APPENDICIES

Strategic Stormwater Solutions

for Transit-Oriented Development

FINAL REPORT APPENDICIES SAINT PAUL, MN DECEMBER 23, 2013

Strategic Stormwater Solutions

for Transit-Oriented Development

Final Report Appendicies

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APPENDICES

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MEMORANDUM

TO: Central Corridor Stormwater and Green Infrastructure SAC

FROM: Charles LeFevere

DATE: May 3, 2012

RE: **Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure**

I. MEMORANDUM PURPOSE AND INTENT

The purpose of this memorandum is to describe the statutory framework that provides authority for the governmental units primarily involved with stormwater management: to construct, operate and maintain stormwater infrastructure; to impose regulatory requirements that developers and others install and maintain stormwater infrastructure in connection with activities that affect stormwater; to raise revenues by taxation, assessments and charges to fund stormwater infrastructure improvements; and to borrow money for stormwater management projects.

These are the basic tools in the toolbox of these governmental units to cause stormwater management infrastructure to be constructed, operated and maintained. Not all of the various means of providing for such stormwater management are currently being used. But having a understanding of all of these tools should help to identify the most appropriate governmental unit to exercise its authority, the most appropriate balance of public and private involvement and the most appropriate means of paying for projects.

It is not within the scope of this memorandum to identify all regulations that could affect the ability to construct any stormwater management structure. A stormwater management project, particularly if it is combined with other (stacked) elements such as art, plantings, fountains, or parking facilities, may have to comply with relevant zoning codes, plumbing codes, building codes, health codes, limitations on use of public right-of-way, land covenants and restrictions, and the like. It is not reasonably possible to identify and address all of the legal requirements that could apply to a stacked/green

infrastructure project. Those constraints will have to be identified as individual projects are selected and designed.

In general, the local regulatory requirements for stormwater management are found: for the City of Minneapolis, at Minneapolis Code, Title 3, Chapter 54; for the City of St. Paul, at St. Paul Code, Part II, Title VI, Chapter 52; for Capital Region Watershed, at Capital Region Watershed District Rule, Adopted 9/06/06 – Effective 10/01/06 – Revised 11/03/10; and for the Mississippi WMO, at the MWMO Watershed Management Plan 2011-2021, Appendix. F.

II. GOVERNMENTAL FRAMEWORK

A. Local Governmental Units Authority to Construct, Operate and Maintain

1. Watershed District.

a. Watershed districts in the metropolitan area have the authority of a watershed management organization (WMO) to construct and maintain drainage systems under Minn. Stat., Secs. 103B.211, subd. 1 and 103D.335, subd. 23. Additionally, watershed districts have the authority to construct, operate, maintain and repair ditches, drains, watercourses, dams, and reservoirs. Minn. Stat., Sec. 103D.335. The procedures to be followed to exercise these powers depend on the nature of the project and the source of funding. See, e.g., Minn. Stat., Secs. 103D.601-.625, 103D.701-725.

2. Joint Powers Watershed Management Organizations.

a. Joint Powers WMOs are authorized to construct and maintain drainage systems under Minn. Stat., Sec. 103B.211, subd. 1(4). This power is included in the Joint and Cooperative Agreement for the Mississippi WMO.

3. Cities.

a. Cities are authorized to construct, operate and maintain storm sewer systems under Minn. Stat., Sec. 444.075. See also St. Paul Charter Secs. 1.03, 13.01, 13.02, 15.01.

4. Interagency authority. Because different agencies have different authority and areas of interest, some projects – particularly those meeting different public purpose objectives – may require joint or cooperative efforts. There is broad authority for cities and WMOs to exercise their powers jointly or cooperatively.

a. Minn. Stat., Sec. 471.59 provides general authority for governmental units to act jointly or cooperatively in the exercise of their powers.

b. Joint power WMOs are authorized to enter into contracts with persons or governmental agencies. Minn. Stat., Sec. 103B.211, subd. 1(8).

c. The Joint and Cooperative Agreement of the Mississippi WMO authorizes the organization to contract with any government unit, private or nonprofit association to accomplish the purposes for which the WMO is organized.

d. Watershed districts are authorized by Minn. Stat., Sec. 103D.355, subds. 2 and 21 to cooperate and contract with other agencies and to be included in joint powers organizations under Minn. Stat., Sec. 471.59.

5. Eminent Domain.

a. The authority to acquire property for storm sewer systems by eminent domain is available to watershed districts under Minn. Stat., Sec. 103D.335, subd. 11, and to cities under Minn. Stat., Sec. 444.075. The Mississippi WMO does not have independent authority to exercise this power but could indirectly acquire property for a project by eminent domain through a member city. See also St. Paul Charter, Sec. 13.01; Minneapolis Charter Chapter 4, Section 15 and Chapter 8, Section 10.

B. Local Governmental Units Authority to Regulate

1. Watershed District.

a. Watershed districts are authorized under Minn. Stat., Secs. 103D.341, 103D.545 and 103D.551 to adopt and enforce rules (subject to the limitations of Minn. Stat., Sec. 103B.211, subd. 1, as provided in Minn. Stat., Sec. 103D.335, subd. 23(b)). In addition, watershed districts in the metropolitan area can impose regulations as a WMO (See II.B.2., below).

2. Joint Powers Watershed Management Organization

a. Joint power WMOs can have the authority of a watershed district to regulate the use and development of land under limited circumstances, under Minn. Stat., Sec. 103B.211, subd. 1(3).

b. Generally WMOs impose regulatory requirements indirectly, through member cities. The WMO's watershed management plan is required to include an implementation program, which includes a CIP and standards and schedules for amending the comprehensive plan and official controls of local government units to bring about conformance

to the WMO's watershed plan. Minn. Stat., Sec. 103B.231, subd. 6(8). Cities, in turn, are required to adopt local watershed management plans that conform to the WMO's plan. The law requires cities to include in their local plans an implementation program, including a description of official controls (such as zoning, subdivision and building regulations). Minn. Stat., Sec. 103B.235, subd. 2. Cities are then required, after approval by the WMO of their local plans, to adopt and implement the local plan within 120 days and to amend their official controls accordingly within 180 days. Minn. Stat., Sec. 103B.235, subd. 4.

3. Cities.

a. Cities generally exercise regulatory control over activities involving stormwater management through their general police powers or their authority to adopt official controls under Minn. Stat., Ch. 462 (land use, zoning, subdivision and building regulations).

III. FUNDING AND FINANCING OF PUBLIC EXPENSES

A. Revenue Raising Measures

1. Stormwater Utilities

a. Cities are authorized to operate storm sewer utilities under Minn. Stat., Ch. 444. Cities have latitude in allocating costs to users as long as charges are "just and equitable." Charges can be imposed for use, availability and connection. The statute authorizes charges to be based on area and runoff, types of premises, the nature of the runoff or any other equitable method. See also St. Paul Charter, Sec. 15.02. The Minneapolis Stormwater Utility is provided for in City Code Title 19, Chapter 510. The St. Paul Storm System charge is provided for in St. Paul Code Part II, Title X, Chapter 81.

b. Joint powers WMOs can be granted the power to operate a utility if so delegated by member cities through the joint powers agreement. This has been done in the Vadnais Lakes Area WMO, but the Mississippi WMO does not have this authority in its Joint and Cooperative Agreement.

c. Under Minn. Stat., Sec. 444.075, subd. 2a, watershed districts can collect charges established under Minn. Stat., Sec. 103D.729 for projects under Minn. Stat., Sec. 103D.730.

d. Stormwater utilities features and advantages.

i. Flexibility in allocation of charges
ii. No need to prove special benefit

iii. Possible to build incentives into fee structure

2. Jurisdiction-Wide Ad Valorem Taxes

a. Cities

i. Cities can pay for public projects with general ad valorem tax funds.

b. Watershed District

i. Watershed districts can levy a tax throughout the watershed, or in a sub-watershed unit, to pay the costs of maintenance of capital projects funded in part by county payments under Minn. Stat., Sec. 102B.251. Minn. Stat., Sec. 103B.251, subd. 9.

ii. Watershed districts are authorized to levy a tax for their general fund, which can also be used for construction or implementation and maintenance of projects. Minn. Stat., Sec. 103D. 905, subd 3.

iii. Watershed districts in the metropolitan area are authorized to levy a tax under Minn. Stat., Sec. 103B.241 to implement projects in their plans.

c. Joint Powers WMO

i. By special law, codified at Minn. Stat., Sec. 275.066, the Mississippi WMO was made a special taxing district, thereby allowing it to receive taxes levied under the authority of Minn. Stat., Ch. 103B, including levies against property in the watershed for projects in the WMO's plan under Minn. Stat., Sec. 103B.241, subd. 1.

3. Special District Ad Valorem Taxes or Charges

a. Special Assessments

i. First class cities are authorized to construct and maintain storm sewer systems funded by special assessments against benefited properties under charter and Minn. Stat., Secs. 435.17 - .195 Minneapolis Charter, Chapter 8, Section 10.

ii. Watershed districts are authorized to levy special assessments for projects under Minn. Stat., Sec. 103D.901. See also Minn. Stat., Secs. 103D.701-.725

b. Special Service Districts

i. Cities are authorized to establish special service districts to provide services not ordinarily provided by general fund revenues, under Minn. Stat., Secs. 428A.01-428A.101. Charges may only be imposed on commercial, industrial or vacant land and may be based on service directly provided, a reasonable classification of the types of premises or any other equitable basis. Because of petition and veto requirements, this authority requires substantial support from the businesses affected.

ii. Cities are authorized to establish Housing Improvement Areas under Minn. Stat., Secs. 428A.11-428A.21 for improvement to housing areas, including common areas of condominiums. As in the case of special service districts described above, there is flexibility in the allocation of charges among property owners, but substantial support from affected residents is required.

c. Ad valorem taxing district.

i. Cities are authorized to establish storm sewer improvement districts within the city and levy ad valorem taxes for storm water management projects within the district under Minn. Stat., Secs. 444.16-444.20.

ii. Ad valorem taxes (or changes based on tax capacity and collected with taxes) can be collected for projects in special service districts and Housing Improvement Areas under Minn. Stat., Ch. 428A (see III.A.3.b, above).

iii. Cities are authorized to levy a tax within the watershed for costs of watershed management plan preparation and for projects in an approved plan. Minn. Stat., Sec. 103B.241.

iv. The Mississippi WMO is authorized to levy a tax within the watershed for costs of watershed management plan preparation and for projects in an approved plan. Minn. Stat., Secs. 103B. 241, 275.066.

v. Cities are authorized to establish a watershed management tax district to pay the costs of planning and may establish such a district, which may be a sub-watershed unit, to levy taxes for the cost of construction and maintenance of water management facilities in the city's local plan CIP. Minn. Stat., Sec. 103B.245.

vi. Counties are authorized to levy taxes within a watershed to pay the costs of WMO capital projects paid by the County under Minn. Stat., Sec. 103B.251.

vii. Watershed districts are authorized to establish a water management district or districts for the purpose of collecting revenues and paying the costs of projects initiated under Minn. Stat., Secs. 103B.231, 103D.601, 103D.605, 103D.611 or 103D.730. Minn. Stat., Sec. 103D.729.

4. County Funding for WMO capital projects. WMOs are authorized to certify to the county, for county payment, the costs of capital projects in the CIP of an approved watershed managed plan, under Minn. Stat., Sec. 103B.251.

5. Incentives and Assistance through Economic Development and Redevelopment Projects.

a. Cities and their economic development and redevelopment partners (port authorities, economic development authorities, housing and redeveloped authorities) have development tools that could be used, in part, to pay costs of stormwater infrastructure. These include tax increment, land cost write-downs, and construction of public improvements, among others, for qualifying projects. When such funding is available in connection with a qualifying project in which there are opportunities for stormwater management infrastructure, funds could be used directly for a public improvement or indirectly, requiring the developer to include such infrastructure as a condition of development assistance. Minn. Stat., Ch. 469.

B. Borrowing

1. Watershed District

a. Watershed districts are authorized to borrow funds under Minn. Stat., Sec. 103D.335, subd. 17 (up to $2,000,000) and to issue certificates, warrants and bonds under Minn. Stat., Sec. 103D.335, Subd.1(4).

2. Joint Powers Watershed Management Organization

a. The Mississippi WMO does not have independent authority to borrow money.

3. Cities

a. Cities are authorized to issue bonds under Minn. Stat., Sec. 429.091 for projects funded by special assessments.

b. Cities are authorized to issue bonds under Minn. Stat., Sec. 444.19 for projects funded with a storm sewer improvement district tax.

c. Cities are authorized to issue bonds under Minn. Stat., Secs. 428A.06 and 428A.16 for projects in special service districts, and housing improvement areas, respectively.

d. Cities are authorized to issue bonds under Minn. Stat., Sec. 444.075, subd. 2 for utility projects funded with utility charges.

e. Cities are authorized to issue bonds for projects funded with a tax in a watershed management tax district under Minn. Stat., Sec. 103B.245.

4. Counties

a. Counties are authorized to issue bonds to pay for WMO capital projects funded by the county under Minn. Stat., Sec. 103B.251

IV. CONCLUSIONS

Cities, watershed districts and joint powers WMOs have the authority to require stormwater management measures to be taken as a condition of subdivision or building activities. These governmental entities also have broad authority to acquire land and to construct, operate and maintain stormwater management infrastructure, either individually or in cooperation with other governmental units. These governmental units also have a broad array of options for funding such public improvements by raising funds from appropriate parties. These options range from utility charges and assessments against targeted or benefited properties to ad valorem tax levies over the entire taxing jurisdiction or an appropriate subdistrict.

SRF Consulting Group, Inc. | Engineers Planners Designers

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MEMORANDUM

TO: Wes Saunders-Pearce
Water Resource Coordinator

FROM: David Filipiak, PE, CFM

DATE: February 27, 2013

SUBJECT: Central Corridor Shared, Stacked Green Infrastructure (CCSSGI Regulatory Memorandum)

Stormwater in the Central Corridor is governed under a number of different regulatory authorities; all within the legal framework identified in the memorandum entitled 'Governmental Authority Relating to Stormwater Infrastructure' (Kennedy and Graven, May 3, 2012). Managing stormwater, and the water resources it flows to, is ever changing, with new technologies and an increasing awareness of the impact on receiving waters due to non-point sources of pollution.

This memorandum is not intended to provide a historical reference nor look into the future of stormwater requirements. Instead, it is intended to provide a snapshot of the rules and regulations that have been applied in the analysis and design of shared, stacked function stormwater concepts developed for the Central Corridor Stormwater and Green Infrastructure study.

Regulations

Projects within the corridor generally need to meet the regulations of the following agencies:

- Cities of Saint Paul and Minneapolis
- Capitol Region Watershed District (CRWD)
- MPCA via the NPDES General Construction Permit

In addition, the Mississippi Watershed Management Organization (MWMO) has a set of guidelines that need to be adhered to if the project is to be submitted for grants from the MWMO.

These rules and guidelines are found in the Table 1. In general, the CCSSGI concepts and advanced designs have, and will continue to, adhere to the following requirements, which are generally the most restrictive of those that apply in each category:

1. Rate Control
    a. Saint Paul – 1.64 cfs/acre for any redevelopment larger than 0.25 acres.

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    b. Minneapolis – No increase over existing (pre-development) conditions for the 2-year, 10-year and 100-year SCS Type II 24-hour rain event. Additional rate control may be required by the SWS reviewer if needed, based on system knowledge of pipe capacity and/or localized flooding issues.

2. Volume Control
    a. Saint Paul (CRWD Criteria)
        i. Sites less than 1 acre – none required.
        ii. Sites greater than 1 acre – infiltrate runoff from a 1-inch rainfall (0.9 inches) from impervious surfaces, with a 30 percent increase in volume for filtration-type devices.
    b. Minneapolis (MPCA criteria)
        i. Sites less than 1 acre – none required.
        ii. Sites greater than 1 acre – infiltrate ½ inch from new impervious surfaces where soil conditions are conducive to infiltration.

3. Water Quality
    a. Saint Paul – Cumulative increase of impervious surface of 1 acre or more – Water quality volume of ½ inch from new impervious surfaces (treatment via wet sedimentation basin, infiltration/filtration, regional ponds, a combination of practices, or alternative methods) and/or (CRWD criteria) – 90 % TSS removal for the runoff generated by a 2.5-inch rainfall.
    b. Minneapolis – For projects that discharge to Mississippi River, which includes CCSSGI projects: 70% Total Suspended Solids (TSS) removal for the proposed project for runoff generated by a 1.25-inch rainfall and/or (MWMO criteria) – 90% TSS from the 95th percentile daily rainfall total (currently 1.17 inches in 24 hours) over the entire area of the site (not just areas of the site being developed or disturbed).

Anticipated Future Changes

There are a number of initiatives currently being studied and discussed that could change the regulations as they apply to the corridor, including:

- The Minimal Impact Design Standards (MIDS) discussions, which intend to introduce agreed upon computations/etc. for stormwater best management practices.

- Regular updates to the MS4 programs administered by the MPCA.
- Potential responses by cities to waste load allocations under future TMDL's (total maximum daily load) on downstream water bodies. In the corridor, the Mississippi River is the receiving body.

DWF/bls

Attachment

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TABLE 1 - REGULATORY CRITERIA FOR STORMWATER – SUMMARY

ENTITY	SURFACE WATER QUANTITY-RATE CONTROL	SURFACE WATER QUANTITY-VOLUME CONTROL	SURFACE WATER QUALITY	FLOODPLAIN	PERMIT REQUIREMENTS	OTHER REQUIREMENTS
City of Saint Paul (Chapters 52, 63, and 69)	▪ Peak stormwater discharge rates from the site for all storms up to and including the critical 100-year frequency will not exceed: $Q = 1.64 \times A$ where Q = the maximum acceptable discharge rate in cubic feet per second and A = the site area in acres. Discharge of all stormwater runoff and surface water shall be in a fashion so as to preclude drainage onto adjacent property or toward buildings.		▪ Permanent stormwater pollution controls: Where a project's ultimate development replaces vegetation and/or other pervious surfaces with one (1) or more acres of cumulative impervious surface, a water quality volume of one-half (½) inch of runoff from the new impervious surfaces created by the project must be treated.	▪ Flood control for buildings: The low floor elevation for new construction must be a minimum of one (1) foot above the critical one hundred-year flood elevation and at least four (4) feet above normal groundwater elevation.	▪ Stormwater Runoff Rate Control: Stormwater runoff rate control is required for sites larger than one-quarter (¼) of an acre which go through the city's site plan review process. Construction activity of one (1) acre or more within the city shall submit a stormwater pollution control plan to the city for approval.	Sustainable stormwater 'overlay' policy for public projects and private projects receiving $200k in public funding Parking lot stormwater landscape requirements (Section 63.319 (b))
City of Minneapolis (Chapters 54 and 551)	▪ Projects must not increase rate from existing conditions (pre-development) for the 2-year, 10-year, and 100-year, SCS Type II 24 hour storm. Additional rate control may be required by the SWS reviewer if needed, based on system knowledge of pipe capacity and/or localized flooding issues.		▪ For projects on sites 1 acre or more that discharge to Mississippi River, which includes CCSSGI projects: 70% Total Suspended Solids (TSS) removal for the proposed project for runoff generated by a 1.25-inch rainfall	▪ The low floor elevation for new construction must be a minimum of one (1) foot above the critical one hundred-year flood elevation	▪ For projects on sites 1 acre or more: Stormwater Management Plan must be approved, and typically includes the following elements: o Narrative o Plans and specifications o Site area calculations o Hydrologic and hydraulic modeling results o Water quality modeling results o Operation and maintenance plan o Soil reports o Additional as needed	▪
Capitol Region Watershed District	▪ Rate control - Runoff rates shall not exceed existing runoff rates for the 2-year, 10-year, and 100-year critical storm events. ▪ Peak flow rate and the total volume of flow must not cause new water conveyance problems or exacerbate existing water conveyance problems. Enlargement of existing connections is considered a new connection.	▪ Volume reduction - Stormwater runoff volume reduction shall be achieved onsite in the amount of one inch of runoff from impervious surfaces. ▪ The required Stormwater runoff volume reduction shall be calculated as follows: Required Volume (ft3) = Impervious surfaces (ft2) x 1.0 (in) x 0.9 coefficient x 1/12 (ft/in. ▪ If infiltration is not possible, the volume to be filtrated shall be increased by 30%.	▪ Water quality - Stormwater BMPs shall remove 90% of total suspended solids from the runoff generated by a 2.5-inch rainfall event (NURP water quality storm).	▪ No placement of fill within the 100-year floodplain is allowed unless compensatory storage is provided. Compensatory storage must be provided on the development or immediately adjacent to the development within the affected floodplain. Compensatory storage must be completed prior to or concurrently with permitted floodplain filling.	▪ Permit required for projects disturbing greater than one acre of land, or 10,000 sq. ft. of land adjacent to a waterbody and repairs, replaces, or creates impervious surface ▪ Permit required for new direct connections or replacement of existing connections to the Trout Brook Storm Sewer Interceptor or other components of CRWD's municipal storm sewer system. CRWD must approve the methods for making a new direct connection or replacing an existing connection.	▪ Maintenance plans ▪ Pretreatment of infiltration facilities ▪ Design and placement of infiltration BMPs shall be done in accordance with the Minnesota Department of Health guidance called "Evaluating Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas." (Final version to govern) ▪ Excess volume reduction may be banked for use on another project. Excess banked volume reduction amounts shall not exceed the volume of two inches over the total drainage area to the BMP

TABLE 1 - REGULATORY CRITERIA FOR STORMWATER – SUMMARY

ENTITY	SURFACE WATER QUANTITY-RATE CONTROL	SURFACE WATER QUANTITY-VOLUME CONTROL	SURFACE WATER QUALITY	FLOODPLAIN	PERMIT REQUIREMENTS	OTHER REQUIREMENTS
Mississippi Watershed Management Organization	1. Runoff rates for the proposed activity shall not exceed pre-development runoff rates for the Type II distribution 2-, 10-, and 100-year critical storm events (as defined by TP-40 and/or subsequent revisions – see Table 3). 2. Runoff rates may be restricted to less than the pre-development rates when the capacity of the downstream conveyance system is limited.	▪ Recommended procedures for volume control projects are found in Appendix F of the Watershed Management Plan.	▪ Projects shall achieve a removal of 90% TSS (Total Suspended Solids) from the 95th percentile daily rainfall total (currently 1.17 inches in 24hrs) over the entire area of the site (not just areas of the site being developed or disturbed). ▪ Alternative compliance is available on in Appendix F of the MWMO Watershed Management Plan.	▪ All habitable buildings, roads, and parking structures on or adjacent to a project site shall comply with the flood control and freeboard requirements depending on 1 of 4 conditions as described in Appendix F.		▪ Activity shall be phased to minimize disturbed areas subject to erosion at any one time. ▪ Drainage Alterations allowed only under review and City permit
Mississippi Watershed Management Organization Incentivized Standards		▪ The MWMO encourages developers to use volume infiltration practices where site conditions are favorable. The MWMO prefers that sites with soils classified as Hydrologic Soil Group A or B meet the MWMO's water quality standard or goal through infiltration for at least that part of the site where Hydrologic Soil Group A or B soil is present.	▪ Stormwater best management practices should mimic, as close as feasibly possible, the site's historic water quality condition for the 95th percentile daily rainfall total (1.17 inches in 24hrs). Best management practices shall be selected on the basis of site-specific conditions, including soil types, depth to water table, and the presence of known or suspected contaminated soils. ▪ The MWMO encourages developers to use volume infiltration practices where site conditions are favorable. The MWMO prefers that sites with soils classified as Hydrologic Soil Group A or B meet the MWMO's water quality standard or goal through infiltration for at least that part of the site where Hydrologic Soil Group A or B soil is present.		▪ All Member Grant, Greening and capital projects funded by the MWMO will need to meet the Standards defined in section 3.1.3 The MWMO's Standards Language. In addition, funding requests for capital projects that work towards achieving the following rate, water quality and volume goals for onsite stormwater treatment will benefit in the MWMO's project selection process.	
Minnesota Pollution Control Agency via the NPDES Construction Stormwater Permit Program			For projects adding one or more acres of connected impervious surface: ▪ Treat ½ inch of runoff from the new impervious surfaces by one of the following: 1. Wet Sedimentation Basin, 2.a) Infiltration (required if within 1 mile of the Mississippi River in 2.b) /Filtration designed for 80% TSS removal, 3. Regional ponds designed for no more than 5.66 cfs per acre discharge, 4. A combination of the above practices, or 5. An alternative, pre-approved method designed to achieve 80% TSS on an average annual basis. ▪ Linear projects may use grasses swales, smaller ponds or grit chambers, if amount of available right of way is lacking.		▪ The development and implementation of a SWPPP is required when an NPDES Permit is needed (see below). ▪ The NPDES Permit is required for stormwater discharges associated with construction activity (5 acres or more) and with small construction activity (1 acre or more that is part of a common plan or development) as defined in 40 C.F. R. part 122.26(b)(14)(x) and (b)(15).	▪ Include access for maintenance of outlet structure and of the facility in general.

CENTRAL CORRIDOR STORMWATER
& GREEN INFRASTRUCTURE PLAN

PUBLIC ART INTEGRATION RECOMMENDATIONS

Prepared by Craig David
July 8, 2013

"FLUXion ≈≈ gARTens"

The Network of Stormwater 'gARTens'
along the Central Corridor

'Public Art' **AS** 'Green Placemaking'
'Green Placemaking **AS** Public Art'

Stacy Levy, 'Straw Garden', Architecture Daily Facebook Page, KNOT RAIN-GARDEN

What is 'FLUXion' ?

- **'FLUXion': (flük shən)** ***n.*** 1. A flowing. 2. Continual change. 3. That which flows.

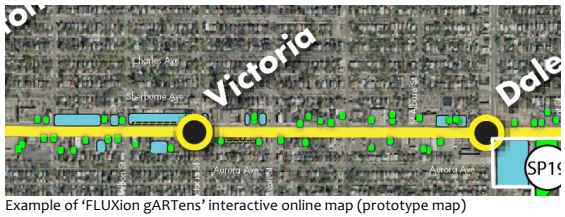
What is a 'gARTen' ?

- **'gARTen': (gärt' n)** ***n.*** **1.** A green space/place created **as Public Art**.
  2. A green space/place that celebrates 'water', especially stormwater.
  3. A green space/place whose primary functions are to manage stormwater and be utilized (or viewed) by the public.

'Meet, Sit, Talk' Lorna Green, University of Leeds, UK PARK 'gARTen'

What is the 'FLUXion ≈ gARTens' Network?

- 'FLUXion ≈ gARTens' is a network of many green art spaces/places that are open to the public, and developed along the Central Corridor.
- Individual gARTens (green spaces/places designed in collaboration with artists as public art) function primarily as stormwater management systems while creating artistic public green spaces/places.
- Individual gARTens are authentic green places, gardens, pocket parks and art works.
- Individual gARTens are green spaces/places created as environmental, economic, social, and aesthetic sites



Example of 'FLUXion gARTens' interactive online map (prototype map)

- 'FLUXion ≈ gARTens' is branded and utilized with an interactive website that maps, illustrates, documents and describes all the connected 'gARTens'. (one can travel gARTen to gARTen with the help of a smart phone, ipad or lap top).
- 'FLUXion ≈ gARTens' are satellite arboretums and botanical gardens that are mapped, illustrated and utilized through the interactive website, and (hopefully) integrated into the University of Minnesota Arboretum System.

Glendale Townhome Community Gardens
Photo: makingbettermn.org
COMMUNITY GARDEN

Alphabet City Community Garden, Photo: pps.org
COMMUNITY GARDEN

What are the Stacked Benefits of 'FLUXion ≈ gARTens' ?

- on-site stormwater management, watershed conservation
- environment: stormwater pollution abatement, wildlife habitat, energy conservation (shade), carbon sequestration
- health: green corridors - walking, biking and use of transit
- health: food systems, urban farms, community gardens, sustainability
- celebration of stormwater, watersheds, food systems and the environment
- education about stormwater, watersheds, food systems and the environment
- education about environmental public art integration, public art as green space
- green space utilization: social and economic development and sustainability
- commercial and residential development and sustainability
- cultural integration and understanding
- aesthetic value: commercial / residential appeal
- participatory development of green infrastructure and public art by community
- celebration of trees, plants and green space

'Landmark Tree', Bur Oak Photo: P. Hamilton
Eleanor Graham Community Garden
City of St. Paul 'Landmark Tree Program',
LANDMARK TREE PROGRAM – SACRED TREE
(Curfew Commons)

Topiary Park, Columbus, OH TOPIARY GARDEN
Photo: Topiary Park

What benchmarks designate a green space as a gARTen ?

- an artist is a part of the design – implementation team
- stormwater management, plant materials, and environmental elements are fundamental
- public art is a primary component
- the public and community are able to access, utilize or observe the space
- a maintenance plan is developed and employed

'Sustainable Roundabout', Hoerr Schaudt LA
Normal, IL. Photo: dirt.asla.org
SUSTAINABLE ROUNDABOUT gARTen

'Living Water Garden', Betsy Damon
Chengdu, China Photo: greenmuseum.org
PLAYGROUND gARTen, (Curfew Commons Site)

What are the precedents and possibilities for 'gARTens' ?

- public green space gARTen , park gARTen
- community gARTen, urban farm gARTten, green outdoor market
- vernacular gARTen, (owner maintained, eclectic, authentic: function varies)
- mini arboretum, botanical gARTen, ornamental gARTen
- stormwater fountain, water feature gARTen
- traffic round-about, boulevard gARTen,
- walk/bike path gARTen, alley gARTen
- green wall gARTen, public rooftop gARTen
- educational gARTen, playground gARTen,
- restaurant cooks gARTen, restaurant herb gARTen
- sculpture gARTen, topiary gARTen
- environmental gARTen , tree gARTen

'Urban Rain', Jackie Brookner, Roosevelt Community Center, San Jose, CA
Photo: Gates + Associates LA FUNCTIONAL STORMWATER PUBLIC ART

What are the Public Art possibilities for 'gARTens' ?

The line between art, architecture and landscape design has been blurred in recent years. These possibilities will be collaborative efforts between artists, designers, engineers and architects.

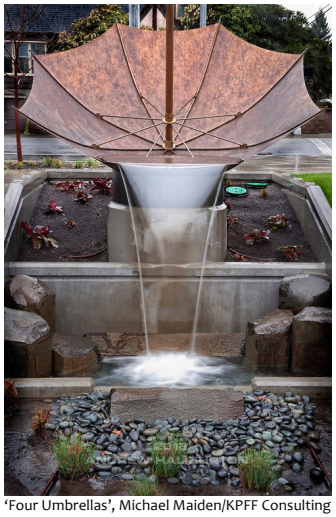
- stormwater sculpture, stormwater feature
- stormwater fountain, stormwater playground
- green wall, green mural wall
- mixed use green space
- performance based public art, temporary art installation
- artist designed fencing, stormwater grate, catch basin stencil
- artist designed green space, topiary garden, ornamental garden
- artist designed botanical / arboretum garden
- artist designed rain garden
- artist designed functional gARTen buildings

Public Art Possibilities – Precedents:

'Living Pavilion', Ann Ha and Behrang Behin, Architectural Daily
SCULPTURAL GREEN BUILDING UTILIZES RAIN WATER

'Living Pavilion', Ann Ha and Behrang Behin, Architectural Daily
SCULPTURAL GREEN BUILDING UTILIZES RAIN WATER

Public Art Possibilities – Precedents:



'Four Umbrellas', Michael Maiden/KPFF Consulting
Stormwater Sculpture and 'gARTen'
Portland Environmental Services, Portland, OR
RAINWATER FEATURE SCULPTURE

'Whole Flow', Buster Simpson, Whole Foods
Stormwater sculpture and 'gARTen'
Whole Foods, Pasadena, CA. Photo: Buster Simpson
RAINWATER FEATURE SCULPTURE

Buster Simpsom/Peg Butler. Stormwater Bike Rack
Portland Environmental Services, Portland, OR
Photo: Daily Journal of Commerce, RAIN SCULPTURE

Buster Simpsom/Peg Butler. Stormwater Bike Rack
Portland Environmental Services, Portland, OR
Pic: Daily Journal of Commerce, RAIN SCULPTURE

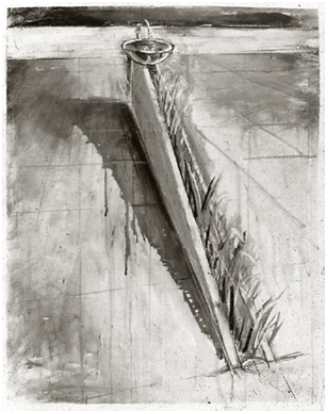
Public Art Possibilities – Precedents:

'Bay Meadows Fountain and Stones', Gates + Associates LA
San Mateo, CA Photo: Gates + Associates LA FUNCTIONAL FOUNTAIN

Green Wall Mural, Saks Fifth Avenue, Palm Beach, FL.
Photo: inhabit.com GREEN WALL MURAL

Public Art Possibilities – Precedents:

Jane Ingram Allen, "Blue River", Mixed Use Green Space
Photo: greenmuseum.org PERFORMANCE ART SPACE



'Drinking Fountain for People and Plants'
Mark Van Kempen Environmental Art (unrealized)
FUNCTIIONAL WATER SCULPTURE

'Underground Stormwater Sculpture'
Mark Van Kempen Environmental Art
WATER FEATURE (Curfew Commons Site)

Public Art Possibilities – Precedents:

Cal Anderson Park Fountain, Seattle, WA Photo: seattle.gov
PUBLIC FOUNTAIN

Dreiseitl Rainwater Sculpture, Herbert Dreiseitl
Ann Arbor, MI Pic: Huron River Watershed Council
RAINGARDEN FEATURE (BMP?)

