/MAINTENANCE

$200 - $1000 PER SIGN

No physical maintenance when rated for outdoor conditions.

Fig. 33

STREET CLOSURE FEATURES

DESCRIPTION

MOBILE PLANTERS • REMOVABLE BOLLARDS

Flexible street closure devices enable multifunctional and adaptable use of public right-of-way while ensuring pedestrian safety and comfort during programmed events. These features can also serve as seating or planters.

COST/MAINTENANCE

$100 - $1000+ PER FEATURE

Little to no maintenance for removable bollards. See Raised Planters as another street closure alternative.

Fig. 34

ALLEY IDENTIFICATION

DESCRIPTION

ALLEY GATEWAYS • GROUND + WALL MARKERS

A few San Marcos alleys already have names and this effort should be expanded across downtown as reconstructed. Public input and historic references should be integrated and signage can range from street or wall signs to gateways.

COST/MAINTENANCE

$200 - $1000 PER SIGN

Once installed, little to no maintenance.

Fig. 35

BIKE SUPPORT

DESCRIPTION

BIKE RACKS • REPAIR STATIONS

Bike racks and bike repair stations encourage people to access downtown using sustainable transportation, help cultivate a more connected cycling network, and support downtown access and parking supply while improving human health and well-being.

COST/MAINTENANCE

$100-$1500+ PER RACK

Once installed, bike racks require no maintenance.

Fig. 36

PUBLIC ART

WALL MURALS • OVERHEAD + INTERACTIVE ART

With neighborhood involvement, murals and public art can simultaneously build community and beautify an alley. Art also shows that a space is cared for and occupied, and can deter graffiti and vandalism.

COST VARIES BY TYPE

Once installed, little to no maintenance.

Fig. 37

STREET FURNITURE

PUBLIC BENCHES • SHADING • POTTED PLANTS

Street furniture invites pedestrian activity by providing shade and seating, and creating places for downtown visitors to gather, rest, people watch, and talk.

$500 - $1000+ PER BENCH / SHADE

Durable coatings and materials require little to no maintenance.

Fig. 7

PROGRAMMED EVENTS

GREEN ALLEY TOUR • COMMUNITY EVENT

With low traffic and intimate character, alleys lend themselves to community events, such as concerts, art walks, block parties, etc. Kissing Alley is a good example, which is now a notable downtown gathering space largely due to regular programming.

COST VARIES DEPENDING ON ACTIVITY

Ongoing management of event requests, reservations, and road closures.

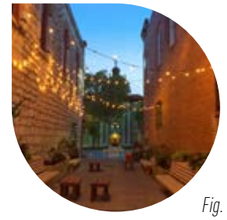


Fig. 38

SUSTAINABLE PUBLIC LIGHTING

DARK-SKY COMPLIANT • SOLAR-POWERED • LED

Lighting enables safe night-time use and traffic through an alley, and sustainable technologies like dark-sky compliant fixtures, LEDs, and solar-powered fixtures, help to minimize energy draw and disruption to flora and fauna.

COST VARIES BY TYPE, ENERGY DRAW

If set on light-sensing timers, little maintenance beyond periodic bulb replacements, which is infrequent with LEDs.

ADJACENT PROPERTIES TOOLKIT

While the City of San Marcos can make improvements to the public right-of-way, much of the character of the downtown alleyways is actually defined by adjacent private property. **As alley reconstruction is undertaken by the city, property owners should also be engaged and incentivized to seize the opportunity to improve the rear of their lots.**

Private projects can be geared to boost not only economic activity but can just as easily contribute to the environmental and social goals of the Green Alley Initiative.

As noted in the case studies, some cities have assessed property owners a minority percentage cost share (15%) to incorporate improvements that benefit their lot. Others have offered 25% matching grants for private improvements undertaken on adjacent lots during the time of alley reconstruction. Some of the toolkit components may also qualify for other grants, such as the Business Improvement and Growth (BIG) grants offered by the City of San Marcos.

For further information, see the following resources:

- For private improvement grants, refer to the Potential Funding Sources section.
- For a list of relevant manufacturers and knowledge sources, refer to the Industry Contacts section.

Fig. 39

WASTE ENCLOSURES

DESCRIPTION

RECYCLING, COMPOST, + LANDFILL MANAGEMENT

Enclosing serviced waste containers and transitioning to side-loading waste containers should be prioritized to improve the overall appearance and function of alleys. Green walls utilizing concrete masonry units, wood, or metal screens should be promoted for enclosures.

COST/MAINTENANCE

COST VARIES BY MATERIAL + SIZE

No additional maintenance required beyond waste collection itself.

Fig. 40

DE-PAVING

DESCRIPTION

INFILTRATION • AESTHETICS • AIR QUALITY

Most parking lots have more impermeable cover than necessary. Removing these areas of asphalt and concrete helps to reverse associated environmental damage (polluted runoff, urban heat island effect, etc.) by allowing for ground surface revegetation.

COST/MAINTENANCE

$2 TO $5 / SF OF ASPHALT OR CONCRETE

Both asphalt and concrete can be recycled for reuse in road or building construction projects.

Fig. 41

BUILDING ACCESS

DESCRIPTION

ENTRIES • WINDOWS • AWNINGS

Opening up previously closed entries and windows or creating new building access or space utilization via alleys can increase pedestrian traffic and overall economic vitality of downtown. City grants may be available for such business improvements.

COST/MAINTENANCE

COST VARIES BY BUILDING CONDITION

After install, typical building maintenance.

Fig. 42

RAIN GARDENS

DESCRIPTION

LARGER BIOFILTRATION + POLLINATOR HABITATS

When planted with native grasses and flowering perennials, rain gardens can be a beautiful, cost effective way to provide stormwater treatment and reduce runoff. Rain gardens lend themselves to larger, irregular spaces and can also double as "Monarch Waystations" for butterflies.

COST/MAINTENANCE

$10 - $30 / SF INSTALLED

Once established, typical native plant care and regular debris removal.

Fig. 43

OUTDOOR PATIOS + FURNITURE

DESCRIPTION

SEATING • TABLES • SHADING •LIGHTING

Businesses - from cafes to retail stores - can occupy underutilized outdoor space by extending their business outdoors with seating, tables, shade, and sustainable lighting for patron and employee use.

COST/MAINTENANCE

$50 - $1000+ PER ITEM

Typical furniture maintenance.

Fig. 44

GREEN + COOL ROOFS

DESCRIPTION

GREEN ROOFS • HIGH ALBEDO ROOF / COATINGS

Cool roofs with high solar reflectance as well as planted green roofs reduce the urban heat island effect as well as energy costs by insulating from outdoor conditions. Green roofs can also retain and filter stormwater and improve air quality.

COST/MAINTENANCE

$5 /SF COOL ROOF - $20+ /SF GREEN ROOF

Typical roof maintenance for cool roofs. Once established, typical plant care for green roofs.

Fig. 45

BUSINESS SIGNAGE

DESCRIPTION

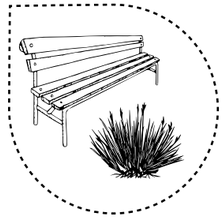
WALL, BLADE + HANGING SIGNS • LIGHTING

Signage and wayfinding helps to guide potential patrons to business locations and human-scaled signs with appropriate lighting on alleys can also help boost general pedestrian traffic. Associated lighting should be dark-sky compliant and energy efficient.

COST/MAINTENANCE

$100 - $1000+ PER SIGN

Once installed, little to no maintenance.



