# A Pathway to Green Infrastructure

## Green Infrastructure Concept Plan
## Corporation of Shepherdstown, West Virginia

**Matt Pennington**

**Alexis Yost**

Downstream Strategies
Ideas that sustain.



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# Green Infrastructure Concept Plan

Matt Pennington
Alexis Yost

## ABOUT THE AUTHORS

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Mr. Pennington is an environmental, community, and economic development planner with extensive expertise helping local governments and organizations balance economic and population growth with the preservation of natural resources. He is a certified Chesapeake Bay Landscape Professional (CBLP) and an award-winning stormwater professional who focuses on comprehensive planning, green infrastructure design and implementation, hazard mitigation, and securing grants for community projects and programs.

Mr. Pennington has been providing technical assistance to local governments, watershed organizations and other nonprofits. He is experienced in creating targeted audience outreach campaigns to reduce nonpoint pollution reduction for 13 years. In 2018, he led the Local Engagement Initiative on behalf of the West Virginia Department of Environmental Protection and is the former chair of the U.S. Environmental Protection Agency's Chesapeake Bay Program Local Leadership Workgroup.

Mr. Pennington earned a B.S. in Urban and Regional Planning from Frostburg State University.

**Alexis Yost, Staff Planner**

Ms. Yost is a landscape designer and planner with a holistic approach to creating places that stand the test of time. With experience in the principals of conservation ecology and sustainable design, she aims to implement techniques that support science and serve communities within Appalachia and beyond. Her portfolio features a variety of projects spanning from small-scale parklets to large-scale urban and regional plans, with technical skills demonstrated that ensure each plan follows through to completion.

## ACKNOWLEDGEMENTS

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# 1. INTRODUCTION

Recent heavy rains in the Eastern Panhandle have exhausted the historic stormwater infrastructure and caused nuisance flooding in the Corporation of Shepherdstown—West Virginia's oldest municipality.

This report and concept plan, prepared for the Corporation of Shepherdstown, evaluates several candidate sites owned by the local government to reduce flooding hazards using green infrastructure (GI). GI uses vegetation and soil to address flooding, as opposed to gray infrastructure, which uses pipes and concrete. GI practices can range from planting trees and native perennial flowers to engineered rain gardens and wetland development. The U.S. Environmental Protection Agency's (EPA's) Chesapeake Bay program has promoted urban green infrastructure as a best management practice (BMP) to control stormwater runoff and filter out pollution that flows into nearby streams and rivers.

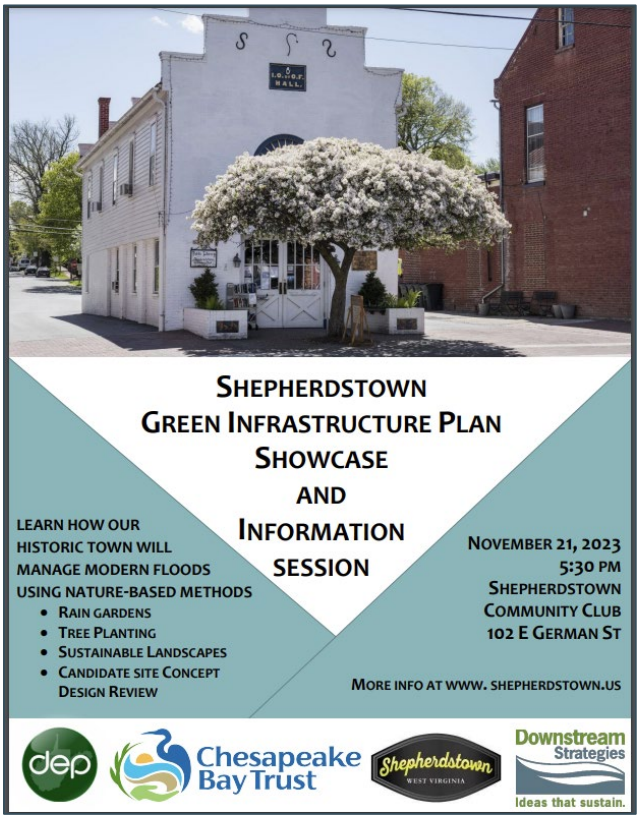
## 1.1 Utility conflicts

Existing locations for water and sewer infrastructure were evaluated during the concept plan development. This evaluation was based on "redline" plans provided by the Corporation of Shepherdstown. All sites must be thoroughly cleared by WV811 to determine if any utility conflicts exist before proceeding to engineering.

## 1.2 Public forum

Downstream Strategies facilitated focus group and stakeholder input meetings to identify and review problem areas. Additionally, two public forums were held on October 31, 2023, and November 21, 2023, to discuss potential candidate sites and receive community feedback.

Each candidate site was reviewed and discussed in a showcase format. All feedback has been compiled and attached in the Appendix of this report. This intial public input should be reivewed for consideration into into future designs.