Public Art Possibilities – Precedents:

Painted Stencil, Catch Basin Photo: City of Minneapolis
EDUCATIONAL COMPONENT TO gARTen

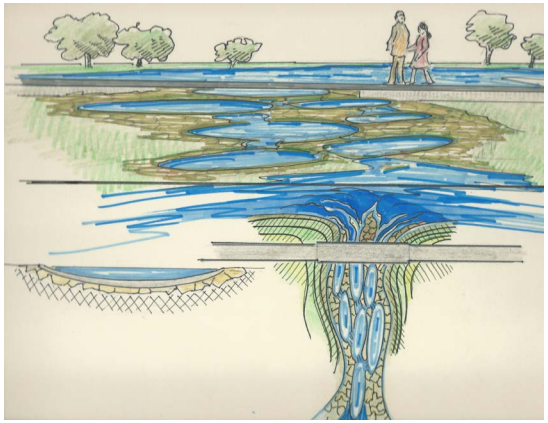
Town Hall Square, Hattersheim, Herbert Drieseitl , WATER FEATURES (Curfew Commons Site)

Public Art Possibilities – Precedents:

'Tanner Springs Park', Herbert Drieseitl, Portland, OR ARTIST DESIGNED SPACE

Urban Hydrology, Herbert Dreiseitl, WATER FEATURE
(Curfew Commons Site)

'Waterworks Garden', Lorna Jordan (Curfew Commons)



'Reflecting Discs Spillway', Curfew Commons, Craig David

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Public Art Possibilities – Precedents:

'Prisma', Nurenberg, Germany, Herbert Drieseitl, WATER FEATURE

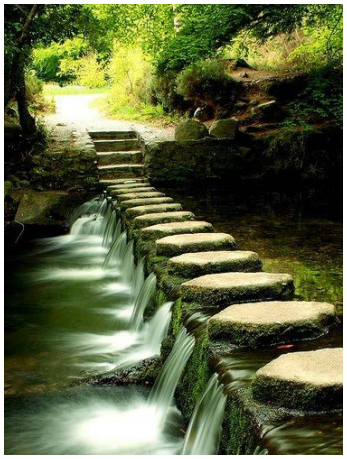

Photo: Homesthetics.net (Curfew Commons Site)

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Public Art Possibilities – Precedents:

Green Infrastructure Plantings: Oak Savanna and Limestone Seat Walls (Bluffs)
Craig David, (Curfew Commons)

Horton Park Arboretum, Photo: Wikipedia
MINI ARBORETUM

Public Art Possibilities – Precedents:

Brooklyn Botanical Garden,
BOTANICAL GARDEN, MINI ARBORETUM

Hua Mei Bird Garden, photo: Project for Public Spaces
VERNACULAR GARDEN, MIXED USE SPACE

Public Art Possibilities – Precedents:

'Temescal Creek Channel', Bay St. Memorial, Gates + Associates LA
Emeryville, CA. Photo: Gates + Associaltes LA
FUNCTIONAL STORMWATER PUBLIC ART

'Beckoning Cistern', Buster Simpson, Seattle, WA. Photo: Buster Simpson
FUNCTIONAL STORMWATER PUBLIC ART

Public Art Possibilities – Precedents:

'Water Feature', Vera Katz Park, Portland, OR
Photo: Bryn Davidson
FUNCTIONAL STORMWATER PUBLIC ART

Rain Garden, Vera Katz Park, Portland, OR
Photo: Bryn Davidson
ARTIST DESIGNED RAIN GARDEN

"Urban Waterfall" by Linda Wysong, Portland Community College,
Water Education Plaza, Portland, OR. Photo: Linda Wysong
(Boeser Site)

Public Art Possibilities – Precedents:

"Floating Bouys' on Underground Cistern,
by Lango Hansen L.A. , Portland Community College
Photo: Lango Hansen, L.A. (Boeser Site)

"Floating Bouys' on Underground Cistern, by Lango Hansen L.A. ,
Portland Community College, Photo: Lango Hansen, L.A. (Boeser Site)

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Public Art Possibilities – Precedents:

Bryant Park Entry, pps.org
ARTIST DESIGNED KIOSKS, STREET PTG

Bryant Park, NYC, Chess / Backgammon pps.org
ARTIST DESIGNED TABLES, BENCHES

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Public Art Possibilities – Precedents:

'Dragonfly Building', Inhabit.com
CONCEPTUAL FARM TOWER

Nanyang Tech University School of Art, Photo: Environment
GREEN ROOF, ARTIST DESIGNED PAVING

Botanical Apartment, Phuket, Thailand
Photo: Cherise Randle, greenlifestyles.org
GREEN URBAN APT BUILDING - gARTens
ARTIST COLLABORATION

Organic Building, Osaka Japan, G. Pesce, Architect
Photo: Bridgette Meinhold, Inhabit
STORMWATER COLLECTOR gARTens
ARTIST COLLABORATION

Links for 'gARTens' and green public art ideas:

- The Green Museum – www.greenmuseum.org
- The Project for Public Spaces – www.pps.org
- Inhabit – www.inhabit.com
- Green Lifestyles – www.greenlifestyles.org
- Environment - http://www.environment.gen.tr
- Architecture Daily / Facebook – Facebook- Architecture Daily
- The Dirt – www.dirt.asla.org
- Reimagining Stormwater, C. Baeumler – goggle search
- Architizer – www.architizer.com
- Jackie Brookner, environmental artist – www.jackiebrookner.net
- Herbert Dreiseitl, environmental artist – www.dreiseitl.com
- Buster Simpson, environmental artist – www.bustersimpson.net
- Mark Van Kempen environmental artist – www.mbvstudio.com

Federal Courthouse Plaza, Martha Schwarts – Tom Otterness
PUBLIC ART AS GREEN SPACE

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SRF Consulting Group, Inc. | Engineers Planners Designers

SRF No. 7687-0280

MEMORANDUM

TO: Wes Saunders-Pearce, Water Resource Coordinator
City of Saint Paul, MN

FROM: Nichole Schlepp, ASLA
Joni Giese, ASLA, AICP

DATE: December 23, 2013

SUBJECT: Analysis and Evaluation For Shared, Stacked-Function, Green Infrastructure

Purpose

This memorandum summarizes the input gathered from stakeholders, and precedent investigations that set the foundation for technical evaluation of shared, stacked-function green infrastructure (SSGI). This memorandum also documents the process used to solicit and screen potential redevelopment sites along the corridor that resulted in a list of high priority sites. Finally, this memorandum summarizes the investigation of four potential SSGI approaches on two of the high priority sites, including conceptual designs developed and cost-benefit analyses performed.

Referenced Memorandums

- White Paper: Shared, Stacked-function, Green Infrastructure Policy Investigation

SSGI Opportunities and Barriers

Developers Focus Group

Over the course of the project, the project team met with select developers with project experience in the Cities of Saint Paul and/or Minneapolis. The group discussed existing approaches and methods to stormwater management and identified opportunities and implementation barriers of SSGI.

Existing stormwater management considerations include:

- Location is the primary determinant in deciding whether to redevelop a site. Developers will make stormwater management work for site selected.
- Stormwater approach used is based on estimated construction and long-term maintenance costs. Underground treatment is expensive to construct.

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- Some developers believe that cities typically require developers to over-engineer their systems as a safeguard since existing utility mapping may not be accurate.
- Incentives do motivate developers in deciding to what extent they will implement stormwater treatment elements, but may not necessarily be a driver of the approach taken. Potential/existing incentives mentioned include:
  - Minneapolis stormwater quantity and quality credits
  - Expedited permitting process
  - Density bonuses
- Developers typically are not pioneers regarding new technologies, unless it is on a very small scale. They want to see in-place examples first. It was expressed that cities and large corporations provide a benefit when they implement new technologies from which others can learn.
- Most treatment is being placed underground.
- Most developers see stormwater management features as an initial installation cost, not as an on-going utility.
- LEED certification – Developers are doing buildings that meet LEED certification levels, but are not going through the certification process due to costs. When LEED certification is done, main reason is to use it as a marketing tool.
- Development processes work better when they are streamlined.

Opportunities for SSGI from a developer's perspective included the following:

<u>Sharing</u>

- Private-private sharing not desirable (last resort)
  - Financiers (private and public) want to understand and control risk (e.g., default, long-term management/maintenance, environmental liability)
    - Developers typically don't rely upon their neighbors – too much risk if the relationship goes bad, if maintenance is not being performed, or other creates an environmental liability.
    - Legal agreements between private property owners are difficult to create.
- Private-public sharing is more desirable
  - Less perceived risk by financiers
  - Opens up opportunity to increase density
- Connecting to existing stormwater facilities may pose problems for affordable housing projects due to current affordable housing financing regulations.

<u>Stacked Function</u> – Developers are already doing stacked function developments – it is a matter of business due to high cost of land.

<u>Shared, stacked-function green infrastructure</u>

- Developers are supportive of this concept. They felt the topic was a worthwhile exploration.

- Regional stormwater facilities are desirable to developers as it reduces risk, is a known component when developing the site and is perceived to be a better approach than handling stormwater on a site-by-site basis.
- Developer contributions should be considered to cover:
  - Initial construction
  - Long-term maintenance
  - Easements
- Developers liked the concept of integrating art.

In summary, the developer focus group indicated that sharing stormwater facilities between private developments and public agencies is the preferred approach versus sharing occurring solely between private developments. This is primarily due to perceived risk by developers and their financiers. The group also stated adjacencies to open space provide value to residential and retail developments through increased rents or unit sale prices. Finally, they indicated that predictable development processes are valuable. These insights help inform the development of potential SSGI approaches.

Stakeholder Advisory Committee

A Stakeholder Advisory Committee (SAC) was established for the project. Committee members represented various departments in the Cities of Saint Paul and Minneapolis, the Capitol Region Watershed District (CRWD), the Mississippi Watershed Management Organization (MWMO), the University of Minnesota, and the Saint Paul Riverfront Corporation. The SAC provided corridor and community insight and advised the project team.

Project opportunities identified by the SAC were as follows:

- Shift the paradigm about how stormwater is managed.
- Make the development process easier by addressing stormwater earlier in the approval process.
- Maximize all types of environmental benefits.
- Create win-win scenarios.

The investigation quickly raised a number of logistic issues that a successful SSGI implementation approach must address. Below is a summary of the implementation challenges that were identified:

***Shared* Green Infrastructure**	**Developer Concern**	**Agency Concern**
How can initial implementation costs be covered for phased implementation?	X	
How to encourage/incentivize/regulate the use of ***shared*** green infrastructure between private property owners?		X
How can newer green infrastructure technologies be encouraged, or and be tested?		X

***Shared* Green Infrastructure (Cont.)**	**Developer Concern**	**Agency Concern**
How can long-term functionality risk be minimized for new technologies?	X	X
How to educate/communicate with and incorporate businesses that may own property but not expected to redevelop, to be part of a "shared" agreement?		X
How can stormwater treatment requirements be effectively communicated to property owners who plan to or are in the process of redevelopment?	X	X
Should private property runoff treatment be allowed in public right-of-way or on public property? How would equitable use of the site be determined?		X
Can shared green infrastructure be implemented and maintained for less than green infrastructure implemented on individual parcels?	X	
Can shared green infrastructure be implemented in a manner that still maintains long term opportunities for a site?	X	

***Stacked-function* Green Infrastructure**	**Developer Concern**	**Agency Concern**
How can public art be incentivized on private property?		X
Should public art be incentivized on private property?		X
How can shared green infrastructure contribute to the creation of open spaces along the corridor?		X
Are there particular stacked functions that should be incentivized?		X
How can numerous related initiatives along the corridor be coordinated?		X
How can stormwater runoff be recycled for aesthetic uses?	X	X
In what ways can runoff be reused/recycled?	X	X
To what extent should visible green infrastructure along the corridor be encouraged/incentivized?		X
Can intangible benefits associated with shared, stacked-function green infrastructure be quantified?	X	X
How is long-term maintenance of private shared BMP managed?	X	X
How are long-term maintenance costs for shared facilities allocated and collected?	X	
When a BMP fails, how can agencies determine which owner is at fault and force the property owner(s) to bring it back into compliance?		X

In summary, many of the potential SSGI implementation barriers identified by the SAC and developers focus group revolved around long-term risk management and associated cost implications.

Literature Review

A review of national studies related to SSGI was performed over the course of the project. Several concurrent studies of particular interest titled, *River North: Area Wide Green* Infrastructure Study (Wenk Associates, 2013), *Creating Clean Water Cash Flows* (Natural Resources Defense Council, EKO Asset Management Partners, the Nature Conservancy, 2013) and *Banking on Green* (American Rivers, the Water Environment Federation, the American Society of Landscape Architects, ECONorthwest, 2012) were all investigating variations of SSGI, which affirmed this is an issue of interest across the country. These national studies consistently indicated that green infrastructure was less expensive to construct than traditional gray infrastructure, regardless of scale. Note that the studies do not necessarily compare gray to green costs where existing stormwater systems are in place or where contamination or utility conflicts are present. The studies also illustrated new models for stormwater management must be initiated through leadership within municipal government. The following two precedents projects provided insight on how new SSGI policies could be developed and integrated with existing governmental rules and processes:

Fee-in-Lieu Program, Charlotte, NC – This community provides flexibility in their stormwater regulations in order to better facilitate desired redevelopment along a transit corridor. The City of Charlotte instituted an off-site mitigation program to provide flexibility and reduce cost barriers for site-constrained redevelopment properties that supported growth and economic development along Charlotte's light rail system. An ordinance allows property developers to pay a one-time fee if cost or site constraints prevent them from meeting their stormwater retention mandates. The City charges developers a fee per impervious acre and constructs off-site facilities in a cost-efficient manner on city-controlled lands. [1]

Stormwater Management Enhancement Districts, Philadelphia, PA – The City of Philadelphia facilitates the aggregation of properties into Stormwater Management Enhancement Districts (SMEDs), which are areas identified as having potential for large, coordinated green infrastructure projects. The City takes leadership in identifying SMEDs and contracts with an engineering specialist to evaluate potential green infrastructure retrofits that are technically, economically, and practically attractive and prepare a Stormwater Improvement Plan. These proactive steps taken by the City encourage the use of stormwater facilities that take advantage of economies of scale and also lower retrofit project assessment and analysis costs, thus incenting desired development.[2]

[1] Valderrama, Alisa. et. al. *Creating Clean Water Cash Flows: Developing Private Markets for Green Stormwater Infrastructure in Philadelphia*, Natural Resources Defense Council, January 2013, pg. 40.
[2] Valderrama, Alisa. et. al. *Creating Clean Water Cash Flows: Developing Private Markets for Green Stormwater Infrastructure in Philadelphia*, Natural Resources Defense Council, January 2013, pg. 30.

SSGI Precedents

Conceptually, shared, stacked-function stormwater management is not a new approach. Historically, for new developments in growing municipalities, the term "regional pond" was often used to describe a similar situation where one stormwater facility was built by a city for the benefit of many parcels, and by virtue of size may also provide passive recreational amenities and/or wildlife habitat. In other instances, smaller developments built common (shared) ponds in outlots, owned by homeowner associations. (However, often the outlot would go into tax-forfeiture and become owned by a city.)

SSGI builds on this general concept but seeks to employ it on a much smaller scale in a fully developed environment. Examples of SSGI can be found both locally and nationally. The following precedent projects were examined in more detail to better understand how SSGI is being applied and designed, along with associated opportunities and constraints.

National Precedents

Normal IL Roundabout – This project harvests, cleanses, and reuses co-mingled (public and non-public) stormwater runoff to create a water-based amenity in a new community open space.

Canal Park, Washington DC – Stormwater runoff captured from the site and adjacent private buildings will be harvested, cleansed and reused to create water-based amenities and for toilet flushing in a new urban park.

Local Precedents

Tartan Crossings, Oakdale, MN – As part of the redevelopment of an underperforming strip mall into new commercial sites, the City's Public Works Department constructed an artistically designed shared stormwater feature that functions as a new recreational, aesthetic and educational amenity in public right-of-way.

Trout Brook Nature Sanctuary, Saint Paul, MN – Stormwater runoff from an existing residential neighborhood will be daylighted from storm sewers to help enhance a new park. Cleansed through a series of ponds, the treated runoff will provide a significant water source for a newly re-established historic waterway that will run through the new park sanctuary.

Central Corridor, Saint Paul, MN – Boulevards cross streets to the Green Line were retrofitted by the CRWD to incorporate stormwater planters and rain gardens at a dozen locations. Localized runoff from the streetscape and, in some instances, private parking lots, are treated by these features.

Victoria Park, Saint Paul, MN – Stormwater runoff from an adjacent street was directed into a stormwater swale within the newly created Victoria Park and will function as an aesthetic park feature.

Heritage Park, Minneapolis, MN – Stormwater runoff from residential redevelopment sites and adjacent neighborhoods is daylighted from storm sewers and cleansed through a series of filtration basins that are incorporated into a neighborhood street designed to emulate a parkway. The harvested stormwater provides water for new parkland amenity ponds.

Hamline Library Green Alley, Saint Paul, MN – The City constructed a porous bituminous pavement alley that collects and infiltrates stormwater runoff from the alley itself and adjacent private and public parcels.

Potential Redevelopment Sites Identification

The project team desired to develop a pool of up to ten potential redevelopment sites along the corridor that would be strong candidates for conceptual SSGI design and evaluation. Project stakeholders were solicited and previous station area plans and sub area studies were reviewed to identify potential future redevelopment sites along the corridor. This effort resulted in a significant quantity of potential sites. To better facilitate a process of screening the list down to ten sites, clusters of potential development projects were consolidated into groups. These groups were comprised of adjacent sites that could potentially share stormwater facilities. As desired future park/open space locations were identified in Saint Paul's station area plans, each Saint Paul grouping also included a park/open space candidate site. If a potential site could not be logically grouped with other potential redevelopment sites, it was eliminated from the screening process. A total of 37 groups of potential redevelopment sites were developed (see attached Figures 1-8) comprised of 13 groups in Minneapolis and 24 groups in Saint Paul.

The 37 groups were screened using site suitability factors, such as topography and depth to bedrock and project parameters, such as distance from University Avenue and site size. In addition to the site suitability and project parameter screening criteria, the following overarching selection criteria were used to make the final selection:

- A geographical distribution of sites based on the approximate project percentage in each city (30 percent of project area located in Minneapolis and 70 percent of project area located in Saint Paul).
- A range of large and small sites.
- Several potentially contaminated sites.
- A range of potential development scenarios with near to mid-term development potential based on input received from Saint Paul and Minneapolis Planning staff.

The selection process resulted in three site groups located in Minneapolis and seven site groups located in Saint Paul. A brief summary of the 10 site groups follows:

Site M2 – West Bank Cedar Avenue

- The City is already planning to make streetscape improvements along this corridor and is working with owners of private plazas adjoining the right-of-way to concurrently update those spaces. This is a high visibility, diverse, and unique commercial area with a lot of pedestrian and auto traffic.

Site M4 – University of Minnesota Potential Bio-Med Expansion

- This group would entail working with University staff to develop a concept that may also include retrofit sites identified in the MWMO Bridal Veil Creek Study.

Site M7 – Development at 4th St SE & 29th Ave SE (Prospect Park Station)

- The City is working with two different developers on new residential development (2901 4th Street southeast & 2635 4th Street southeast) in a current industrial area.

The existing street has no sidewalks/curb/boulevard and is scheduled by the City for reconstruction.

- The group overlaps with a Bridal Veil Study catchment area and a recommended retrofit location.

Site SP3 – Westgate

- This group contains a larger site that is seeing developer interest. The Saint Paul Parks Department has developed several park configurations concepts for this area. The Saint Paul Riverfront Corporation previously developed a concept plan for the area.

Site SP5/SP6 - Wabash Commons/Raymond/Myrtle

- Several existing planning studies address sites in this medium sized group.

Site SP9 – Charles Common

- This group would highlight the development of a centralized treatment system for parcels that abut University Avenue.

Site SP14 – Bus Barn Site

- A portion of this large group is currently receiving redevelopment attention. The site provides the opportunity to investigate the integration of stormwater within a larger open space amenity feature.

Site SP17 – Lexington Village Commons

- This medium to large sized group is located adjacent to the typical SAC meeting location (Wilder Foundation), which may allow for SAC field visits.

Site SP19 – New Rondo Park, Dale and University

- This medium sized group includes a number of parcels along University Avenue.

Site SP20 – Western and University/Old Home Site

- A number of small sites along University Avenue comprise this group.

The project team received SAC member feedback on the recommended sites at the July 17, 2012 SAC meeting before making the final selection of the 10 potential advance design site groups.

Investigations of Potential SSGI Approaches

In August 2012, six SSGI approaches were presented to the SAC for consideration. Based on feedback received, the following four were selected for additional feasibility analysis:

- New Public Parks/Open Spaces
- Street Right-of-Way
- Green Alleys
- Shared Parking Facilities

Detailed descriptions of the six SSGI approaches presented and SAC feedback can be found in the White Paper, *Shared, Stacked-Function, Green Infrastructure Policy Investigation*.

SSGI Illustrative Exercise

Concurrent with the selection of the four potential SSGI approaches, the project team prepared illustrative concepts to assist project stakeholders with visualizing how SSGI could be manifested in a redevelopment project. For the purpose of the exercise, Wacouta Commons, located in downtown Saint Paul was selected to illustrate how the new public parks/open space SSGI approach could take form. This exercise asked the question, "If SSGI had been implemented when Wacouta Commons park was initially developed, how could have it looked and functioned?" This exercise assumed that rate control was incorporated into the new multi-family structures that bound the south and west sides of the park. Existing site conditions are depicted in attached Figures 9-10. The project site is approximately 5 acres as shown in Table 1 below. The current drainage patterns would allow for the harvesting of runoff from an additional 11.5 acres.

Table 1: Wacouta Commons Project Area Acreages

Total Project Site		**5.0 Acres**
	Development	3.0 Acres
	Open Space/Park	0.9 Acres
	Streets r/w	1.1 Acres
Available Offsite Drainage area		**11.48 Acres**

The following hydrologic data was calculated for the site.

Table 2: Wacouta Commons Site Hydrologic Data

Hydrologic Data	1.3" Volume Control Cubic Feet (CF)	1.64 cfs/ac Rate Control Cubic Feet (CF)	Percent (%) of volume for project
Total Project Site	**16,364**	**23,290**	
Development	11,169	15,058	68
Open Space/Park	1,159	2,126	7
Street Right-of-way	4,035	6,106	25
Available Offsite	**44,815**	**82,721**	

Concept A

Informed by the Normal, IL roundabout precedent, this concept illustrated a highly engineered system featuring two cisterns, vegetated filters, and UV filters that would allow for the daylighting of treated stormwater in an interactive channel/fountain in the park (see Figure 11). The main cistern provides gross pollutant removal/retention for site use. A vegetative filter channel is used for secondary treatment. The secondary cistern provides clean water for the water channel for park vegetation irrigation. The cisterns shown were

sized to meet the water quality and volume control requirements, but could be sized for rate control. In addition, the cisterns could be sized to harvest runoff from the off-site drainage area, as this water may be needed to supply all the needed irrigation water needs for the park.

Concept B

In this concept, a series of cascading bioretention basins comprise the majority of the park. Pathways, boardwalks and plazas that surround and pass between the basins provide park visitors visual access to diverse basin habitats (see Figure 12). The basins shown were sized to meet the water quality and volume control requirements, but could be sized for rate control. The system could be designed as a gravity system with shallow storm sewer connections to the basins. Each basin would likely have a different vegetative appearance due to varying volumes of runoff draining to each basin. This concept was inspired by Tanner Springs Park in Portland, Oregon.

Concept C

This concept illustrated a terraced central lawn framed by tree allees and small gathering spaces. An underground passive irrigation system and permeable pavement parking bays would be used in this concept to meet stormwater requirements (see Figure 13). The stormwater facilities were sized to meet the water quality and volume control requirements, but could be sized for rate control. The system could be designed as a gravity system with shallow storm sewer connections to the irrigation system. Rooftop runoff that would enter the system would not require pretreatment. The irrigation could be supplemented with offsite runoff via a cistern/pump system.

The exercise highlighted that the physical form of SSGI could vary widely in terms of the amount of park space dedicated to stormwater facilities and the desired level of park user interaction with the harvested and treated stormwater.

SSGI Conceptual Designs

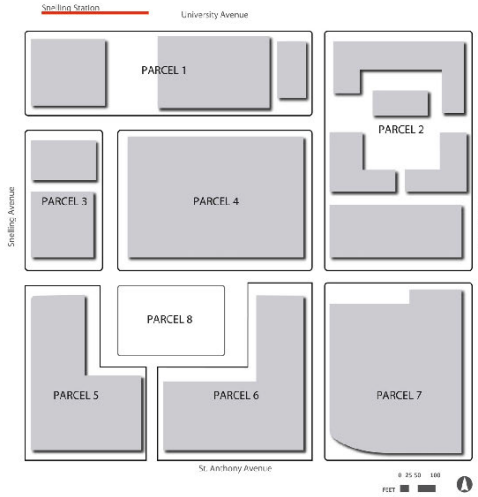
Two potential redevelopment sites along the corridor, the Bus Barn and Brownstone sites, were selected to further investigate the feasibility of implementing the four SSGI approaches (see Figure 14). Design goals for concept development included:

- Meeting regulatory requirements for stormwater with SSGI
- Harvesting offsite water if possible to support the stormwater facility, as needed
- Integrating public art into the design process

Concept designs and estimated life cycle costs were developed for each of the four SSGI approaches on both sites for a total of eight SSGI concepts and life cycle cost estimates. In order to determine if cost efficiencies could be achieved using SSGI, stormwater treatment approaches and estimated life cycle costs were developed for the Bus Barn site, assuming that stormwater treatment was performed on an individual site basis.

General block and building configurations used for the Bus Barn Site were based on previously developed station area plans or current proposed redevelopment plans, as shown in the illustration below. The illustration also lists the BMPs used in the individual parcel concepts.

Bus Barn- Conceptual Parcels and BMPs:



Parcel	BMPs Used			
	Green Roof	Underground Infiltration/ Filtration (Site Open Space)	Pervious Pavers with Underground Infiltration/ Filtration (Parking Lot)	Bioretention and Pond
1	√	√		
2			√	
3	√	√		
4	√	√		
5	√	√		
6	√	√		
7	√	√		
8				√

Bus Barn Site

The Bus Barn site is representative of a large-scale, urban village redevelopment area. With a size of 34-acres, the Bus Barn site is envisioned as a long-term, phased, development area. It was assumed that select streets and blocks would be reconfigured and that significant demolition and reconstruction of buildings would occur as part of the redevelopment process. General block and building configurations were based on the Snelling Station Area Plan. Figure 15 depicts the existing drainage patterns on the site. Figures 16-19 illustrate Bus Barn site design concepts, key design elements, and design assumptions for each SSGI approach. Public art concepts developed for the Bus Barn site are depicted in Figures 20 – 21.

Brownstone Site

The Brownstone site is representative of a small parcel redevelopment project. The Brownstown site was selected as it is small in scale, yet exceeded one acre where water quality and volume control standards are required. Existing drainage patterns on the site are shown in Figure 22. Small projects typically consist of existing building expansions, or the complete demolition of several structures, parcel assembly and development of a larger building. Figures 23-26 illustrate Brownstone site design concepts, key design elements, and design assumptions for each SSGI approach. Public art concepts developed for the Brownstone site are depicted in Figure 27.

Costing Approach and Summary

The preparation of estimated life cycle costs was based on a combination of national studies and local construction experience. Sources of costing data included:

- Best Management Practices Construction Costs, Maintenance Costs, and Land Requirements, Prepared for Minnesota Pollution Control Agency, June 2011
- Water Environment Research Foundation (WERF), BMP and LID Whole Life Cost Model: Version 2.0
- Green Values National Stormwater Management Calculator, Center for Neighborhood Technology
- Recent construction bids

Figure 28 lists assumptions that were used in the development of the estimated life cycle costs. Tables 3 – 5 summarize the outcomes of the life cycle costing exercise.

Table 3: Life Cycle Cost Summary

	Bus Barn Site Life Cycle Costs		Brownstone Site Life Cycle Costs	
	Cost per Cubic Foot of Volume Achieved	Cost per Square Foot of Impervious Surface	Cost per Cubic Foot of Volume Achieved	Cost per Square Foot of Impervious Surface
Individual Parcel Basis	$17.60 P $362.80 GR	$11.00 P $35.40 GR		
Open Space Concept	$18.80	$2.50	$36.70	$4.90
Street R/W Concept	$19.40	$2.60	$24.90	$3.40
Alley Concept	$19.20	$2.60	$21.90	$3.10
Structured Parking Concept	$8.50	$1.20	$32.80	$4.70

P = Pervious Pavers, GR = Green Roof

Table 4: Bus Barn Site - Detailed Summary of Estimated Life Cycle Costs

	Construction Costs					Life Cycle Costs	
	Capital Cost	Cost/ CF of Volume Achieved	Cost/ SF of Impervious Surface	Annual O & M Cost	Life Span Years	Cost/ CF of Volume Achieved	Cost/ SF of Impervious Surface
Individual Parcel Basis	$1,025,658 P $ 744,447 GR	$10.50 P $164.10 GR	$6.60 P $16.00 GR	$3,832 P $21,231 GR	25: Green Roof and Pavers 30: Pipe Gallery	$17.60P $362.80 GR	$11.00 P $35.40 GR
Open Space Concept	$1,040,900	$6.00	$0.80	$13,632	10: Bioretention 25: Pond	$18.80	$2.50
Street R/W Concept	$2,161,389	$12.40	$1.60	$40,420	25: Pavers 40: Tree Trenches	$19.40	$2.60
Alley Concept	$2,157,881	$12.20	$1.60	$45,060	30: Pavers 60: Pipes	$19.20	$2.60
Structured Parking Concept	$ 933,759	$5.20	$0.70	$18,675	50	$8.50	$1.20

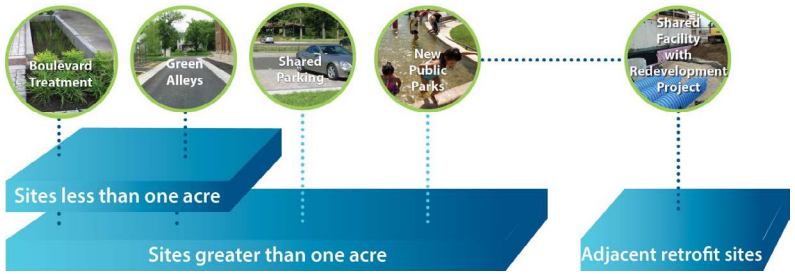
P = Pervious Pavers, GR = Green Roof

Table 5: Brownstone Site - Detailed Summary of Estimated Life Cycle Costs

	Construction Costs					Life Cycle Costs	
	Capital Cost	Cost/ CF of Volume Achieved	Cost/ SF of Impervious Surface	Annual O & M Cost	Life Span Years	Cost/ CF of Volume Achieved	Cost/ SF of Impervious Surface
Individual Parcel Basis	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Open Space Concept	$264,683	$28.40	$3.80	$2,350	60	$36.70	$4.90
Street R/W Concept	$110,626	$11.80	$1.40	$384	25:Pavers 10: Bump-outs	$24.90	$3.40
Alley Concept	$138,027	$13.90	$2.00	$2,610	30:Pavers 60: Pipes	$21.90	$3.10
Structured Parking Concept	$200,867	$19.90	$2.90	$4,017	50	$32.80	$4.70

Findings

This investigation indicated that the four SSGI approaches identified (Parks, Parking, Alleys, and Street Right-of-way) were feasible at both the urban village and small site scale. In addition, the study indicated that several of these approaches lend themselves more strongly to a particular scale of development. For example, while green alleys can be incorporated into all scales of development, this approach is a more viable option for use with small scale development projects than the parks approach. Likewise, a structured parking approach is better aligned with an urban village development scale. The figure below highlights the applicability of the four SSGI approaches to different development scales.



A comparison of the individual basis estimated costs to conceptual SSGI estimated costs indicated that cost efficiencies can be achieved through the sharing of stormwater facilities. Also, the incremental cost increase to provide water quality and volume control measures in addition to rate control (e.g., filtration or infiltration features) for a shared facility are not significant.

Another finding indicated that while it is more difficult to implement a SSGI facility that serves numerous small redevelopment parcels, these small parcels appear to receive higher benefit from SSGI than larger development sites, as it is easier for larger developments to allocate space to green infrastructure.

Attachments

H:\Projects\7687_Correspondence\Memorandums\Tech Analysis memo\131223 CCSSGI Final Tech Analysis and Eval Memorandum.docx

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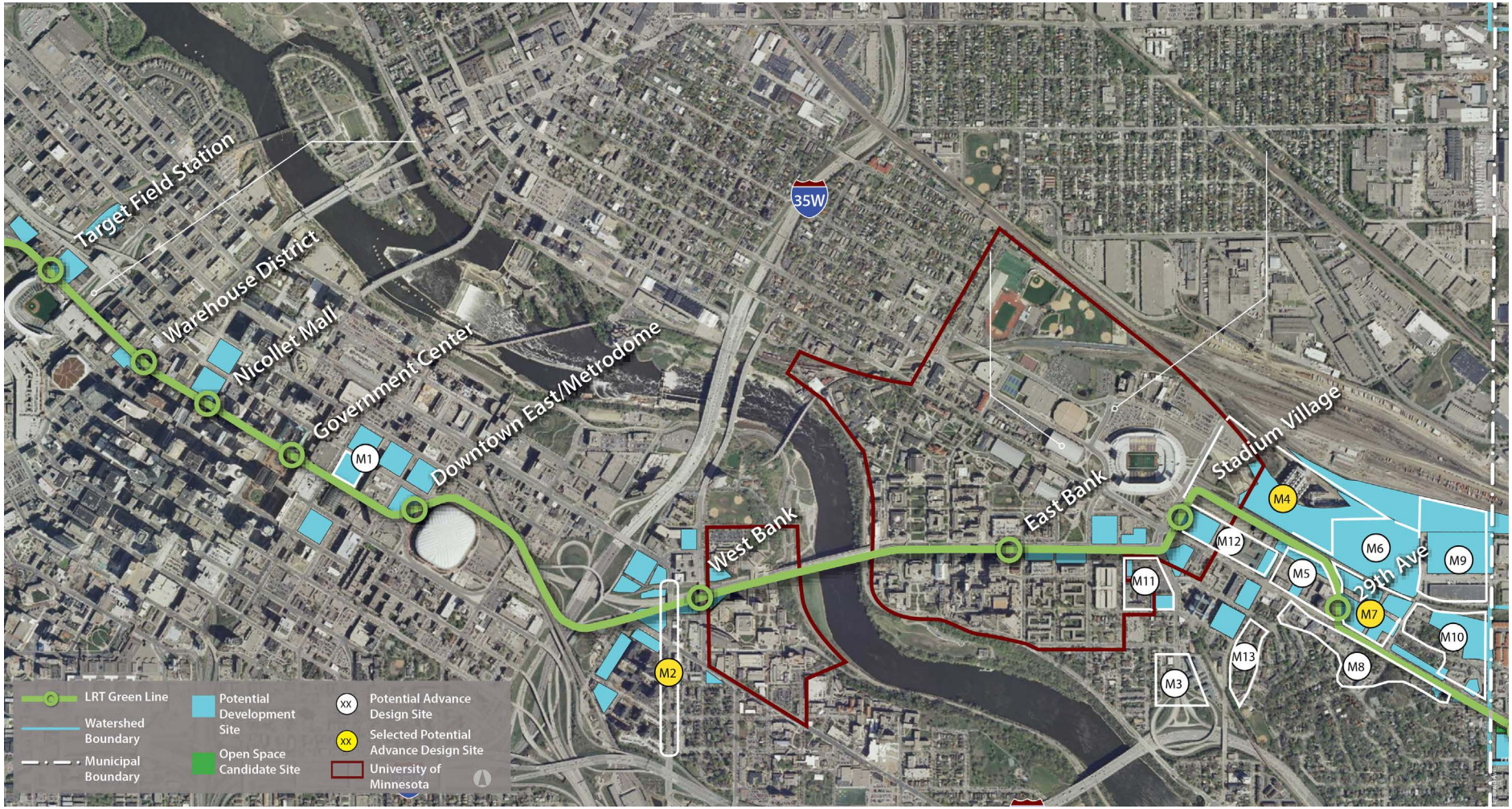


FIGURE 1 Corridor Analysis West Segment

FIGURE 2 Corridor Analysis Central Segment

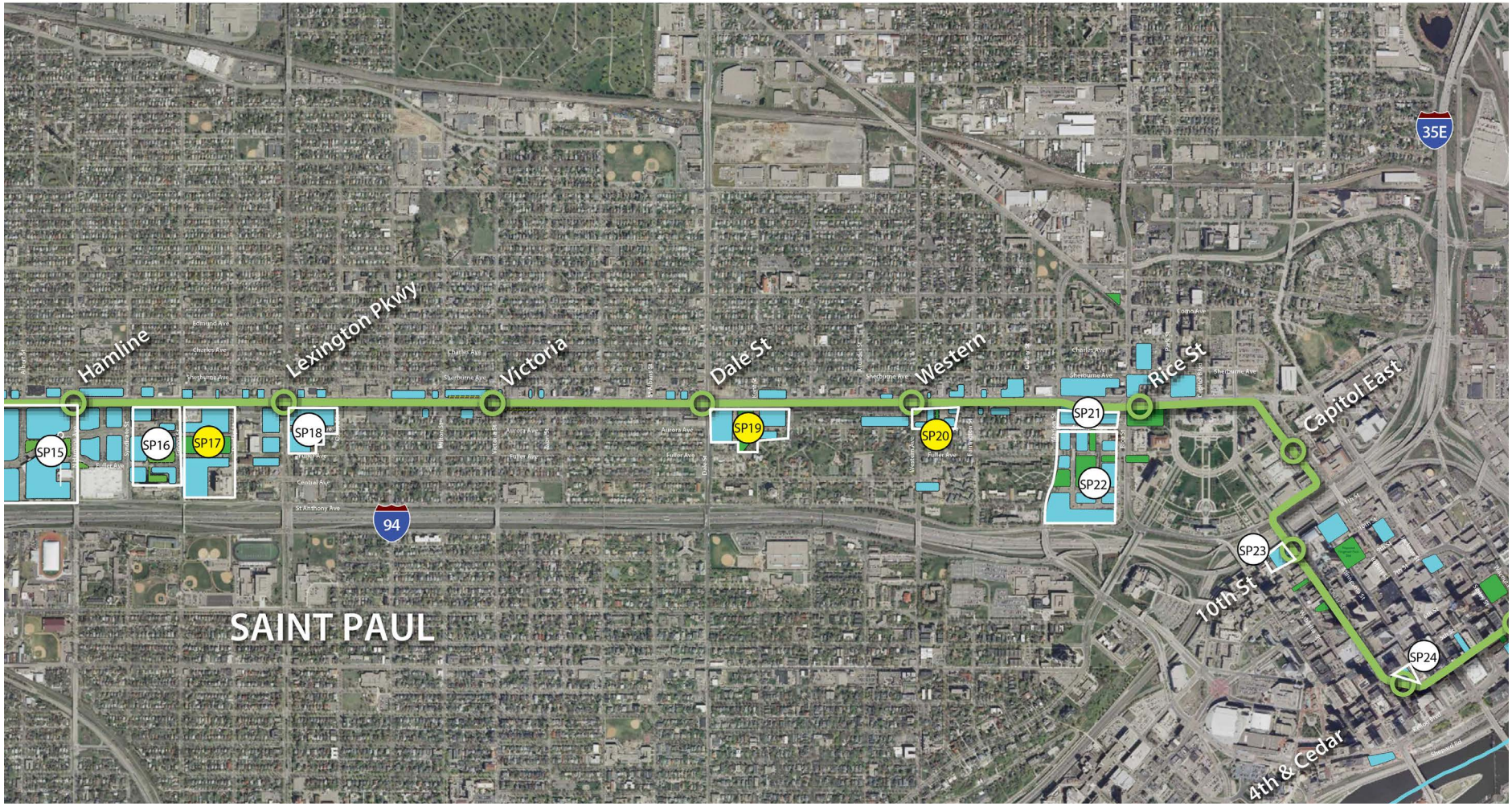


FIGURE 3 Corridor Analysis East Segment

Overarching Selection Criteria (any one of these criteria could override matrix results)