OTHER TOOLKIT COMPONENTS

DESCRIPTION

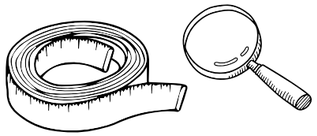
GREEN INFRASTRUCTURE • PUBLIC SPACE

Most components within the other presented toolkits can be employed by adjacent property and business owners to incrementally contribute to environmental and social improvements downtown.

COST/MAINTENANCE

SEE OTHER COMPONENTS FOR COSTS

See other toolkits and components for maintenance / notes.

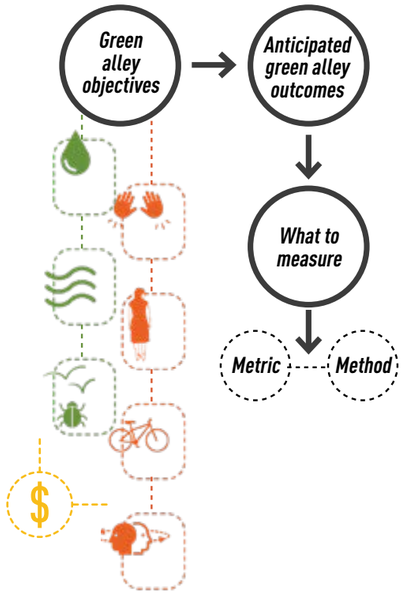


METRICS & OUTCOMES

The interventions proposed by the Green Alley Initiative are intended to have beneficial outcomes for the environment, the downtown economy, and quality of life for humans and wildlife alike - but it is only by both qualitative and quantitative measurement that these impacts are truly acknowledged and then proliferated.

The following points of measure and information gathering, noted in the Landscape Architecture Foundation's Evaluating Landscape Performance (Canfield, Yang, Whitlow, 2018), are recommended for collection and study as San Marcos' Green Alleys are built out. These points of study also provide partnership opportunities for the City of San Marcos with various Texas State University departments and community groups.

Initial performance assessments are optimally performed one to five years after project construction is complete. This allows time for natural processes, site programming, and user behaviors to stabilize, yet ensures that institutional memory about the goals and design intent of the project has not been lost.



HELPFUL COMPARISONS

before
after
Comparing a given metric before and after a specific intervention; requires the gathering of baseline information prior to project implementation.

conventional
sustainable
Comparing a project metric to the same in a conventional project; requires a comparable space, actual or hypothetical

benchmark
project
Comparing a project metric to an accepted standard or average value; requires precedents or historic measurements.

COMMON ENVIRONMENTAL METRICS

Stormwater:
- Annual volume and percent of total runoff retained on site
- Runoff retained for a design storm
- Reduction in peak discharge / runoff rate for a design storm
- Reduction in stormwater fees, infrastructure, or treatment costs (*conventional gray infrastructure versus green*)

Flooding:
- Reduction in frequency of localized flooding
- Reduction in peak discharge at an outlet point

Temperature & Urban Heat Island:
- Air temperature (degrees or percent);
- Surface temperature (of a bench, a window, etc.);
- Increase in reflectivity of materials;
- Area covered by shade

Biodiversity:
- Increased bird or pollinator sightings
- Increased native plant species

COMMON SOCIAL METRICS

Recreational or community value:
- Visits or use to a project site
- Quality of experience (via user survey)
- Increased conservation values and awareness (via user survey)

Transportation:
- Increase in walking or biking use
- Reduction in distance traveled by car within Downtown
- Associated health or time allocation trends (time spent outdoors downtown)

COMMON ECONOMIC METRICS

Increased localized revenue-generating activity

Avoided Costs Due to Delivered Ecological and Social Services

ANTICIPATED GREEN ALLEY POLLUTANT REMOVAL

> Permeable pavers can remove 93% Total Suspended Solids (TSS).
>
> - CITY OF SAN MARCOS STORMWATER TECHNICAL MANUAL, 2019

TABLE 2: An example of one outcome of Green Alleys is the filtration of stormwater. Permeable pavers can remove considerable pollutants from runoff, providing cleaner water flowing into the River. The table below demonstrates approximate pollutant capture and removal should all downtown alleys be reconstructed with permeable pavers.

- **What is TSS?** Total Suspended Solids, commonly comprised of dust, grime, decomposed asphalt and dirt.
- **What is TN?** Total nitrogen, commonly from fertilizers, lawn runoff, parks, and commercial business activities.
- **What is TP?** Total phosphorus, found in fertilizer and identified as the target chemical to control for river and aquifer health (WQPP, 2017)

ALLEY ID	ALLEY NAME	WATER STORAGE VOLUME *(gallons*)*	TSS REMOVED *(lbs / year**)*	TN REMOVED *(lbs / year**)*	TP REMOVED *(lbs / year**)*
A		23,501	530	3.19	1.03
B		23,846	538	3.23	1.04
C		23,846	538	3.23	1.04
D		24,192	545	3.28	1.06
E	Kissing Alley	23,501	530	3.19	1.03
F	Jack's Alley	27,216	614	3.69	1.19
G		30,240	682	4.10	1.32
H		30,240	682	4.10	1.32
I	Feltner Alley N	22,464	506	3.04	0.98
J		17,971	405	2.44	0.78
K		23,846	538	3.23	1.04
L		23,933	540	3.24	1.04
M	Feltner Alley S	47,693	1,075	6.46	2.08
N	Telephone Alley	46,310	1,044	6.28	2.02
O	Railroad Alley	47,002	1,060	6.37	2.05
P		39,744	896	5.39	1.74
GREEN ALLEY TOTALS: *Potential annual*		**475,546 gals** of stormwater storage volume	**10,720 lbs** of Suspended Solids removed annually	**64 lbs** of Nitrogen Removed annually	**21 lbs** of Phosphorus removed annually

See appendix for full calculations

** Based on 21 inches of open base with a 33% porosity. With an open base of 21 inches, the pavers can absorb a 6.3 inch rain, equivalent to more than a 2-year 24-hour rain event using Atlas 14 data for Austin, TX. If the open base is increased to 30 inches, they can absorb a 25-year 24-hour storm event.*

*** Based on an average annual rainfall of 33 inches for San Marcos*

POTENTIAL FUNDING SOURCES

Supplemental federal, state, or local monies can help make green alley projects feasible. Below is a list of funding sources available for both green infrastructure and public space improvements.

URBAN GREENING + COOLING

- Environmental Protection Agency (EPA)
  Office of Sustainable Communities
  // Greening America's Communities Program
  EPA program to help cities develop an implementable vision that incorporate innovative green infrastructure.
  www.epa.gov/smartgrowth/greening-americas-communities
  Application Timeline: Periodic and varies
  Eligibility: Public entities, local governments

- National Science Foundation
  // Environmental Sustainability Program Grant
  Promotes sustainable engineered systems that support human well-being and natural (environmental) systems.
  www.nsf.gov/funding/pgm_summ.jsp?pims_id=505695
  Application Timeline: Accepted year round
  Eligibility: Non-profits, state and local governments, higher education institutions

- Environmental Fund of Texas
  Grants that fund projects primarily dealing with the following areas: water, natural areas, native wildlife, environmental education and awareness, and collaboration.
  www.efundtexas.org/donate-1
  Application Timeline: Accepted year round
  Eligibility: 501c3 Non-profits, eligibility quiz required

- Foundation for Sustainability and Innovation Grant
  Funded projects orient toward use of resources in sustainable ways, technology, economics, and community development that is harmonious with the natural world.
  www.fsifoundation.com/grants
  Application Timeline: Two rounds per year, spring and fall
  Eligibility: Non-profits

- Keep Texas Beautiful // Native Gardens Grant
  Provides affiliate communities with funds to create and maintain native plant demonstration gardens.
  www.ktb.org/native-garden-grants
  Application Timeline: Year round
  Eligibility: Keep San Marcos Beautiful (affiliate)

- Tree Fund // Rotating Research Grants
  Awards grants to empower tree care professionals, their customers, and the communities in which they live and work.
  www.treefund.org/researchgrants
  Application Timeline: Ongoing annual grant opportunities
  Eligibility: Varies; individuals, public entities, etc.