Participants discuss candidate sites during November 21, 2023 Showcase

## 1.3 West Virginia Stormwater Manual

Many of the recommendations refer to design standards found in the West Virginia Stormwater Management and Design Guidance Manual, issued by the West Virginia Department of Environmental Protection November 2012.

## 1.4 Cost Estimates

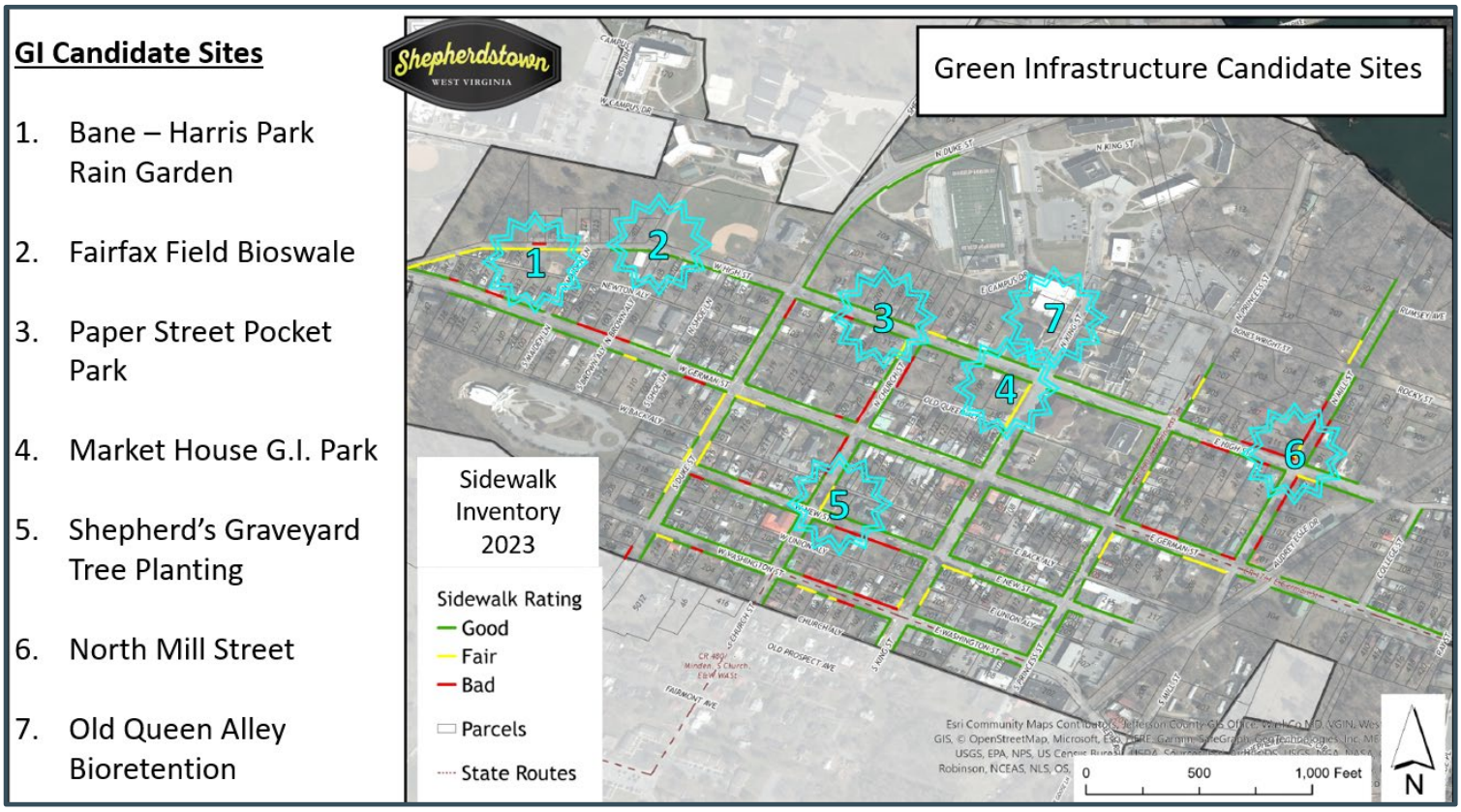
Downstream Strategies has developed these cost estimates based on the most current Jefferson County Bonding Estimates last updated in 2020. Design estimates have been based on assumed hourly market rates and anticipated levels of effort.

Finally, all candidate sites have a calculated dollar-per-acre-treated ratio for both the design and construction phases.

# 2. CANDIDATE SITES

Figure 1 illustrates an overview of the GI candidate sites for this concept plan. In the future, this plan will serve as the basis for grant opportunities to fund detailed engineering plans and construction. The sections that follow provide concept renderings and preliminary design and construction estimates.