- Geographical distribution
- Range of development scenarios

SELECTION TIER	SITE SELECTION PARAMETERS																POTENTIAL TRIPLE BOTTOM LINE OPPORTUNITIES							
Criteria Category	Project Parameters								Site Suitability								Environmental Function				Social Function			Economic Function
Criteria	Can be shared among multiple parcels	Identified as potential redevelopment site in previous study?	Established development program for site	Proximity to the corridor	Probable SSGI construction cost	Potential for redevelopment/ project timeline	Site size (1 ac to 10 ac)	Opportunity for linkage of features to create enlarged green space	Contaminated soils	Utility conflicts	Bedrock	Groundwater	Contributing drainage area	Appropriate subgrade soils (A or B)	Available storm sewer system	Topography	Under public control	Volume control	Rate control	Water quality	Additional Ecological benefits	Integration of public art	Green reference	Provide community open space	Promotes Redevelopment
POTENTIAL SITES – MPLS																								
5th and Portland (M1)	◐	●	○	●	○	○	●	○	○	○	●	●	◐	◐		◐	○							
Cedar Avenue (M2)	●	●	◐	◐	●	◐	●	◐	●	○	●	●	●	◐		◐	◐							
Huron Boulevard Area (M3)	◐	○	○	○	◐	○	●	◐	◐	◐	●	●	◐	◐		◐	◐							
University of Minnesota Potential Bio-Med Expansion (M4)	●	●	○	●	○	○	◐	●	○	○	●	●	●	◐		◐	◐							
Prospect Park Station West (M5)	●	●	○	●	○	○	◐	◐	○	○	◐	◐	◐	◐		●	○							
Crushers Site (M6)	●	●	○	●	○	○	◐	●	○	◐	●	●	◐	◐		◐	○							
Prospect Park Station East (M7)	●	●	●	●	○	●	◐	●	○	○	◐	◐	◐	◐		●	○							
Prospect Park/University Ave (M8)	●	●	○	●	○	○	◐	◐	○	○	◐	◐	●	◐		○	◐							
Industrial (M9)	●	●	◐	◐	○	◐	◐	◐	○	○	●	●	◐	◐		◐	○							
Residential/Light Industrial (M10)	●	●	○	●	○	○	◐	◐	○	◐	◐	◐	●	◐		●	○							
Washington/Huron (M11)	●	●	○	●	○	○	◐	○	○	○	●	●	●	◐		◐	○							
Stadium Village Station (M12)	●	●	○	●	○	○	◐	○	○	○	◐	◐	●	◐		◐	○							
Glendale Townhomes (M13)	◐	○	○	◐	○	○	●	◐	○	○	◐	◐	◐	◐		●	●							

Potential Advanced Design Site ● Most desirable ◐ Moderately desirable ○ Least desirable

FIGURE 4 Site Selection Matrix- Potential Minneapolis Sites

Overarching Selection Criteria (any one of these criteria could override matrix results)

- Geographical distribution
- Range of development scenarios

SELECTION TIER	SITE SELECTION PARAMETERS																POTENTIAL TRIPLE BOTTOM LINE OPPORTUNITIES							
Criteria Category	Project Parameters								Site Suitability								Environmental Function				Social Function			Economic Function
Criteria	Can be shared among multiple parcels	Identified as potential redevelopment site in previous study?	Established development program for site	Proximity to the corridor	Probable SSGI construction cost	Potential for redevelopment/ project timeline	Site size (1 ac to 10 ac)	Opportunity for linkage of features to create enlarged green space	Contaminated soils	Utility conflicts	Bedrock	Groundwater	Contributing drainage area	Appropriate subgrade soils (A or B)	Available storm sewer system	Topography	Under public control	Volume control	Rate control	Water quality	Additional Ecological benefits	Integration of public art	Green reference	Provide community open space	Promotes Redevelopment
POTENTIAL SITES – ST. PAUL																								
Technology Common (SP1)	◐	●	○	◐	◐	○	●	◐	◐	●	●	●	◐	◐	●	●	○							
University/Curfew (SP2)	◐	●	○	●	●	○	●	◐	●	◐	●	●	●	◐	●	◐	○							
Westgate (SP3)	●	●	◐	◐	○	◐	◐	●	○	●	●	●	●	◐	●	●	○							
Emerald/University (SP4)	◐	●	●	●	●	●	●	◐	●	●	●	●	◐	◐	●	○	○							
Wabash Common (SP5) *Merged with SP6*	●	●	●	◐	○	◐	◐	●	○	○	●	●	●	◐	●	●	◐							
Raymond/Myrtle (SP6) *Merged with SP5*	◐	●	○	●	●	○	●	●	●	●	●	●	◐	◐	●	●	○							
Raymond/Charles (SP7)	●	●	○	●	●	◐	●	◐	●	○	●	●	●	◐	●	●	◐							
Prior and University (SP8)	●	○	◐	●	○	●	●	○	○	●	●	●	◐	◐	●	●	○							
Charles Common (SP9)	●	●	◐	●	●	◐	●	●	●	●	●	●	●	◐	●	●	○							
Episcopal Homes (SP10)	●	○	●	●	●	●	●	○	●	◐	●	●	◐	◐	●	●	○							
Fairview/University (SP11)	●	●	○	●	◐	○	◐	◐	◐	◐	●	●	●	◐	●	●	○							
Dickerman Park Area (SP12)	●	●	○	●	◐	○	◐	●	◐	◐	●	●	●	◐	●	●	○							
Snelling Ave Site (SP13)	◐	●	○	◐	●	○	●	●	●	◐	●	●	◐	●	●	●	○							
Bus Barn Site (SP14)	●	●	○	●	○	◐	◐	●	○	●	●	●	●	◐	●	◐	○							
Midway (SP15)	●	●	○	●	○	○	◐	●	○	●	●	●	●	◐	●	◐	○							

Potential Advanced Design Site ● Most desirable ◐ Moderately desirable ○ Least desirable

FIGURE 5 Site Selection Matrix- Potential Saint Paul Sites, cont.

Overarching Selection Criteria (any one of these criteria could override matrix results)

- Geographical distribution
- Range of development scenarios

SELECTION TIER	SITE SELECTION PARAMETERS																			POTENTIAL TRIPLE BOTTOM LINE OPPORTUNITIES							
Criteria Category	Project Parameters								Site Suitability									Environmental Function				Social Function			Economic Function
Criteria	Can be shared among multiple parcels	Identified as potential redevelopment site in previous study?	Established development program for site	Proximity to the corridor	Probable SSGI construction cost	Potential for redevelopment/ project timeline	Site size (1 ac to 10 ac)	Opportunity for linkage of features to create enlarged green space	Contaminated soils	Utility conflicts	Bedrock	Groundwater	Contributing drainage area	Appropriate subgrade soils (A or B)	Available storm sewer system	Topography	Under public control	Volume control	Rate control	Water quality	Additional Ecological benefits	Integration of public art	Green reference	Provide community open space	Promotes Redevelopment
POTENTIAL SITES – ST. PAUL																											
Lexington Urban Village (SP16)	●	●	○	●	◐	○	◐	●	◐	◐	●	●	●	◐	●	◐	○										
Lexington Village Commons (SP17)	●	●	◐	●	◐	◐	◐	●	◐	●	●	●	●	◐	●	●	○										
Aurora Avenue Community Park (SP18)	●	●	○	●	○	◐	●	◐	○	◐	●	●	●	◐	●	●	○										
New Rondo Park, Dale and University (SP19)	●	●	○	●	◐	◐	●	●	◐	●	●	●	●	●	◐	●	○										
Western and University/Old Home Site (SP20)	●	●	○	●	◐	◐	●	◐	◐	○	●	●	●	◐	●	●	◐										
University and Rice (SP21)	◐	●	○	●	◐	○	●	◐	◐	●	●	●	●	◐	●	●	○										
Sears Site (SP22)	●	●	○	◐	○	◐	◐	●	○	●	●	●	●	◐	●	◐	○										
Cedar Ave/ 10th-12th St (SP23)	◐	○	○	●	○	○	●	○	◐	○	○	◐	◐	◐	◐	◐	◐										
4th and Cedar Plaza (SP 24)	◐	●	◐	●	○	●	●	◐	●	●	○	◐	◐	◐	◐	●	●										

Potential Advanced Design Site ● Most desirable ◐ Moderately desirable ○ Least desirable

FIGURE 6 Site Selection Matrix- Potential Saint Paul Sites, cont.

GLOSSARY OF SITE SELECTION CRITERION - DRAFT 08/29/2012

CRITERION	DESCRIPTION	●	◐	○
Project Parameters				
Can be shared among multiple parcels	Highly valued given study's emphasis on shared function.	Numerous parcels	Limited	None
Identified as potential redevelopment site in previous study?	Emphasis based on SAC comments regarding parcels that have already had public vetting for future redevelopment and is part of an approved plan/ document.	Yes	N/A	No
Established development program for site	The site has a design development program.	Design Development	Conceptual	No
Proximity to the corridor	Greater value is placed on sites that are closer to the Central Corridor.	Within 3 blocks	3-5 blocks	>5 blocks
Probable SSGI construction cost	Subjective value based on site suitability measurements (bedrock, contamination).	Low	Medium	High
Potential for redevelopment/project timeline	Greater value is placed on redevelopment that is planned to occur in a shorter timeframe.	3 years	3-10 years	>10 years
Site size (1 ac to 10 ac)	A 1-10 acre site (1-2 blocks) has enough water to sustain features and has more potential to avoid some of the other site suitability measures (crossing streets, etc).	1-10 acres	>10 acres	<1 acre
Opportunity for linkage of features to create enlarged green space	Ranking based on proximity to other potential redevelopment or future open space.	Potential	Moderate Potential	No Potential
Site Suitability				
Contaminated soils *(source: MPCA "What's in my neighborhood?" data)*	Are there known contamination issues for a site that would impact design or costs of BMPs?	Non existent	Potential/unknown	Known contamination
Utility conflicts	Are there known utilities that need to be relocated in order for BMPs to be constructed that would affect the design or have cost implications? (streets/ overhead utilites crossing site)	None	Potential/unknown	Known multiple relocates required
Bedrock *(source: County Well Index, Depth to Bedrock, and site experience)*	Is bedrock close enough to the surface that it would affect choices of BMPs or have cost implications?	Non existent	Potential/unknown	Known bedrock
Groundwater *(source: County Well Index, Depth to Bedrock and site experience)*	Is bedrock close enough to the surface that it would affect choices of BMPs or have implications on the potential for infiltration BMPs?	Non existent	Potential/unknown	Known high groundwater
Contributing drainage area *(compared topography/slope of the site with site boundary)*	Is the topography or drainage systems such that a BMP can serve more than one property owner, simply serve the site, or potentially not serve the site?	More than individual site	Site only	Less than individual site
Appropriate Subgrade Soils (A or B) *(source: NRCS SSURGO data for Ramsey County and Hennepin County)*	This criterion addresses the sites ability to infiltrate stormwater.	Known A/B soils	Likely C soils/Urban Soils	Known D soils (clay)
Available storm sewer system (gravity) *(source: St. Paul Storm Sewer Data- mapped rim/sump depth, compared to site slope)*	Is the site served by an adequate drainage system at an elevation available for a passive drainage system, or does it require other measures to provide for a positive outlet that affects the short and long term costs?	Available	Available but requires construction to access	Not available without pumping
Topography *(2' contours mapped according to slope criteria)*	Is the site easily adaptable to BMPs with some but not too much slope?	1-4% slopes	0.5-1% or 4-5% slopes	> 5% slopes
Under public control	Greater value is placed on sites where the open space/SSGI is under public control.	Municipal (St Paul/Mpls)	Other Agencies/Public Entities	Private

FIGURE 7 Site Selection Matrix-Glossary of Site Selection Criterion

CRITERION	DESCRIPTION	●	◐	○
Environmental Function				
Volume control	Can/does the site meet all of its regulatory requirements for volume control?	Meets requirements on site	Partially meets requirements on site	Not able to meet requirements on site
Rate control	Can/does the site meet all of its regulatory requirements for rate control?	Meets requirements on site	Partially meets requirements on site	Not able to meet requirements on site
Water quality	Can/does the site meet all of its regulatory requirements for water quality ?	Meets requirements on site	Partially meets requirements on site	Not able to meet requirements on site
Additional ecological benefits	Provides ecological benefits beyond stormwater management (wildlife/air quality/etc) to mimic natural systems.	Full	Partial	None
Social Function				
Integration of public art	Art is an integral part of the design, with more value placed on publicly accessible locations.	Public	Private	None
Green reference	The project should be identifiable as incorporating sustainable/green infrastructure.	High	Medium	Low
Provides community open space	Higher value was placed on developments that created open space available to the public.	Public	Private	None
Economic Function				
Promotes redevelopment	Perceived attractiveness of site for redevelopment	High	Medium	Low

FIGURE 8 Site Selection Matrix- Glossary of Site Selection Criterion, cont.

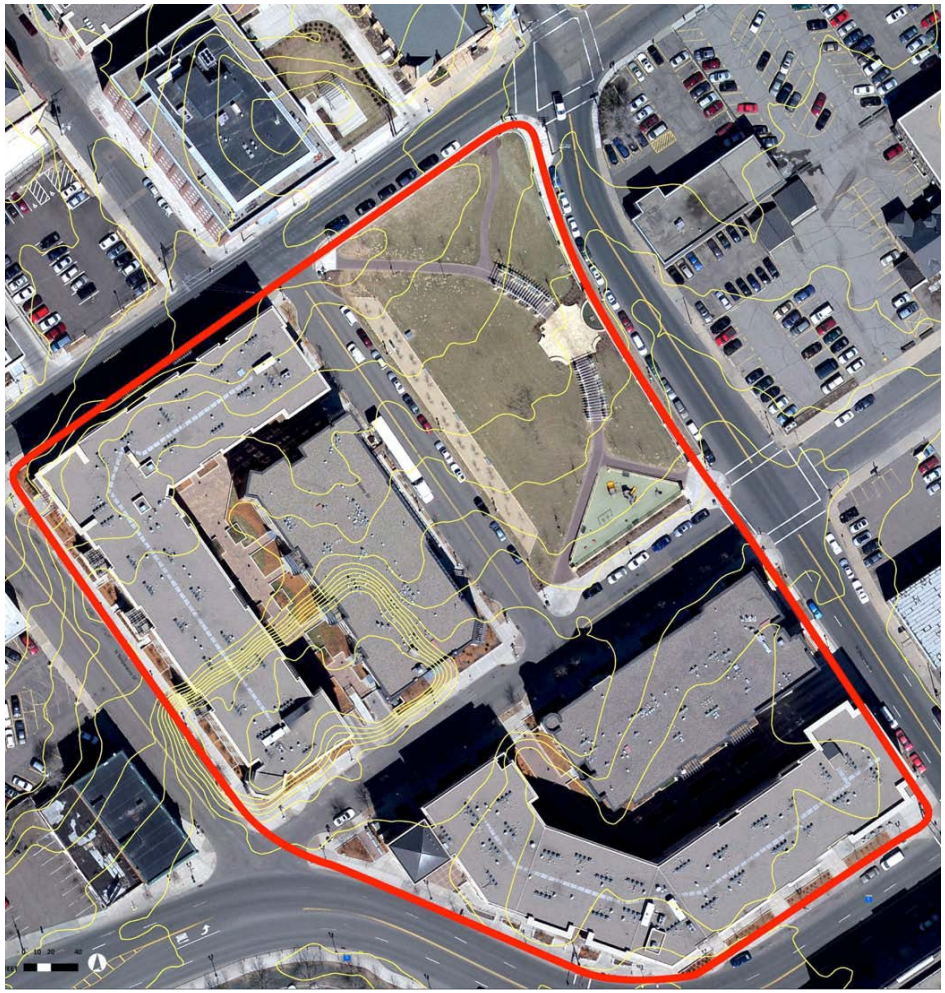


FIGURE 9 Wacouta Commons Existing Topography

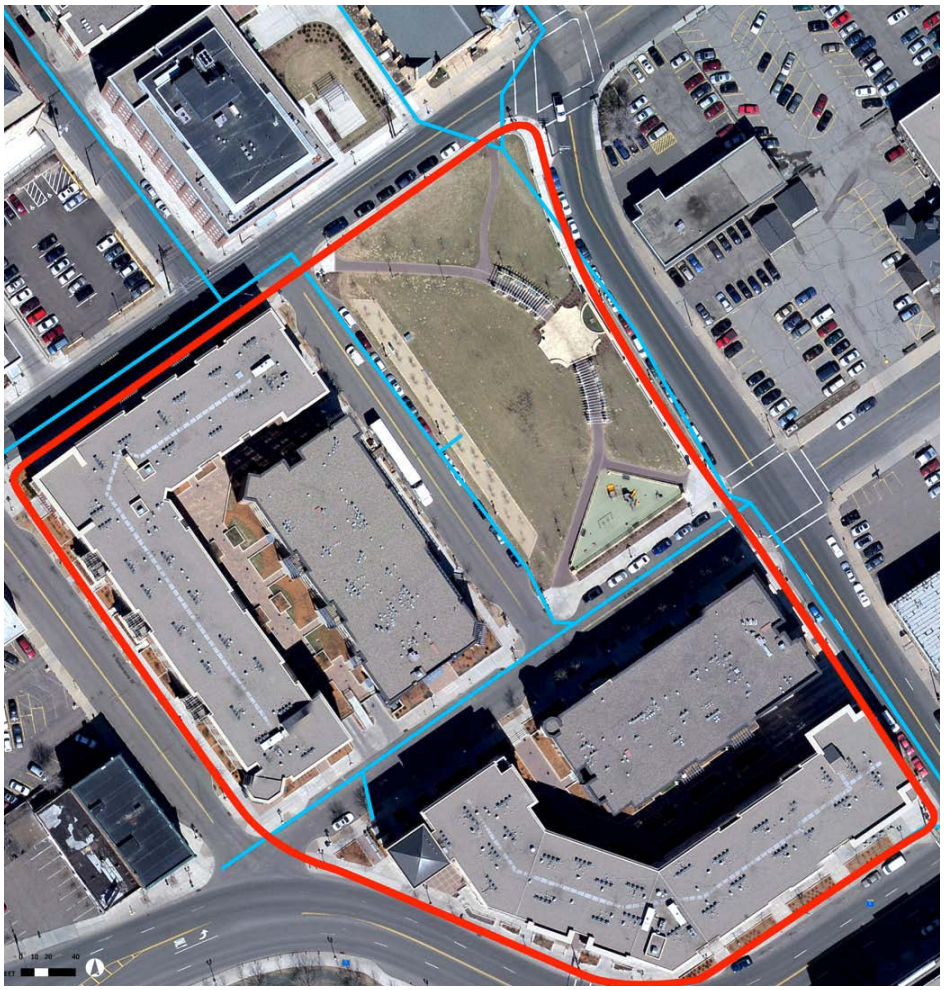


FIGURE 10 Wacouta Commons Existing Drainage Area

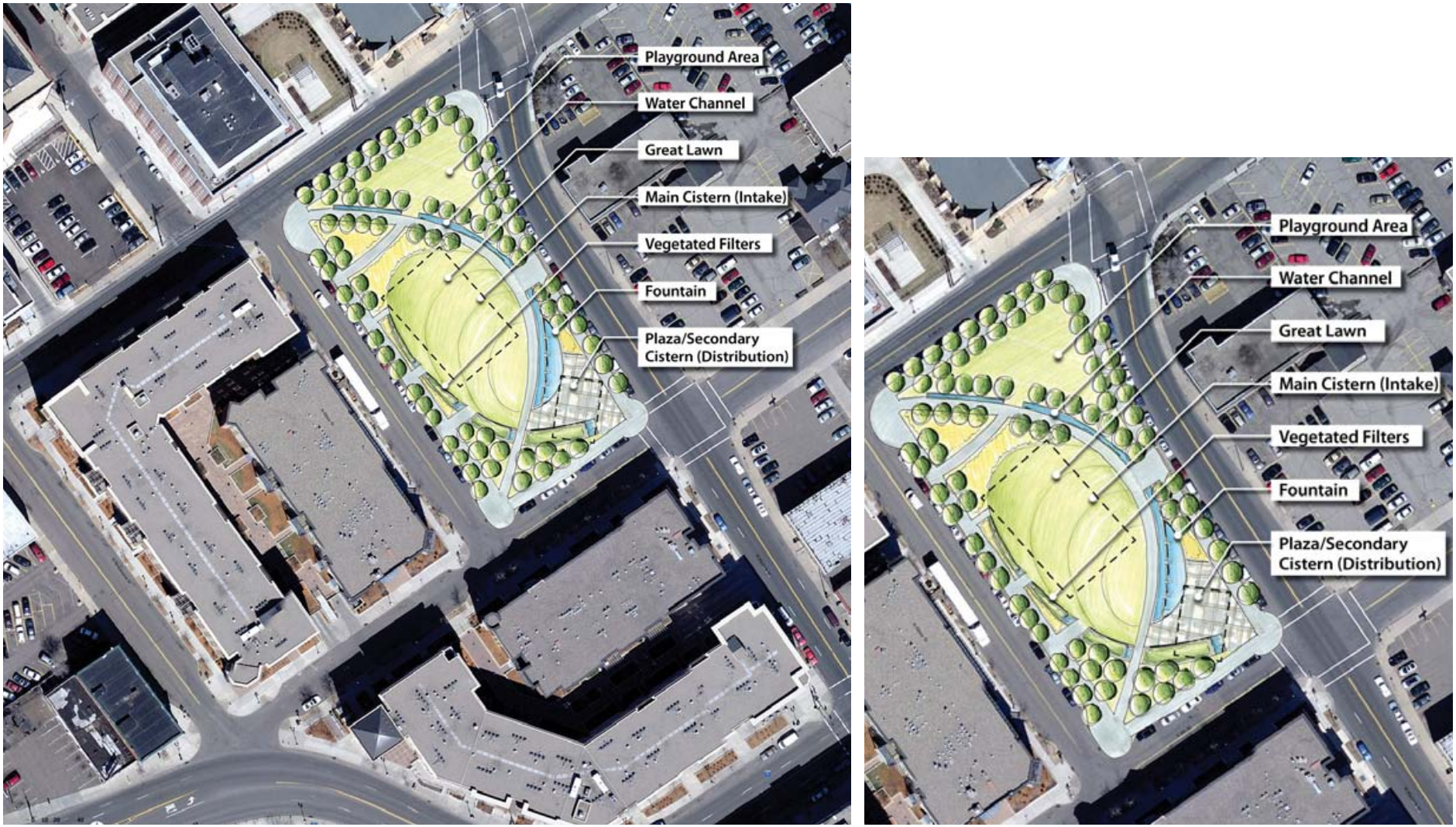


FIGURE11 Wacouta Commons Concept A

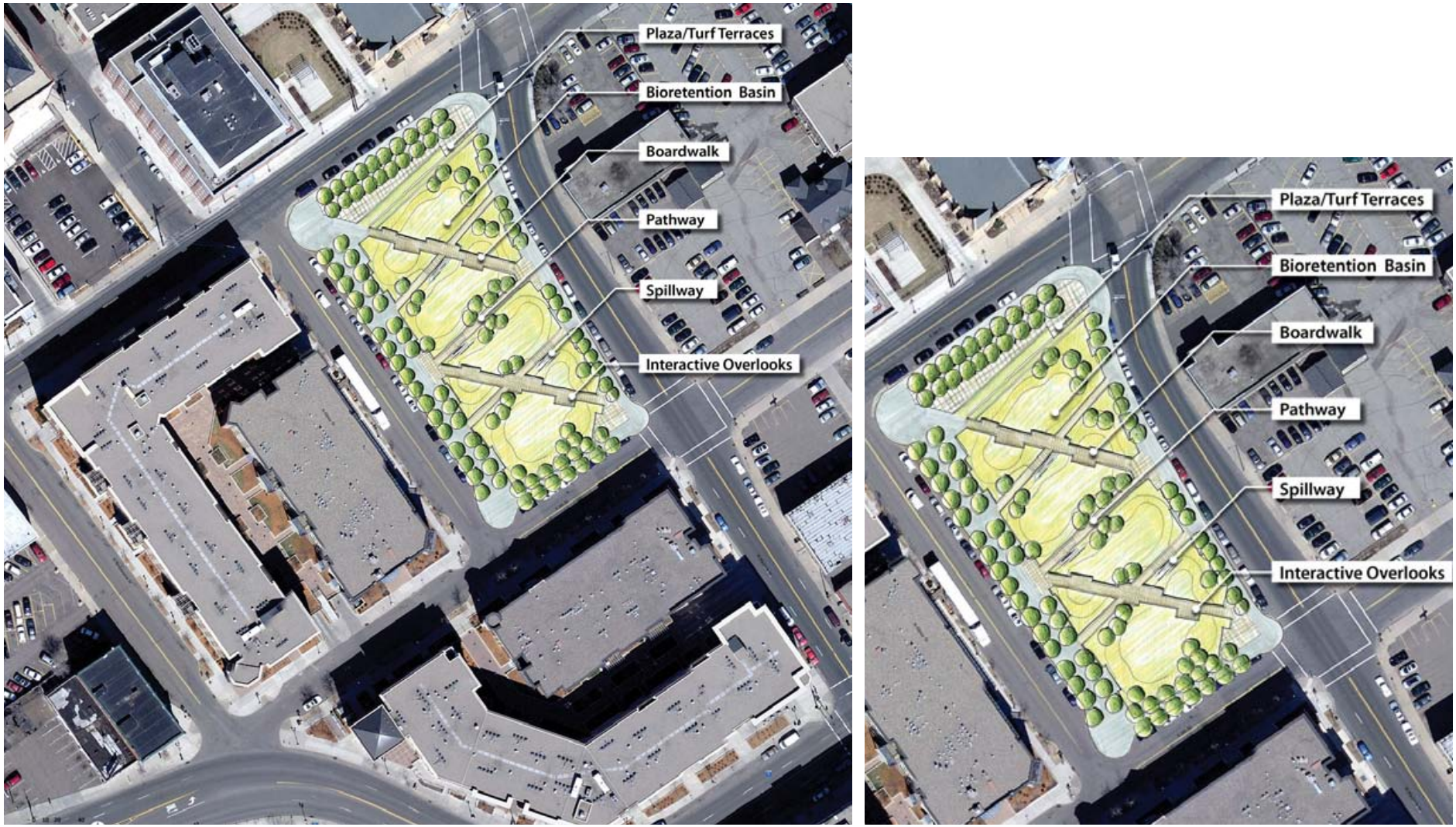


FIGURE 12 Wacouta Commons Concept B

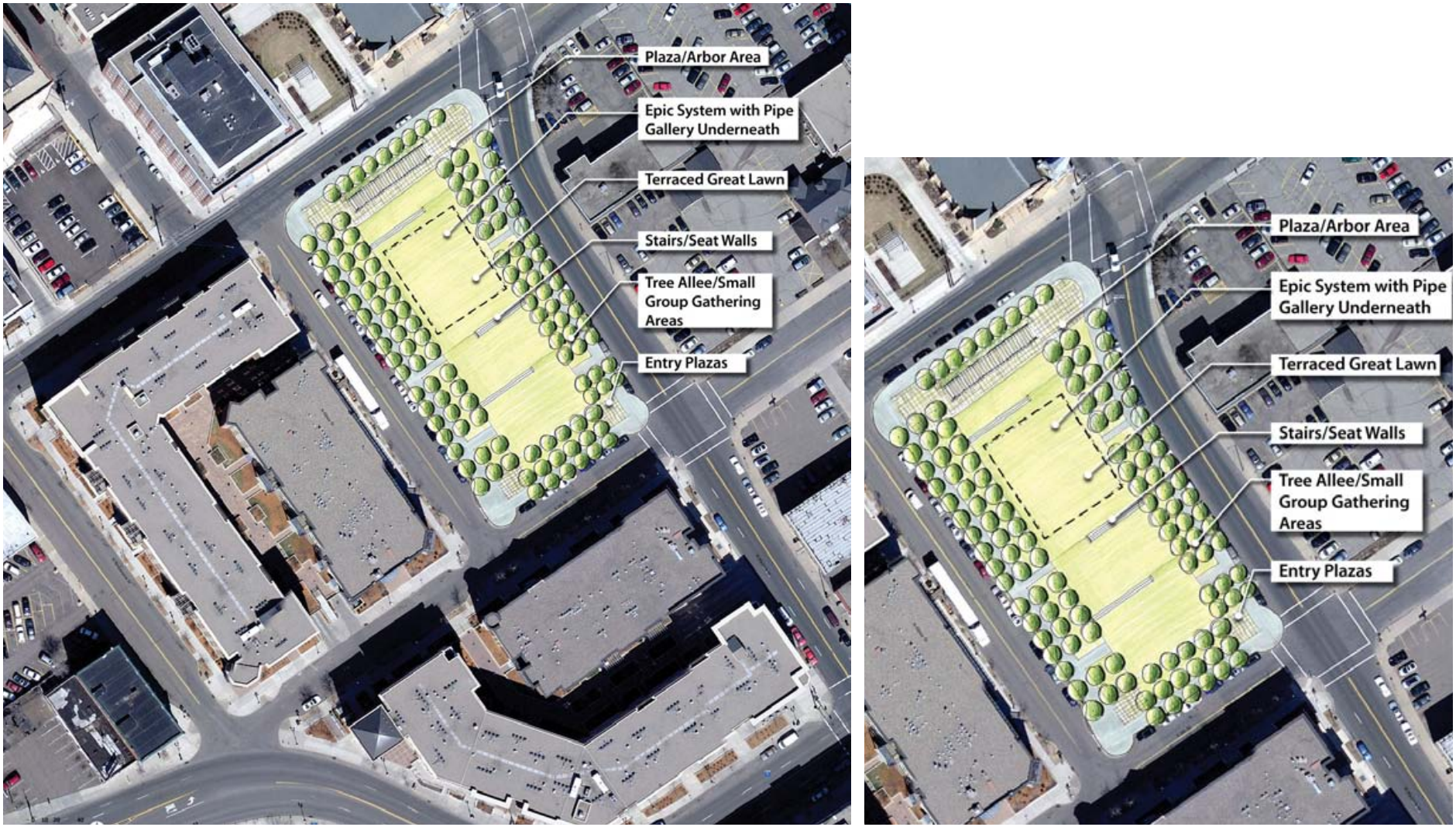


FIGURE13 Wacouta Commons Concept C

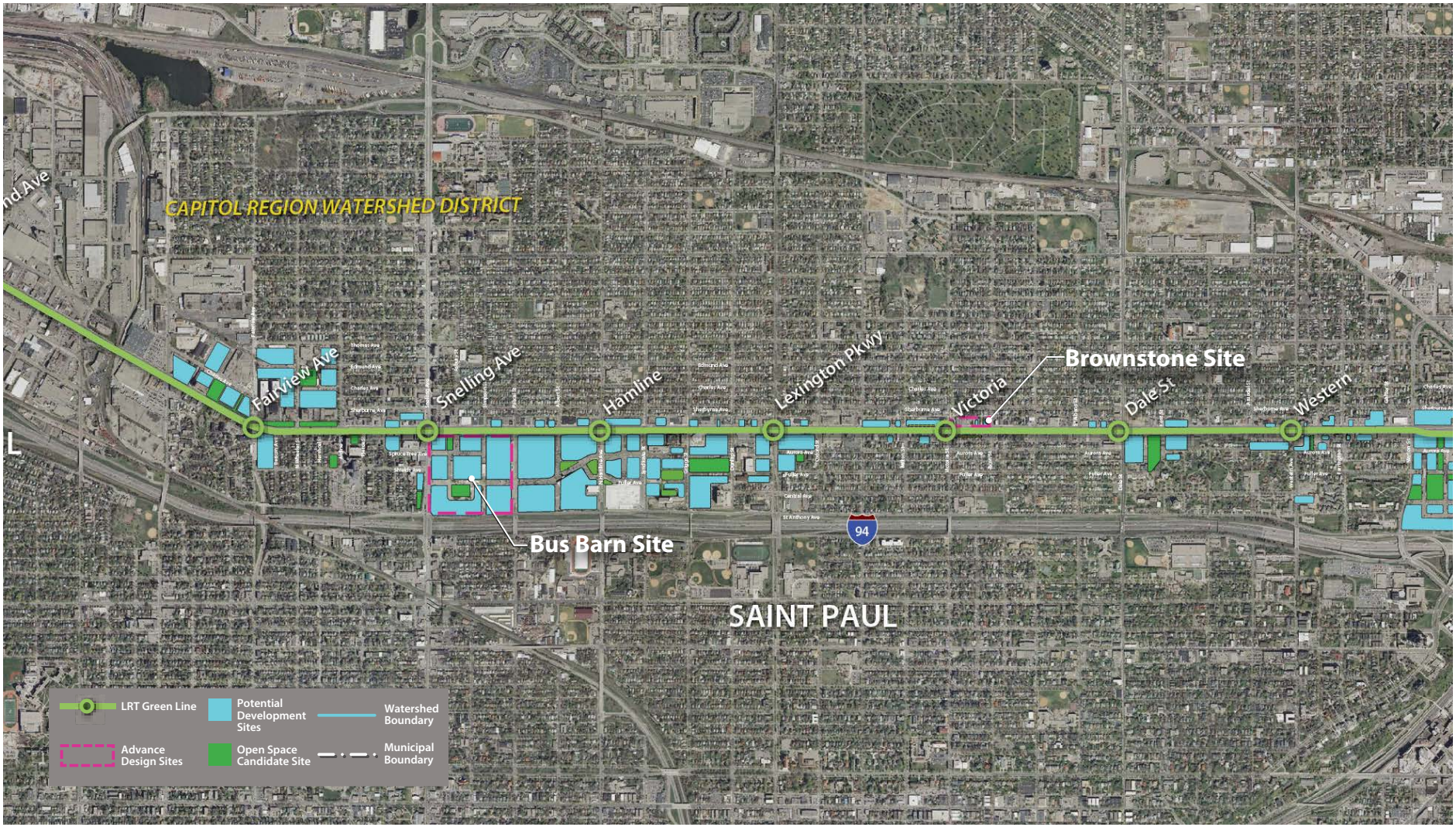


FIGURE 14 SSGI Conceptual Design Locations

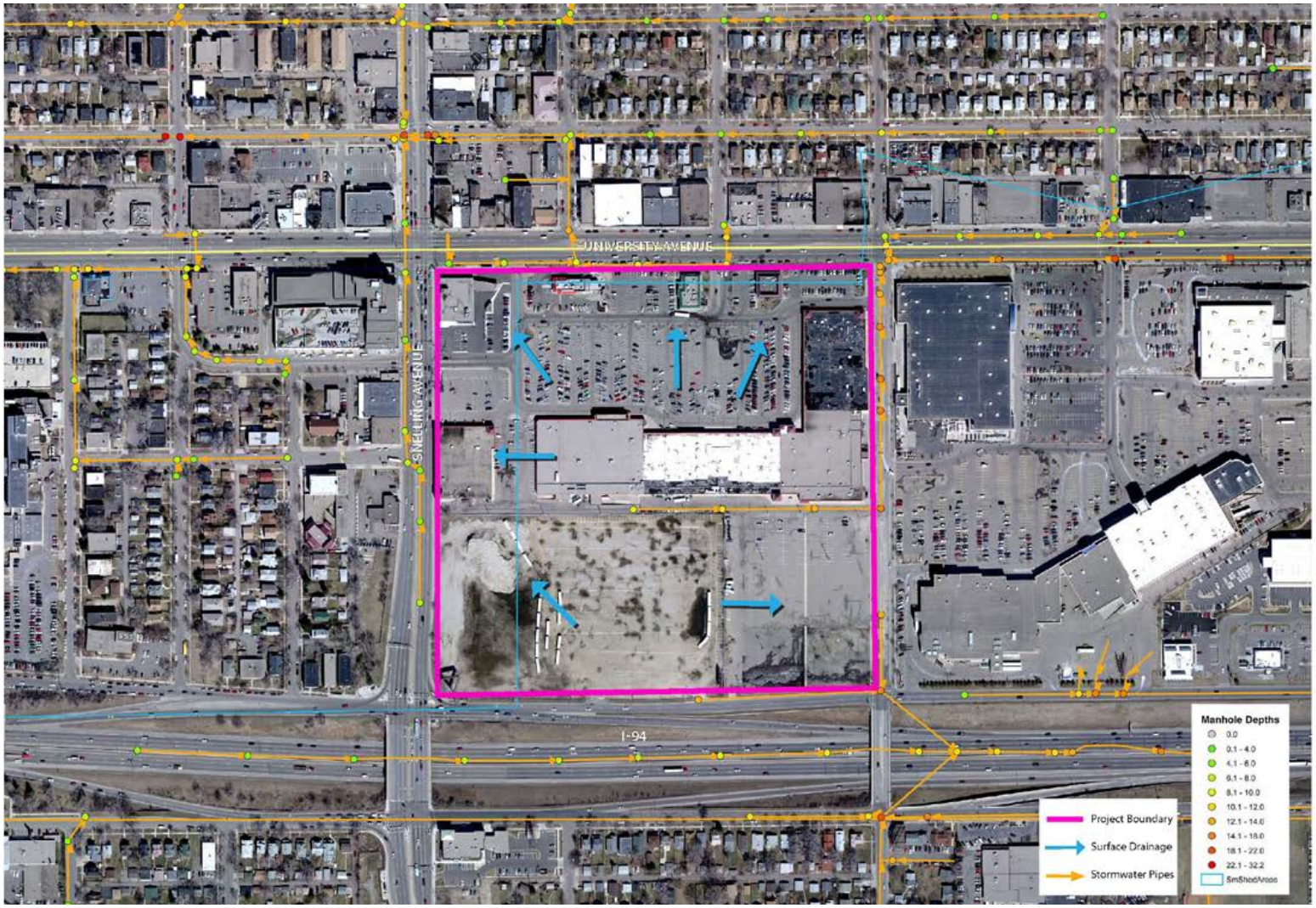
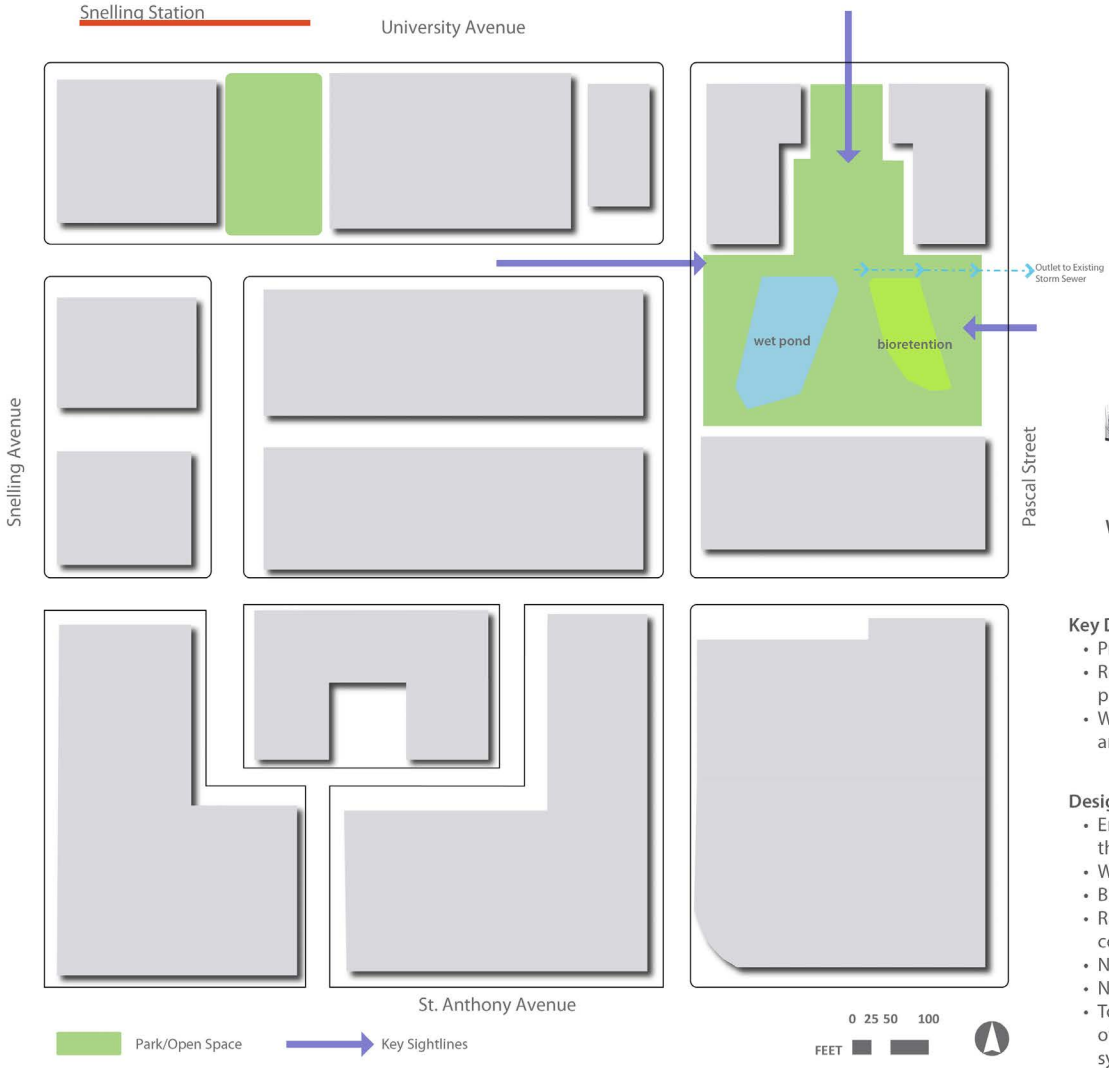
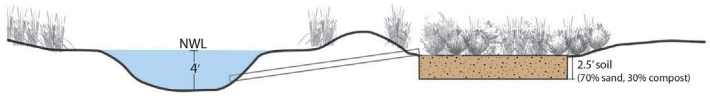