STORMWATER CAPTURE + TREATMENT

- Texas Water Development Board (TWDB)
  // Clean Water State Revolving Fund
  The Clean Water State Revolving Fund, authorized by the Clean Water Act, provides low-cost financial assistance for planning, acquisition, design, and construction of waste water and stormwater infrastructure.
  www.twdb.texas.gov/financial/programs/CWSRF/index.asp
  Application Timeline: Opens in January and due by March for project evaluation for the Intended Use Plan
  Eligibility: Cities, counties, river authorities, public and private entities

- Texas Water Development Board (TWDB)
  // Flood Infrastructure Fund
  Recently approved in 2019, $793 million in grants and low interest rate loans dedicated for infrastructure to reduce flooding, including GSI.
  www.twdb.texas.gov/flood/grant/index.asp
  Application Timeline: Submissions accepted year round
  Eligibility: Cities, counties, river authorities, public and private entities

- Texas Outcomes-Based Finance Challenge
  // Flood Infrastructure Fund
  Collaboration with Quantified Ventures to structure an Environmental Impact Bond (EIB) or other outcomes-based financial vehicles to deliver nature-based and resilience-focused solutions to communities.
  www.quantifiedventures.com/texas-challenge
  Application Timeline: Submissions due November 13, 2020
  Eligibility: Cities, counties, river authorities, local government entities

- Environmental Protection Agency (EPA)
  // 319 Clean Water Act Fund
  Funds projects that address water quality concerns through the implementation of management measures and practices; distributed through the TCEQ.
  www.epa.gov/nps/319-grant-program-states-and-territories
  Application Timeline: Submissions due once a year, summer (July)
  Eligibility: Non-profits and state agencies

- Environmental Protection Agency (EPA)
  // Urban Waters Small Grants Program
  The grants are competed and awarded every two years, with individual award amounts of up to $60,000.
  www.epa.gov/urbanwaters/urban-waters-small-grants
  Application Timeline: Periodic and varies
  Eligibility: Non-profits, state and local governments, universities

- National Fish and Wildlife Foundation (NFWF)
  // Five Star and Urban Waters Restoration Grant Program
  Modest assistance to diverse local partnerships for river, forest, and wildlife conservation.
  www.nfwf.org/fivestar
  Application Timeline: Submissions due once a year, winter (January)
  Eligibility: Public and private entities, preference for organizations who are directly connected to a community and can monitor / sustain projects for five years or more

- Federal Emergency Management Agency (FEMA)
  // Flood Mitigation Assistance Grant Program
  FEMA provides funding to local communities for projects and planning that reduces or eliminates long-term risk of flood.
  www.fema.gov/flood-mitigation-assistance-grant-program
  Application *Timeline: Varies, fall - winter typical*
  Eligibility: State Emergency Management Agencies or office that holds primary floodplain management responsibility

- Federal Emergency Management Agency (FEMA)
  // Building Resilient Infrastructure & Communities (BRIC) Program
  BRIC program funding aims to shift federal focus away from reactive disaster spending toward research-supported, proactive investment in community resilience. Up to $500 million funds available.
  www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
  Application Timeline: September - January 2020-2021
  Eligibility: States that have experienced major disasters in last seven years; local governments eligible as subapplicants to eligible states

TRAVEL, SAFETY + MANAGEMENT

- America Walks
  // Community Change Grants
  Micro grants to support innovative, engaging, and inclusive programs that promote walking and create change at a community level.
  www.americawalks.org/community-change-grants/
  Application Timeline: Annual submissions in the fall
  Eligibility: Advocacy groups, non-profits, and municipalities

- American Association of Retired Persons (AARP)
  // Community Challenge Funds
  Part of the Liveable Communities Initiative, these grants help jump start long-term change through immediate projects in communities.
  www.aarp.org/livable-communities/community-challenge/
  Application Timeline: Annual submissions in the fall
  Eligibility: Non-profits, government entities, and other organizations

- Texas Department of Transportation (TXDOT)
  // Transportation Alternatives Set Aside (TASA) Program
  Funds locally sponsored bicycle and pedestrian infrastructure projects in Texas communities with populations less than 200,000.
  www.txdot.gov/inside-txdot/division/public-transportation/bicycle-pedestrian.html
  Application Timeline: Annual call for submissions
  Eligibility: Local governments, local / regional transportation agencies, non-profits responsible for local transportation safety programs

COMMUNITY OUTREACH + BUSINESS DEVELOPMENT

- City of San Marcos// Business Improvement and Growth (BIG) Grant
  Designed to impact San Marcos properties in need of revitalization, resulting in improved exterior visibility and presentation of a property as well as enhanced occupant safety.
  Application Timeline: Year round
  Eligibility: Commercial property owners or tenants in the Downtown Character District (CD5-D) zoning area

- Lions Club Community Impact Grants
  Funds awarded can be used to support specific humanitarian activities in local chapter communities.
  www.lionsclubs.org/en/start-our-approach/grant-types
  Application Timeline: Year round, at least 90 days prior to project start
  Eligibility: Lions Club chapters that have qualified by donating a minimum of $5,000 to LCIF within one fiscal year.

INDUSTRY CONTACTS + RESOURCES

The following list, while not exhaustive, provides some relevant manufacturer, installer, and informational contacts that can help deliver and service the Green Alley components included in this toolkit.

HIGH ALBEDO + PERMEABLE SURFACES

Keystone Hardscapes | San Marcos
www.keystonehardscapes.com
Material Contact: David Hasness, P.E.(dhasness@keystonehardscapes.com)

Gulf Coast Pavers | Austin, San Antonio, Houston
www.gulfcoastpavers.com/#permeable
Material Contact: Jimmie Hester (jimmie@gulfcoastpavers.com)

Tuscany Pavers | Austin
www.tuscanypaversaustin.com
Material Contact: Garrett Lindholm (tuscanypaversllc@gmail.com)

Cribley Enterprises, Inc. | San Antonio
www.cribleyenterprises.com
Installer Contact: Matt Renegar (mor-ceil@sbcglobal.net)

Russell Boothe Construction | Austin
www.russellboothecc.com
Installer Contact: Rusty Boothe

Speedy Paving | Austin
www.speedy-paving.com
Installer Contact: Gabriel Garcia (512-751-4284)

Porous Pave | National Supplier
www.porouspaveinc.com

GREEN SCREENS + WALLS

Local general contractors , nurseries, + material suppliers

Natura | San Antonio
www.naturahq.com/green-wall-systems

Green Oasis Plantscapes | San Antonio + Austin
www.greenoasis.com/live-green-walls

RAINWATER HARVESTING

Full Circle | New Braunfels
www.fullcircletx.com/index.php

Texas Native Rainwater | Driftwood
www.texasnativerainwater.com

Acer Water Tanks | San Marcos
www.acerwatertanks.com

Austin Drainage + Landscape Development | Austin
www.austindrainagespecialist.com