**Figure 1: Candidate site overview**



## 2.1 Bane-Harris Park bioretention

Established in 1982, Bane-Harris Park is dedicated to two community members, John W. Harris and Quinton Bane, whose efforts led to the development and construction of the park. The park is located at the corner of West High Street and North Maiden Lane and is owned and operated by the Corporation. The proposed bioretention will be located at an underutilized turf section north of the basketball court and will capture and treat the first 0.5" of the 31,190-square-foot drainage area.

Design costs will total $8,611 at $12,0265/acre treated. Current construction estimates total $5,409 at $7,554/acre treated.

This bioretention is the first practice of a treatment train along West High Street. Runoff within this drainage area will continue to be captured and treated along the Baseball Bioswale practice discussed in Section 2.2.

**Figure 2: Bane-Harris Park conceptual rendering**

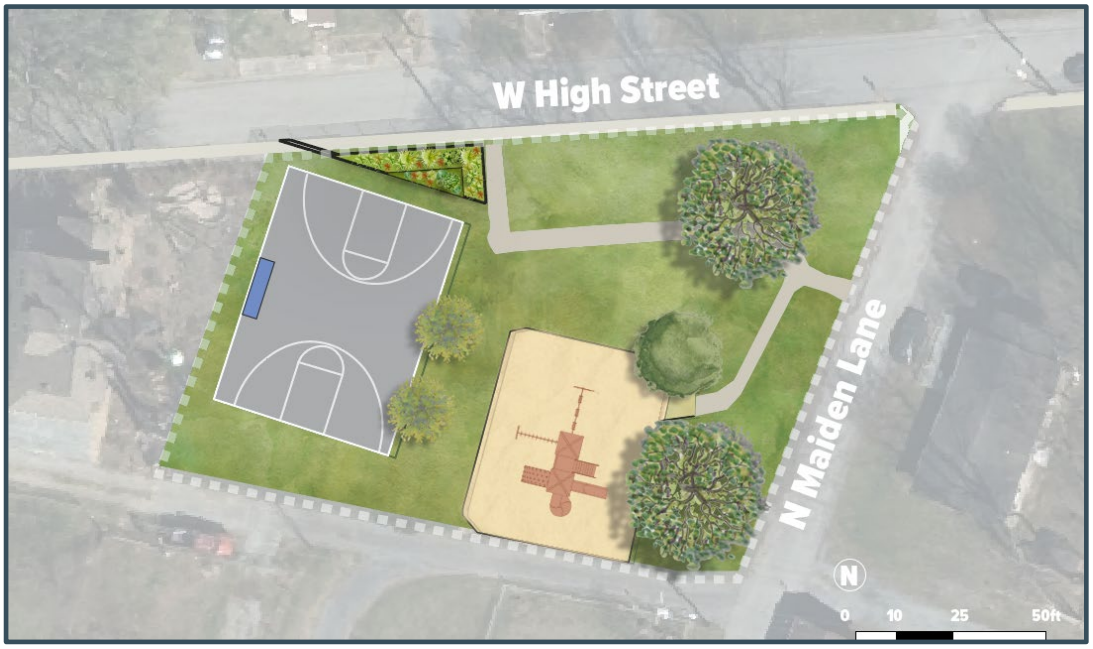



**Table 1: Preliminary cost estimates: Bane-Harris Park bioretention**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $6,671 | Per | 1 | $6,671 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 1 | $440 |
| Curb cut opening with grate | $500 | Per | 1 | $500 |
| BR-7 Bio-media | $ 43 | CY | 12 | $516 |
| Clean #57 gravel (includes delivery) | $23 | CY | 14 | $46 |
| Clean #8 choker stone (includes delivery) | $28 | CY | 7 | $28 |
| Mulch | $28 | CY | 3 | $84 |
| Material delivery | $300 | Load | 1 | $300 |
| Plantings | $1 | SF | 335 | $335 |
| Labor | $2,400 | Day | 1.5 | $3,600 |
| | | | **Preliminary estimate** | **$14,020** |