FIGURE 15 Bus Barn Site Drainage Area





Wet Pond & Bioretention Basin Section

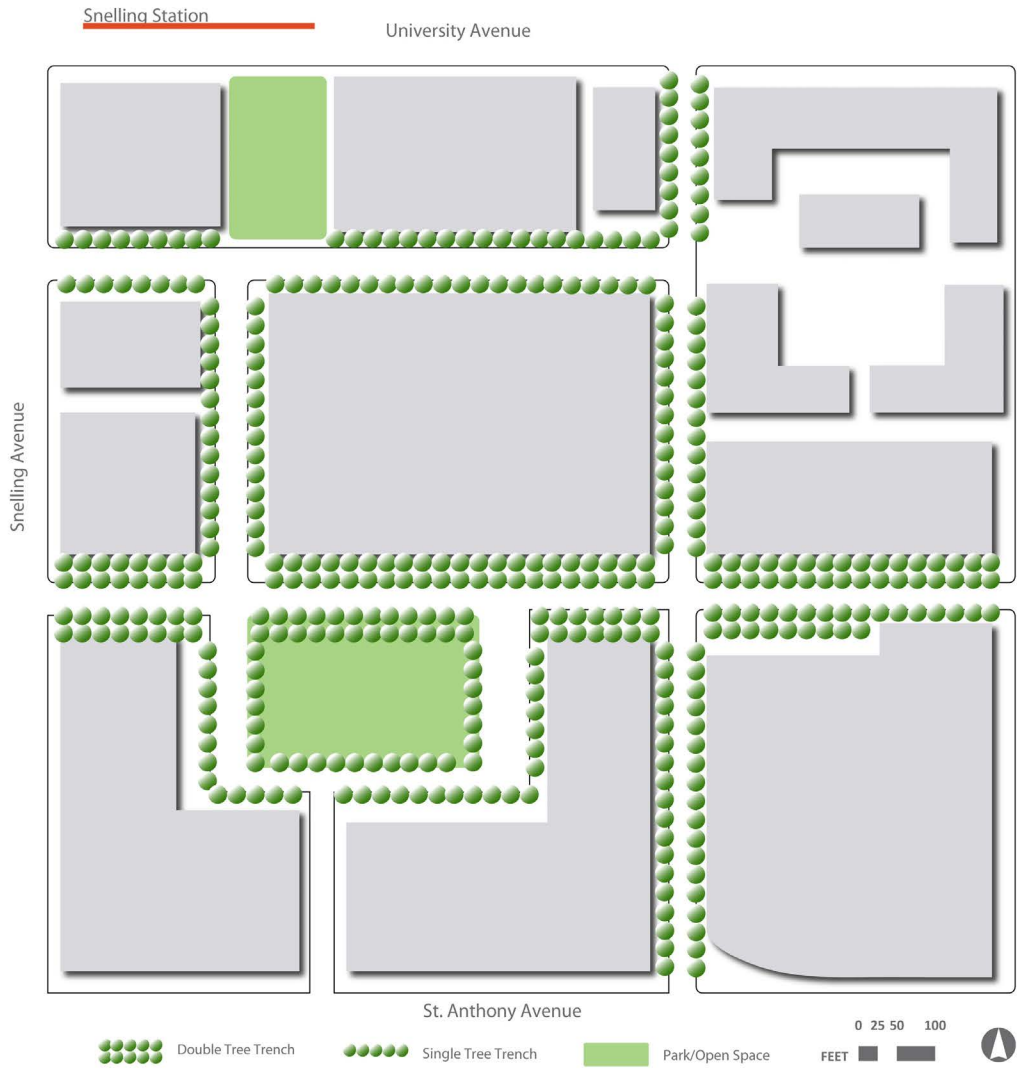
Key Design Points:

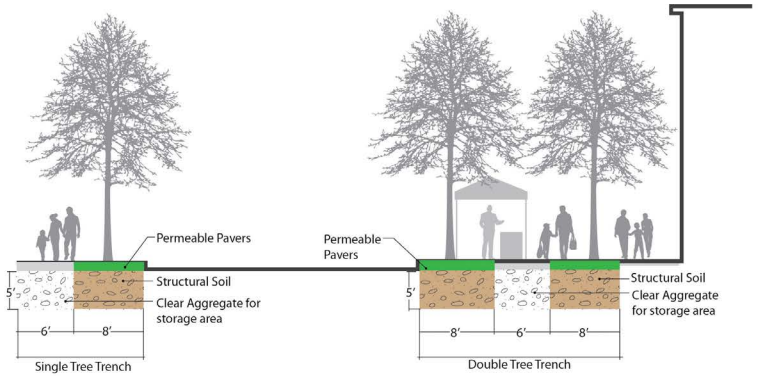
- Provides public & private stormwater treatment
- Reconfigure buildings and relocate park to reinforce key sightlines to park to promote connection between University Avenue and open space
- Wet pond and bioretention area to be shaped to further reinforce sightlines, and provide park amenities

Design Assumptions:

- Entire site drains to and is treated in NE corner of the site, which is the lowest point of the site.
- Wet pond has a 21,900 sq. ft. surface area and is 4' deep.
- Bioretention basin has a 12,600 sq. ft. surface area with 30" of bioretention soil.
- Rate control is through outlet control structure connection to storm drain in NE corner of site.
- Necessary rate control volume = 170,400 cu. ft.
- Necessary retention volume = 127,400 cu. ft.
- Total storage volume achieved = 127,500 cu. ft. below normal water level and surface of bioretention basin. (Assumes active pool can be achieved with the footprint of the system.)

FIGURE 16 Bus Barn Open Space Concept





Tree Trench Section

Site Plan Note:

- Block and building configurations taken from Snelling Station Area Plan

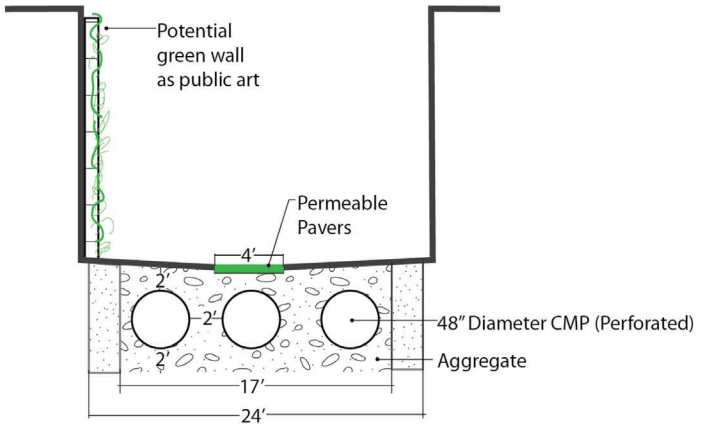
Key Design Points:

- Tree trenches in street right-of-way
- Provides public & private stormwater treatment
- Double tree trench creates a strong green spine/promenade that could extend east
- Double tree trench could host farmers market
- Street trees support street life and street character
- Street trees reinforce wayfinding between station area and open space
- Street trees provide environmental benefits (shade, water uptake)

Design Assumptions:

- Single tree trenches are 14' wide by 5' deep
- Double tree trenches are 22' wide by 5' deep with a 6' concrete walkway between
- Aggregate has 30% void space
- Necessary rate control volume = 174,700 cu. ft.
- Necessary retention volume = 127,400 cu. ft.
- Total storage volume achieved = 174,900 cu. ft.

FIGURE 17 Bus Barn Street R/W Concept



Green Alley Section

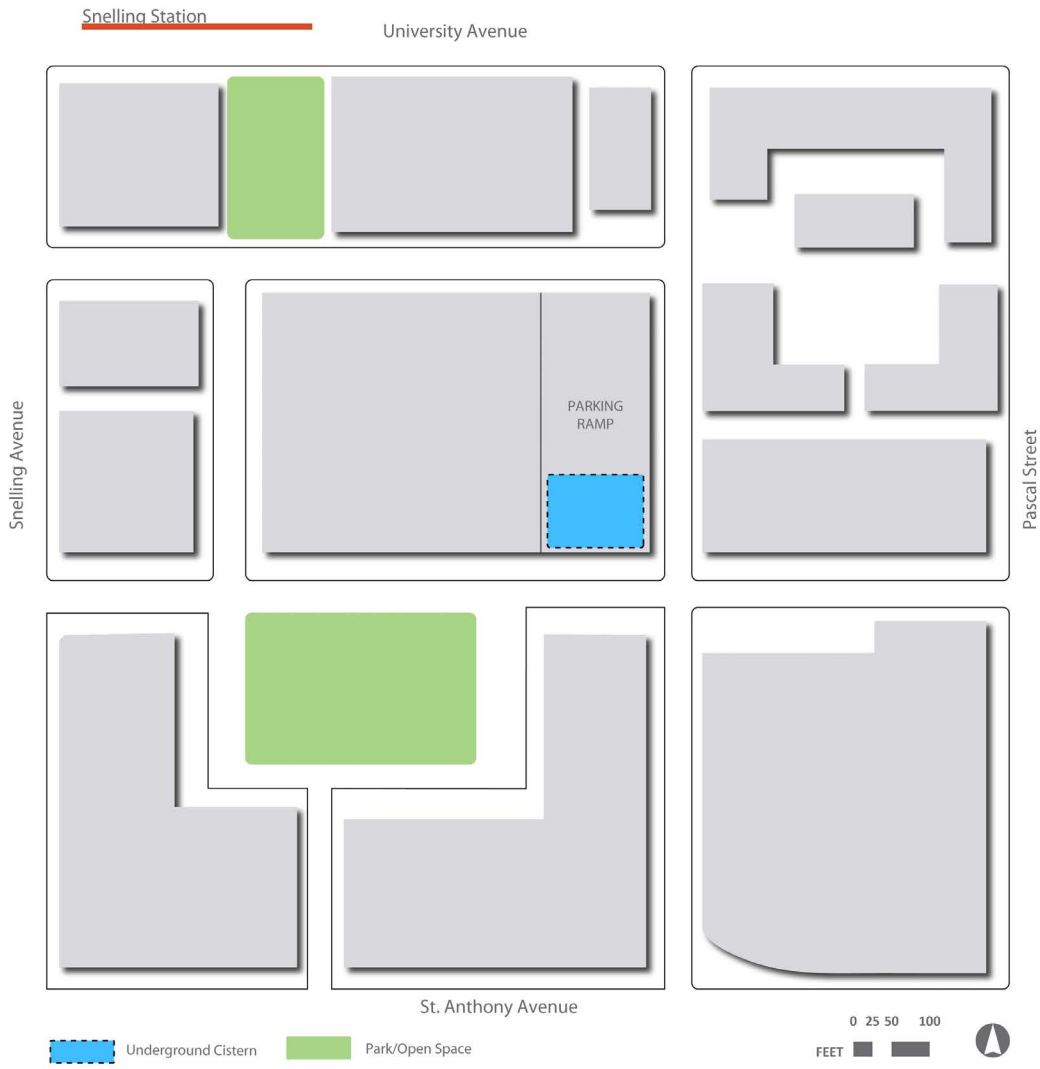
Key Design Points:

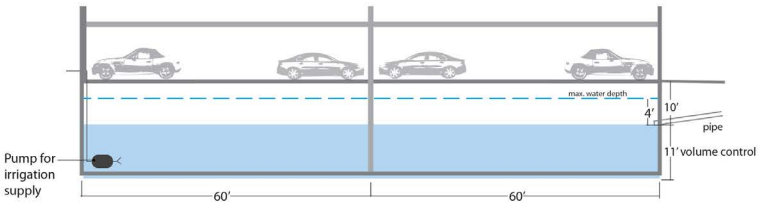
- Provides public & private stormwater treatment
- Green alleys could support back-door access to retail spaces
- Vegetation and public art could be incorporated through use of structure and native vines
- Permeable pavers allow infiltration of surface runoff

Design Assumptions:

- Alley pavement is 20' wide within a 24' R/W
- Aggregate & pipe storage area is 17' wide by 6.25' deep
- Aggregate has 35% void space
- 4' width is less than wheel path of standard car
- Green walls are not included in storage calculations
- Necessary rate control volume = 174,700 cu. ft.
- Necessary retention volume = 127,400 cu. ft.
- Total storage volume achieved = 176,600 cu. ft.

FIGURE 18 Bus Barn Green Alley Concept





Parking Ramp Cistern Section

Key Design Points:

- Provides public & private stromwater treatment
- Shared parking ramp would house a below grade cistern that would provide stormwater treatment for entire site
- Stored water would be used to irrigate landscaped area and street trees throughout site to meet volume retention requirements

Design Assumptions:

- Footprint of cistern structure = 120' x 100'
- Freeboard = 3' from bottom of beam to max. water level
- Necessary rate control volume = 174,700 cu. ft.
- Necessary retention volume = 129,950 cu. ft.
- Total storage volume achieved = 180,000 cu. ft.

FIGURE 19 Bus Barn Structured Parking Concept

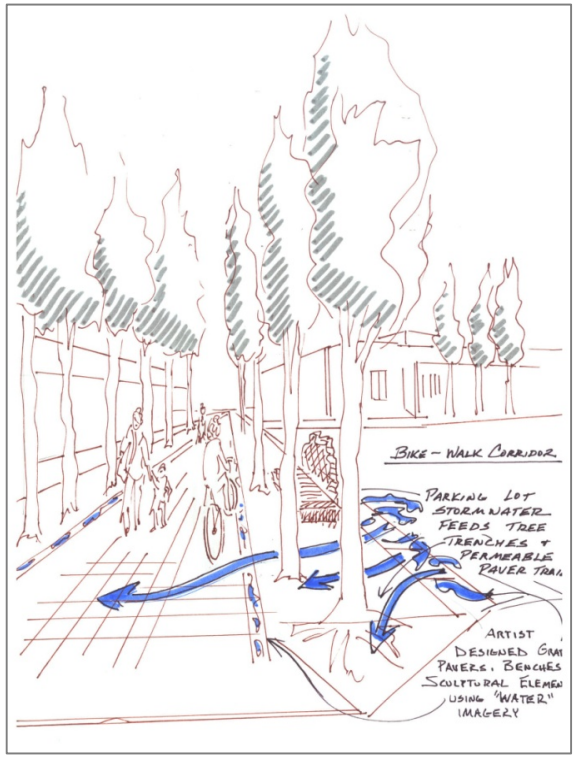
Large open space design

» *"Meet, Sit and Talk" , Lorna Green,1995. The Chancellors Court, University of Leeds. Planting Scheme by Allan R Ruff.*

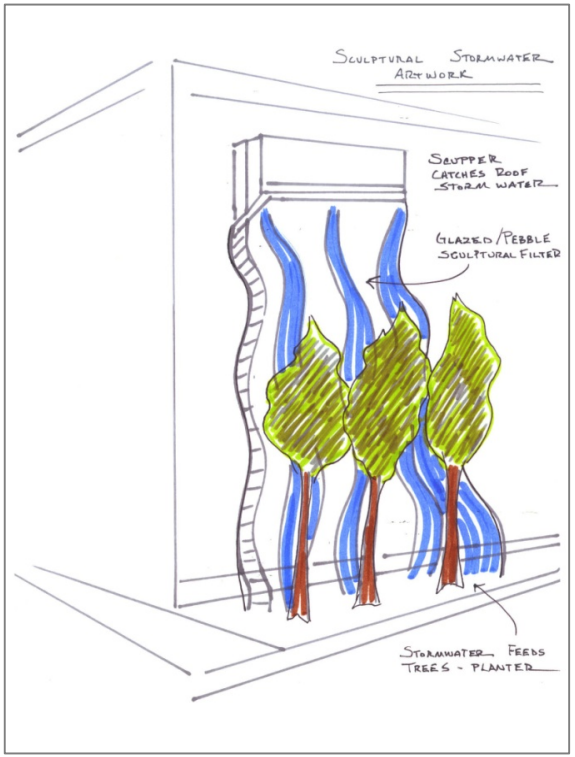
Interactive fountain feature

» *Noguchi Fountain, Hart Plaza, Detroit, MI. Source: blog.modernica.net*

FIGURE 20 Bus Barn Public Art Precedents



Tree trench bike walk corridor



Green Alley Sculpture

Stormwater Sculpture

FIGURE 21 Bus Barn Public Art Concepts

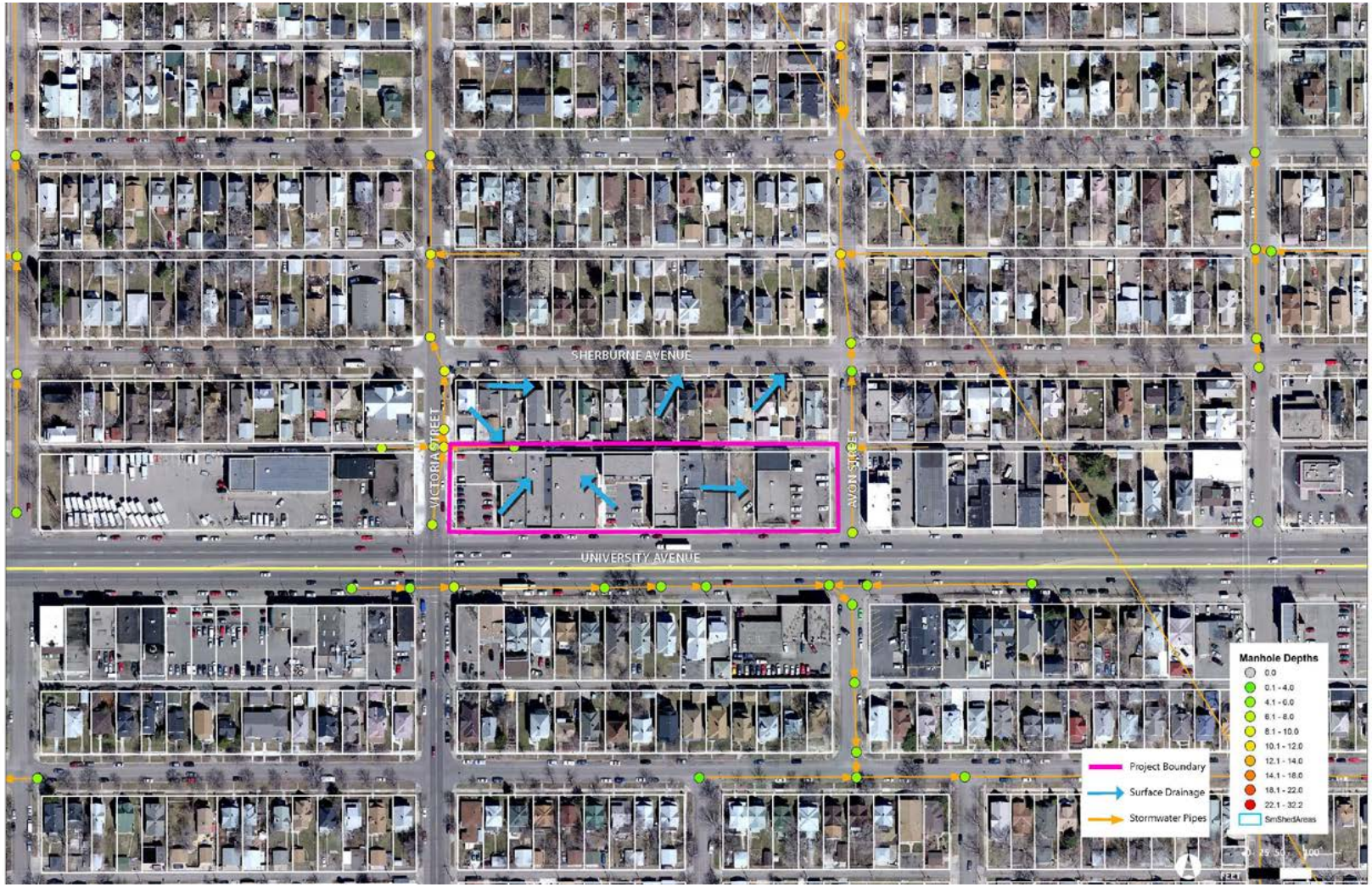
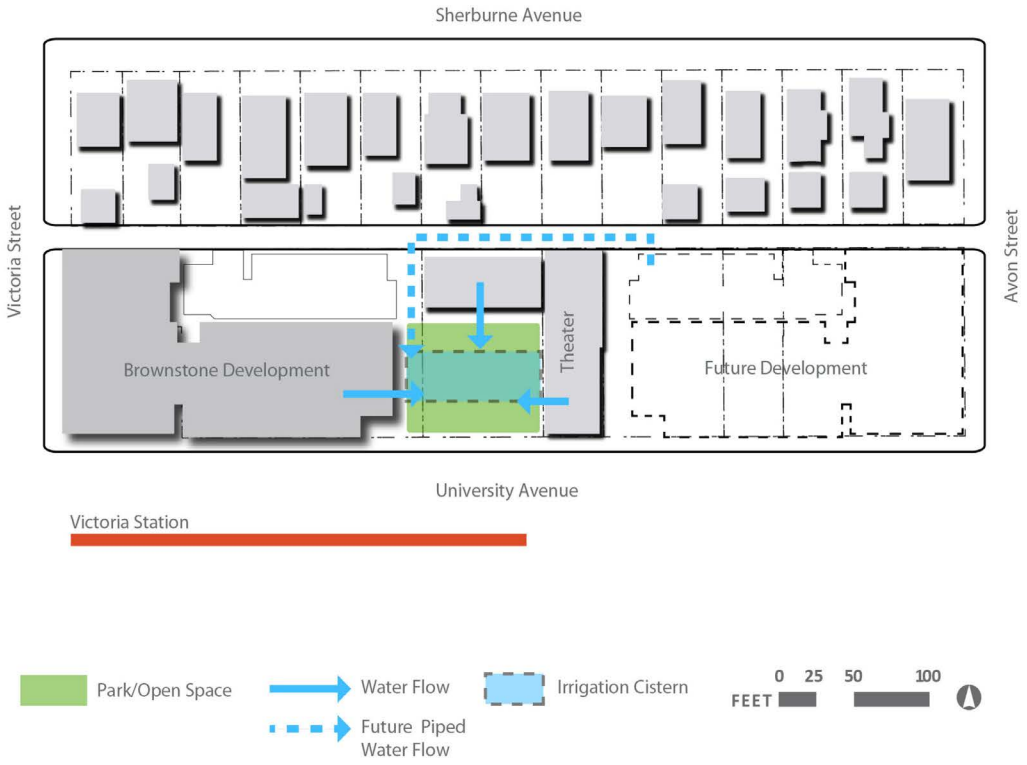
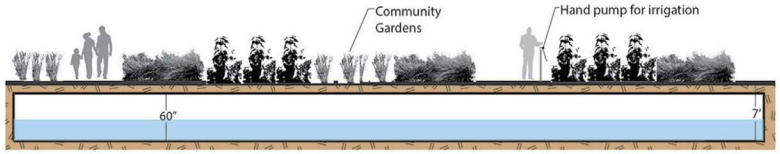


FIGURE 22 Brownstone Site Drainage Area





Irrigation Cistern Section (view looking east)

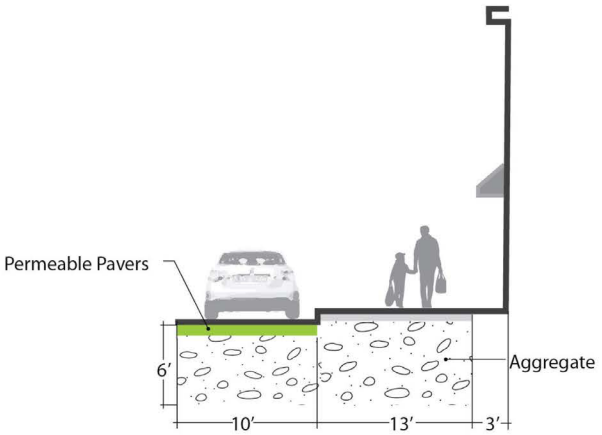
Key Design Points:

- Provides only private stormwater treatment
- Open space treats water from three adjacent buildings
- Open space would serve as a community garden and would be irrigated by an underground cistern
- Water from the future development site would need to be routed into the alley in order to share stormwater BMP

Design Assumptions:

- Cistern for garden irrigation = 88.5' x 36'
- Cistern is composed of solid 60" CMP
- Necessary rate control volume = 9350 cu. ft.
- Necessary retention volume = 6850
- Total storage volume achieved = 10,750 cu. ft.

FIGURE 23 Brownstone Open Space Concept



Permeable Parking Bays Section

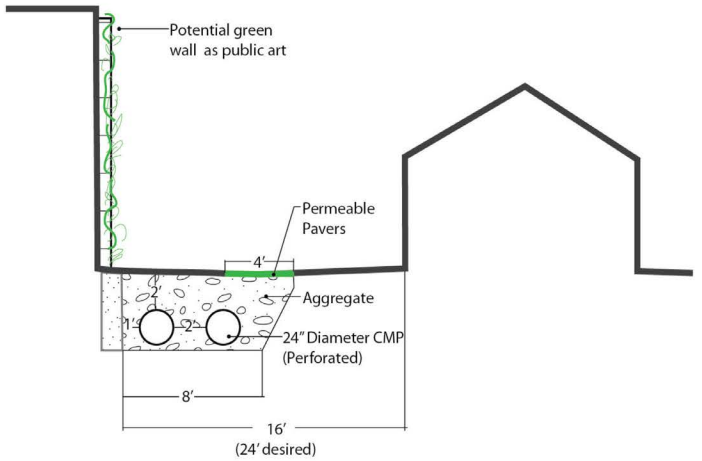
Key Design Points:

- Provides public & private stormwater treatment
- Parking bays and raingardens would be located in the public R/W
- Raingardens would be located in bumpouts

Design Assumptions:

- Takes in water from sidewalk and portions of Avon and Victoria Streets
- Bumpouts are 10' wide x 20' long and 2' deep
- Parking bays are 10' wide and 6' deep
- Additional aggregate storage extends 13' under the sidewalk and has 35% void space
- Necessary rate control volume = 10450 cu. ft. (includes storage for public r/w)
- Necessary retention volume = 7700 cu. ft. (includes storage for public r/w)
- Total storage volume achieved = 10,650 cu. ft.

FIGURE 24 Brownstone Site Street R/W Concept



Green Alley Section

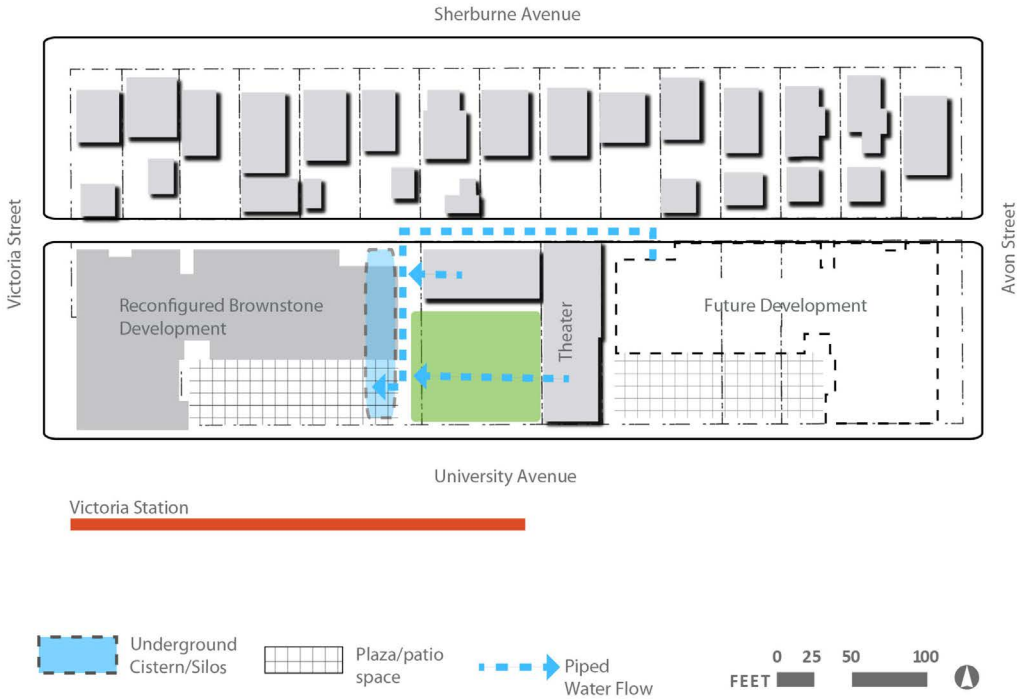
Key Design Points:

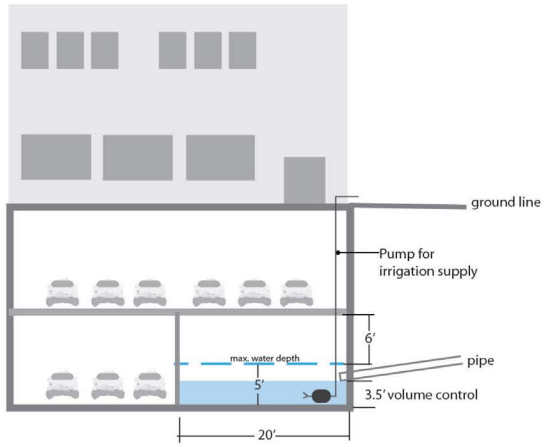
- Provides public & private stormwater treatment
- Green alley treats both new development and adjacent residential that currently drains to alley
- Alley enlarged to the extent possible
- Permeable pavers allow infiltration of surface runoff

Design Assumptions:

- Aggregate is 35% void space
- Green wall is not included in storage calculations
- Necessary rate control volume = 9350 cu. ft.
- Necessary retention volume = 6850 cu. ft.
- Total storage volume achieved = 9900 cu. ft.

FIGURE 25 Brownstone Green Alley Concept





Underground Parking Cistern Section

Key Design Points:

- Provides only private stormwater treatment
- Proposed Brownstone development would be reconfigured to house additional level of underground parking (replace surface parking stalls)
- Parking could be shared between Brownstone and the future development site
- Building reconfiguration allows for plaza/patio space facing the street
- Stormwater would be used to irrigate landscaped areas throughout the site to meet volume retention requirements

Design Assumptions:

- 112' x 18' concrete vault would be integrated into parking structure
- Freeboard = 3' from bottom of beam to max. water level
- Necessary rate control volume = 9350 cu. ft.
- Necessary retention volume = 6850 cu. ft.
- Total storage volume achieved = 9600 cu. ft. (at 5' depth)

FIGURE 26 Brownstone Site Structured Parking Concept

Urban Community Gardening
» *Glendale Townhome Community Gardens. Photo: makingbettermn.org*

Small Green Stormwater Art
» *Malmo, Sweden Photo: Joni Giese*

Green Wall for Alley
» *Source: greenmuseum.org*

FIGURE 27 Brownstone Public Art Precedents

Project wide

- Volume Control Criteria = 1.3 in. rainfall due to urban soils throughout both sites. Filtration requires an extra 30%.
- Water Quality Criteria based on 2.5 inches of rainfall.
- Rate Control Criteria based on 1.64 cfs/acre of drainage area.
- All soils are classified as urban. C soils were used with initial abstractions of 0.2.
- All costs are in 2012 values, with the exception of costs based on MnDOT average bid prices (2011). Estimated annual interest = 4%.
- Costs of pavers are incremental cost above standard concrete or bituminous pavement.
- Permeable pavers include 15" of aggregate.
- Pipe galleries are jetted out every 5 years.
- Installation of pipe gallery is 60% of material cost.
- Costs do not include any engineering or contingency.
- Costs do not include land.
- Replacement cost= Capital cost unless otherwise noted.
- Life Cycle period of 100 years is used to account for differing maintenance schedules and lifespans.
- Normalized whole life cycle unit costs are based on the storage volume achieved, unless otherwise noted.
- The green roof cost was the incremental cost above a standard roof cost

Bus Barn	Brownstone
General • Parks are assumed to have 30% unconnected impervious. • Nonresidential parcels assumed to be high density development with 95% impervious cover. • NE parcel assumed to be multi-family residential development with land use ratios based on Wacouta Commons: Landscaping= 13%, Roof= 64%.	**General** • Land use ratios for the development E. of theater are based on Wacouta Commons: Landscaping= 13%, Roof= 64%. Assumes one assembled development parcel. • The alley is the only ROW contributing runoff to the site.
Open Space – Wet Pond/Bioretention • Stormwater from all parcels will be routed to NE Park. • Rate Control will be handled by overflow outlet control structure. • Wet pond capital cost: $2/cu ft Water Quality Volume (WQV) (Barr).	**Open Space – Pipe Gallery** • One header used to reduce costs. • Capital costs based on previous bids (recent bid tabs). • Solid Wall Underground Pipe O&M: $1.26/cu ft WQV (Barr), Lifespan: 60 years (Contech).