Construction EcoServices | Austin
www.constructionecoservices.com

Texas Metal Tanks | Austin
www.texasmetaltanks.com/services.htm

Poly-Mart Plastic Rainwater Tanks | Pflugerville
www.poly-mart.com/pflugerville-plastic-storage-tanks

Lakota Water Company | Dripping Springs
www.lakotawatercompany.com
Contact: Alan Rossing (877-652-5682, alan@lakotawatercompany.com)

Contain Water Systems Inc | Marble Falls
www.containwatersystems.com

WILDLIFE SUPPORT

Texas Parks & Wildlife Department // Biologists
www.tpwd.texas.gov/landwater/land/technical_guidance/biologists/

Texas Chapter of the Wildlife Society
www.tctws.org

Texas State Wildlife Society
https://www.txstwildlife.com/

National Wildlife Foundation Certified Wildlife Habitat
www.nwf.org/garden-for-wildlife/certify

NATIVE PLANTS & TREES

City of San Marcos Discovery Center Native Plant Sales
www.sanmarcostx.gov/1528/Native-Plant-Sale

Lady Bird Johnson Wildflower Center | Austin
www.wildflower.org

Hill Country Gardens | New Braunfels
www.hillcountrygardens.com

Fanick's Garden Center | San Antonio
www.fanicknursery.com

The Natural Gardener | Austin
www.tngaustin.com

Deep Root Silva Cells | National Supplier
www.deeproot.com/products/silva-cell.html

RAISED PLANTERS

Local general contractors , nurseries, + material suppliers

BIOFILTRATION PLANTERS + RAIN GARDENS

Austin Drainage + Landscape Development | Austin
www.austindrainagespecialist.com

Construction EcoServices | Austin
www.constructionecoservices.com

Filterra Stormwater Biofiltration Solutions | National
www.conteches.com/stormwater-management/biofiltration-bioretention

INTERPRETIVE, IDENTIFICATION, + BUSINESS SIGNAGE

Local artisans and carpenters

Sign Crafters | San Marcos
www.signcrafters.net

Sign Arts | San Marcos
www.facebook.com/SignArtsSanMarcos

Blackout Signs | San Marcos
www.blackoutsign.com

ProGraphix | Austin
www.pgaustin.com

Ion Art | Austin
www.ionart.com

PUBLIC ART

Local artisans and carpenters

City of San Marcos Mural Arts Program
www.sanmarcostx.gov/1249/San-Marcos-Mural-Arts-Program

City of San Marcos Arts Commission
www.sanmarcostx.gov/484/Arts-Commission

PROGRAMMED EVENTS

City of San Marcos Main Street Program
www.sanmarcostx.gov/655/Main-Street

City of San Marcos Parks and Recreation
www.sanmarcostx.gov/1184/Special-Events

BIKE SUPPORT

Local and national bike rack suppliers

COSM Construction & Design Standards for Bicycle Racks
www.sanmarcostx.gov/DocumentCenter/View/2037/710s-Bicycle-Racks-PDF

The Hub Cyclery
www.bicyclelounge.com/articles/the-hub-cyclery-homepage-pg181.htm

STREET CLOSURE FEATURES + OUTDOOR FURNITURE

Local general contractors, material + furniture suppliers

SUSTAINABLE PUBLIC LIGHTING

Local electrical suppliers

International Dark Sky Association Resources
www.darksky.org/our-work/lighting/lighting-for-industry/fsa/fsa-products

Elliot Electric Supply | San Marcos
www.elliottelectric.com/locations/98/TX/San%20Marcos.aspx

Dealers Electric Supply | San Marcos
www.dealerselectrical.com

WASTE ENCLOSURES

Local General Contractors and material suppliers

BUILDING ACCESS

Local General Contractors; Window, Door + Awning Suppliers

Architectural Division 8 | Austin + San Antonio
www.archdiv8.com

DE-PAVING

Local demolition contractors

GREEN + COOL ROOFS

Local roofing contractors

Cool Roof Rating Council | North America
www.coolroofs.org/resources/home-building-owners

Green Roofs for Healthy Cities | North America
www.greenroofs.org

DOWNTOWN SAN MARCOS ADVOCACY GROUPS

San Marcos Downtown Association
www.downtownsanmarcos.org

Mermaid Society of Texas
www.mermaidsocietysmtx.com

FREQUENTLY ASKED QUESTIONS

As is common when adopting new technologies or evolving an approach, questions arise relating to implementation and outcomes. For reference, a few questions and answers relating to the Green Alley Initiative in San Marcos have been collected below.

BIG PICTURE: MAKING GREEN ALLEYS A REALITY

What will prioritize / qualify an alley to become a Green Alley?
One of the most important criteria will be the replacement of aging infrastructure prior to green alley activation. Since one of the largest water quality benefits is the use of permeable pavers over an open base to treat and slow down runoff, it is important that underground utilities be upgraded and replaced to ensure minimal disruption to surface improvements. This is a deciding criteria used by the City of Dubuque, Iowa where 88 alleys have been replaced with green alleys.

Is a Pilot Study advisable prior to implementing a Green Alley Initiative for all of San Marcos' downtown alleys?
Yes, and it is also recommended that conventional reconstruction of other downtown alleys be deferred until the completion of a pilot. A good pilot candidate is Kissing Alley since a complete utility upgrade is already planned followed by street reconstruction. It is also already partially activated for public use. Use of partnerships and grant funding is an option for a pilot program.

What is the economic case for implementing a Green Alley Initiative downtown? How can this be calculated?
All of the environmental and social benefits provided by Green Alleys can also meaningfully boost economic activity in a City but are hard to quantify because these services are not typically bought and sold. However, valuation techniques that quantify delivered ecosystem services, such as avoided costs, disaster mitigation, or cultural value, are useful in demonstrating economic benefits, as are more direct studies of the positive business impacts resulting from public space improvements. Contacting cities with robust Offices of Sustainability (i.e. Houston, Austin, San Antonio) for guidance is recommended, as is use of reference documents such as the Center for Neighborhood Technology's "The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental, and Social Benefits."

Who will design, construct, and fund Green Alleys?
It is envisioned that the Green Alley Initiative would be completed primarily under the direction of the City of San Marcos' Capital Improvements Plan, similar to how existing alleys are planned to be reconstructed. However, with the many environmental and social benefits that would accompany Green Alleys, supplemental grant sources as procured through organizational and community partnerships, such as those compiled in the "Potential Funding Sources" section of this document, can help fund their construction. Because Green Alley design benefits from the participation of adjacent private properties, business and land owners should be encouraged to join in Green Alley Initiative efforts with matching expenditure grants or by allocating a small percentage of cost-sharing based on frontage in exchange for rear-lot improvements.

What is a typical construction cost for an activated Green Alley and what is the basis of this cost estimate?
The Section 5 "Green Alley Toolkit" of this document provides typical costs for various green alley components and an example cost calculation table for several alleys is also provided in Appendix B. For permeable pavers, the cost of $16-$30/SF is based on a cross section of 21 inches of open stone, an impermeable liner, and an underdrain pipe topped by permeable interlocking concrete pavers (PICP). This unit cost also includes concrete edge restraints on either side of the alleys, and is derived from several local demonstration projects installed through local watershed partnerships with TCEQ (Plum Creek, Cypress Creek, and Alligator Creek). The installation of permeable pavers on a typical alley is estimated to range between $150,000 - $330,000; and any additional components, such as native plantings, signage, waste enclosures, etc. would be additive on top of this cost, as possible and appropriate.