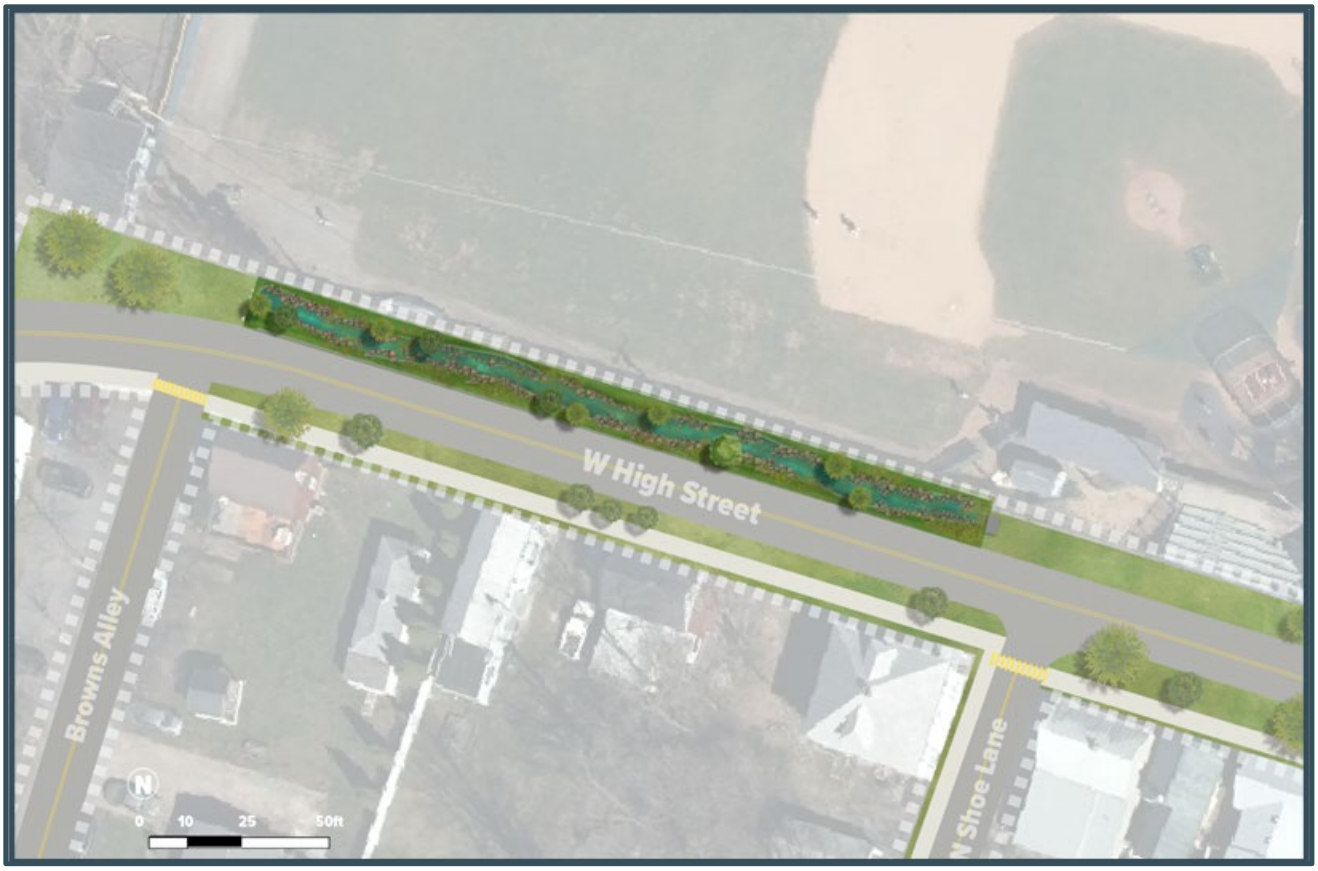
## 2.2 Fairfax Field bioswale

Fairfax Field is the home of Shepherd University Rams baseball team. It is the oldest athletic field on the campus. The proposed bioswale will traverse along West High Street adjacent to the south side of the field. The bioswale will treat approximately 0.1" of runoff from the 13.72-acre drainage area. Design costs will total $11,470 and represent a ratio of $836/acre treated. Current construction estimates total $10,658 at $777/acre treated.

**Table 2: Preliminary cost estimates: Fairfax Field bioswale**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $9,090 | Per | 1 | $9,090 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 1 | $880 |
| BR-7 Bio-media | $ 43 | CY | 58 | $2,494 |
| Clean #57 gravel (includes delivery) | $23 | CY | 15 | $345 |
| Clean #8 choker stone (includes delivery) | $28 | CY | 8 | $224 |
| Mulch | $28 | CY | 12 | $336 |
| Material delivery | $300 | Load | 4 | $1,200 |
| Plantings | $1 | SF | 1,259 | $1,259 |
| Labor | $2,400 | Day | 2 | $4,800 |
| | | | **Preliminary estimate** | **$22,128** |

**Figure 3: Fairfax Field bioswale conceptual rendering**



## 2.3 Paper street pocket park

Paper streets are platted rights-of-way with no physical road and often appear as vacant lots. Shepherdstown has several within its ownership that can be converted into useable green spaces that incorporate green infrastructure elements.

This concept focuses on a paper street near the intersection of High Street and Church Street. Curb cut openings through the sidewalk allow stormwater from the 2.19-acre drainage area to flow into the park's newly reforested conservation and be soaked up by native trees and pollinators. Additional runoff could be collected in a vegetated curb extension North Church Street.

Design costs will total $8,380 and represents a ratio of $3,826/Acre Treated. Current construction estimates total $6,966 at $3,181/acre treated.