Bus Barn	Brownstone
Open Space – Wet Pond/Bioretention (cont.) • Bioretention capital cost: $14/cu ft WQV (2011 Barr Study- modified). • Bioretention Annual O&M: $0.64/sq ft, Lifespan: 10 years (both averages of WERF and NGVC). • Wet Pond Annual O&M: 4.5% of capital cost (average of Barr and Weiss), Lifespan: 25 years, Dredging Cost: 85% of capital cost. • Normalized unit cost based on rate control volume.	**Open Space – Pipe Gallery (cont.)** • Assumes 1 grit chamber.
Street ROW - Tree Trenches • CU soil would be used in tree area (8' wide x 5' deep), aggregate (6' wide x 5' deep). would provide storage under sidewalks. • CU soil capital cost: $87.13/CY (St. Paul recent RSVP project). • Permeable pavers capital cost: $15/sq ft (SRF recent projects), paver cost is incremental cost above standard concrete walk and grates: $9.25/sq ft for single trench, $8.25/sq ft for double trench. • Tree Trench Annual O&M: $0.50/sq ft (Lancaster, PA), Lifespan: 40 years (NGVC). • Tree Trench Pavers Annual O&M: $0.049/sq ft (WERF and NGVC avg), Lifespan: 20 years (NGVC, altered to fit with tree trench replacement timeline).	**Street ROW – Bioretention Bump-outs/ Parking Bays** • Runoff from Victoria and Avon is added to ROW runoff. • Permeable pavers capital cost: $15/sq ft (SRF recent projects), paver cost is incremental cost above standard asphalt pavement: $13.12/sq ft. • Bump-out capital cost: $69.00/ cu ft (includes walls). • Pavers Annual O&M: $0.049/sq ft (WERF and NGVC avg) , Lifespan: 25 years (NGVC). • Bioretention Annual O&M: $0.71/sq ft (includes bump-out walls), Lifespan: 10 years (both averages of WERF and NGVC).
Green Alleys • Alleys have headers at both ends to allow for storm sewer connection flexibility. • Cost of concrete adjacent to pavers is not included in cost estimate. • St. Paul standard plates for CBs are at least 3' deep. Pipe inverts from CBs must be at least 3' below surface. • Permeable pavers capital cost: $15/sq ft (SRF LA Dept.), Paver cost is incremental cost above standard concrete pavement: $9.21/sq ft. • Green Alley Pavers Annual O&M: $0.049/sq ft (NGVC), Lifespan: 30 years (NGVC adjusted to fit with piping replacement schedule). • Perforated Underground Pipe O&M: $1.26/cu ft WQV(Barr), Lifespan: 60 years (Contech).	

FIGURE 28 Bus Barn and Brownstone Sites Life Cycle Cost Assumptions

Bus Barn	Brownstone
Structured Parking • A 6" DIP reuse system will be included for irrigation purposes. • Water in vaults will be available for gray water reuse. • Assumes 3 grit chambers as pretreatment for storm drain systems.	**Structured Parking** • Excavation would occur anyway for parking, but possibly not as much or in that shape, included in cost. • Irrigation system not included, would be installed anyway. • Assumes 1 grit chamber.
• Provides 3' of freeboard between max. water height and bottom of 3' T-beam. • Vaults hold irrigation supply. • Capital costs for walls, floor slab, and excavation from recent projects. • Concrete Vault Annual O&M: 2% of capital cost, Lifespan: 50 years. • Cost includes excavation, but assumes vaults are above water table and bedrock. • Cost does not include foundation. • Irrigation uses will not meet volume control requirements based on 1”/sq ft/ week over assumed landscaped areas.	
Individual • 70% of rooftop is green roof. • Extensive green roof provides minimal retention volume, but reduces rate and volume control requirements. • Green roof requires other rate and volume control storage; underground pipe galleries added. Assumes adequate space to construct a system with the necessary size. • Green roof cost includes membrane and modular extensive system. • Green roof capital cost= $11.37/sq ft (NGVC) • Green Roof Annual O&M: $0.31/sq ft (WERF), Lifespan: 25 years (NGVC). • Pipe gallery capital costs based on previous bids (SRF). • Pipe Gallery Annual O&M: $1.26/cu ft WQV (Barr), Lifespan: 60 years (Contech). • Pavers Annual O&M: $0.049/sq ft (WERF and NGVC avg), Lifespan: 25 years (NGVC).	

FIGURE 28 Bus Barn and Brownstone Sites Life Cycle Cost Assumptions, cont.

SRF Consulting Group, Inc. | Engineers Planners Designers

SRF No. 7687.00170

MEMORANDUM

TO: Wes Saunders-Pearce
Water Resource Coordinator, City of Saint Paul

FROM: David Filipiak, P.E., SRF Consulting Group, Inc.
Joni Giese, ASLA, AICP, SRF Consulting Group, Inc.

DATE: December 23, 2013

SUBJECT: Advanced Design Concepts For Shared, Stacked-Function, Green Infrastructure

Referenced Memorandums

- Technical Memorandum: Existing Stormwater Rules and Regulations
- White Paper: Shared, Stacked-Function Green Infrastructure Policy Investigation
- White Paper: FLUXion ≈ gARTens
- Technical Memorandum: Analysis and Evaluation For Shared, Stacked-Function, Green Infrastructure

Introduction

Based on the findings from the investigation of different development scales, it was deemed appropriate to continue investigating the four potential shared, stack-function green infrastructure (SSGI) approaches and to further test two of the SSGI approaches on potential development sites along the corridor. One of the sites, referred to as the Boeser Site, was selected to test the street right-of-way SSGI approach. The second site, Curfew Commons Park, was selected to test the park/open space SSGI approach. Concepts developed for these sites were based on their actual location and site conditions, but were theoretical in nature and do not imply that development reflecting the concept will ultimately occur.

For the following two sites, or any other potential site to be considered, a thorough engineering feasibility study is absolutely critical to ensure constructability, refine estimates of probable cost, and provide adequate specificity to inform final design. The discussion that follows provides the site context and analysis, design concepts, and findings for the two advance design sites.

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Boeser Site

Project Context

The Boeser Site is located near the Prospect Park/29th Avenue Green Line station in Minneapolis and is generally bounded by University Avenue on the south, 29th Avenue SE on the west, the University of Minnesota transitway on the north and 30th Avenue SE on the east. A local developer is pursuing the redevelopment of an obsolete industrial site into a multi-family apartment building. The City of Minneapolis is planning a phased reconstruction of 4th Street between 23rd Avenue SE to Malcolm Avenue SE.

The concept explored for the study was based on the premise that runoff from the Boeser Site, 4th Street, and the site south of 4th Street could be managed in the 4th Street right-of-way. The SSGI concept developed for purposes of this study, though based on the actual location and site conditions, is theoretical and does not imply that the City of Minneapolis will ultimately approve any or all of the concept elements.

Project Background and Analysis

Previous Studies

The development program for the Boeser Site SSGI concept was based on the following studies:

- Green Fourth - Building a Great Neighborhood Street, Cuningham Group and Prospect Park 2020 (2013)
- University District Alliance Urban Design Framework Phase II: Using Greenways and Green Infrastructure as a Vital Design Strategy to Achieve Sustainable Communities, Metropolitan Design Center, University of Minnesota, College of Design (August, 2012)
- Boeser Property, The Cornerstone Group and Close Associates Inc. Architects (January 29, 2013)
- Boeser Site Stormwater Feasibility Study, MWMO and Barr Engineering (May 8, 2013)

Drainage Concept

The stormwater design concept includes the treatment of the entire Boeser parcel, 4th Street between 29th Avenue SE and 30th Avenue SE and approximately 75 percent of the block south of 4th Street based on available topographic mapping. The division of treatment volume is roughly 83 percent private development and 17 percent public street right-of-way (see Figure 1).

Regulatory Requirements

The primary stormwater requirements are found in Chapter 54 of the City of Minneapolis's Code of Ordinances, which requires 70 percent TSS removal from the runoff generated by the site from a 1.25-inch rainfall. This removal rate for a single event storm equates to 80 percent removal when analyzing average annual storm data.

In addition, the rate of runoff from the site needs to be limited to the existing conditions for the 2-, 10-, and 100-year, 24-hour Type II storm event.

The Boeser Site Stormwater Feasibility Study (Barr, 2013) computed the treatment volume required to achieve higher levels of treatment by maximizing the area of the treatment BMP. While not required of a new development, the study looked to increase the treatment while balancing out the shared functions of the street system.

Design Assumptions

The concept developed was based on the following assumptions and do not imply any have received approval by the City of Minneapolis or private utilities:

- According to the Boeser Site Stormwater Feasibility Study (Barr, 2013), the Boeser parcel will result in 79.1 percent impervious cover. This impervious percentage was also applied to the block south of 4th Street.
- The site south of 4th Street will also have comparable residential development density as the Boeser parcel.
- Water volume requirements are to meet or exceed the 70 percent total suspended solids (TSS) Minneapolis removal requirements as computed in the Boeser Site Stormwater Feasibility Study (Barr, 2013).
- Bioretention basins would provide space for active storage to achieve some level of rate control, but because the site and roadway reduce impervious surfaces from existing conditions, it was assumed (but not verified) that rate control would not be required.
- The presence of contaminated soils in this area will not allow infiltration, as such, the systems are designed as filtration facilities.
- 4th Street is a Municipal State Aid (MSA) Street and will comply with the following MSA street design standards based on a projected ADT <10,000.
    - 11-foot travel lanes
    - 8-foot. parking lanes
    - 2-foot. curb reaction area if no parking lane
    - 300-foot. horizontal road radius
- Existing sanitary sewer (southern side of the right-of-way) and watermain will need to be accommodated. New storm sewer will likely be necessary.
- Private utilities will be housed in a vault system under the sidewalk areas.

Boeser Site Design SSGI Concept

The Boeser Site concept envisions a high amenity street that accommodates pedestrians, bicycles and cars (see Figures 2 and 3). The road could function as a convertible street incorporating different paving patterns that extend between the street and sidewalks to visually connect the space as a whole.

A designated bikeway is not shown as the University of Minnesota Transitway that includes a multi-use trail is located one block north of the project area. Low projected traffic volumes will allow bicyclists to share the road with cars. If a serpentine alignment of 4th Street were possible, it could allow for the creation of larger outdoor gathering areas and stacked-function bioretention basins within the street right-of-way.

The walkway weaves through deep and shallow rain gardens creating a wide variety of spaces for gathering. The bioretention basins not only manage stormwater, but also define and enhance user comfort of the outdoor gathering spaces by providing greenery and shade. Seat walls connected to the deep bioretention basins provide an element of pedestrian safety while also creating flexible spaces for resting.

Stormwater runoff from the private development rooftops is directed to the bioretention basins either through raised planters, then conveyed under the public sidewalk. (In the winter, stormwater runoff from the rooftops could bypass directly into the storm drain system to minimize the risk of freezing runoff impacting the sidewalk.) Water from the road could also enter the deep bioretention basins through curb cuts or modified catch basins. There would be 18-inches of storage above the soil in the deep bioretention basins. Shallow bioretention basins would also filter water from the sidewalks. Any overflow will be directed into a storm drain system within the street right-of-way.

Public art concepts for the Boeser Site focus on creating a sensory experience, a place for celebrating and interacting with water. Water is taken from the rooftops interacts with a kinetic sculpture, creating sound and reflecting light. (see Figure 4).

Estimated Capital and Operations & Maintenance Costs

Although a theoretical exercise, to foster an initial discussion an estimate of probable construction and Operations & Maintenance (O&M) costs were assembled including all of the elements needed to achieve the stormwater goals. Earthwork needed to install engineered soils, drain tile, outfalls, etc. were included in the estimate. The preparation of estimated capital costs for the SSGI concept was based on recent construction bids. Additional assumptions used to develop of the estimated costs can be found in Figure 5. The City of Minneapolis prepared comments regarding the cost estimates prepared for the Boeser Site and can be found as an attachment to this memorandum.

An estimated capital cost of $112,000 was developed for the Boeser Site SSGI concept (see Table 1). As a point of comparison, estimated capital costs of $246,000 was developed assuming that stormwater facilities would be developed on an individual parcel basis. The individual basis concepts and costs were taken from the Boeser Site Stormwater Feasibility Study (Barr, 2013), where stormwater was managed in bioretention basins located above structured parking.

As a point of investigation to see how cost recovery might function, the Boeser Site SSGI estimated costs were allocated between the contributing private and public parcels based on the volume of runoff contributed to the system, which resulted in $93,000 of the estimated SSGI costs allocated to the private parcels and $19,000 of the estimated SSGI costs allocated to the public right-of-way (see Table 1). As bioretention basins are assumed to be used in both the individual and SSGI scenarios, no O&M cost differential is anticipated between the individual and SSGI approaches (see Table 2).

Table 1: Boeser Site Estimated Capital Cost Allocation

Runoff Source	Individual Basis	Shared	Difference	Percent Change
Private (A) Future Residential	$231,000	$93,000	$138,000	60%
Public (B) 4th Street R/W	$15,000	$19,000	($4,000)	(27%)
Total	**$246,000**	**$112,000**	**$134,000**	**54%**

Table 2: Boeser Site Estimated O&M Cost Allocation

Runoff Source	Individual	Shared	Difference
Private (A) Future Residential	$2,924	$2,924	$0
Public (B) 4th Street R/W	$602	$602	$0
Total	**$3,526**	**$3,526**	**$0**

Findings and Triple Bottom Line Benefits

Key findings and triple bottom line benefits associated with the Boeser Site SSGI concept include:

Economic: A comparison of the individual basis estimated costs to conceptual SSGI estimated costs indicated that SSGI results in net capital cost efficiencies overall. Much of the savings resulted from relocating bioretention basins from over the structured parking to the street right-of-way, thereby eliminating flood control/lining costs associated with the underground parking in the private developments.

However, a cost recovery analysis revealed complexities, particularly when allocating costs based on contributing runoff volume (or impervious surface). Using this cost allocation approach, the developer realized a disproportionate amount of savings relative to the City in the shared system, resulting in inequity. This allocation method is one possibility; there may be other suitable allocation methods, depending on how SSGI is approached. Therefore, careful consideration must be given when determining funding sources and developing cost recovery approaches for SSGI to ensure a balanced distribution of costs and benefits.

Full consensus was not achieved regarding the site analysis and outputs. The SSGI concept of addressing redevelopment stormwater management responsibilities in the public right-of-way as a shared system needs additional study to fully consider all the possible alternatives and costs. While this study begins that assessment, consideration of how SSGI impacts overall project costs and benefits will vary project to project and may include costs not considered here; such as, opportunity costs of stormwater management site elements versus density or placement of utilities, or the equitable distribution of ongoing operation and

maintenance responsibilities and costs among public and private participants, or the impact on stormwater utility fees and credits.

Environmental: The bioretention filtration systems shown in the concepts provide the volume required to meet the current requirements. Additional treatment could be achieved in the same footprint if additional retaining walls were added, particularly to the shallow basins, at an additional cost.

Beyond the environmental benefits of stormwater management, the bioretention basins and new street trees irrigated with harvested stormwater provide numerous environmental benefits, such as habitat creation, urban heat island mitigation, and air quality improvements.

Social: The provision of stormwater supported vegetation in the street right-of-way improves livability by creating comfortable outdoor environments for walking and recreating. Increasing street activity strengthens the social fabric of the city and improves safety.

Curfew Commons Park

Project Context

Curfew Commons Park is located approximately two blocks south of the Green Line Westgate Station in Saint Paul. The site is currently comprised of industrial and commercial uses. The City's plans call for this area to transition to residential, office and parkland uses. With the recent development of multi-family residential adjacent to the site and anticipated new residential development, this area will be underserved by parkland.

Project Background and Analysis

Previous Studies

The development program used the Curfew Commons Site SSGI concept was informed by the following studies:

- Westgate Station Area Master Plan, Central Corridor Design Center
- Curfew Commons: Potential Park Configurations, City of Saint Paul, Department of Parks and Recreation (December, 2012)

Contributing Subwatershed Analysis

Surface drainage to the site is generally from the north, as the topography generally falls from the north/northwest to the south east. (Figure 6). The area north of the site is relatively flat, with the existing subwatersheds served by a storm sewer system that crosses the proposed park site roughly 12 feet below the surface (see Figure 6). Due to the depth of the storm sewer it was determined that the contributing subwatershed available for treatment within the site would be limited to the surface drainage in the blocks adjacent to the park and not all areas served by the storm sewer, resulting in a total drainage area of 23 acres that can be directed to the park. While the existing storm sewer is too deep for stormwater harvesting from the pipeshed, it does provide a fair amount of vertical flexibility for the new systems.

The park concept is based on the premise that stormwater runoff from the future adjacent multi-family redevelopment site and from the new streets is directed to the new park. Due to

topographic constraints, runoff from the proposed office redevelopment site east of the park cannot be accommodated in the design without significant excavation.

Existing residential lots facing Curfew Street between the site and Franklin Avenue that do not currently receive stormwater treatment are likely to remain. Stormwater runoff from this street can be easily intercepted and treated in the park.

Regulatory Requirements

Stormwater requirements for water quality, runoff volume control, and runoff rate control are found in the Capitol Region Watershed District (CRWD) rules and City of Saint Paul ordinances respectively. Water quality and runoff volume control are required when a site disturbs one acre or more. The CRWD rules require 90 percent TSS removal for the runoff generated by a 2.5-inch rainfall. With regards to runoff volume control, sites disturbing more than one acre are required to infiltrate runoff from a 1-inch rainfall (0.9 inches) from impervious surfaces, with a 30 percent increase in volume for filtration-type devices. BMP's that meet the volume control requirements typically meet the water quality requirements.

The City of Saint Paul also requires runoff from sites disturbing greater than 0.25 acres to discharge from their site at no more than 1.64 cfs/acre for all storm events.

The stormwater volume required to meet the CRWD regulations for each of the contributing land uses is shown in Figure 7. The existing residential area draining to Curfew Street is been tabulated separately, as this area could be kept separate from the new park via the existing trunk storm sewer.

Design Assumptions

The concept developed was based on the following assumptions:

- The design is based on previous park configuration studies prepared by the Saint Paul Parks and Recreation Department. The concept park size (4.9 acres) and shape was influenced by a number of factors, including street connectivity, parcel configurations, and estimated future population. In particular, the park was configured to allow for two-phased implementation that correlates to underlying parcel ownership and configurations (see Figure 8).
- The concept assumes the City's acquisition of land for the park with the construction of new streets that bound three sides of the park. All of the new streets are configured in accordance with City of Saint Paul standards for residential streets (66-foot right-of-way, 30-foot pavement section for two=-way travel and parking on both sides of the street) with intersections spaced at a minimum of 75 feet.
- The concept also assumes that the development of new multi-family housing on the west side of the park and office uses on the east side of the park. Redevelopment is assumed to occur at a similar density as the multifamily housing north of Franklin Avenue (95 percent impervious).
- Based on soil borings for an adjacent road project it is believed that the underlying soils are clay/clay loams, and as such, volume reduction requirements would be met using a filtration system approach.
- The north-south street runoff would be conveyed within the street section and then enter a shallow storm sewer at the intersections adjacent to the park. Storms pipes then outfall into the park bioretention basins.

Design Charrette

A design charrette was conducted with a portion of the SAC to brainstorm how stormwater features could be integrated into potential park programming. From this exercise two concepts were developed. The first concept envisioned the creation of interactive water features using harvested stormwater within the park (Figure 9). The second concept envisioned a more passive stormwater system where vegetated filtration basins surround and contribute irrigation water to a great lawn (Figure 10). The first concept may be appropriate for a high visibility park located directly on University Avenue where high park usage would be expected. Treating the harvested water to a potable standard, as assumed in the first concept, is anticipated to be more expensive to construct and operate than a more passive system. The second concept takes a more traditional vegetated filtration basin approach that may be more appropriate for proposed new parks located a block or two off of University Avenue. The primary function of these parks is to provide recreational space for new corridor residents. This concept assumes that park users will not interact with the harvested water, with standing water filtrating through the soil no longer than 48 hours after a rain event. It was decided to move forward with the passive system approach for the advance design site, as it would be replicable for more of the proposed new parks along the corridor.

Curfew Commons SSGI Concept

Design Goals

There are a number of overarching design goals that influenced the concept development for the Curfew Commons site:

- Celebrate the presence and movement of water in the park.
- Create a design that could be replicable for other future parks along the corridor with moderate construction and O&M costs.
- Create a design that is flexible enough to respond to variable programming needs as the surrounding land redevelops.

SSGI Concept Description

The concept depicts stormwater management within the park taking the form of filtration basins (see Figures 11-14). Figure 15 depicts the various subwatersheds that are treated within the park. The stormwater system as shown meets or exceeds the regulatory requirements for volume control, which with the filtration mechanisms will meet the water quality goals as well.

The basins are designed to provide quiet passive park uses when they are dry, which is a majority of the time, and surround a great lawn. A filtration basin located in the NW corner of the park is comprised of three terraces, separated by ornamental weirs that can be used as seat walls when the basin is dry. If water fills up the first terrace, it will spill through a slot in the weir to the adjacent terrace in the basin (see Figures 13 and 14).

Three micro graded filtration basins are located in the SW, North, and SE portions of the park. The micro grading is part of an art piece that responds to the volume of stormwater in the basin. Fluctuating water levels associated with various rainfall events will make the basins appear to change shape. The micro grading and associated varying intensities of flooding in the basins will also influence vegetation varieties and patterns within the basins, thereby producing a variety of hydrologic regimes and varied habitat.

Water that filters through the filtration basins is piped into the underground irrigation system of the great lawn, and only when it is full will the system discharge to the trunk storm sewer. The underground irrigation system is an integral part of the system, in that the volume stored in the underground soil media is counted in meeting the CRWD volume control measures. It typically consists of a sandy soil media over an impermeable liner, interconnected with a piping system that distributes water throughout the lawn. An overflow is built into the pipe system to ensure the correct amount of water is stored for the plant system.

This overall drainage system will also meet the City's rate control requirement through temporary storage in the filtration basins and for larger events, in the great lawn. Based on historic rainfall data, the filtration basins will overflow onto the great lawn only once a month during the summer when heavier rains typically occur. The great lawn will contain a highly permeable soil media that will absorb most minor overflow events, and an overflow inlet is incorporated at the southeast corner of the lawn for extreme storm events. Figures 16 and 17 illustrate the surface water expected for various storm events. All vegetated surfaces are expected to be dry within 48 hours of a storm event.

The following describes other park design elements:

- A playground area is located in the SW corner to serve future residential anticipated to be located immediately west of the park.
- A plaza and pavilion located in the NE corner will serve future office/retail uses by providing space for markets, kiosks, food trucks, and outdoor dining.
- A wooded hill located in the SE corner of the park would serve as a buffer from the highway and provide a backdrop to great lawn events.

Public Art Integration

The intent of the FLUXion ≈ gARTens concept for Curfew Commons was to delight, educate and reinforce the triple bottom line benefits provided by SSGI. Proposed artworks for the park include:

- Park plantings that recall pre-European settlement plantings (most likely Oak Savanna habitat). Native materials will help interpret and educate about the natural landscape and create a connection to the Mississippi River (see Figure 18).
- Terraced retaining walls, seating elements, and/or spillways incorporate public art and are designed to enliven and animate water.
- Playground area located in the SW corner would be integrated into the larger concept of the park to celebrate water and teach children about different ecosystems.
- Micro graded basins highlight runoff volumes resulting from varying rainfall events.

Water Budget

The design of Curfew Commons provides a benefit beyond standard volume reduction measures, as plants in the vegetated spaces and great lawn will uptake stormwater, thereby reducing discharges into the storm sewer system, and ultimately to the Mississippi River. As shown in Tables 3 and 4, for an average year, 12 percent of the runoff would be reused as passive irrigation water for the great lawn. For an average dry year, 40 percent of runoff would be reused as irrigation.

Table 3: Water Budget for an Average Year (2006)

Annual Precipitation-April-October (in)	21.48
Total Runoff (cu.ft.)	789,529
Runoff Reused (cu.ft.)	91,259
Percentage Reused (%)	12 %

Table 4: Water Budget for a Dry Year (1976)

Annual Precipitation (in)	11.54
Total Runoff (cu.ft.)	255,188
Runoff Reused (cu.ft.)	101,715
Percentage Reused (%)	40 %

Estimated Capital and Operations & Maintenance Costs

Several estimates of probable construction and O&M costs were assembled examining various shared BMPs within the park to estimated construction and O&M costs assuming stormwater is treated on an individual parcel basis. The estimated costs included all of the elements needed to achieve the stormwater goals. Earthwork needed to install engineered soils, drain tile, outfalls, etc. were included in the estimate. Land costs and mass grading for the site were not included as the costs are extremely variable depending on if the park is part of a larger development or not. Additional assumptions used to develop of the estimated costs can be found in Figure 19.

Shared BMP Alternatives

This exercise compared estimated construction and O&M costs of the shared scenarios included:

- Shared gray infrastructure
- Shared green infrastructure with pervious pavers in the street parking bays adjacent to the park
- Shared green infrastructure without pervious pavers

As shown in Tables 5 - 8, compared to the individual basis, all of the shared infrastructure alternatives showed lower construction costs. The analysis also indicated that the O&M costs for green infrastructure are higher than O&M costs for gray infrastructure.

Table 5: Individual Cost Basis

Runoff Source	Capital Cost	Percent	Annualized O & M Cost	Percent	BMP Strategy
Streets	$214,740	33%	$5,450	29%	Perforated pipe gallery with filtration
Park	10,340	2%	1,400	7%	Rain garden/filtration
New Development	325,540	51%	9,530	50%	Perforated pipe gallery with filtration
Existing Residential	92,323	14%	2,540	14%	Perforated pipe gallery with filtration
Total	**$642,940**	**100%**	**$18,920**	**100%**	

Table 6: Individual vs. Shared Gray Infrastructure

	Capital Cost	Annualized O&M Cost	BMP Strategy
Individual Basis	$642,940	$18,920	Individual Basis
Shared Gray Infrastructure	$577,960	$7,410	Underground filtration system (using Triton or similar system)
Savings	$64,980	$11,510	
Savings Percentage	10%	61%	

Table 7: Individual vs. Shared Green Infrastructure with Pervious Pavers in the Street Parking Bays

	Capital Cost	Annualized O&M Cost	BMP Strategy
Individual Basis	$642,940	$18,920	Individual Basis
Shared Green Infrastructure with Pavers	$591,030	$31,460	• Pavers/grit chambers for pretreatment • Filtration basins • Irrigation system under great lawn
Savings (Increase)	$51,910	($12,540)	
Savings (Increase) Percentage	8%	(66%)	

Table 8: Individual vs. Shared Green Infrastructure without Pervious Pavers

	Capital Cost	Annualized O&M Cost	BMP Strategy
Individual Basis	$642,940	$18,920	Individual Basis
Shared Green Infrastructure with Pavers	$508,340	$32,150	• Grit chambers for pretreatment • Filtration basins • Irrigation system under great lawn
Savings (Increase)	$134,600	($13,230)	
Savings (Increase) Percentage	21%	(70%)	

While the underground irrigation system benefits the great lawn, it is fairly expensive to construct. Therefore, another analysis was performed later in the project (see Tables 9 – 10) using refined estimated costs that better reflected costs associated with filtration basin excavation to examine the implications of removing the underground irrigation system.

Table 9: Individual vs. Shared Green Infrastructure with Underground Irrigation

	Capital Cost	Annualized O&M Cost	BMP Strategy
Individual Basis	$759,030	$8,060	Individual Basis
Shared Green Infrastructure with Underground Irrigation	$548,380	$25,160	• Grit chambers for pretreatment • Filtration basins • Irrigation system under great lawn
Savings (Increase)	$210,650	($17,100)	
Savings (Increase) Percentage	28%	(212%)	

Table 10: Individual vs. Shared Green Infrastructure without Underground Irrigation

	Capital Cost	Annualized O&M Cost	BMP Strategy
Individual Basis	$759,030	$8,060	Individual Basis
Shared Green Infrastructure w/o Underground Irrigation	$342,770	$25,160	• Grit chambers for pretreatment • Filtration basins
Savings (Increase)	$416,260	($17,100)	
Savings (Increase) Percentage	55%	(212%)	

Treatment of Existing Residential on Curfew Street

The Curfew Commons design exercise revealed that SSGI opened the opportunity to provide stormwater treatment for parcels that are not likely to redevelop in the near future in a cost efficient manner. Figure 7 depicts the subwatersheds that can be harvested and treated in the park. The area denoted as Curfew Street/Contributing Residential (E) currently does not receive treatment and does not require treatment as it is not being redeveloped. Yet, it can easily be captured and cost efficiently treated in the park. The City can also let the water bypass the park and enter the storm sewer untreated, consistent with current conditions. Tables 11 and 12 compare the cost of treating this water with not treating it for the various BMP alternatives investigated above.

Table 11: Cost of Treating vs. Not Treating Curfew Street Residential

Alternative	With Curfew St /Residential	Without Curfew St/ Residential	Cost Change ($)	Percent Change
Gray Infrastructure	$691,892	$615,674	$76,218	11%
Green Infrastructure	$548,374	$495,882	$52,492	10%
Green Infrastructure w/o Underground Irrigation	$342,768	$293,482	$49,286	14%

Table 12: Cost/Cubic Foot of Treating vs. Not Treating Curfew Street Residential

Alternative	With Residential $/CF	Without Residential $/CF	Change $/CF
Gray Infrastructure	$9.66	$9.63	**$0.03**
Green Infrastructure	$7.66	$7.82	($0.16)
Green Infrastructure w/o Underground Irrigation	$4.79	$4.63	$0.16

As a point of investigation to see how cost recovery might function, the Curfew Commons SSGI estimated construction and O&M costs (including underground irrigation) were allocated between the contributing private and public parcels based on the volume of runoff contributed to the system, as shown in Tables 13 and 14.

Table 13: Curfew Commons Capital Cost Allocation

Runoff Source	Individual	Shared	Difference	Percent Change
Streets (A)	$247,000	$164,510	$82,490	33%
Park (B)	$13,600	$16,450	($2,850)	(21%)
New Development (C)	$390,900	$290,640	$100,260	26%
Existing Residential (D) & (E)	$107,500	$76,780	$30,720	29%
Total	**$759,000**	**$548,380**	**$210,620**	**28%**

Table 14: Curfew Commons O&M Cost Allocation

Runoff Source	Individual	Shared	Difference	Percent Change
Streets (A)	$2,180	$7,549	($5,369)	(246%)
Park (B)	$1,050	$755	$295	28%
New Development (C)	$3,811	$13,336	($9,525)	(250%)
Existing Residential (D) & (E)	$1,018	$3,523	($2,505)	(246%)
Total	**$8,059**	**$25,162**	**($17,103)**	**(212%)**

Findings and Triple Bottom Line Benefits

Key findings and triple bottom line benefits associated with the Curfew Commons SSGI concept include:

Economic: Similar to the Boeser Site, a comparison of the individual basis estimated costs to conceptual SSGI estimated costs indicated that SSGI results in net capital cost efficiencies overall. However, a cost recovery analysis that allocated costs based on contributing runoff volume (or impervious surface) indicated the developer receiving a disproportionate amount of savings relative to the city in the shared system, resulting in inequity.

The cost comparisons also indicated that O&M costs associated with green infrastructure exceed gray infrastructure O&M costs.

By taking stormwater into a park facility, the City obtains a capital and maintenance funding source that will help finance the shared, stacked-function portion of park construction and maintenance. For a majority of the time, the stormwater facility will be dry and will serve a

recreational use, yet the funds used to construct and maintain the facility are derived by its stormwater function.

While not empirically established through this study, discussions with the development community indicated that creation of new open spaces will make development parcels along the corridor more attractive to developers in comparison to other potential redevelopment parcels in the city that are not adjacent to open space. Developers prefer parcels adjacent to open spaces as they expect to receive higher returns on their investment through increased rents or unit sale prices. In turn, redevelopment of underperforming parcels increases the city's tax base.

Environmental: Beyond the environmental benefits of stormwater management, the vegetated filtration basins in the park will introduce new habitat to the urban core. The conversion of pavement to vegetated surfaces will also help mitigate the urban heat island effect.

Social: Using stormwater features to facilitate parkland development will provide needed open space amenities for an underserved area. The stormwater supported irrigation of the great lawn, enhances the visual appeal and turf health for an area that is anticipated to receive heavy use. This will heighten livability by providing a place for exercise and recreation.

Additional Considerations: The findings also indicated that runoff from smaller parcels currently not receiving treatment can be effectively included in SSGI projects.

Finally, the investigation and resulting SAC discussion of findings suggested that the strongest benefit derived from SSGI implementation may be the community enhancements and associated improved livability, as these are key redevelopment outcomes desired.

Attachment:
City of Minneapolis Water Resources Administrator Memorandum dated December 23, 2013

H:\Projects\7687_Correspondence\Memorandums\Advance Design\131223 CCSSGI Advance Design Memorandum.docx

Minneapolis
City of Lakes

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Steven A. Kotke, P.E.
City Engineer
Director

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Minneapolis MN 55415

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MEMORANDUM

DATE: December 23, 2013

TO: Wes Saunders-Pearce, Water Resource Coordinator, City of Saint Paul

FROM: Lois Eberhart, Water Resources Administrator, City of Minneapolis

SUBJECT: Boeser Site Analysis in SRF Consulting Group Memorandum No. 7687.00170, Appendix E [or Appendix E1] of the Report titled Strategic Stormwater Solutions for Transit-Oriented Development

Please include this Memorandum in the Report, and make reference to it from the SRF Memorandum cited above. Cities are regulated under the federal Clean Water Act, through Municipal Separate Storm Sewer System (MS4) Permits, to require development and redevelopment projects to reduce post-construction runoff and pollutant loading from project areas. This Study explored whether there are shared, stacked-function green infrastructure (SSGI) methods that can successfully substitute for meeting requirements on individual development and redevelopment properties.

Regarding the Boeser Site in Minneapolis, City of Minneapolis staff did not participate in the development of cost estimates for this study. While we recognize the creative and conceptual nature of this report, we note that many factors and costs of actual right-of-way reconstruction that incorporates green infrastructure components were left out of the cost analysis presented for this theoretical design concept. If they had been included, a considerably higher differential cost between the "individual basis" and the "shared" would have been the result.

Minneapolis is very mindful of cost-benefit in its selection of locations where green infrastructure is used in right-of-way projects, and considers the need based on many factors, including (but not limited to) the cost-benefit of pollutant load reductions, street flooding issues, aging infrastructure, spatial constraints, stormwater system capacity, and averting combined sewer overflow conditions. If a redevelopment proposal for the Boeser site or any other site were to include a request for special consideration of stormwater requirements, the request would be considered on a case-by-case basis.