IN THE WEEDS: GREEN ALLEY TECHNICAL DETAILS

Why should Green Alleys incorporate permeable pavers and surfaces instead of typical impermeable pavers or asphalt?
Unlike asphalt or conventional pavers, permeable pavers and earthen surfaces absorb and filter stormwater runoff on-site, which prevents pollutants from entering directly into streams and also reduces localized flooding.

What is the required maintenance and maintenance costs of permeable paver surfaces and Green Alleys, as a whole?
Permeable pavers require semiannual sweeping with a regenerative air sweeper and joint stone reinstatement when the gap reaches 1/3 to ½ inch deep (i.e. the spacer ridge on the paver is visible). This is anticipated to cost about $500 per alley, per year. Green Alleys with increased vegetation and potential nesting habitat will also require seasonal maintenance, which would require further budgeting through city staff time and/or private maintenance contracts, as well as supplemented with organized volunteer time.

How does Green Alley maintenance compare to asphalt?
Asphalt requires crack sealing, seal coating, and pot hole repair annually or as needed, slurry seal on a 5-7 year cycle, and mill and overlay of the surface at a 15-20 year cycle. Use of hydrocarbon-based products containing heavy metals and polynuclear aromatic hydrocarbons (PAHs) are the industry standard for asphalt maintenance. As described previously, permeable paver maintenance is lower impact and the service life of maintained pavers is typically longer at 30-50 years versus asphalt or concrete at 25-30 years.

Are utilities hard to repair under permeable pavers?
No, utility repair is easier and less destructive than with asphalt or concrete - but just requires a different approach. Pavers can be "unzipped" by removing them along with the stone base, which can then be put back in place without much waste and no visible patch.

Won't pavers last longer if the surface doesn't absorb water?
No, the open graded gravel and stone retain strength when wet and are designed for infiltration so heaving and other maintenance issues associated with conventional pavers and water are prevented.

What techniques exist for alleys between historic buildings where water infiltration to adjacent basements is a concern?
Where buildings directly abut the alley, an underdrain pipe is recommended below permeable pavers to help collect and draw water out towards connecting storm drains or areas of soil infiltration. In addition, building foundations can be waterproofed to a depth of 4' feet or more as required with liquid or spray-applied products; and the open stone base can be isolated from the building with an impermeable liner. A 12" or greater concrete edge restraint also helps further isolate the pavers from adjacent surfaces or structures.

What does the presence of groundwater mean for Downtown San Marcos's use of green infrastructure?
Designing systems to accommodate present groundwater is common with green infrastructure and just requires adequate separation between the water table and the bottom of the proposed profile.For permeable pavers, a separation of 2 feet minimum is recommended. Refer to the Downtown Groundwater section of this document for further details (pages 18-19).

What is the pollutant load potential of a Green Alley Initiative as compared to a regional stormwater management pond?
The potential load reduction for total suspended solids (TSS), nitrogen, and phosphorus is presented in Section 5 "Metrics and Outcomes" of this document. These reductions are preliminary and assume a 5:1 off site contributing drainage area from adjacent impervious cover. The percent removal for TSS is slightly higher for permeable pavers at 93% as compared to 89% for bioretention (Table 3.3 of the 2019 SW Tech Manual) and the flow through permeable pavers is faster than through engineered soil in the pond. Without a detailed analysis, a preliminary estimate is that a greater mass of TSS removal can be achieved by the pavers.

Can runoff also drain to rain gardens, biofiltration areas, or Focal Points in Green Alleys instead of permeable pavers?
Yes, rain gardens are another City-preferred Low Impact Development practice and provide infiltration of runoff, water storage and water quality much like the permeable pavers. Where space is constrained, they can be a challenge to locate but partnership with alley-adjacent properties can help provide solutions for placement.

Why is the cross section showing 21 inches of open base on the Appendices? How was this determined?
For the exercise of calculating water storage capacity and pollutant load reduction, a depth of 21 inches (4 inches of ASTM #57 stone and 17 inches of ASTM #2 stone) was used. This is based off of a 2019 Plum Creek Watershed Partnership permeable paver parking lot that was designed for regular car and delivery truck traffic and had features such as ribbon curbs, impermeable liner, and an underdrain system. The lot is over clays with high shrink and swell properties, not unlike much of downtown San Marcos. Current costs estimates and the ICPI model were used to calculate stone thickness for both hydraulic load and weight bearing load requirements.

6 / NEXT STEPS

MAKING GREEN ALLEYS A SAN MARCOS REALITY

BUILDING A GREEN ALLEY COMMUNITY

As this document hopefully demonstrates, Green Alleys in San Marcos can be powerful stormwater management systems, serving as useful corridors between local businesses while also collectively soaking up hundreds of thousands of gallons of runoff, removing tens of thousands of pounds of sediment annually, supporting urban biodiversity, and improving the downtown experience for its many visitors and residents.

But bringing this vision to fruition requires the support, commitment, and excitement of the entire San Marcos community. Overcoming the gravity of the status quo requires momentum and is one of the biggest hurdles for City staff and advocates alike. Municipality operations, particularly in the fields of utilities, stormwater management, and road infrastructure, are based upon repetition and depend upon engineered systems that have remained deeply unchanged for decades. This makes the introduction of new methods and technologies difficult, and green alleys are certainly unexplored for many city departments across the US, including San Marcos.

The Green Alley Initiative is just a first step in inspiring the creation of a green infrastructure network in Downtown San Marcos. The groundwork to facilitate the full life cycle of distributed green infrastructure, from conception to end of life, must be laid to increase not only familiarity but also the desire to work with these technologies amongst the groups of people that will oversee its design and long-term maintenance. Building a Green alley Community will require support from not only citizens, stakeholders, businesses, etc. but also from within the City as an organization itself.

As a concluding note, the following page includes ideas for different areas where City staff can positively impact the implementation and adoption of green infrastructure city-wide. And if you are a citizen reading this document and would like to see Green Alleys become a reality tomorrow, please reach out to city staff and elected leaders to let them know you support these ideas today.

SUPPORT KNOWLEDGE BUILDING

The first and easiest step is to support knowledge building amongst the community and City of San Marcos staff. Ensuring widespread familiarity with and acceptance of green infrastructure concepts is critical to their successful deployment. All departments needed to design, execute, fund, and maintain green alleys and other GSI should have all necessary training available from industry standards and other municipalities advanced in these practices. Stormwater Management staff are natural candidates to guide interdepartmental knowledge building and should be granted the capacity to lead education and research efforts that help build greater understanding of San Marcos' local conditions and demystify concerns associated with green infrastructure. Texas State University's new School of Civil Engineering also presents opportunity for collaboration with faculty on research, as well. Some of these recommended efforts include:

- Green Infrastructure Technical Trainings: Career-building accreditations are available for staff to earn while becoming both capable and familiar with GSI technologies. Training is offered through organizations like the National Green Infrastructure Certifcation Program (NGICP), Interlocking Concrete Pavement Institute (ICPI), San Antonio River Authority (SARA), and more.
- Groundwater Mapping of Downtown Area: To better understand the flow and location of the groundwater table in the Downtown, efforts to map subsurface water levels should be undertaken to inform decisions for green infrastructure in this area.
- Stormwater Flow Modeling in Downtown Alley Ways: Quantifying anticipated precipitation and runoff, potential capture and conveyance by permeable systems in alleys, and avoided storm pipe upsizing costs across Downtown can help build both environmental and financial support for green infrastructure.