**Table 3: Preliminary cost estimates: Paper street pocket park**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $6,000 | Per | 1 | $6,000 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 1 | $880 |
| Curb cut opening with grate | $500 | Per | 2 | $1,000 |
| Seed and straw stabilization | $0.13 | SF | 1,828 | $238 |
| Material delivery | $300 | Load | 1 | $300 |
| Plantings | $1 | SF | 1,828 | $1,828 |
| Labor | $2,400 | Day | 1.5 | $3,600 |
| | | **Preliminary estimate** | | **$15,346** |

**Figure 4: Paper street pocket park conceptual rendering**



Example Pocket Park
Image Source: Google Maps, 2023

## 2.4 Market house green park

A half-block area of King Street will be transformed into an absorption gathering place. Approximately 7,000 square feet of impervious surface will be converted into a green park for the community to enjoy all year long. Native trees and pollinator-friendly plants will collect stormwater flows from a 6.5-acre drainage area.

**Figure 5: Market house green park conceptual rendering**


All runoff from the 6.5-acre drainage area of road, rooftops, and parking lots will be directed into this new green space and be credited as a sheet flow to conservation area.

A proposed traffic control roundabout will serve a dual purpose with the installation of a small bioretention facility that collects runoff from a portion of New Street and King Street.

**Figure 6: Market house green park public forum comments**


The market house candidate site received the most comments during the November public forum. Additional public meetings and special considerations should be provided during the design and engineering phase.

Design costs will total $35,000 at $5,385/acre treated. Current construction estimates total $110,430 at 16,989/acre treated.

**November 21 Public Forum Comment Highlight**

- **Has a traffic study been conducted? Is there a need for additional bicycles parking?**
- **Add "limited access" control at New and King.**
- **Leave existing parallel parking as is.**
- **The Market House being closed off could be a great space for town / atmosphere. I would like to see alternate plans.**

**Table 4: Preliminary cost estimates: Market house green park**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $3,620 | Per | 1 | $32,620 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 1 | $880 |
| Asphalt removal | $9 | SF | 7,000 | $63,000 |
| General excavation | $13 | CY | 260 | $3,380 |
| 6" drainage connection pipe | $10 | LF | 60 | $600 |
| Roundabout bioretention | $10 | CF | 614 | $6,140 |
| Curb installation | $45 | LF | 120 | $5,400 |
| Seed and straw stabilization | $0.13 | SF | 7,000 | $910 |
| Plantings | $1 | SF | 7,000 | $7,000 |
| Labor | $2,400 | Day | 10 | $24,000 |
| | | | **Preliminary estimate** | **$145,430** |

## 2.5 Shepherds Graveyard tree planting

Trees are one of the oldest green infrastructure BMPs for stormwater management: their roots soak up runoff and, while loosening soil to increase infiltration, their leaves and branches intercept rain in their canopy above the surface before it even has a chance to become runoff. In addition to reducing flood risks, trees provide shade, windbreaks, wildlife habitat, and natural beauty.

The church can further aid in stormwater reduction by diverting its downspouts to flow into the graveyard and provide irrigation for the trees. The reforested area will receive flows from a 0.39-acre drainage area.

Design costs will total $440 at $1,128/acre treated. Current construction estimates total $6,650 and at $17,051/acre treated.

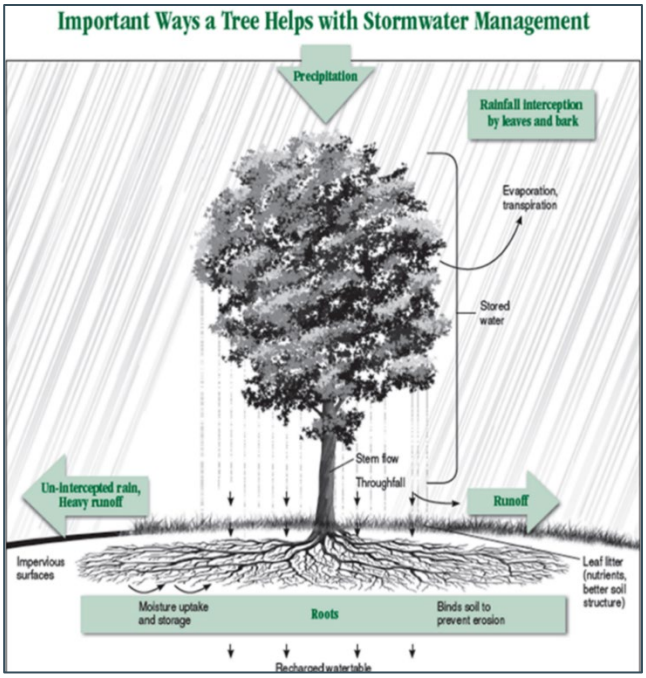



Image Source: Tree City USA, 2024

**Figure 7: Shepherds Graveyard conceptual rendering**


**Table 5: Preliminary cost estimates: Shepherds Graveyard**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Trees and materials | $0.50 | SF | 10,000 | $5,000 |
| Downspout disconnection | $10 | LF | 45 | $450 |
| Landscape design | $880 | Per | 0.5 | $440 |
| Labor | $2,400 | Day | 0.5 | $1,200 |
| | | | **Preliminary estimate** | **$7,090** |

## 2.6 North Mill Street

One of the largest drainage areas at 12.5 acres, the Lower Mill Street bio-conveyance will not only treat stormwater runoff but also protect historical properties from flash floods.