Call 311 Minneapolis
City Information and Services

www.ci.minneapolis.mn.us
Affirmative Action Employer

FIGURE 1 Boeser Site Drainage Concept

FIGURE 2 Boeser Site Conceptual Design Plan View

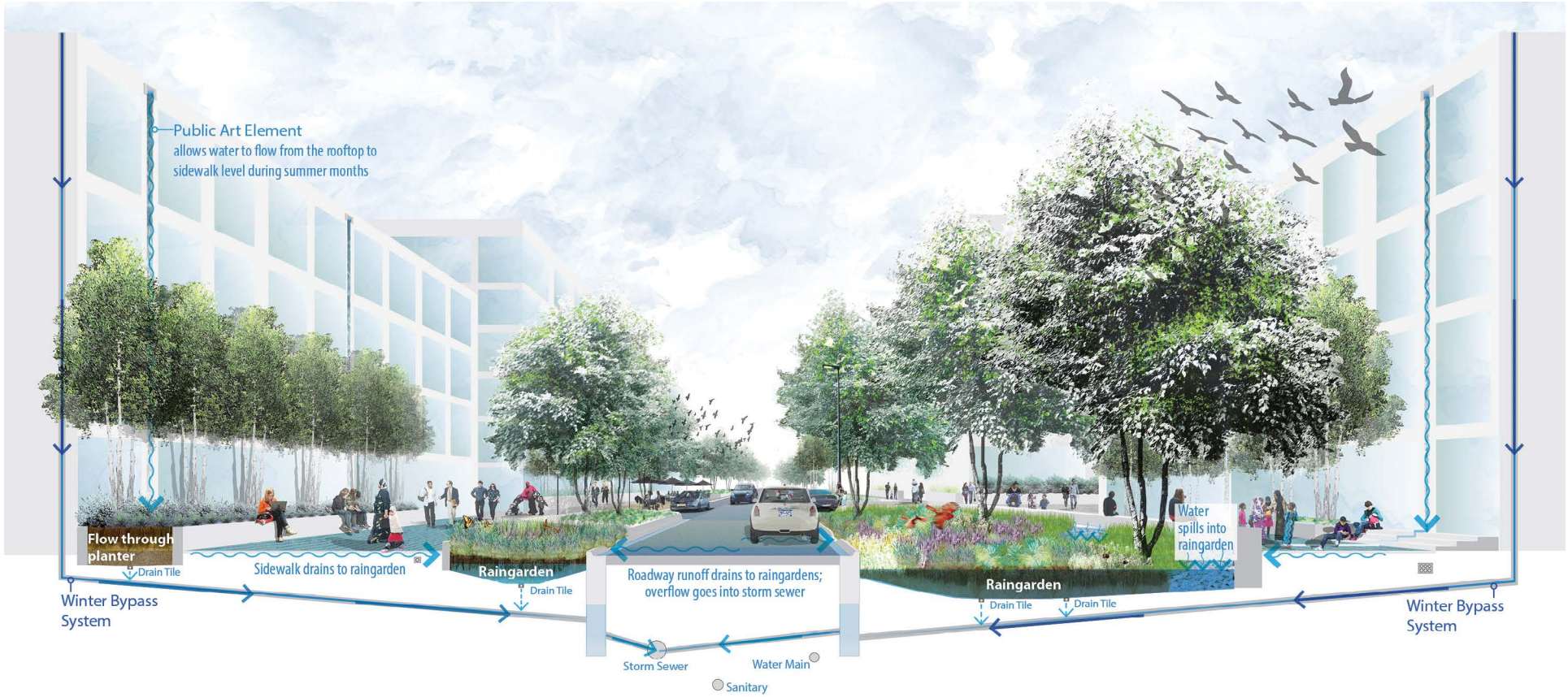


FIGURE 3 Boeser Site Conceptual Design Section Perspective- Stormwater Diagram

- *Top- Green Streets of Portland, Oregon. Land Perspectives, landperspectives.wordpress.com*
- *Middle- 'Water Brand' by Hartness Vision Photo: AECCafe-ArchShowcase Summit Singhai*
- *Bottom- Holalokka, Oslo, Norway. Atelier Dreiseitl.*

FIGURE 4 Boeser Site Conceptual Design Public Art Concepts

Project wide

- Volume Control Criteria = As defined in the Boeser Site Stormwater Feasibility Study (Barr, 2013)
- Rate control is assumed to occur within the bioretention areas.
- All soils are classified as urban. C soils were used with initial abstractions of 0.2.
- Land use ratios for the potential development on the opposite side of 4th Street assumed to have similar density and runoff requirements.
- All costs are in 2012 values, with the exception of costs based on MnDOT average bid prices (2011). Estimated annual interest = 4%.
- Design, administration, legal costs are 15% of total cost.
- All costs include 20% contingency.

Shared Green Infrastructure

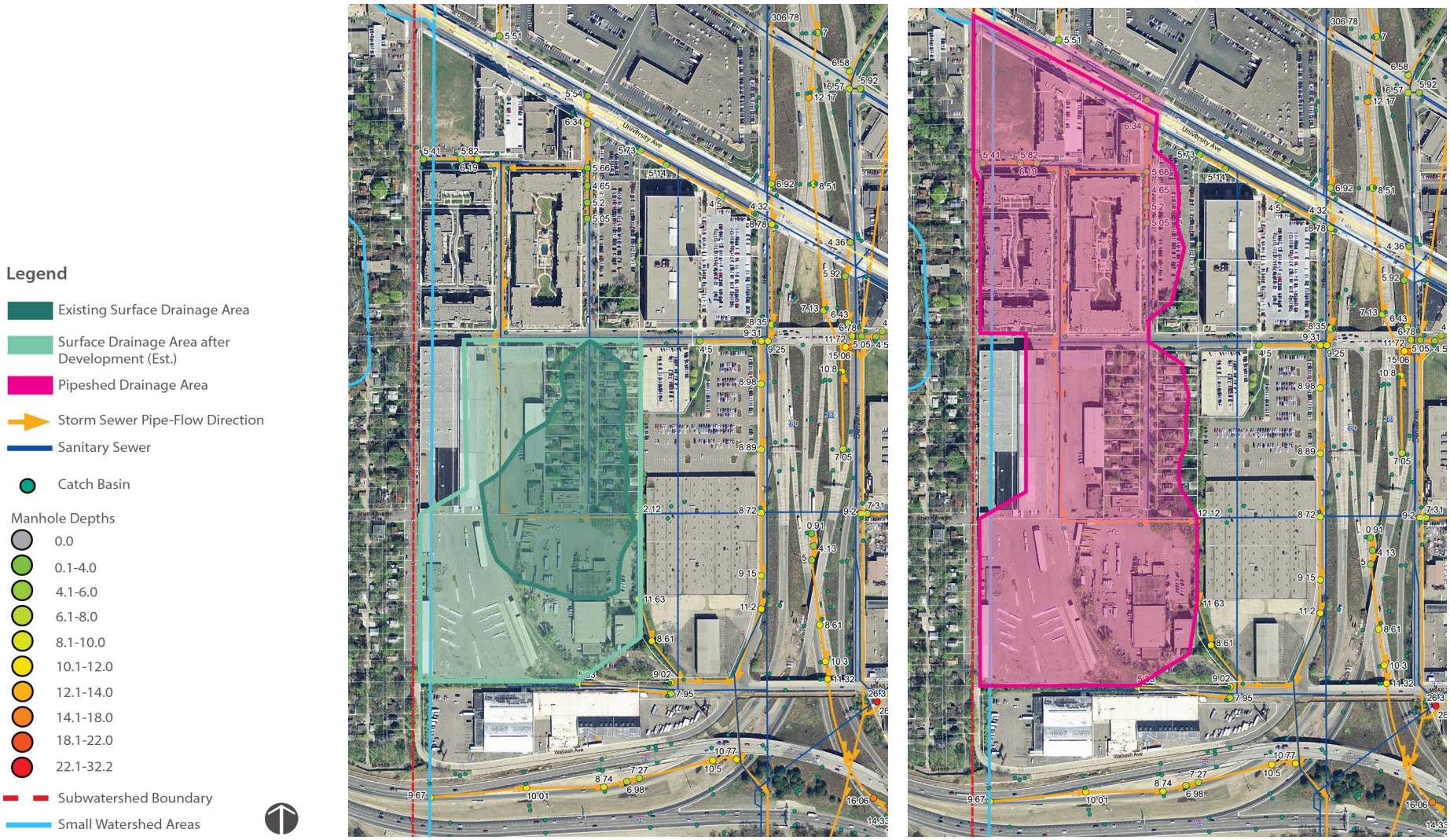
Bioretention

- Bioretention capital cost based on average bids from previous projects
- Resulting costs of $17.60/cf of volume which includes overflow structures
- Bioretention Annual O&M: $0.50/sq ft (Multiple studies, including a CRWD Rain Garden Study)
- Bioretention – 15" to 18" of ponding
- Designed as filtration basins with drain tile due to the potential for contaminated soil

Individual Development Treatment

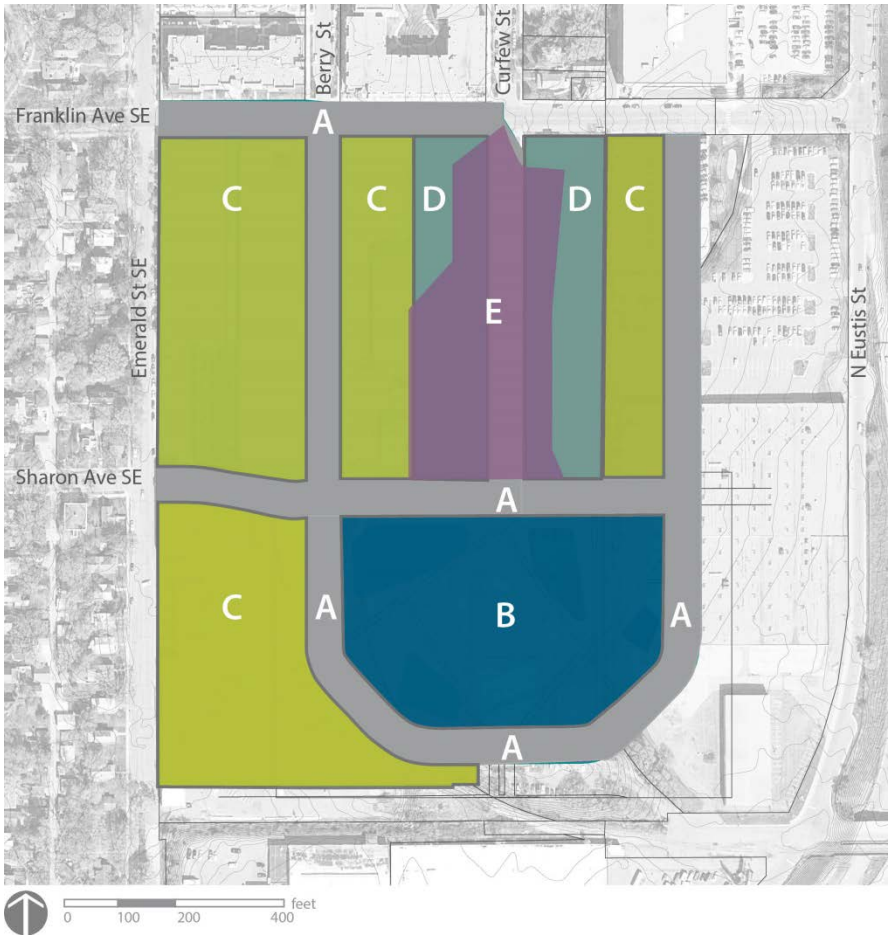
- Capital costs for the site based on the Boeser Site Stormwater Feasibility Study (Barr, May, 2013)
- Bioretention Annual O&M: $0.50/sq ft (Multiple studies, including a CRWD Rain Garden Study)

FIGURE 5 Boeser Site Cost Assumptions



Surface Drainage Area *Pipe Drainage Area*

FIGURE 6 Curfew Commons Existing Drainage Areas



Runoff Source	Revised Required Volume (Cu. Ft.)	Percent
Streets (A)	18,913	26%
Park (B)	2,051	3%
New Development (C)	37,810	53%
Existing Residential (draining to new development) (D)	4,656	7%
Curfew St/Contributing Residential (E)	8,157	11%
Total	**71,587**	**100%**

FIGURE 7 Stormwater Volume Required to Meet Regulations

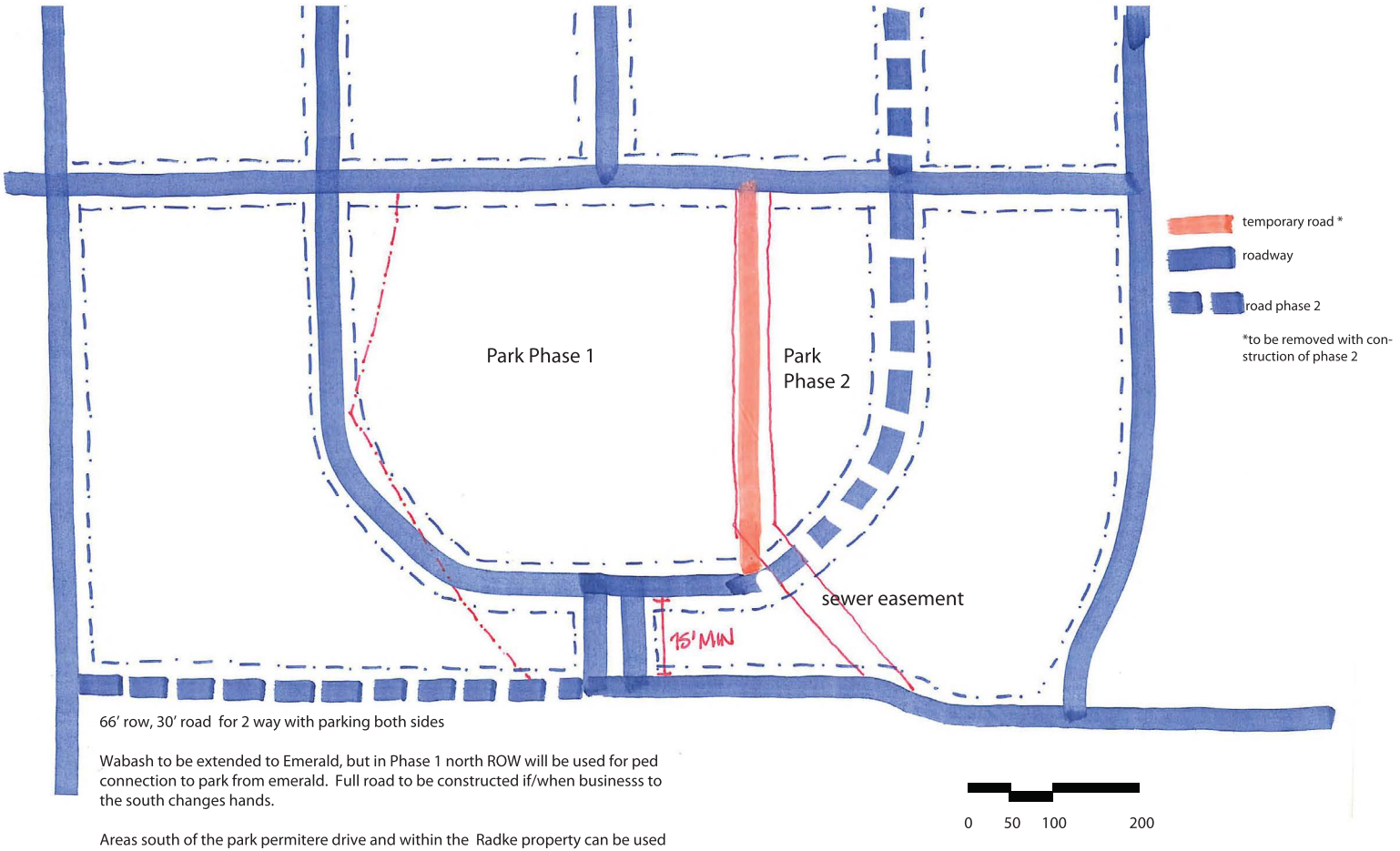


FIGURE 8 Additional Design Factors- Received from Saint Paul Parks

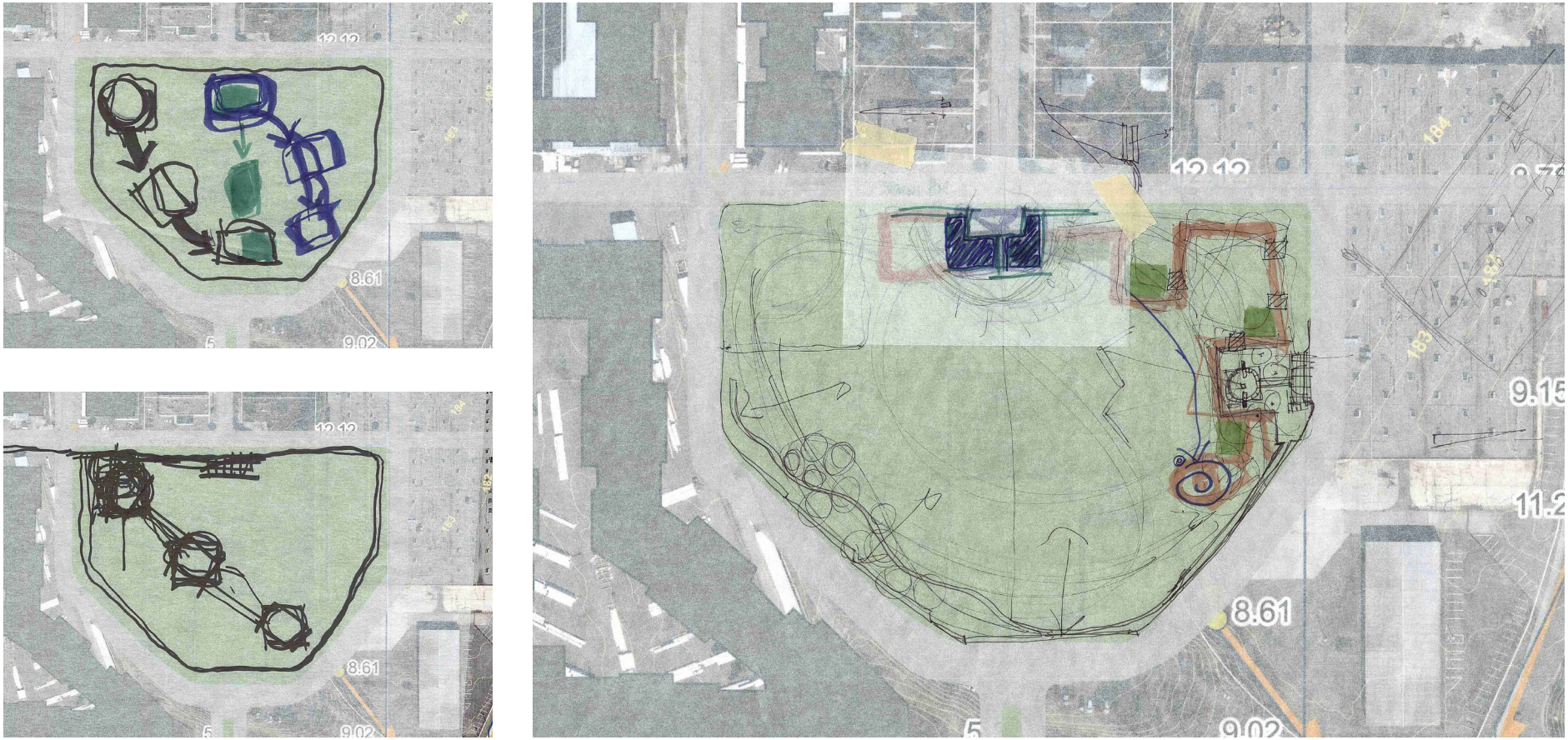


FIGURE 9 Curfew Commons Design Charrette Concepts

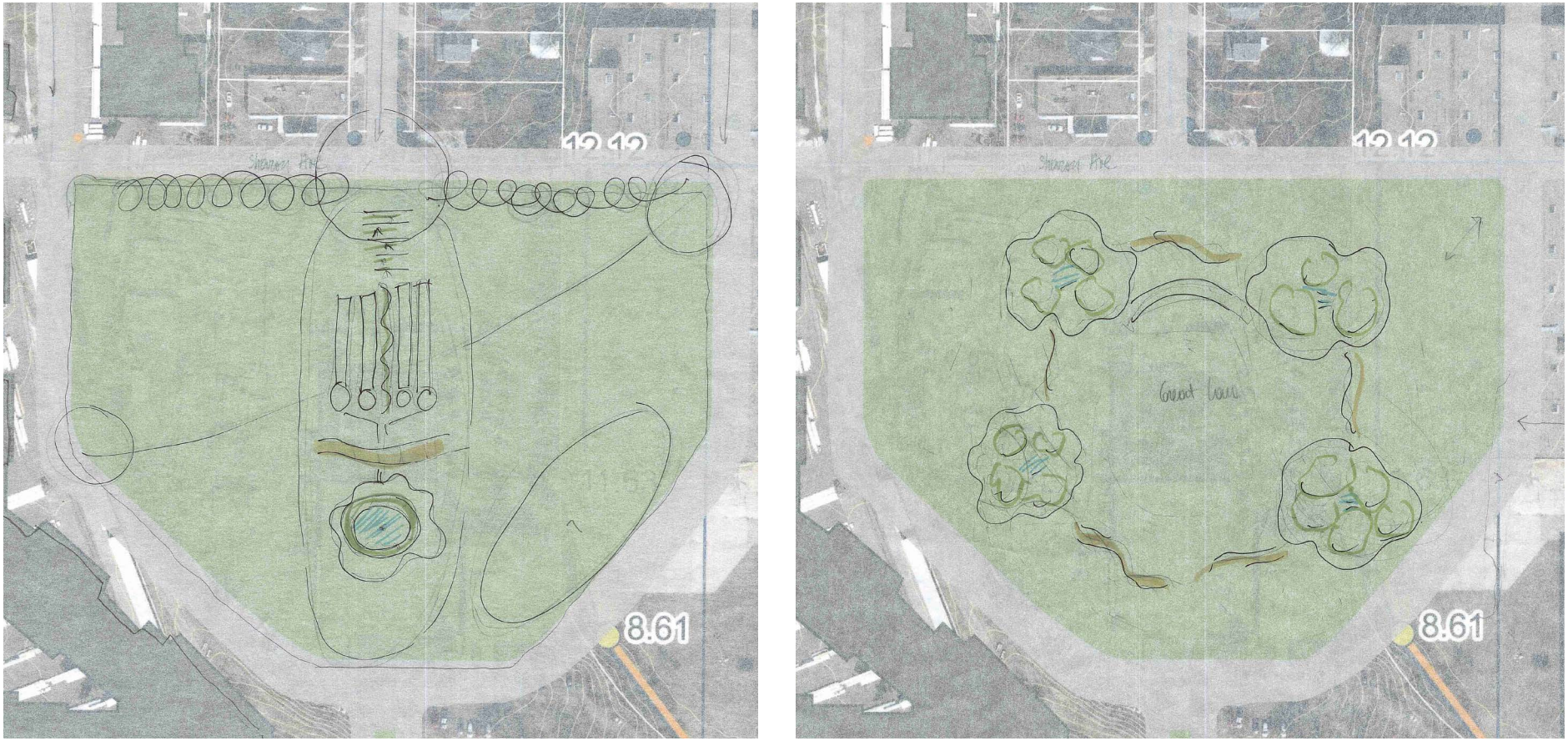


FIGURE 10 Curfew Commons Design Charrette Concepts

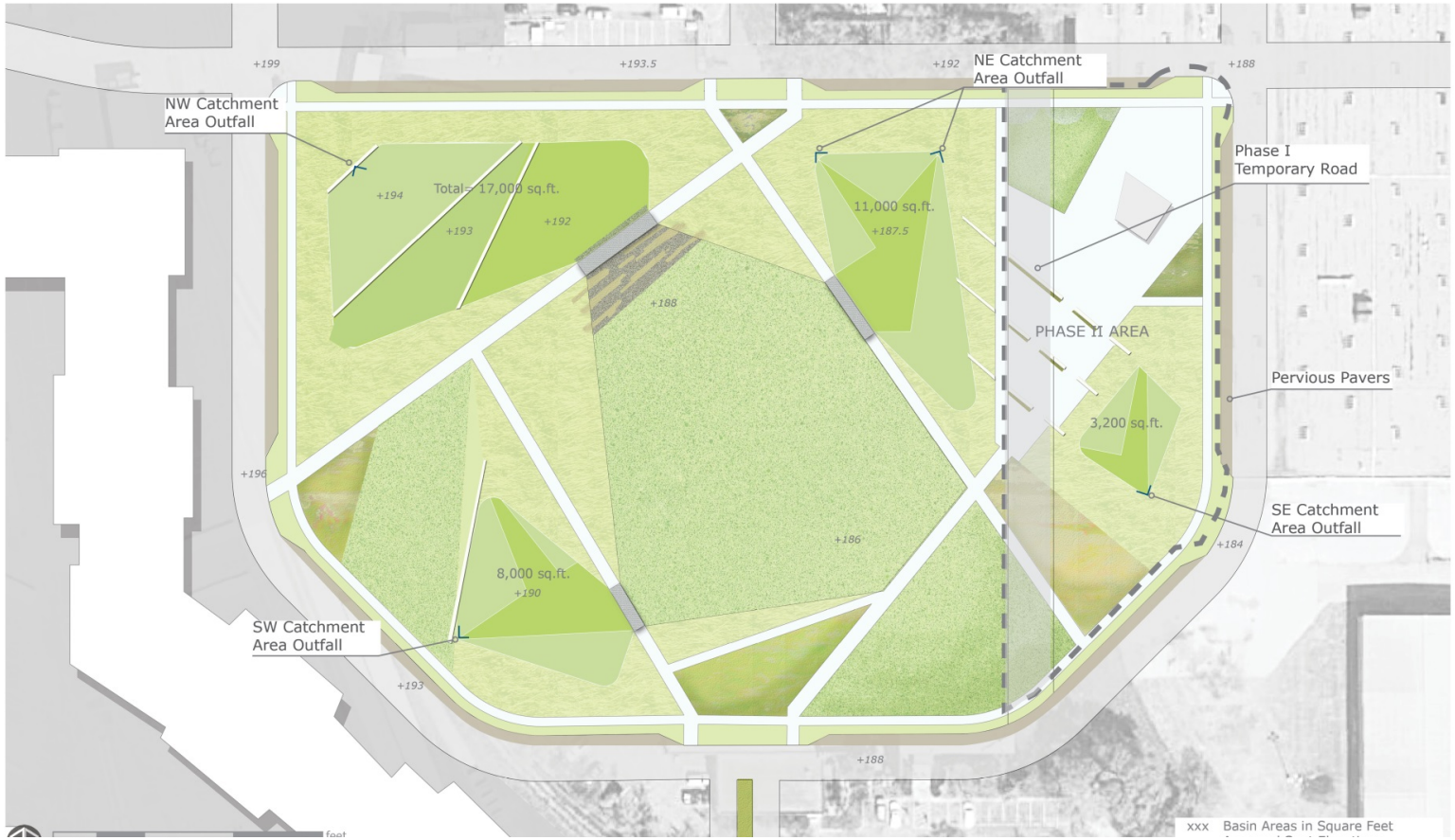


FIGURE 11 Curfew Commons Design Concept- Ground Plane View

FIGURE 12 Curfew Commons Design Concept- Canopy View

FIGURE 13 Curfew Commons Design Concept- Section View

FIGURE 14 Curfew Commons Design Concept- Section Detail

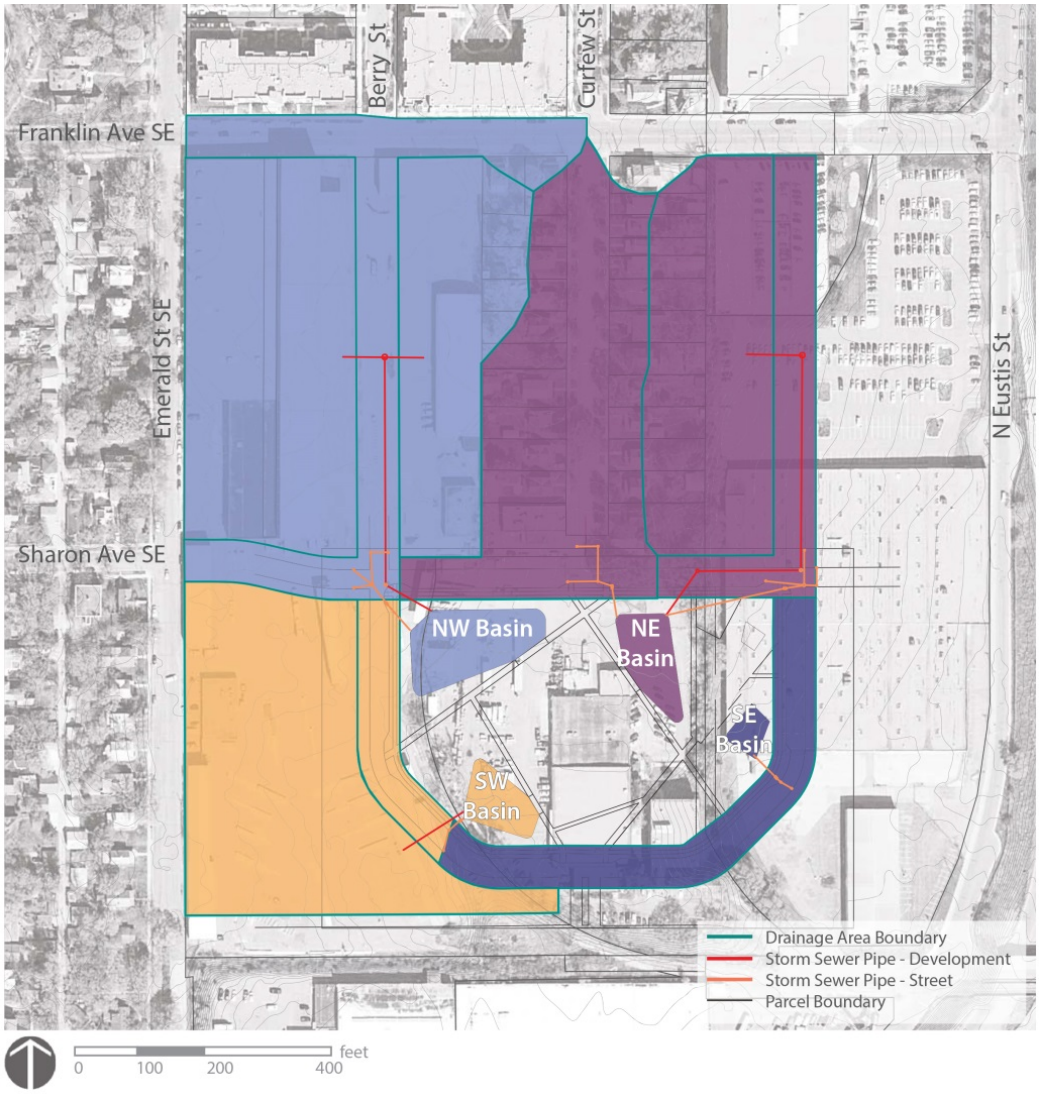
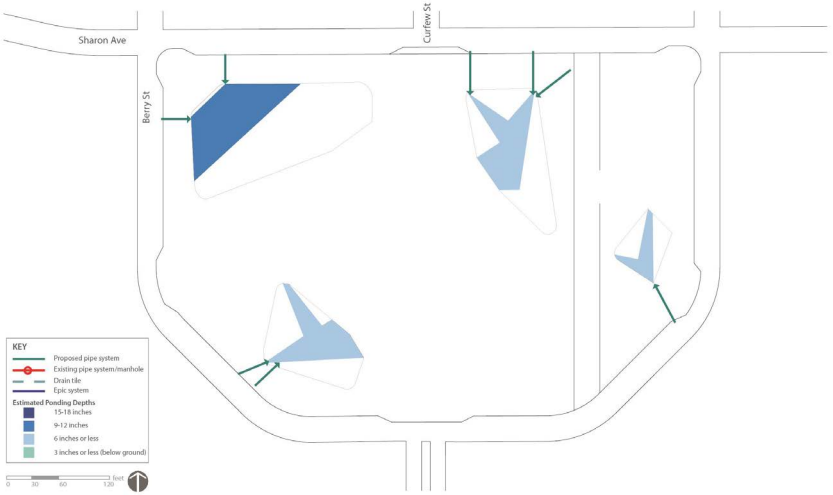
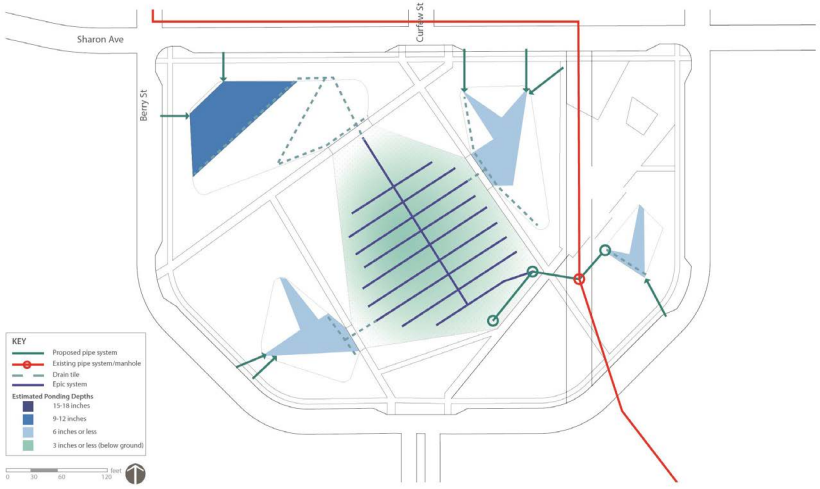


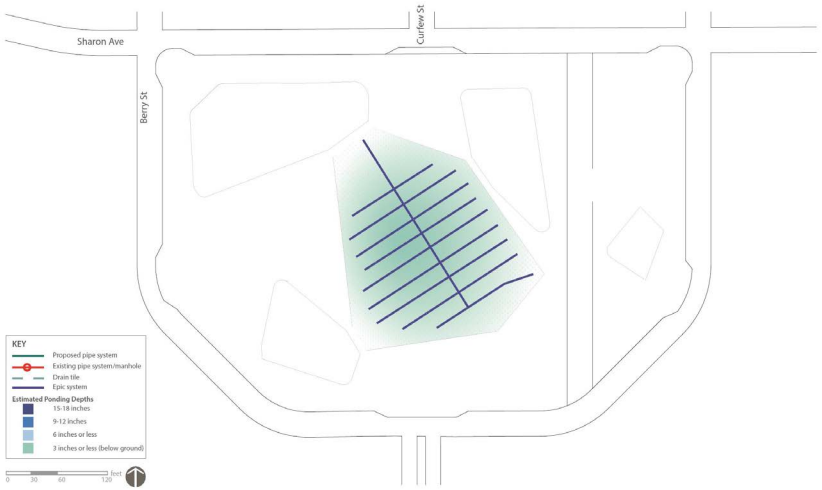
FIGURE 15 Curfew Commons Treatment Areas



Basin ponding for Typical Summer rain event (.33 inches)

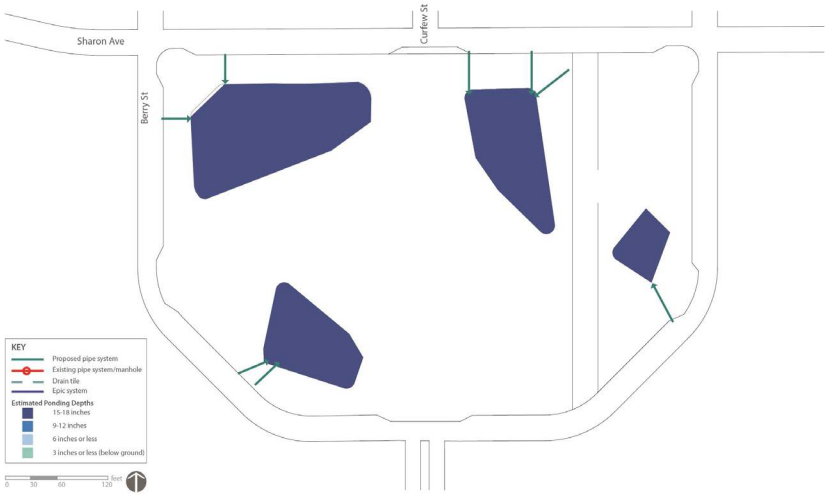


Basin draw down

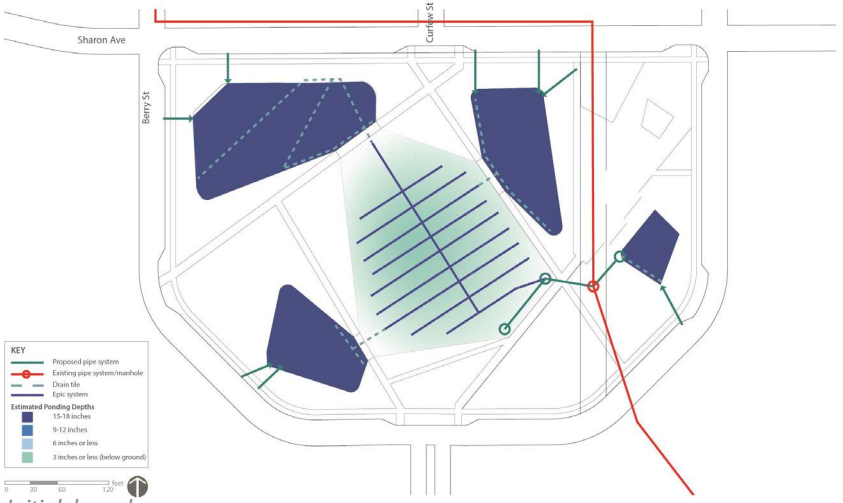


Runoff Stored Underground (3" depth) for Great Lawn Uptake

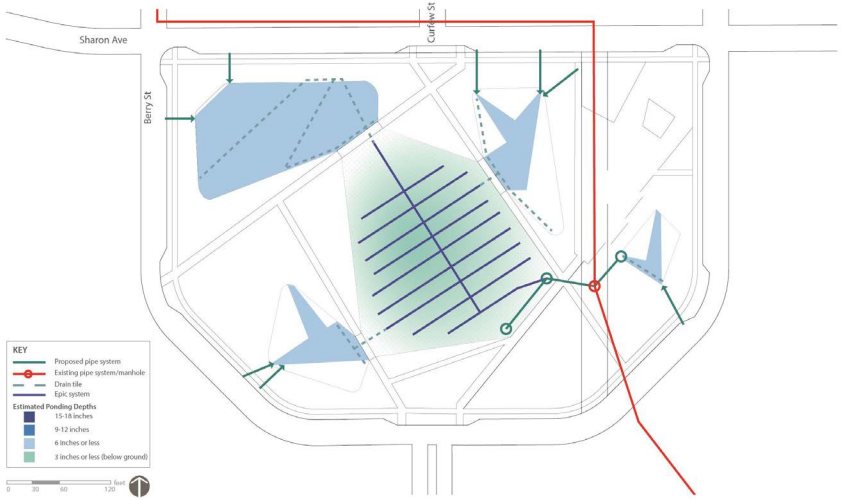
FIGURE 16 Curfew Commons Typical Summer Rain Event