CREATE GREEN JOBS + MAINTENANCE PROTOCOLS

In 2020, San Marcos finds itself the midst of the Covid-19 Pandemic, a force that has highlighted the community's workforce vulnerability and overreliance on low-paying, unstable service industry jobs, many of which may be lost permanently. At the same time, the Pandemic has also revealed the importance of accessible and well-maintained outdoor public space as people seek ways to safely get outside their homes. Now more than ever is the time for the City to invest in green jobs to help improve the community's resilience. The creation of green infrastructure maintenance-based staff positions is an incredible way to do just that while also developing the much needed insitutional knowledge and skills required to confidently steward projects into long-term functional life post-installation. Steps to achieve this should include:


Measuring the Water Levels at a Piezometer


Maintaining GSI


Kissing Alley Pilot Opportunity

- Create a Green Stormwater Maintenance Department: GSI maintenance requires a different skill set and direction than typical street or utility departments are accustomed to and more cities are seeing that this work warrants its own department to better serve the infrastructure investment.
- Develop GSI Maintenance Protocols: Parallel to the step above should be the creation of robust GSI maintenance standards. These typically require an understanding of natural systems and native plant care, invasive species or weed identification and removal, the ability to follow directions on plan sets or maintenance covenants, and use of small hand tools.

FUND OPPORTUNITY + SUCCESS

Funding is key for both the initial feasibility and long-term success of green infrastructure projects. Work that can be done today to help make green alleys a reality includes:

- Pursue Grants for a Green Alley Pilot + Beyond: Many potential funding sources (see pgs. 42-43) offer annual opportunities to unlock funding for CIP projects by integrating GSI into the scope. Aiming to secure funding for a pilot green alley is a great way to kickstart the program.
- Dedicate Revenue Stream for GSI Maintenance Funds: Identifying and dedicating a steady monetary source to be used exclusively for green alley and other GSI maintenance is necessary to ensure proper care for GSI investments.

REFERENCES

BIBLIOGRAPHY

Beatley, Tim. *Biophilic Cities: Integrating Nature Into Urban Design and Planning*. Washington, D.C., Island Press, 2010.

Canfield, J., Yang, B., Whitlow, W. *Evaluating Landscape Performance*. Landscape Architecture Foundation, 2018. Accessed September 2019 at landscapeperformance.org

City of San Marcos. *Stormwater Technical Manua*l. Accessed July 2019 from sanmarcostx.gov/DocumentCenter/View/13243/San-Marcos-Stormwater-Technical-Manual-PDF

International Concrete Pavement Institute (ICPI), American Society of Civil Engineers (ASCE). *Permeable Interlocking Concrete Pavements, ASCE/T&DI/ICPI 68-18*, 2018.

Newell, J. P. et al.. "Green Alley Programs: Planning for a sustainable urban infrastructure?" *Cities*, 2012.

Texas Parks and Wildlife Department (TPWD). *"Texas Ecoregions: Blackland Prairies."* Accessed September 2019 at tpwd.texas.gov

The Meadows Center for Water and the Environment, Texas State University. *The Upper San Marcos River Watershed Protection Plan*. September 2018.

United States Environmental Protection Agency (EPA). *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans*. August 2014.

Wolch, J. et al.. "The Forgotten and the Future: Reclaiming Back Alleys for a Sustainable City." *Environment and Planning*, Vol 42, 2010, 2874-2896.

GREEN ALLEY RESOURCES

City of Austin Downtown Commission (2013). *"Activating Austin Downtown Alleys as Public Space."* Retrieved from www.austintexas.gov

City of Chicago Department of Transportation (2010). *"The Chicago Green Alley Handbook."* Retrieved from www.chicago.gov

City of Melbourne (2016). *"Laneway Visions and Greening Map."* Retrieved from participate.melbourne.vic.gov.au/greenlaneways

Fialko, M., Hampton, J.(2011). *"Seattle Integrated Alley Handbook: Activating Alleys for a Lively City."* Retrieved from greenfutures.washington.edu

Global Shapers Community Portland (2019). List of Completed Alley Projects. Retrieved from pdxshapers.com/alley-project-ideas

Trust for Public Land (2012). *"Alleys Amplified: The South Los Angeles Green Alley Master Plan."* Retrieved from www.lastormwater.org

UCLA Luskin Center for Innovation (2014). *"Avalon Green Alley Network Demonstration Project."* Retrieved from www.lastormwater.org

CASE STUDY PROJECT SITES

City Of Dubuque: Green Alley Reconstruction Program
cityofdubuque.org/1818/Green-Alley-Reconstruction

City Of Roswell: Reimagining and Revitalizing Alleys in Downtown Historic Roswell
roswellgov.com/government/departments/community-development/plans-projects/east-west-alley-master-plan

City Of Longmont: Alleyscape and Breezeway Project
www.downtownlongmont.com/about/ldda-projects-and-programs/alleyscape-development-project

LA Green Alleys + South Park Neighborhood: The Avalon Green Alley Demonstration Project
www.tpl.org/green-alleys and https://www.lastormwater.org/green-la/south-la-green-alley-master-plan/

DATA + OTHER SOURCES

City of San Marcos Downtown Master Plan. Broadus & Associates, October 2008. Accessed August 2019 from sanmarcostx.gov/918/Downtown-Master-Plan

City of San Marcos Preferred Plant List. Accessed September 2019 from sanmarcostx.gov/DocumentCenter/View/6263/Plant-List-PDF

City of San Marcos Public GIS Data. Accessed July 2019 from sanmarcostx.gov/761/GIS

United States Environmental Protection Agency Stormwater Calculator. Accessed August 2019 from epa.gov/water-research/national-stormwater-calculator

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APPENDICES

APPENDIX A // GREEN ALLEY EXAMPLE COST ESTIMATES

DOWNTOWN SMTX GREEN ALLEYS

ESTIMATED PERMEABLE PAVER + ANNUAL MAINTENANCE COSTS

ALLEY CODE	ALLEY NAME	APPROXIMATE AREA (sqft.)	PERM PAVER RECONSTRUCTION COSTS ($30 / sf) (a)	PERM PAVER MAINTENANCE COSTS ($1,000 annually) (b)
A	*x*	5,440	$163,200	$1,000
B	*x*	5,520	$165,600	$1,000
C	*x*	5,520	$165,600	$1,000
D	*x*	5,600	$168,000	$1,000
E	*Kissing Alley*	5,440	$163,200	$1,000
F	*Jack's Alley*	6,300	$189,000	$1,000
G	*x*	7,000	$210,000	$1,000
H	*x*	7,000	$210,000	$1,000
I	*Feltner Alley N*	5,200	$156,000	$1,000
J	*x*	4,160	$124,800	$1,000
K	*x*	5,520	$165,600	$1,000
L	*x*	5,540	$166,200	$1,000
M	*Feltner Alley S*	11,040	$331,200	$1,000
N	*Telephone Alley*	10,720	$321,600	$1,000
O	*Railroad Alley*	10,880	$326,400	$1,000
P	*x*	9,200	$276,000	$1,000
TOTAL		**110,080**	**$3,302,400**	**$16,000**

DOWNTOWN SMTX GREEN ALLEYS

ESTIMATED EXAMPLE GREEN ALLEY COSTS (AS VISUALIZED ON PGS. 26-30)