Sag sections of the North Mill Street profile create ponding that overflows onto private property. This concept plan recommends dissipating stormwater volumes along Mill Street by capturing runoff that flows along the curbs into vegetated curb extensions which will reduce flash flood impacts. These bump-outs can also be used as traffic calming devices to increase safety near the Cullison Park recreational playground.

Curbing can be extended northerly along Mill Street to properly collect and convey flow into rain gardens. Consideration should be given to the driveway access section located at 204 and 207 North Mill Street and resolved with an engineering solution such as a revised grading strategy or slotted drainpipe. Additionally, given the topographic nature of these two properties, waivers or variances to sidewalk requirements should be considered if owners choose to use this space to install green infrastructure features.

Design costs will total $35,000 at $2,800/acre treated. Current construction estimates total $35,424 at $2,834/acre treated.

Floodwater overtopping curb at 204 North Mill Street

**Figure 8: North Mill Street 3D conceptual rendering**

**Figure 9: North Mill Street conceptual rendering**

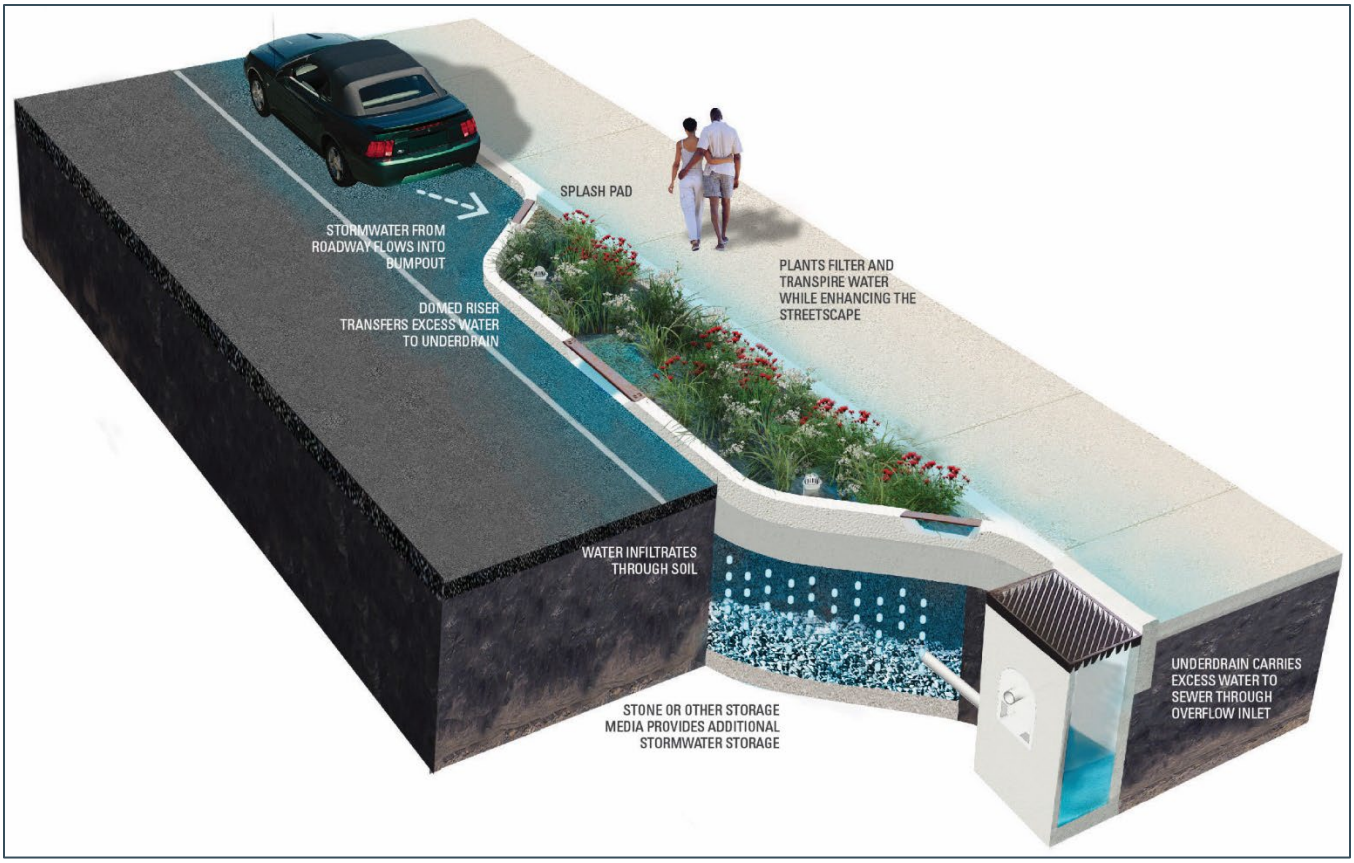



Image Source: Philadelphia Water Department, 2024

**Table 6: Preliminary cost estimates: North Mill Street**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $33,060 | Per | 1 | $33,060 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 0.5 | $440 |
| Sidewalk removal | $9 | SF | 743 | $6,687 |
| Two bump-out rain gardens | $10 | CF | 1,189 | $11,890 |
| Curb Installation | $45 | LF | 200 | $9,000 |
| Seed and straw stabilization | $0.13 | SF | 743 | $100 |
| Plantings | $1 | SF | 547 | $547 |
| Labor | $2,400 | Day | 3 | $7,200 |
| | | | **Preliminary estimate** | **$70,424** |

**November 21 public forum comment highlight – North Mill Street**

- **Speed bumps were not well received.**
- **Some comments were not in favor of road narrowing.**

## 2.7 Old Queen Alley bioretention

Shepherdstown Town Hall is located at the bottom of Old Queen Alley's slope. A significant amount of runoff flows to the back entrance of Town Hall due to no existing stormwater management methods along the alley. This concept plan proposes redesigning a small parking lot that is owned and operated by the Corporation to allow for the installation of a small bioretention feature.

The parking stalls will slide outward to align with the existing adjacent parking area on the corner of King Street and Old Queen Alley. This newly available green space between the edge of the parking area and property line will be sufficient to accommodate an appropriately sized bioretention facility.