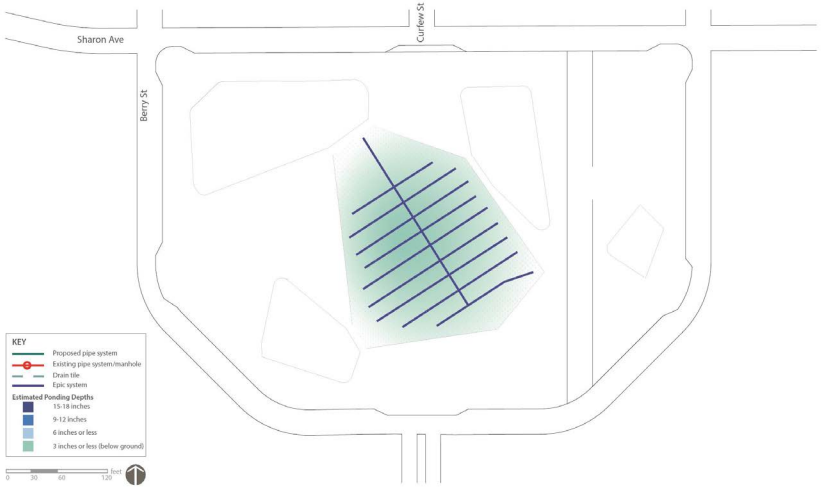
Basin ponding to meet regulatory requirements



Initial draw down



Later draw down



Runoff Stored Underground (3" depth) for Great Lawn Uptake

FIGURE 17 To Meet Regulatory Requirements

- *Top Row- Rainwater Sculpture, Herbert Dreiseitl. Waterworks Garden, Lorna Jordan. Freres-Charon Plaza, Affleck and de la Riva*
- *Middle Row- Public art sketch concepts for Curfew Commons, Craig David.*
- *Bottom Row- 'The Living Water Garden'. Chengdu Schuan Province, China, 1999. Public art sketch concepts for Curfew Commons, Craig David.*

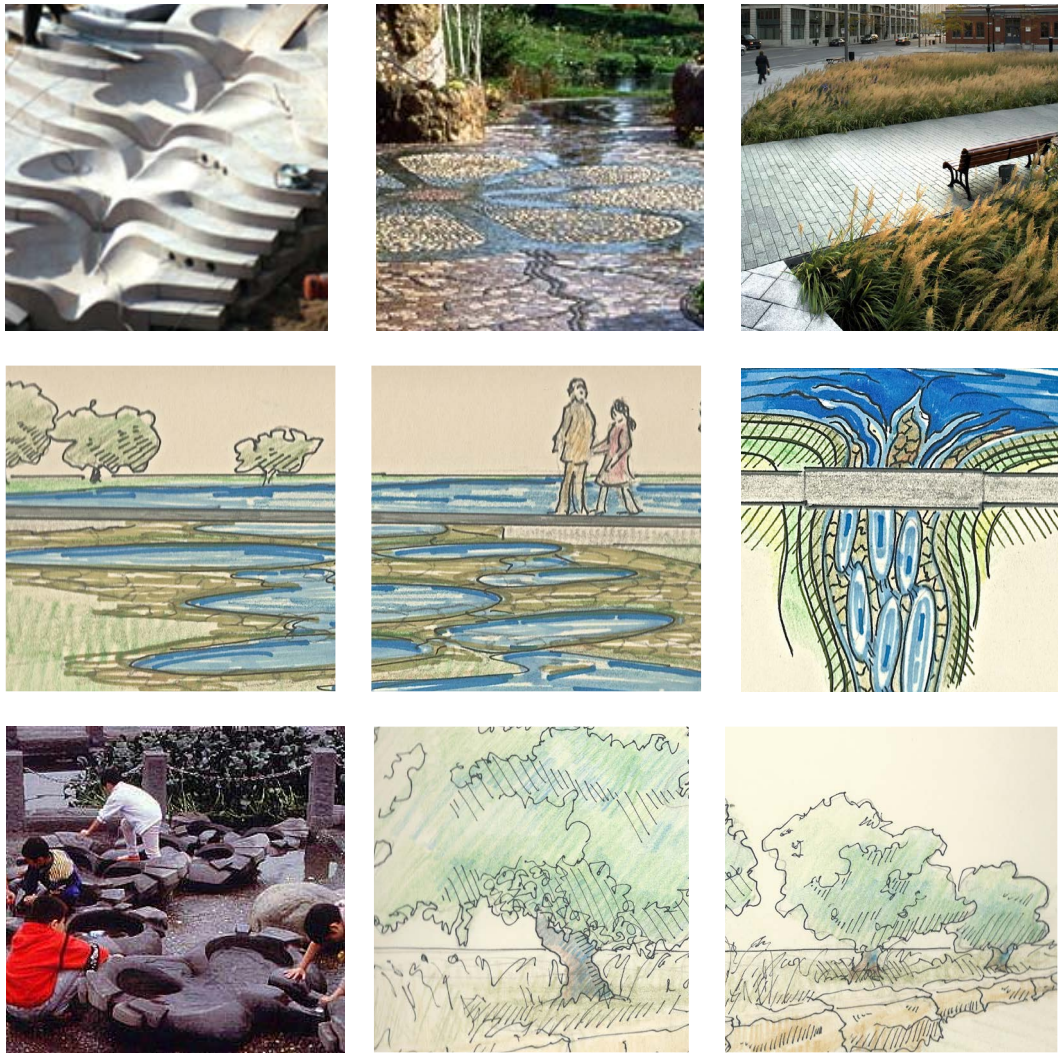


FIGURE 18 Curfew Commons Public Art Concepts

Project wide

- Volume Control Criteria = 1.3 in. rainfall due to clay soils throughout site. Filtration requires an extra 30%.
- Rate Control Criteria based on 1.64 cfs/acre of drainage area.
- All soils are classified as urban. C soils were used with initial abstractions of 0.2.
- Land use ratios for the new developments are based on an example block between Emerald St. and Berry St. from Ellis Ave. to Franklin Ave.
- R/W does not need to meet rate control requirements.
- R/W runoff will be pretreated in grit chambers before entering the park.
- Design, administration, legal costs are 15% of total cost.
- All costs include 20% contingency.
- Costs do not include land or mass grading. Disposal of excavated material from BMP placement is $15/CY.
- 2013 Construction

Shared Green Infrastructure	Shared Gray Infrastructure
Bioretention • Bioretention capital cost based on average bids from previous projects. • Bioretention Annual O&M: $0.64/sq ft, • NW Bioretention: 15” ponding, Others: 18” ponding • NW Bioretention has rock drainage layer, others have drain tile • Requires 3 grit chambers where pavers do not pretreat road runoff.	**Open Space – Pipe Gallery** • Capital costs based on manufacturers suggested installed unit cost ($5.50/cu ft) and the addition of drain tile and sand for filtration. • Solid Wall Underground Pipe Gallery O&M: $1.26/cu ft WQV (Barr) • Pipe gallery isolator row (1/5 of volume) is jetted out every 2.5 years.

FIGURE 19 Curfew Commons Costing Assumptions

Shared Green Infrastructure
Underground Irrigation- Great Lawn • Installed capital cost: $7/sq ft (EPIC suggested installed price), includes netlon turf reinforcement, turf, piping, EPDM liner, sand, EPIC chambers • Annual O&M: $75/2000 sq ft and $10/ additional 1000 sq ft for aeration (kompareit landscaping quote)
Individual Development Treatment
Individual - Pipe Gallery • Capital costs based on manufacturers suggested installed unit cost and the addition of drain tile and sand for filtration. Unit costs adjusted to reflect economy of scale. $5.64/ cu ft for medium system, $5.78 for small system. • Solid Wall Underground Pipe Gallery O&M: $1.26/cu ft WQV (Barr) • Pipe galleries are jetted out every 5 years. • If additional rate control is needed to meet discharge requirements, it will occur on the building roof. • Public R/W and park require same grit chambers as shared scenario. • Individual developments do not require grit chambers.

FIGURE 19 Curfew Commons Costing Assumptions, cont.

SRF Consulting Group, Inc. | Engineers Planners Designers

SRF No. 7687.0030

MEMORANDUM

TO: Wes Saunders-Pearce
Water Resource Coordinator, City of Saint Paul

FROM: Joni Giese, ASLA, AICP

DATE: December 23, 2013

SUBJECT: Shared, Stacked-Function Green Infrastructure Policy Investigation

Purpose

The purpose of this memorandum is to document investigations performed that informed the development of shared, stacked-function green infrastructure (SSGI) implementation policy recommendations.

Referenced Memorandums

- Technical Memorandum: Analysis and Evaluation For Shared, Stacked-Function, Green Infrastructure
- White Paper: Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure
- Technical Memorandum: Existing Stormwater Rules and Regulations
- Technical Memorandum: Advanced Design Concepts For Shared, Stacked-Function, Green Infrastructure

Project Focus

The Strategic Stormwater Solutions for Transit-Oriented Development (TOD) project investigated whether stormwater management along the Central Corridor could more robustly achieve the community's redevelopment vision for the corridor.

The memorandum documents investigations into potential shared, stacked-function green infrastructure (SSGI) implementation from a policy perspective. SSGI is a stormwater management framework where stormwater runoff generated from multiple parcels is jointly treated in shared green infrastructure. The green infrastructure is located and designed to provide economic, environmental and social (triple bottom line) benefits to the community beyond treating stormwater (referred to as "stacked-function"). Additional information regarding barriers identification and conceptual studies related to SSGI implementation can be found in the memorandums referenced above.

Project Context

Currently under construction, Metro Transit's Light Rail Transit Green Line (also known as the Central Corridor) will run 11 miles from Target Field in downtown Minneapolis, Minnesota, to Union Depot in downtown St. Paul, Minnesota, beginning in 2014 (see Figure 1). The corridor is host to a wide variety of land uses, such as the highly urban downtown cores of Saint Paul and Minneapolis, the Minnesota State Capitol, the University of Minnesota Twin Cities Campus, industrial and retail uses, and multi-family and

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single-family residences. A vast majority of the corridor is covered with impervious surfaces and there few parks or green spaces along the corridor. The corridor also hosts a wide range of socio-economic conditions and is a key gathering location for, and home to, a diverse array of ethnic communities, creating a rich cultural resource for the community.

Corridor Redevelopment Goals

As cities and neighborhoods along the corridor have planned for this new LRT line, the implementation of TOD emerged as a primary redevelopment goal for the Central Corridor. The Center for Transit-Oriented Development (CTOD) provides the following definition of TOD:

> *Transit-oriented development is often defined as higher-density mixed-use development within walking distance – or a half mile – of transit stations. Transit-oriented development projects should also:*
>
> - *Increase "location efficiency" so people can walk and bike and take transit*
> - *Boost transit ridership and minimize traffic*
> - *Provide a rich mix of housing, shopping and transportation choices*
> - *Generate revenue for the public and private sectors and provide value for both new and existing residents*
> - *Create a sense of place*
>
> *TOD is really about creating attractive, walkable, sustainable communities that allow residents to have housing and transportation choices and to live convenient, affordable, pleasant lives—with places for our kids to play and for our parents to grow old comfortably.*

Saint Paul

Traversing the corridor from east to west, the Saint Paul segment of the corridor starts in, and runs through, the heart of downtown Saint Paul, past the Minnesota State Capitol, and then follows University Avenue to the western municipal limits. Numerous parcels along University Avenue are currently underperforming and are ready for redevelopment. With 14 of the 18 new stations along the Green Line lying within the Saint Paul municipal limits, the City and partnering organizations have been activity planning for anticipated redevelopment along the line.

Previous City-led planning efforts highlight the community's desire for TOD, an increase in the number of parks and open spaces along the corridor, and the use of green infrastructure. (Note: The "Green Line" was formerly referred to as the Central Corridor before official branding of the LRT.) These previous efforts have continued to build upon each other and include the following plans and studies:

- *Central Corridor Development Strategy plan (2007)*
- *Central Corridor station area plans (10 plans for stations along University Avenue; plus, one plan addressing all of the downtown stations) (2008)*
- *Mitigating the Loss of Parking in the Central Corridor study (2009)*

These City adopted plans call for the evaluation and revision, if appropriate, of existing policies such as stormwater management to better support the City's vision for the corridor. Additional efforts to facilitate desired development have included:

- Creation of the Traditional Neighborhood 4 Zoning District and updates to other Traditional Neighborhood Zoning Districts to facilitate higher density development, reduce parking demand, and create a more of a pedestrian- and transit-oriented environment.

- Rezoning of parcels along the corridor.
- Publication of a Transit-Oriented Development Guidebook.
- Establishment of a Design Center organization to facilitate early development review discussions.

In addition to the previous planning and zoning efforts, and concurrent with this plan, a park creation analysis is underway. The Minnesota Chapter of the Trust for Public Land, with participation from city partners, is spearheading the "Green Line Parks and Commons Initiative."

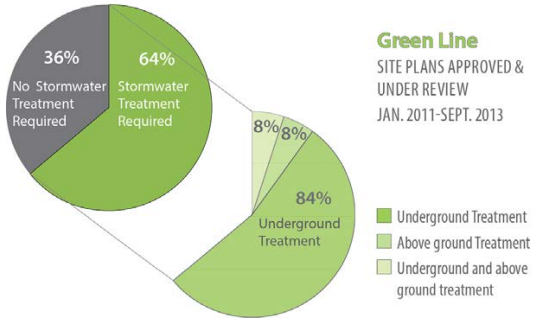
Minneapolis

From east to west, the City of Minneapolis' segment of the Green Line traverses University Avenue, the University of Minnesota campus and downtown. The City is experiencing significant redevelopment activity within, and adjacent to, the University. The downtown segment is also experiencing significant redevelopment as this section of the corridor is also a part of Metro Transit's Blue Line that has been operating for approximately eight years. Similar to Saint Paul, the City of Minneapolis and stakeholder organizations have been actively planning for anticipated redevelopment along the line. Previous planning efforts highlight the community's desire for TOD, vibrant and flexible public spaces, along with environmental sustainability though the incorporation of green infrastructure and stormwater best management practices in transit–related redevelopment projects. Representative previous efforts include the following plans and studies:

- *The Minneapolis Plan for Sustainable Growth (2009)*
- *University of Minnesota East Gateway District Master Plan (2009)*
- *University of Minnesota Twin Cities Campus Master Plan (2009)*
- *Bridal Veil Subwatershed Study (MWMO, 2011)*
- *Stadium Village University Avenue Station Area Plan (2012)*

Recent Development along the Green Line

When redevelopment occurs in established urban communities, stormwater management facilities are competing with other site features for limited and valuable space, resulting in stormwater facilities being relegated underground a vast majority of the time. Since 2011, 84 percent of redevelopment sites along the Green Line requiring stormwater management placed stormwater below ground. When this happens, an opportunity to use stormwater to create a green, sustainable and vibrant community is lost.



Definition of SSGI

Governmental agencies across the country are looking for techniques to improve environmental health and community livability. Agencies are also looking for more efficient approaches to delivering community services. This project developed the concept of shared, stacked-function green infrastructure (SSGI) as a stormwater management approach that addresses environmental health, community livability and cost efficiencies within current statutory standards.

Shared

When redevelopment occurs in older, established urban communities such as the Central Corridor, buildings, open space, surface parking, streets, alleys and stormwater facilities are all competing for limited and valuable space. In response to this situation, stormwater is typically being managed in expensive underground facilities that are quite large in order to meet water quantity and/or rate control requirements. In addition, most of the recently constructed facilities do not integrate stormwater with reuse or other features that could support corridor enhancements. This study hypothesized it would be beneficial to construct shared stormwater facilities that collect and treat runoff from multiple parcels (both smaller and larger than one acre). These shared facilities could provide cost efficiencies, enable runoff/pollutant reduction for small parcels that otherwise may not require such treatment, and provide substantial water supplies that could be reused to improve the environmental and social character of the corridor.

Stacked-Function

This study hypothesized the space used for stormwater management, along with the captured stormwater runoff itself, can be used to provide triple bottom line benefits to the corridor beyond stormwater management, thereby creating a "stacked-function." For example, economic benefits can be achieved when space can be used to accommodate multiple functions such as stormwater facilities and parking facilities. Environmental benefits are realized when stormwater facilities mimic the natural hydrologic cycle or introduce new habitat into the urban environment. Social benefits result from the provision of new street trees and open spaces that improve corridor livability. In addition, when stormwater facilities are placed below ground, the community loses their understanding and personal experience with natural systems. Also lost is the opportunity to learn about the environmental impacts associated with increased impervious surfaces. By expressing stormwater management on the surface or using stormwater to support environmental benefits, a richer and meaningful environment is created.

The goal of this study was to identify feasible stormwater stacking opportunities that:

- Merged triple bottom line uses with stormwater facilities to make efficient use of valuable urban land.
- Reused captured stormwater runoff to enhance the environmental health and corridor livability.
- Provided opportunities to interpret, educate and celebrate water in the corridor through the artful design of stormwater facilities.

Green Infrastructure

Both nationally and locally, there is a movement towards the use of green infrastructure to manage stormwater. Several representative definitions of green infrastructure follow:

- *Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water. (United States Environmental Protection Agency)*
- *Green infrastructure is strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations. (The Conservation Fund)*
- *Stormwater management approach that utilizes natural landscape features and hydrologic processes to treat stormwater by infiltrating, evapotranspiring, and/or reusing runoff. Green infrastructure also achieves other environmental goals such as carbon sequestration, reductions in urban heat island effect, improved air quality, improved wildlife habitat and increased opportunities for outdoor recreation. (Capitol Region Watershed District)*

While there are variations between these definitions, they all consistently state that green infrastructure uses landscape features and/or natural processes to manage and/or treat stormwater in a manner that provides environmental benefits. Green infrastructure aligns well with the vision for a revitalized central corridor that includes new green spaces along the corridor, along with environmentally sound and sustainable redevelopment.

Right-of-Way Considerations

Cities are the stewards of the right-of-way as the public right-of-way supplies a benefit to the civic community at large. The right-of-way must accommodate a variety of public needs, such as transportation facilities (e.g., streets, sidewalks, and transit), above and below ground utility services (e.g., water mains, storm and sanitary sewers, stormwater management practices to mitigate public projects, electric, gas, and cable services) and environmental enhancements (e.g., street trees and ground vegetation). Frequently, these various public uses are competing for the limited space available within the right-of-way. Therefore, the addition of any non-public use within the right-of-way involves significant risk for any governmental agency responsible for the public right-of-way.

Both Minneapolis and St. Paul have long-standing processes to evaluate and control uses proposed for the right-of-way that may have direct benefit to only a limited group. Encroachment permits are issued as a means to review, approve and track non-public features within the right-of-way. Typically an applicant is required to demonstrate that a private "need" cannot be met on private property thereby justifying the permit.

The public right-of-way provides possible real estate for hosting shared stormwater management. However, the placement of shared stormwater facilities in the right-of-way must provide public services and value beyond simply benefiting the developer, such as installing street trees that provide habitat, stormwater management, and shade, thereby improving neighborhood livability.

Preliminary Project Findings

Over the course of four SAC meetings and a developer focus group meeting, the following issues came to light regarding the potential implementation of SSGI. Many of the SSGI findings revolved around long-term risk management and associated cost implications.

- There is competition for space on redevelopment parcels between stormwater management and other site programmatic elements.
- There is a lack of funding to purchase, develop, operate and maintain new public open spaces along the corridor.
- Cities/agencies want to ensure the long-term functionality of stormwater management facilities both on private and public land.
- Private development places value on having open space next to development parcels.
- Private-private sharing is difficult to achieve due to current financing requirements and long-term relationship risks between private land owners.
- Private-public shared stormwater facilities are desirable to developers because the stormwater treatment approach is then a known component when developing the site and perceived risk is reduced.

The investigation quickly raised a number of logistic issues that successful SSGI implementation approach must address, such as:

- Where will the SSGI be located and who will own the property?
- Who will administer, operate and maintain the SSGI?
- Can SSGI facilities be constructed in a phased manner to coincide with phased redevelopment?
- How can the initial SSGI construction be funded in a fair and equitable manner?
- How can the SSGI long-term operations and maintenance be funded in a fair and equitable manner?
- What contingency plans are needed in case redevelopment doesn't occur, or only partially occurs?
- Will SSGI work within the existing statutory framework?

These issues were influential in the development of the potential SSGI approaches.

Potential SSGI Approaches

Six potential SSGI approaches were developed and presented to project stakeholders. Stakeholders were requested to complete a survey form indicating their level of interest in pursuing each of the approaches further. Based on survey responses (see Figures 2 – 4 for survey form and response summaries) and SAC meeting discussion, the following four were selected for additional feasibility analysis. The SSGI approaches were developed with the goal of providing mutual benefit for all affected stakeholders, or at a minimum, the approaches would not create a hardship for any of the affected stakeholders. These approaches are not mutually exclusive but were evaluated individually to simplify the analysis.

New Public Parks/Open Spaces: Hosting stormwater in new public parks/open spaces benefits adjacent redevelopment as it eliminates the spatial constraints of treating stormwater on site and reduces soft development costs. Developers also benefit by the adjacency of a new open space, which makes their parcel more desirable to potential tenants or purchasers. By taking stormwater into a park/open space, the city obtains capital and maintenance funding from the developer that will help finance the shared, stacked-function portion of park/open space construction and maintenance. It also

allows other city projects to participate in the facility, such as stormwater treatment for new or reconstructed streets. By sharing a stormwater facility, economies of scale can be achieved, resulting in reduced construction costs for all parties sharing the facility.

Shared stormwater facilities in public parks/open spaces also provide a cost effective opportunity to treat stormwater from adjacent parcels currently not receiving treatment that are not anticipated to redevelop in the near future.

Shared Parking Facilities: A key component of TOD is the creation of a pedestrian friendly environment and the efficient use of available space, which may result in the development of shared parking facilities. Owners of parking facilities and those using it typically develop mutually-agreeable operating and liability arrangements. It is feasible that a water treatment facility could be built into new parking structures or under shared parking lots and the legal agreement expanded to include the shared stormwater facility.

This type of shared facility also allows for the accumulation of a significant volume of water that will support reuse options, such as irrigation or building toilet flushing.

Green Alleys: A vast majority of blocks in Saint Paul are served by alley access. These "shared" driving facilities are strategically located to conveniently collect and store stormwater runoff. New pervious pavements allow for the infiltration of water, while still providing the structural support needed for vehicle movement. Alleys are also typically free of major underground utilities that compete for underground space with stormwater facilities. While this approach doesn't heighten awareness of water, it does support efficient use of space in highly urbanized environments.

Street Right-of-way: Green infrastructure located in street boulevards (e.g., tree trenches, rain gardens, and boulevard swales) may be able to host shared stormwater treatment facilities. Runoff collected in these facilities may be able to be used to irrigate new streetscape plantings that would increase environmental health, improve streetscape aesthetics, and provide a comfortable walking environment. These facilities also heighten residents' awareness of and connection to water and natural processes in the urban landscape. Significant engineering, regulatory and jurisdictional issues would need to be addressed to determine feasibility of any given project.

Based on review comments received from project stakeholders, the following two potential SSGI approaches were not pursued further.

New Private Parks/Open Spaces: Hosting stormwater in new private parks benefits adjacent redevelopment as it eliminates the spatial constraints of treating stormwater on site. Developers also benefit by the adjacency of a new open space, which makes their parcel more desirable to potential tenants or purchasers. By taking stormwater into a park facility, economies of scale can be achieved, resulting in reduced construction costs for all parties sharing the shared facility.

It was decided not to pursue this approach as the Minnesota Chapter of the Trust for Public Land, with participation from city partners, was spearheading the, "Green Line Parks and Commons Initiative," that could potentially address this topic.

A Special Service District: This approach was different from the others as it was an inquiry into stakeholders' interest in using a non-traditional stormwater funding approach. After SAC discussion, it was determined that a special service district would be difficult to establish as it requires owner approval to establish and needs to be renewed after designated periods of time.

SSGI Implementation

While SSGI can be used to assist with the creation of TOD, the development of effective policies and implementation tools is critical to the successful implementation of SSGI.

The study quickly concluded that a "one size fits all" may not be a realistic SSGI implementation approach. The variable ways in which SSGI can be implemented lends to a case-by-case evaluation. However, general frameworks are needed to help guide implementation feasibility discussions.

Draft Policy Resolution

A recommended first step to implement SSGI is the development and adoption of a SSGI policy resolution. The initial policy resolution brought forward should highlight SSGI benefits and how its use can assist with the creation of the City's adopted TOD vision. To increase policy makers' comfort with its use and to refine implementation protocols, it is recommended that the resolution request authorization for pilot implementation of SSGI. SSGI policy resolutions can be brought forward to those agencies that influence or direct stormwater management implementation, primarily municipalities and MWOs. A sample SSGI policy resolution template can be found in Figure 5.

Perform Pilot Projects

Several pilot projects should be identified and performed for the purpose of testing and refining the SSGI implementation framework developed in this study. The use of pilot projects allows agencies to further attempt the approach without making a commitment in perpetuity to its implementation. A municipal agency will likely need to initiate the identification and selection of pilot sites in partnership with other stakeholder agencies and the development community. Establishing public-private partnerships very early in the site development process will foster the most benefit to assessing suitability and interest for a pilot effort.

Engineering feasibility studies should be prepared for strategic locations along the Green Line where implementation of SSGI would achieve the City's redevelopment vision. Pilot site locations must be evaluated more closely to thoroughly understand existing conditions and proposed improvements. A feasibility study would evaluate soil conditions, drainage patterns, infrastructure and utility locations, and would develop an approach or combination of approaches that illustrates the properties served, the level of treatment, probable cost, and other pertinent information. Pilot sites should be selected to test various SSGI:

- Development scales.
- Approaches, such as green alleys, open space or parking.
- Funding and cost recovery mechanisms.

After a designated number of pilot projects have been implemented, monitored and evaluated, agencies can make the determination whether the approach provides desired TOD benefits, and that agencies (i.e., staff) are fully capable of successfully delivering this approach. If SSGI is deemed feasible, modifications to implementation protocols identified through the pilot process should be incorporated into the SSGI framework. Another benefit of performing pilot projects is the creation of demonstration sites for others to see and learn from should SSGI be deemed feasible.

If the pilot projects indicate that SSGI provides public and private benefits, another policy resolution authorizing the use of SSGI could be brought forward for adoption.

Revise Regulatory Framework

While a majority of SSGI implementation recommendations address the development of an approach to define answers to logistic issues and thereby reducing risk, there are regulatory considerations as well, which differ across the cities and WMOs. If elected/appointed officials choose to move beyond

pilot projects into a long-term implementation mode, it will likely require modification of existing stormwater rules and local ordinances.

Pertinent topics (not necessarily exhaustive) to scrutinize at a finer level of detail would include:

- *On-site management.* The current CRWD rules require an applicant to follow a regimented series of stormwater compliance steps, the first being that stormwater must be managed on-site (Rule C.3(2)i). Both municipalities reflect that stormwater must be managed on-site (e.g., Minneapolis Chapter 54.70(1)a.1.; Saint Paul Chapters 69.504b and 63.319(a)). Minneapolis does have provisions for off-site stormwater management considerations but the wording indicates that provision is not to be used to circumvent on-site requirements. Flexibility would need to be incorporated into these processes to allow shared facilities when their use provides public benefit.
- *Encroachment.* Cities of Saint Paul and Minneapolis both have requirements relating to encroachments into the right-of-way, which can potentially inform successful SSGI implementation.
- *Code consolidation.* The City of Saint Paul has multiple locations for expressing stormwater management requirements. Any revisions would need to include all locations to ensure there are no conflicts or discord.
- *Green requirements.* Cities of Saint Paul and Minneapolis have regulatory tools which, in certain circumstances, encourage the use of natural features and vegetation in stormwater management (Minneapolis Chapter 54.70(3)ii; Saint Paul Chapters 63.319(b)1 and 66.344(b)5). These could be expanded or adapted to better support stacked-function green infrastructure implementation.

Jurisdictional stormwater regulations need to be reviewed and modified to remove or clarify regulations that specifically prohibit or discourage SSGI implementation.

Additionally, the City of Saint Paul has a charter prohibiting the diversion of park uses (Saint Paul Chapter 13.01.1). Through SAC discussions, it was determined that retrofitting SSGI into existing Green Line parks (within Saint Paul) would not be a high priority. Given that SSGI can be used as tool to assist with the development of new Saint Paul parks along the Green Line, its use should be strongly considered. Before this tool can be realized, Saint Paul will need to evaluate if changes are necessary to the existing charter to allow for the incorporation of SSGI in new parks along the Green Line. To that end, the City has already developed an official interdepartmental Cooperative Agreement that has been used to retrofit existing parks for large-scale stormwater runoff reduction. The "Green Line Parks and Commons" analysis being prepared by the Trust for Public Land may provide further clarification on this issue.

Institutionalize SSGI into Agency Processes

The institutionalization of SSGI into agency processes is critical to its implementation. The feasibility of SSGI should be discussed between implementing agencies and developers early in the development process, before significant time or funds are invested in developing a traditional site plan. Traditional review procedures, such as site plan review, is too late in the development process to introduce SSGI discussions as developers have already invested significant time and funding into the plans being brought forward for agency review. Therefore, SSGI implementation may require modifications to existing agencies processes to allow for early discussion and evaluation.

The implementation of SSGI is not limited to the redevelopment of individual parcels. There are a number of scenarios that could trigger SSGI feasibility discussions, such as:

- Street reconstruction project
- Replatting assembled land(s)

- Construction project requiring stormwater management permits
- New public facility construction (e.g., schools, libraries, parks)
- Development of a small area master plan or stormwater retrofit analysis

Inserting SSGI feasibility discussions and evaluations to these agency processes is a key step in institutionalizing SSGI.

SSGI may provide cost-efficient stormwater management for runoff from small parcels that otherwise would not receive treatment in the near future. Therefore, the development of a retrofit program that provides a process to initiate the SSGI feasibility discussion, evaluate opportunities and to identify potential funding mechanisms may be advantageous.

Implementation Tools

The successful implementation of SSGI entails the creation and use of multiple tools to educate Green Line development stakeholders about TOD benefits that can be achieved through the use of SSGI. The tools also serve to assist agencies with incorporating SSGI feasibility evaluations and implementation as standard practice. The following tools have been developed as base templates that agencies can modify to meet their agency's specific needs and goals.

SSGI Assessment Tool

Given that a number of factors must align in order to utilize SSGI, the determination whether SSGI is feasible needs to occur on a case-by-case basis. This study suggests that agency staff use an assessment tool to help evaluate whether SSGI would be appropriate. A sample SSGI assessment tool template, as shown in Figure 6, provides a series of questions that agency staff can ask early in the development process to assess whether SSGI is a tool that can be used to further the goal of TOD for the proposed project at hand. This tool is envisioned to be used by agency staff that first interact with the development community, as an early determination of feasibility is essential if SSGI is to be successfully implemented.

Decision-making Flowcharts and Matrices

Numerous options exist for how SSGI can be implemented and funded. At times the multitude of options and complexity of funding options can appear to be overwhelming. To assist agency staff with the evaluation of funding options, a series of flow charts and matrices templates have been developed that articulate the various funding options currently available. Sample flow chart and matrices templates were developed for each of the four SSGI approaches and can be found in Figures 7 - 29:

- New Parks and Open Spaces
- Shared Parking Facilities
- Green Alleys
- Street Right-of-ways

The flowcharts are designed to lead agency staff through a series of questions on such issues as SSGI ownership and maintenance and then provide funding alternatives based on answers provided. The matrices provide more detail than the flowcharts about the opportunities and constraints associated with the various funding options.

Pilot Project Educational and Outreach Materials

Educational and outreach materials should be utilized to inform Green Line development stakeholders about potential pilot opportunities, if a community is interested in advancing SSGI approaches. The audience primarily would involve developers, but these materials also could help inform elected/appointed officials about TOD benefits that can be achieved through SSGI pilot projects. The materials help provide a consistent message about current stormwater challenges, the intent of SSGI, and the potential opportunity, given that SSGI use is not formally

adopted. Education and outreach materials may be useful when a developer begins initial dialogue with the city, a Green Line neighborhood group, or other early stages of property redevelopment. The materials can be complementary to existing resources such as Saint Paul's "TOD Guidebook for the Central Corridor." At a minimum, the outreach materials can help encourage and foster site designs that more creatively incorporate natural vegetation into stormwater management. A sample brochure can be found in Figures 29 - 30.

Findings and Conclusions

In a highly urban corridor, SSGI represents a balancing of risk, roles, and responsibilities (particularly for city departments) in the context of broader triple-bottom line benefits. Leadership from elected/appointed officials will be necessary to effectively support and advance with this strategic stormwater solution initiative. This may involve adopting resolutions, sponsoring code modifications, or other similar actions.

Flexibility Supports Vision

Stormwater management is currently performed on a parcel by parcel basis and segregated between private and non-private ownership. This is done to address mandates for on-site compliance, manage risk exposure for long term maintenance demands, and simply due to the fact that urban parcels redevelop in a sporadic manner making it difficult to coordinate shared facilities. In practice, in dense urban areas, the status quo often results in development managing stormwater underground.

Yet, there are key events such as the construction of major infrastructure projects like light rail transit that trigger concentrated redevelopment where sharing of stormwater facilities may be feasible and conducive to the creation of desired TOD. This is of particular importance for small, space-constrained, urban redevelopment parcels where numerous programmatic requirements are competing for valuable space. In these situations, flexibility could be provided in the current stormwater management approach to allow for SSGI implementation, if doing so would be beneficial in achieving the community's corridor vision of a green, vibrant, sustainable neighborhood.

Define a Process

SSGI can be successfully implemented, but will likely involve a case-by-case approach. Therefore, processes – such as decision trees or screening methods – must be put in place to assess its feasibility early in the development process. Tools such as flowcharts identifying necessary incremental commitments must also be in place to assist agency staff and developers to efficiently structure a SSGI approach that creates a balanced approach for funding and risk management. These processes and tools must be general enough to work across a variety of possible development scenarios while acknowledging many stakeholders may potentially participate.

The SSGI Assessment Tool (in combination with an outreach brochure) is essential to establish a structured dialogue to identify where a potential project may be feasible, while also maintaining baseline expectations for stormwater management.

Development Scale is Important

This study identified four SSGI approaches (Parks, Parking, Alleys, and Street Right-of-way) that successfully provide triple bottom line benefits supportive of TOD. In addition, the study indicated that several of these approaches lend themselves more strongly to a particular scale of development. For example, while green alleys can be incorporated into all scales of development, this approach is a more viable option for use with small scale development projects than the parks approach. Likewise, a structured parking approach is better aligned with an urban village development scale. Figure 31 highlights the applicability of the four SSGI approaches to different development scales.

Potential for Financial Balance

Government units have broad authority and multiple options to raise revenue for SSGI costs. This will likely require significant political leadership. Yet a financially "neutral" funding source is preferable, rather than relying upon grants or general funds solely from one municipal department. A financially neutral funding source, such as a tax district, allows for greater equity and predictability by virtue of collecting funds from directly benefiting properties.