ALLEY ELEMENTS	ELEMENT COST (PSF / PLF / Each)	ALLEY E / F ELEMENTS	ALLEY E + F ELEMENT COST	ALLEY O ELEMENTS	ALLEY O ELEMENT COST
Permeable Pavers (sf)	$30.00	9,222	$276,660	9,975	$299,250
Permeable Ground (sf)	$10.00	3,300	$33,000	10,085	$100,850
Trees (ea)	$750.00	6	$4,500	20	$15,000
Shrubs (ea)	$75.00	30	$2,250	40	$3,000
Perennials, Grasses (ea)	$25.00	60	$1,500	75	$1,875
Vertical Green Wall (LF)	$25.00	65	$1,625	0	$0
Raised Planter (LF)	$50.00	20	$1,000	0	$0
Rain Barrels (ea)	$1,500.00	3	$4,500	1	$1,500
Benches (ea)	$500.00	2	$1,000	2	$1,000
String Lighting (LF)	$5.00	Existing	-	300	$1,500
In-Ground Lighting (ea)	$250.00	10	$2,500	10	$2,500
Dumpster Enclosure (ea)	$3,000.00	4	$12,000	7	$21,000
Alley Signage (ea)	$7,500.00	2	$15,000	1	$7,500
		SUBTOTAL	$355,535	**SUBTOTAL**	$454,975
		10% Continengency	$35,554	**10% Continengency**	$45,498
		ALLEY E / F EST. LOW COST	**$391,089**	**ALLEY O EST. LOW COST**	**$500,473**
		25% Continengency	$88,884	**25% Continengency**	$113,744
		ALLEY E/F EST. HIGH COST	**$444,419**	**ALLEY O EST. HIGH COST**	**$568,719**

General Disclaimer: All assumed costs are estimates only based on industry approximations and do not constitute a qualified construction estimate. Utility improvement costs are not included.
(a) PICP installed cost with 21 inch open base, concrete edge restraints, underdrain, and impermeable liner
(b) Based on approximate annual per alley costs of $500 for quarterly sweeping and $500 for top stone replacement

APPENDIX B // POTENTIAL GREEN ALLEY STORM EVENT + POLLUTANT REMOVAL CALCULATIONS

DOWNTOWN SMTX GREEN ALLEYS

BASE GREEN ALLEY VOLUME CALCULATIONS

ALLEY CODE	ALLEY NAME	APPROXIMATE AREA (sqft.)	APPROXIMATE AREA (ACRES)	OPEN BASE DEPTH (inches)	POROSITY (%)	WATER STORAGE VOLUME AVAILABLE (FT3)	WATER STORAGE VOLUME AVAILABLE (gal)
A	*x*	5,440	0.125	21	0.33	3,142	23,501
B	*x*	5,520	0.127	21	0.33	3,188	23,846
C	*x*	5,520	0.127	21	0.33	3,188	23,846
D	*x*	5,600	0.129	21	0.33	3,234	24,192
E	*Kissing Alley*	5,440	0.125	21	0.33	3,142	23,501
F	*Jack's Alley*	6,300	0.145	21	0.33	3,638	27,216
G	*x*	7,000	0.161	21	0.33	4,043	30,240
H	*x*	7,000	0.161	21	0.33	4,043	30,240
I	*Feltner Alley N*	5,200	0.119	21	0.33	3,003	22,464
J	*x*	4,160	0.096	21	0.33	2,402	17,971
K	*x*	5,520	0.127	21	0.33	3,188	23,846
L	*x*	5,540	0.127	21	0.33	3,199	23,933
M	*Feltner Alley S*	11,040	0.253	21	0.33	6,376	47,693
N	*Telephone Alley*	10,720	0.246	21	0.33	6,191	46,310
O	*Railroad Alley*	10,880	0.250	21	0.33	6,283	47,002
P	*x*	9,200	0.211	21	0.33	5,313	39,744
TOTAL		**110,080**	**2.53**	-	-	**63,571**	**475,546**

DOWNTOWN SMTX GREEN ALLEYS

STORM EVENT CAPACITY POTENTIAL (a)

	AVERAGE RECURRENCE INTERVAL	PRECIPITATION (inches)	GI CAPACITY (%)
Storm duration: 3 hours	2 yr.	2.70	38.96%
	25 yr.	5.56	80.23%
	100 yr.	7.83	112.99%
Storm duration: 6 hours	2 yr.	3.17	45.74%
	25 yr.	6.77	97.69%
	100 yr.	9.78	141.13%
Storm duration: 12 hours	2 yr.	3.64	52.53%
	25 yr.	7.83	112.99%
	100 yr.	11.30	163.06%
Storm duration: 24 hours	2 yr.	4.14	59.74%
	25 yr.	8.85	127.71%
	100 yr.	12.70	183.26%

(a) Based on Atlas 14 rainfall data for the Austin, Texas station

DOWNTOWN SMTX GREEN ALLEYS

BASE GREEN ALLEY VOLUME CALCULATIONS

ALLEY CODE	ALLEY NAME	APPROXIMATE AREA (sqft.)	APPROXIMATE AREA (ACRES)	OPEN BASE DEPTH (inches)	POROSITY (%)	WATER STORAGE VOLUME AVAILABLE (FT3)	WATER STORAGE VOLUME AVAILABLE (gal)	WATER CAPTURED WITH 1.6 INCHES STORM (gal)(a)
A	*x*	5,440	0.125	21	0.33	3,142	23,501	5,425
B	*x*	5,520	0.127	21	0.33	3,188	23,846	5,505
C	*x*	5,520	0.127	21	0.33	3,188	23,846	5,505
D	*x*	5,600	0.129	21	0.33	3,234	24,192	5,585
E	*Kissing Alley*	5,440	0.125	21	0.33	3,142	23,501	5,425
F	*Jack's Alley*	6,300	0.145	21	0.33	3,638	27,216	6,283
G	*x*	7,000	0.161	21	0.33	4,043	30,240	6,981
H	*x*	7,000	0.161	21	0.33	4,043	30,240	6,981
I	*Feltner Alley N*	5,200	0.119	21	0.33	3,003	22,464	5,186
J	*x*	4,160	0.096	21	0.33	2,402	17,971	4,149
K	*x*	5,520	0.127	21	0.33	3,188	23,846	5,505
L	*x*	5,540	0.127	21	0.33	3,199	23,933	5,525
M	*Feltner Alley S*	11,040	0.253	21	0.33	6,376	47,693	11,011
N	*Telephone Alley*	10,720	0.246	21	0.33	6,191	46,310	10,691
O	*Railroad Alley*	10,880	0.250	21	0.33	6,283	47,002	10,851
P	*x*	9,200	0.211	21	0.33	5,313	39,744	9,175
TOTAL		110,080	2.53	-	-	63,571	475,546	109,786

DOWNTOWN SMTX GREEN ALLEYS

TP LOAD REDUCTION POTENTIAL

ALLEY CODE	TP CONC INITIAL (mg/L) (b)	TP CONC FINAL (mg/L) (c)	TP REMOVED (mg/L)	ANNUAL RAINFALL HAYS (IN)	TP REMOVED (LB/YEAR)(d)
A	0.396	0.09	0.306	33	1.03
B	0.396	0.09	0.306	33	1.04
C	0.396	0.09	0.306	33	1.04
D	0.396	0.09	0.306	33	1.06
E	0.396	0.09	0.306	33	1.03
F	0.396	0.09	0.306	33	1.19
G	0.396	0.09	0.306	33	1.32
H	0.396	0.09	0.306	33	1.32
I	0.396	0.09	0.306	33	0.98
J	0.396	0.09	0.306	33	0.78
K	0.396	0.09	0.306	33	1.04
L	0.396	0.09	0.306	33	1.04
M	0.396	0.09	0.306	33	2.08
N	0.396	0.09	0.306	33	2.02
O	0.396	0.09	0.306	33	2.05
P	0.396	0.09	0.306	33	1.74
					21

(a) 1.6 inches for a rainfall event is the design rainfall for the San Marcos River Corridor and Edwards Aquifer Recharge Zone in Table on page 3-26 of the City of San Marcos Stormwater Technical Manual and is considered the most conservative. This standard also requires 89% TSS reduction.