**Figure 10: Old Queen Alley bioretention conceptual rendering**


The proposed bioretention will capture and treat the first 1" of runoff from the 60,150-square-foot (1.38 acres) drainage area. Design costs will total $14,180 and at $10,275/acre treated. Current construction estimates total $14,268 at $10,339/acre treated. This project should be coordinated with the repaving of Old Queen Alley to achieve an economy of scale for both projects; this will also include grading and crowning the alleyway to allow for drainage to flow towards the bioretention feature.

**Table 7: Preliminary cost estimates: Old Queen Alley bioretention**

| Task | Cost/unit | Units | Qty. | Total |
|---|---|---|---|---|
| Engineering and permitting | $11,800 | Per | 1 | $11,800 |
| Surveying | $10,000 | Per | 0.15 | $1,500 |
| Landscape design | $880 | Per | 1 | $880 |
| BR-7 Bio-media | $ 43 | CY | 68 | $2,924 |
| Clean #57 gravel (includes delivery) | $23 | CY | 14 | $308 |
| Clean #8 choker stone (includes delivery) | $28 | CY | 7 | $196 |
| Mulch | $28 | CY | 16 | $448 |
| Material delivery | $300 | Load | 5 | $1,500 |
| Plantings | $1 | SF | 1,692 | $1,692 |
| Labor | $2,400 | Day | 3 | $7,200 |
| | | | **Preliminary estimate** | **$28,448** |

# 3. INCREASE TREE CANOPY AND NATIVE LANDSCAPES

The Corporation of Shepherdstown is eligible to participate in programs whose missions are to increase tree canopy. The Cacapon Institute assists West Virginia's eastern panhandle communities with hosting tree planting events, and the applications for the program are straightforward. If selected, the applicant receives all trees, materials, and professional assistance to implement a tree planting event at their property. Applicants are required to conduct necessary preparations such as inviting volunteers and digging holes for trees.

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Additionally, Shepherdstown can be an active partner in promoting native landscaping to its property owners. "The Back Alley Garden Tour & Tea" is a grassroots event that shares the landscaping efforts of private homeowners and captures the spirit of green infrastructure at a local level. This program can be a wonderful way to engage the public and educate people on how to convert their homes and businesses into native landscapes.

Leveraging the organic passion for gardening that currently exists will accelerate GI adoption in Shepherdstown.

# 4. POLICY ADOPTIONS

While these candidate sites are specific in nature, Shepherdstown is encouraged to review example policies other communities have adopted to further green infrastructure. The Appendix contains sample language from the City of Portland promoting green infrastructure policy. Additionally, there are a large number of underutilized street corners and intersections where vegetated curb extensions could be incorporated. Shepherdstown has several existing examples that can be repeated thought the municipal street system to reduce stormwater along the right-of way.

Existing vegetated curb extension in Shepherdstown
Image Source: Google Maps, 2023

# 5. CONCLUSION

The next step for Shepherdstown is to develop grant proposals for submission to the Chesapeake Bay Trust Green Streets, Green Jobs, Green Towns (G3). A partner program funded by the U.S. EPA, West Virginia Department of Environmental Protection, and the Chesapeake Bay Trust, G3 supports the design and implementation of green streets, green infrastructure, and urban tree canopy projects. Application periods are typically open January through March. With the completion of this conceptual plan, Shepherdstown is well positioned to apply to G3 in the future for:

- Track 2: Engineered Designs for Green Streets/Green Infrastructure Projects (generally less than $35,000)
- Track 3: Implementation/Construction of Green Streets/Green Infrastructure Projects (generally less than $175,000)

For more information please visit: cbtrust.org/grants/green-streets-green-jobs-green-towns

An additional funding opportunity is the National Fish and Wildlife Foundation's (NFWF's) Chesapeake Stewardship Fund, which provides support to protect and restore the water quality and habitats of the Chesapeake Bay and its tributary rivers and streams. The Fund prioritizes green stormwater infrastructure and projects that reduce stormwater runoff. Once again, given Shepherdstown's current project status, it is recommended to apply for a Small Watershed Grants supports design and implementation, with funding capped at $500,000.

Shepherdstown is encouraged to schedule a meeting with a NFWF field liaison to determine the next steps. Two liaisons with specialization in Shepherdstown's project are:

- Kristen Saacke Blunk, kristen@headwaters-llc.org, (814) 360-9766
- Dave Hirschman, dave@hirschmanwater.com, (434) 409-0993

For more information please visit: nfwf.org/programs/chesapeake-bay-stewardship-fund

# APPENDIX A: COMPILED PUBLIC FORUM COMMENTS

**1-Bane Park Rain Garden**

- Good Idea
- There would need to be a plan for maintenance and a budget for that.

**2- Baseball Bio-Swale**

- Many unsightly power lines at this site. May disallow trees.
- Good idea. Id' like to see this happen.
- Bump Outs on More streets.
- Address stormwater on Back Alley?
- Address Stormwater on Duke / Back Alley.
- Forgotten area. Would like to see plans for High Street happen.

**3- Pocket Park**

- Good idea. How much stormwater will flow here.
- Nice idea. Next to S.U. daycare
- This may increase strangers so close to building with red roof.
- Who would maintain these pocket parks?

**4 - Market House Park:**

- Is the front adequate from a loading zone? There are multiple (simultaneous) deliveries at times. It is also the only access for some businesses.
- Has a traffic study been conducted? Is there a need for additional bicycles parking?
- Missed opportunity of either side of library!
- Location for Farmer Market?
- Why all the grass? Why not trees for shading picnic tables and perennial gardens?
- Must get input from neighbors – who cannot get out.
- Back Alley is not suitable for High Traffic
- Leave Parallel Parking as is.
- Add "limited access" control at New and King.
- No to the parking in front of Bock's house.
- If the Market House is closed off, the Back alley needs to be closed off in that direction.
- If neighbors agree, explore expanding green way to W. New Street with a single lane road.
- More Public Meetings
- Permeable Articulating Concrete Block
- Traffic Patterns Resident Input, Permeable Paver
- Smaller Structure?
- Keep Parking as is.
- Not accurate depiction. That is a house adjacent to the parking lot.
- No!
- Parking configuration detracts from charm and aesthetic.
- Perhaps there is a way to accommodate parking?

- Like. I believe you can leave parallel parking.
- Good idea to close street and create a gathering space behind
- I Like this Green Space is Needed
- The Market House being closed off could be a great space for town / atmosphere. I would like to see alternate plans. (?)

**5- Shepherd's Graveyard**

- Good idea.
- There will need to be a plan/budget for maintenance.

**6 – Old Queen Alley**

- No comments were received.

**7-Lower Mill Street**

- Please consider allowing private owners to suggest areas to be improved.
- Maybe a V-Shaped Water bar instead of a raised-up speed bump
- Where is Run-off being directed? No one likes these traffic bumps and this street is already narrow. Other Ideas?
- Where is the sidewalk?
- Need to also fix drain at corner of German and Mill St.
- Consider Wheelchair and ADA access along sidewalk.
- Speed bumps make it impossible to use a scooter to go to the park.


W High Street
N Maiden Lane
N
0
10
25
50ft


W High Street
Browns Alley
N Shoe Lane
N
0
10
25
50ft


W High Street
N Church Street
N
0
10
25
50ft


E German Street
W Back Alley
W New Street
S King Street
N
0
10
25
50ft


S King Street


W New Street
W Union Alley
N
0
10
25
50ft


Proposed
Bioretention
Garden
Existing
Vegetation
Water Flowline
Old Queen Alley
N King Street
N
0
10
25
50ft


Preserved
Habitat
N Mill Street
N
0
10
25
50ft


Bones Wright Street
(Gravel Road)
N Mill Street
N
0
10
25
50ft


N Mill Street
N
0
10
25
50ft


SLOW
CHILDREN AT PLAY
N Mill Street