(b) City of Austin Environmental Criteria Manual, Sept 7, 2018 Table 1-10
(c) Users Guide to the BMP SELECT Model, 2013, WERF, Table 4 for permeable pavement
(d) Average annual load (pounds) removed per year = (influent conc-effluent conc) x contributing area (acres) x average annual rainfall Hays County x runoff coefficient based on impervious cover (COA Table 1-9 adjusted for 33 inches instead of Austin's 31 inches) x 0.226 (conversion factor to yield pounds per year)

DOWNTOWN SMTX GREEN ALLEYS

TN LOAD REDUCTION POTENTIAL

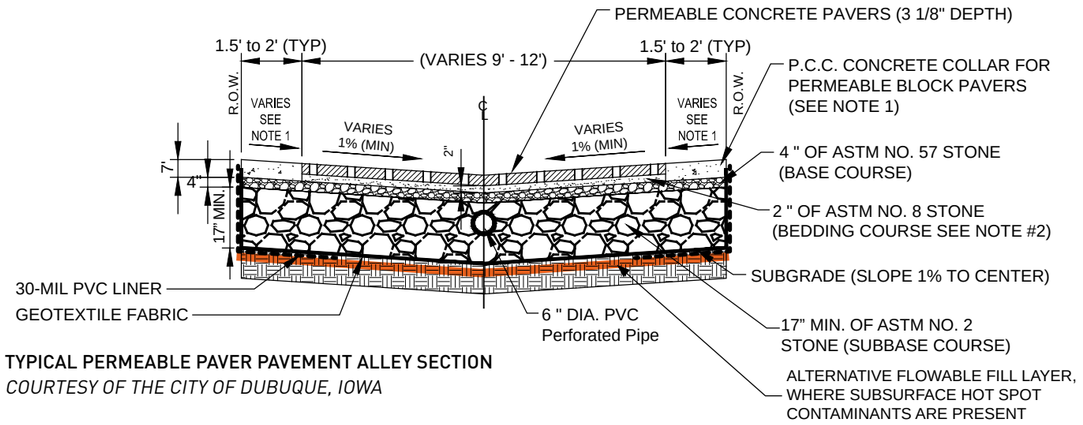
ALLEY CODE	TN CONC INITIAL (mg/L) (b)	TN CONC FINAL (mg/L) (c)	TN REMOVED (mg/L)	ANNUAL RAINFALL HAYS (IN)	TN REMOVED (LB/YEAR)(d)
A	2.22	1.27	0.95	33	3.19
B	2.22	1.27	0.95	33	3.23
C	2.22	1.27	0.95	33	3.23
D	2.22	1.27	0.95	33	3.28
E	2.22	1.27	0.95	33	3.19
F	2.22	1.27	0.95	33	3.69
G	2.22	1.27	0.95	33	4.10
H	2.22	1.27	0.95	33	4.10
I	2.22	1.27	0.95	33	3.04
J	2.22	1.27	0.95	33	2.44
K	2.22	1.27	0.95	33	3.23
L	2.22	1.27	0.95	33	3.24
M	2.22	1.27	0.95	33	6.46
N	2.22	1.27	0.95	33	6.28
O	2.22	1.27	0.95	33	6.37
P	2.22	1.27	0.95	33	5.39
					64

DOWNTOWN SMTX GREEN ALLEYS

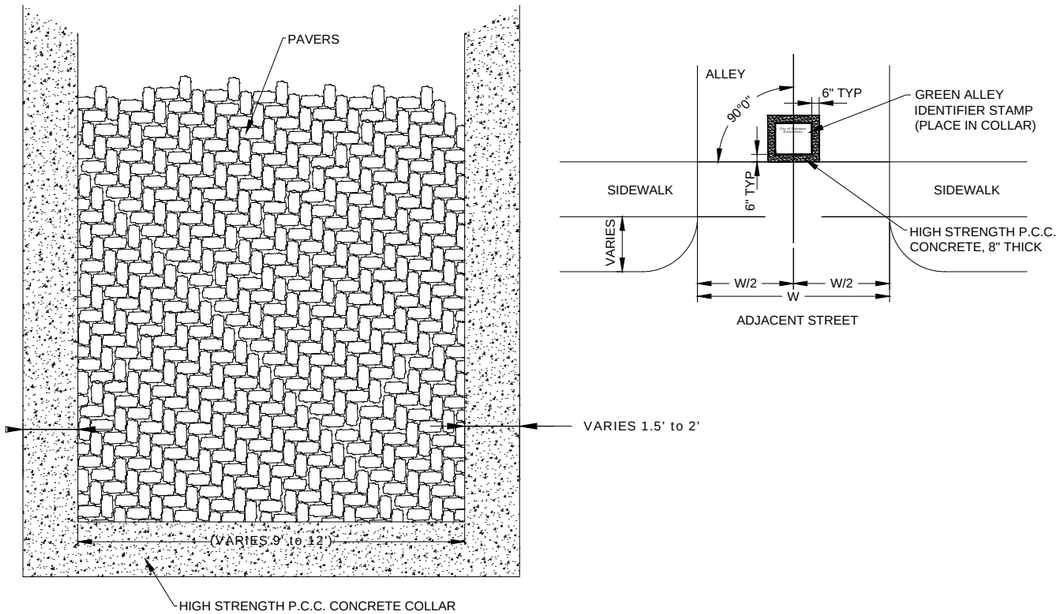
TSS LOAD REDUCTION POTENTIAL

ALLEY CODE	TSS CONC INITIAL (mg/L) (b)	TSS CONC FINAL (mg/L) (c)	TSS REMOVED (mg/L)	ANNUAL RAINFALL HAYS (IN)	TSS REMOVED (LB/YEAR)(d)
A	170	12	158	33	530
B	170	12	158	33	538
C	170	12	158	33	538
D	170	12	158	33	545
E	170	12	158	33	530
F	170	12	158	33	614
G	170	12	158	33	682
H	170	12	158	33	682
I	170	12	158	33	506
J	170	12	158	33	405
K	170	12	158	33	538
L	170	12	158	33	540
M	170	12	158	33	1075
N	170	12	158	33	1044
O	170	12	158	33	1060
P	170	12	158	33	896
					10720

Calculations based on similar methodology for The Upper San Marcos Watershed Protection Plan, and Cypress Creek WPP QAPP dated April 4, 2019 pp 32-38, and a 5:1 offsite to onsite drainage area.



TYPICAL PERMEABLE PAVER PAVEMENT ALLEY SECTION
COURTESY OF THE CITY OF DUBUQUE, IOWA



TYPICAL ALLEY PERMEABLE PAVER ALLEY PLAN
COURTESY OF THE CITY OF DUBUQUE, IOWA

notes