Compared to estimated costs for stormwater facilities on an individual parcel basis, SSGI estimated costs result in net capital cost efficiencies overall. However, a challenge is developing a cost recovery approach that will fairly distribute the reduced costs to all parcels sharing the stormwater facility. For example, analyses herein that allocated costs based on contributing runoff volume (or impervious surface) resulted in some parcels realizing a relative cost increase compared to stormwater management being performed on an individual parcel basis. This allocation method is just one possibility; there may be other suitable allocation methods, depending on how SSGI is approached.

Therefore, careful consideration must be given when determining funding sources and developing cost recovery approaches for SSGI to ensure a balanced distribution of costs and benefits. Specifically, SSGI implementation will place a significant emphasis on the use of development agreements, license agreements or similar formal tools to address financial and obligatory arrangements. These tools will establish acceptable requirements, fees, noncompliance recourses, and other practicalities including long term responsibilities and liability. Fees, responsibilities and liability must run with the land. As a practical matter, license agreements should first be executed to formalize these arrangements, and then be incorporated as an exhibit to a development agreement.

Be Opportunistic

Runoff from untreated, small parcels that otherwise would not redevelop (i.e., employ stormwater management) in the near future can be effectively included in SSGI projects. SSGI provides an approach to opportunistically realize "excess capacity" in stormwater treatment in a cost effective manner, which may utilized as a banked or brokered commodity depending on regulatory frameworks. By casting a wide net on how much drainage area is potentially included in a SSGI project, larger gains in water quality can be attained with minimal additional cost. This is very useful in a corridor where overall redevelopment is very incremental (especially small sites) and public land control is very limited. This may warrant the discussion or development of a retrofit program to capitalize on these opportunities when they arise.

Triple Bottom Line Benefits

The concepts developed illustrated that triple bottom line (economic, environmental, and social) benefits resulted from the use of SSGI, the strongest benefit derived from SSGI implementation may be community enhancements and associated improved livability (environmental and social), which are key redevelopment outcomes desired by the community.

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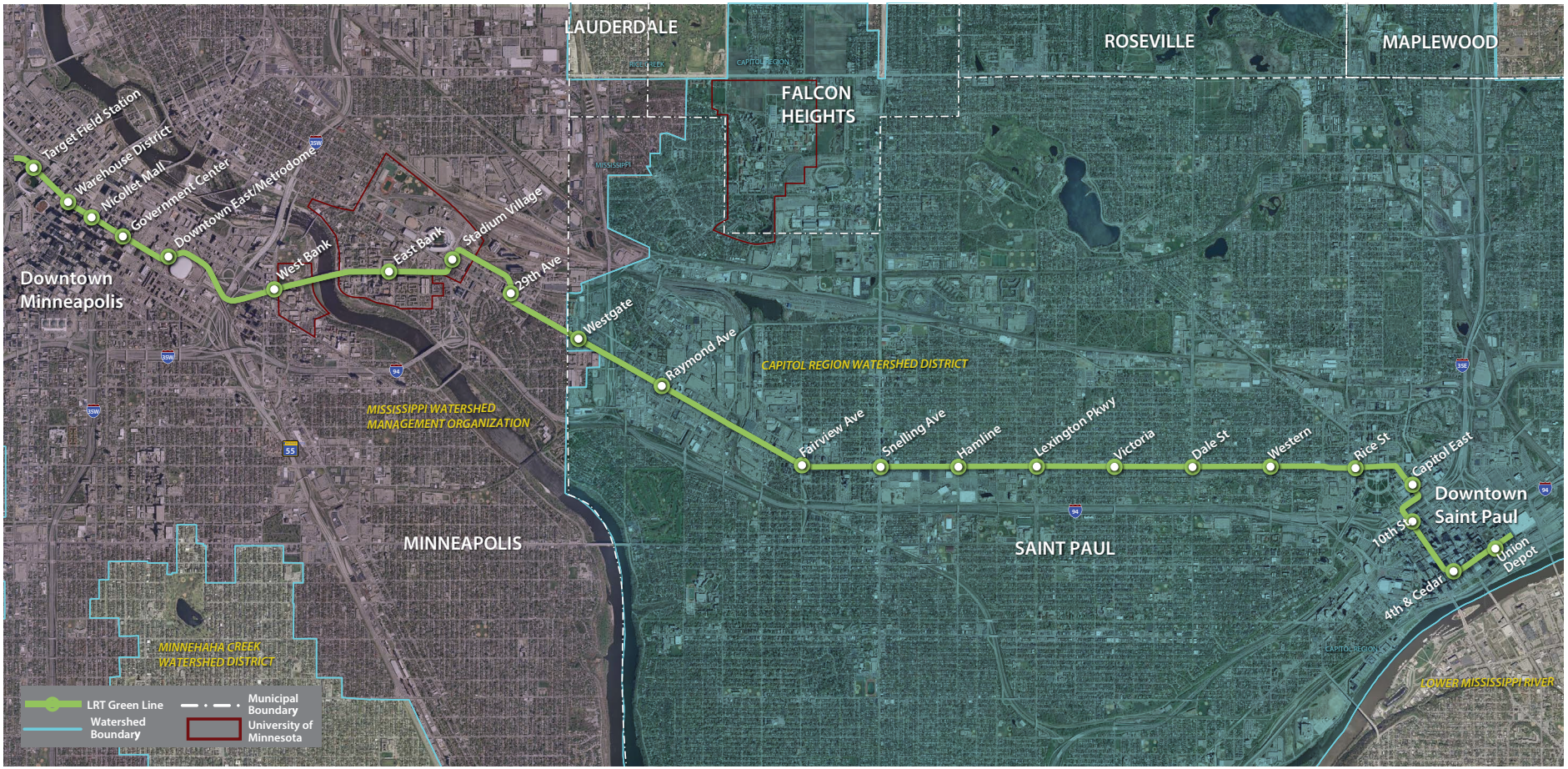


FIGURE 1 Central Corridor Context

Central Corridor Stormwater and Green Infrastructure Plan
SAC Feedback Form

The Central Corridor Stormwater and Green Infrastructure study is investigating the feasibility of implementing shared, stacked-function green infrastructure along the Central Corridor to meet stormwater requirements while also facilitating corridor redevelopment.

Please complete this form and bring it to the August 28 SAC Meeting. If your department has more than one representative on the SAC, please work together to complete the feedback form.

Department/Agency/City _____

1. From your department/agency's perspective, would shared, stacked- function green infrastructure be a valuable tool for achieving the following along the Central Corridor? Please rank on a scale from 1 (low) to 5 (high).

	Low Value				High Value
A. Transit-oriented Development	1	2	3	4	5
B. New Open Space	1	2	3	4	5
C. Innovative parking strategies	1	2	3	4	5

2. What is your department/agency's level of interest in further investigating the feasibility of implementing the following policy approaches? Please rank on a scale from 1 (low) to 5 (high).

	Low				High
A. A special service district could be established to construct and manage facilities owned by the city or other agency. *	1	2	3	4	5
B. New publically owned parks/open spaces could provide stacked-function benefits while hosting a public-private shared stormwater treatment facility.	1	2	3	4	5
C. New privately owned open spaces could provide stacked-function benefits while hosting privately owned shared stormwater treatment facilities.	1	2	3	4	5
D. Permanent shared parking facilities (either publicly or privately owned) could also host either public-private or private-private shared stormwater treatment facilities.	1	2	3	4	5
E. Green Alleys could host public-private shared stormwater treatment facilities.	1	2	3	4	5
F. Green Infrastructure located in street boulevards on parallel or side streets to the Central Corridor could host public-private shared stormwater treatment facilities.	1	2	3	4	5

3. If your department/agency has additional thoughts or suggestions that you want to share with the project team, please feel free to write them on the back of this form.

* There are a number of potential funding sources available to implement shared green infrastructure, such as ad valorum, fees, and special assessments. It is assumed that Policy Approaches B – F will identify a funding source. Policy approach A is specifically looking at one particular funding source (special service districts) to see if there is interest in using it, as it requires approval by those who will be taxed.

FIGURE 2 SAC Feedback Survey Form

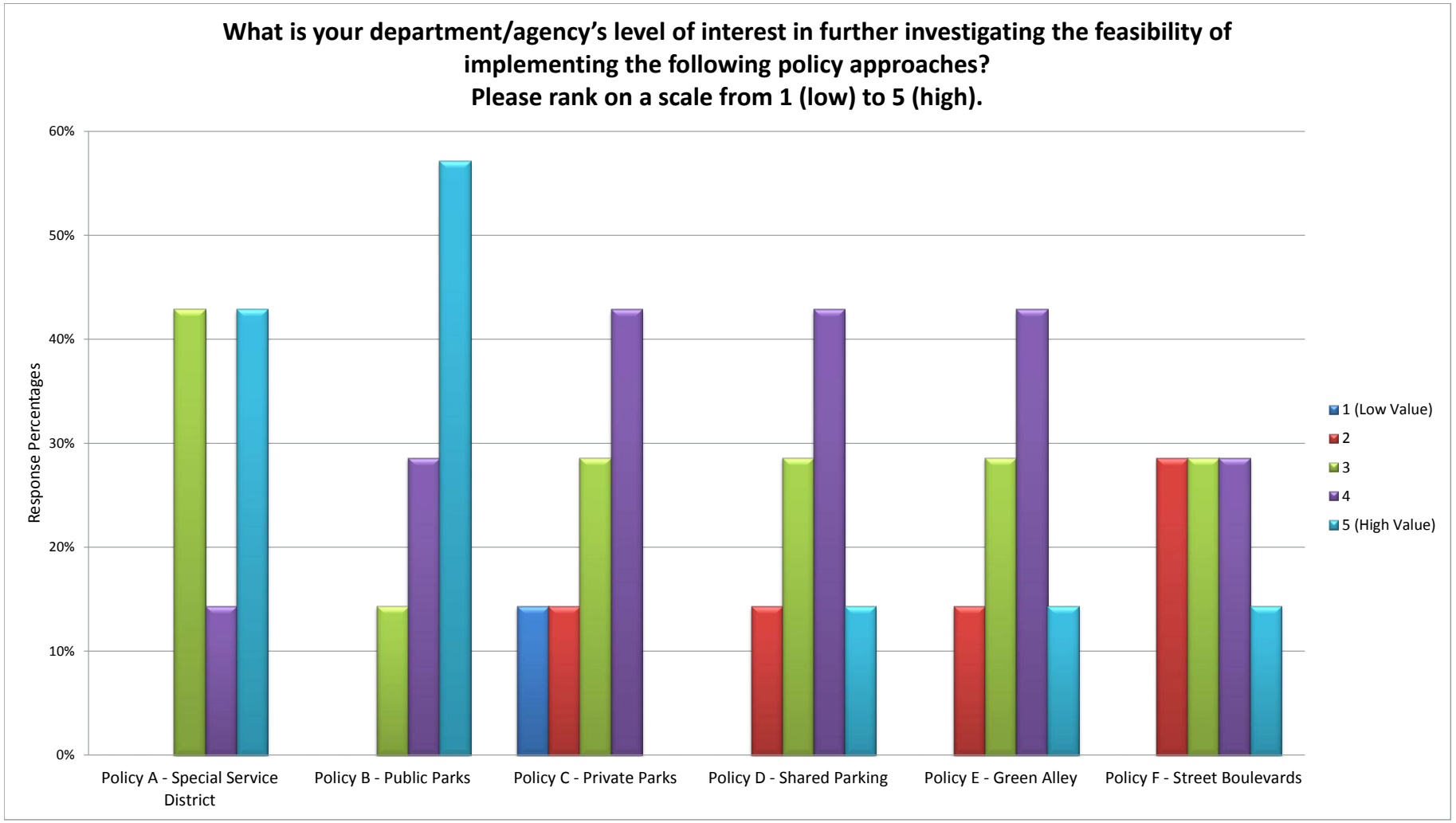


FIGURE 3 SAC Feedback Form Results August 28, 2012

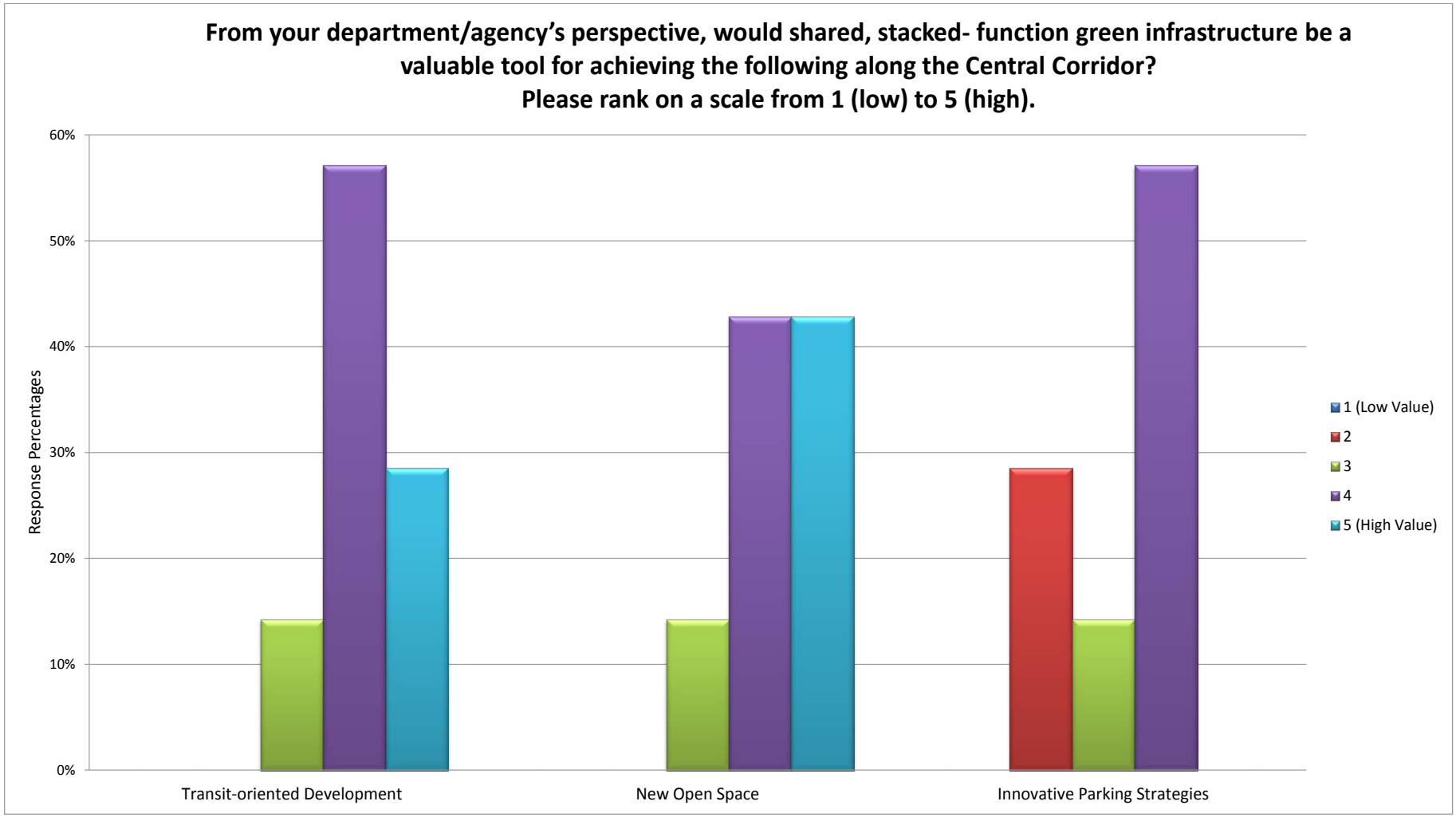


FIGURE 4 SAC Feedback Form Results August 28, 2012

Shared, Stacked-function Green Infrastructure Resolution Template

WHEREAS, the (agency name) recognizes the Light Rail Transit Green Line will spur redevelopment along the Central Corridor, providing an opportunity to construct new parks and open space, transit-oriented development (TOD), and sustainable design, thereby creating healthy and vibrant neighborhoods; and

WHEREAS, the (agency name) recognizes that stormwater runoff is a major cause of water pollution in urban areas and that redevelopment within (agency jurisdiction), must comply with all applicable federal, state, watershed management organization, and municipal stormwater management regulations; and

WHEREAS, the (agency name) recognizes that green infrastructure, which uses vegetation, soils, and stormwater management approaches that mimic natural processes, results in the creation of healthier urban environments by reducing water-based pollutants reaching area lakes and rivers, reducing the urban heat island effect, and creation of pedestrian friendly environments that promote active living; and

WHEREAS, the (agency name) recognizes when redevelopment occurs in established urban communities, stormwater management facilities are competing with other site features for limited and valuable space, resulting in stormwater facilities being relegated underground a vast majority of the time; and

WHEREAS, the (agency name) recognizes since 2011, 92 percent of Saint Paul redevelopment sites along the Green Line requiring stormwater management placed stormwater below ground, resulting in a lost opportunity to use stormwater to create a green, sustainable and vibrant community; and

WHEREAS, the (agency name) recognizes stacking stormwater management with other complementary land uses, such as parks, plazas, parking, streets and alleys, supports TOD through the efficient use of space in urban environments, and thereby, supporting community livability; and

WHEREAS, the (agency name) recognizes that sharing of stormwater management facilities between property owners may result in reduced capital, operations and maintenance expenditures and efficient use of space in urban environments.

NOW, THEREFORE, BE IS RESOLVED, that the (agency name) supports the incorporation of shared, stacked-function green infrastructure into redevelopment projects when doing so would result in economic, environmental or social benefits to the community.

FIGURE 5 Sample SSGI Policy Resolution Template

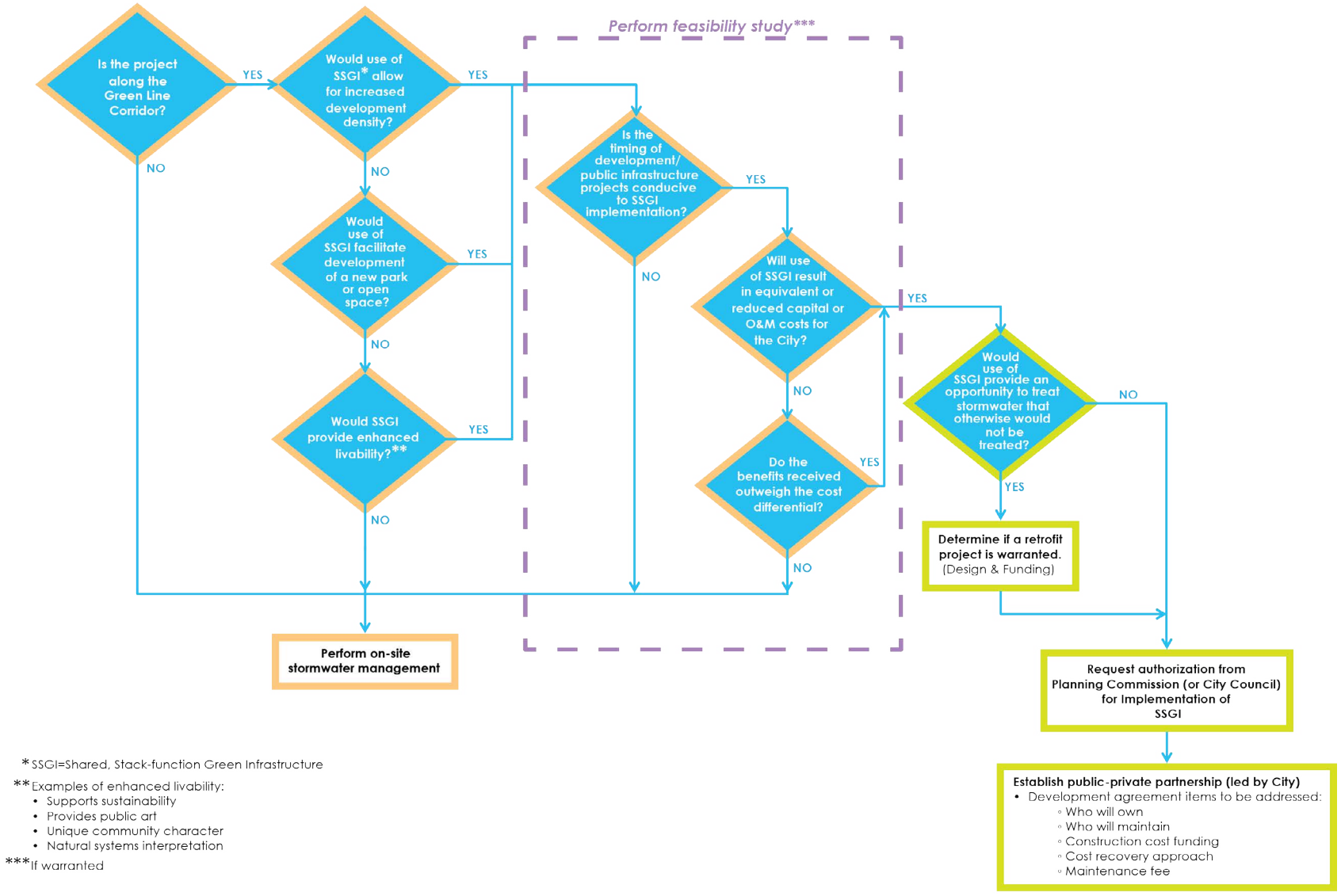


FIGURE 6 Sample SSGI Assessment Tool Template

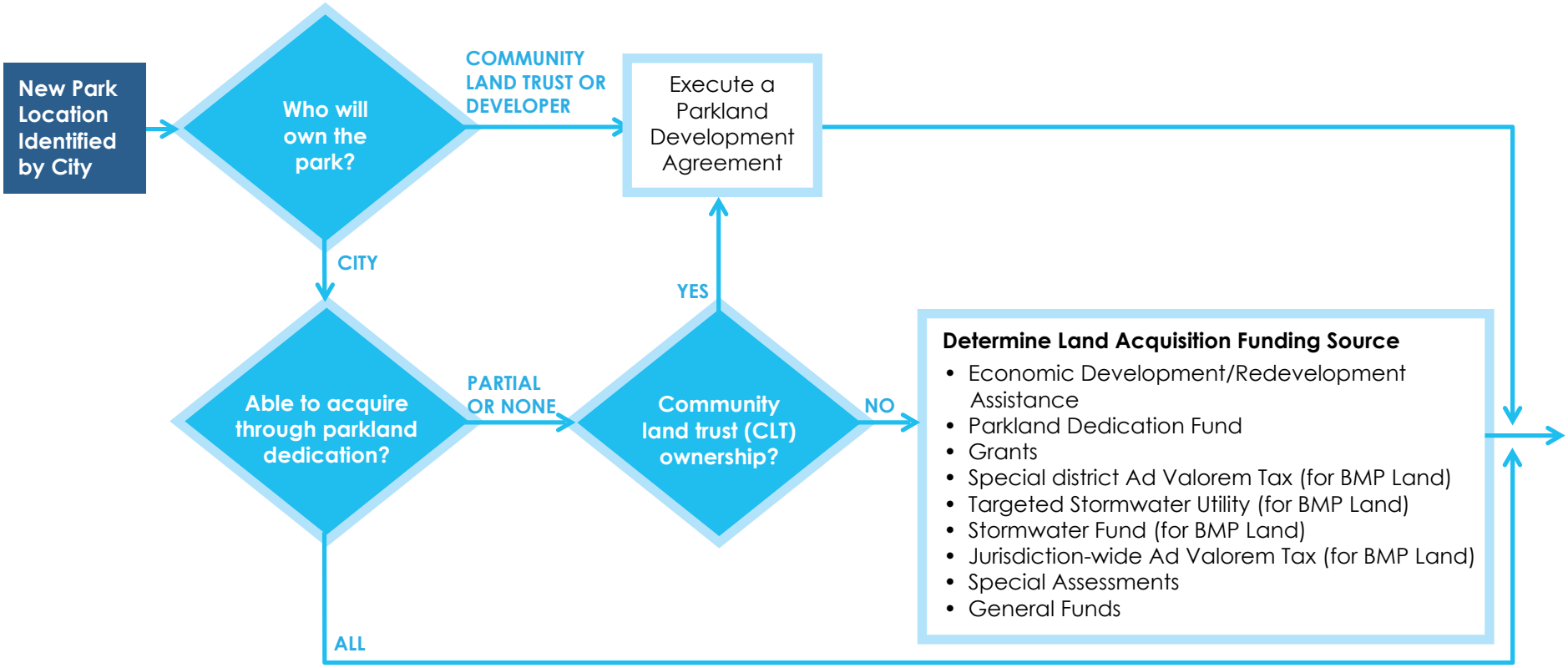


FIGURE 7 New Parks and Open Spaces Sample Flowchart and Matricies

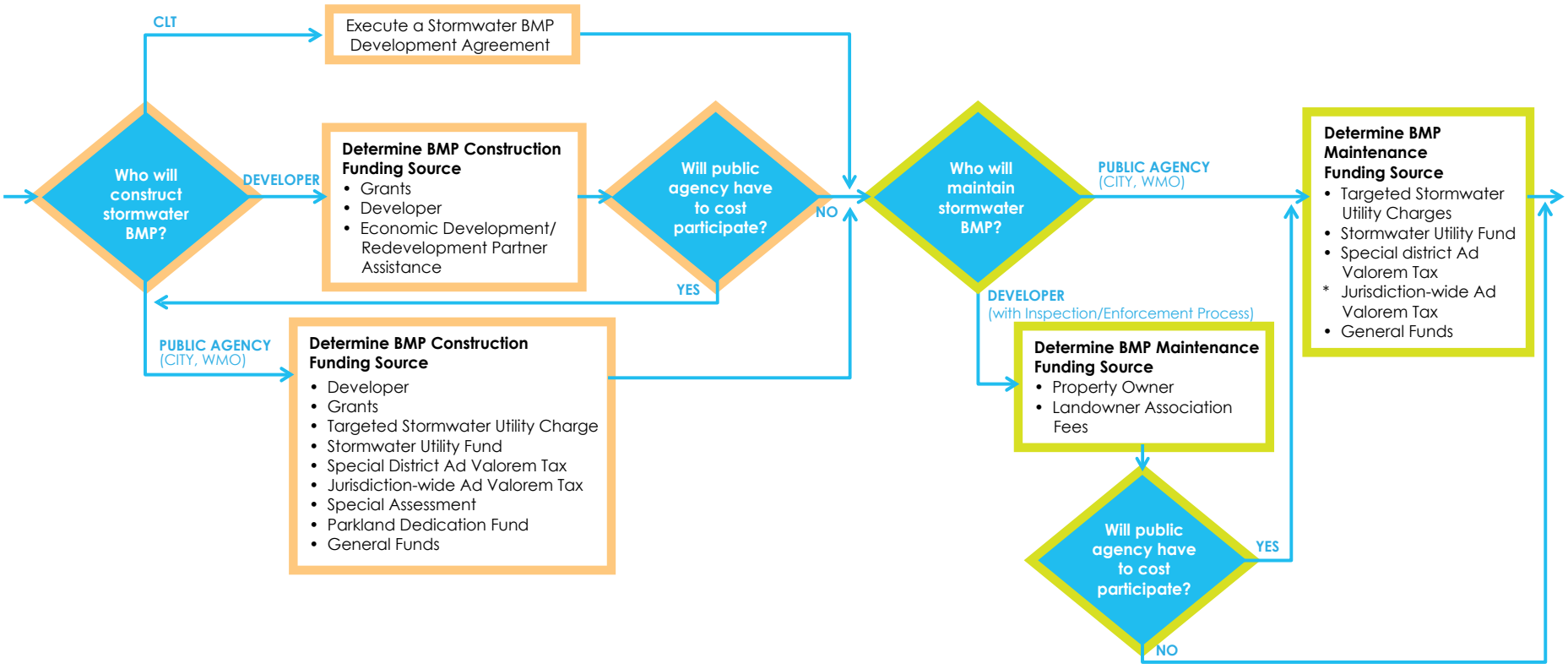


FIGURE 8 New Parks and Open Spaces Sample Flowchart and Matricies, cont.

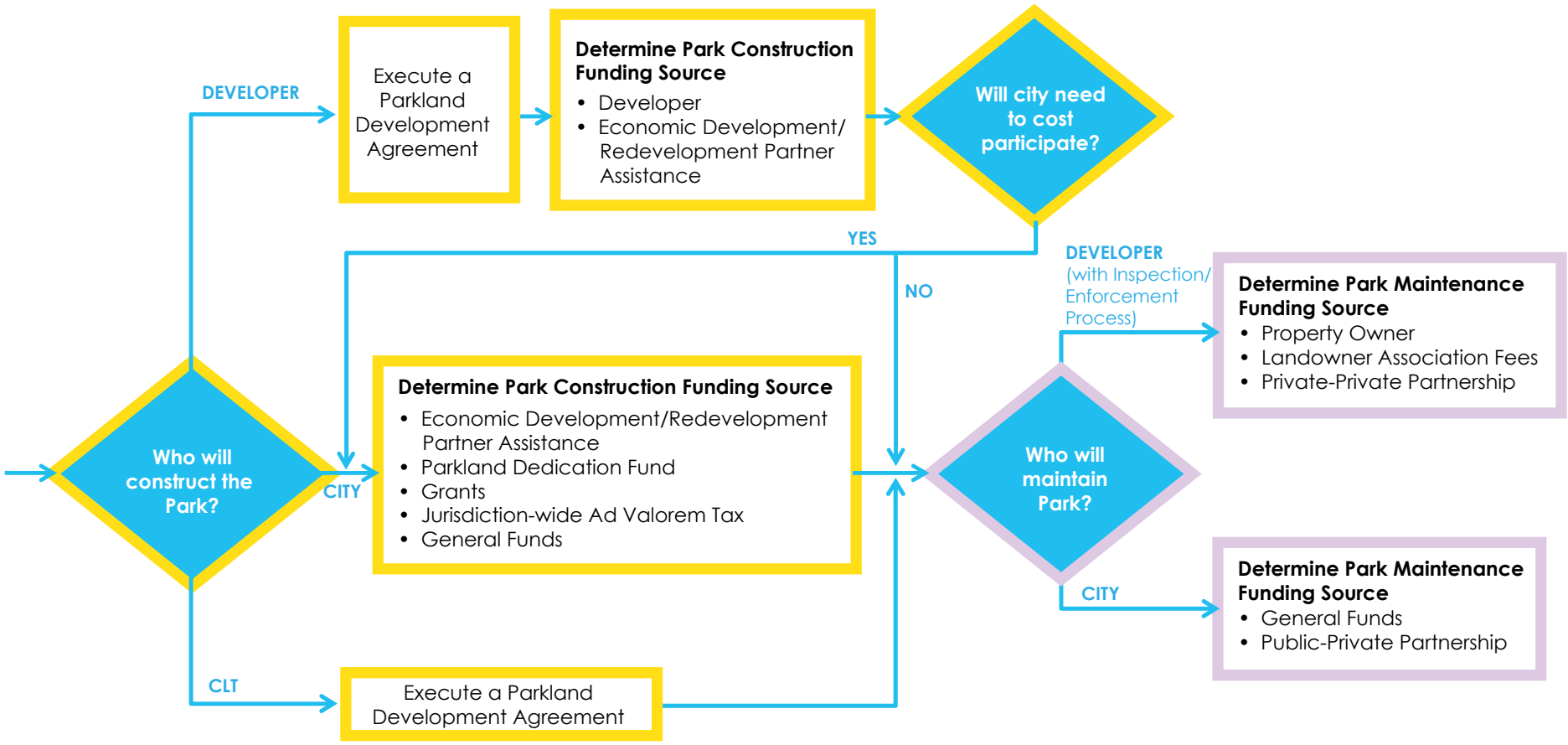


FIGURE 9 New Parks and Open Spaces Sample Flowchart and Matricies, cont.

Parks and Open Space

Table 1: BMP Construction

Shared Facility	Property & BMP Ownership	Parkland Acquisition Funding Source	Who is Responsible for BMP Construction	BMP Construction Funding Source	BMP Construction Cost Allocation Approach	Issues
Parkland	City	1. Economic development/ redevelopment partner assistance[1] a. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 2. Parkland dedication fund 3. Grants 4. Special district ad valorem tax[4] (for BMP land) 5. Targeted stormwater utility charge[2] (for BMP land) 6. Stormwater utility fund[2] (for BMP land) 7. Jurisdiction-wide ad valorem tax[3] (for BMP land) 8. Special Assessment[8] 9. General funds	Developer	1. Developer 2. Economic development/ redevelopment partner assistance[1]	• Per development agreement • As a condition of using parkland for private stormwater treatment, the developer will size and construct the treatment facility to treat runoff from adjacent parcels and public r/w directed to the park. The developer could be required to cover developer's portion of the treatment facility and a pro rata portion of the treatment facility for public r/w generated runoff that is directed to the park	• Is there an opportunity to modify the parkland dedication ordinance to increase required parkland development special fund contributions?
			Public Works or Parks	1. Developer 2. Grant(s) a. *May not occur frequently as grants are generally awarded through a competitive process* 3. Targeted stormwater utility charge[2] 4. Stormwater utility fund[2] 5. Special district ad valorem tax[4] a. *Special assessments - to assist developer with project financing* 6. Jurisdiction-wide ad valorem tax[3,] 7. Special Assessment[8] 8. Parkland Dedication Fund 9. General funds	• Per development agreement • As a condition of using parkland for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from developer's parcel and a pro rata portion of the treatment facility for public r/w generated runoff that is directed to the park	
			Watershed District/WMO	1. Developer 2. Targeted stormwater utility charge[5] 3. Stormwater utility fund[5] 4. Special district ad valorem tax[7] a. *Special assessments - to assist developer with project financing* 5. Jurisdiction-wide ad valorem tax[6] 6. Special Assessment[9] 7. General funds	• Per agreement between City and Watershed District/MWO • As a condition of using parkland for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from developer's parcel and a pro rata portion of the public r/w generated runoff that is directed to the park.	

FIGURE 10 New Parks and Open Spaces Sample Flowchart and Matricies, cont.

Parks and Open Space

Shared Facility	Property & BMP Ownership	Parkland Acquisition Funding Source	Who is Responsible for BMP Construction	BMP Construction Funding Source	BMP Construction Cost Allocation Approach	Issues
Parkland	Community Land Trust (CLT)	• Grants • Charitable Contributions • Endowment earnings	Community Land Trust	• Grants • Charitable Contributions • Endowment earnings	• Contractual agreement needed between CLT and developer for payment of that portion of the treatment facility that treats runoff from developer's parcel.	• Stormwater development agreement needed between City and CLT
	Developer	1. Developer	Developer	1. Grants 2. Developer 3. Economic development/ redevelopment partner assistance[1] a. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria*	• Per development agreement or parkland development agreement • As a condition of using parkland for private stormwater treatment, the developer will size and construct the treatment facility to treat runoff from adjacent parcels and public r/w directed to park. The developer will be required to cover developer's portion of the treatment facility and a pro rata portion of the treatment facility for public r/w generated runoff	

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[1] See Section III.A.5
[2] See Section III.A.1.a
[3] See Section III.A.2.a
[4] See Section III.A.3.c.v
[5] See Sections III.A.1.b/c
[6] See Sections III.A.2.b/c
[7] See Sections III.A.3.c.iv/vii
[8] See Section III.A.3.a.i
[9] See Section III.A.3.a.ii

FIGURE 11 New Parks and Open Spaces Sample Flowchart and Matricies, cont.

Parks and Open Space

Table 2: BMP Maintenance

Shared Facility	Property & BMP Ownership	Who Maintains BMP	BMP Maintenance Funding Source	BMP Maintenance Cost Allocation Approach	Issues
Parkland	City	Public Works	1. Targeted stormwater utility charge[2] 2. Stormwater utility fund[2] 3. Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 4. Jurisdiction-wide ad valorem tax[3] 5. General Fund	• As a condition of using parkland for private stormwater treatment, the developer could be charged to treat runoff from developer's parcel and a pro rata portion of the public r/w generated runoff that is directed to the park	
		Watershed District/WMO	1. Targeted stormwater utility charge[5] 2. Stormwater utility fund[5] 3. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* *4.* Jurisdiction-wide ad valorem tax[6] *5.* General Fund	• Per agreement between City and Watershed District/MWO • As a condition of using parkland for private stormwater treatment, the developer could be charged to treat runoff from developer's parcel and a pro rata portion of the public r/w generated runoff that is directed to the parking ramp	• WMO needs joint powers agreement from city to operate a utility[10] • An inspection/enforcement process is needed to ensure maintenance compliance
	Developer	Developer	1. Property owners 2. Landowner association fees	• Contract between City and Developer	• An inspection/enforcement process is needed to ensure maintenance compliance
		Watershed District/WMO	1. Contracted work		
		Public Works	1. Contracted work		

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[2] See Section III.A.1.a
[3] See Section III.A.2.a
[4] See Section III.A.3.c.v
[5] See Sections III.A.1.b/c
[6] See Sections III.A.2.b/c
[7] See Sections III.A.3.c.iv/vii
[10] See Section III.A.1.b

FIGURE 12 New Parks and Open Spaces Sample Flowchart and Matricies, cont.

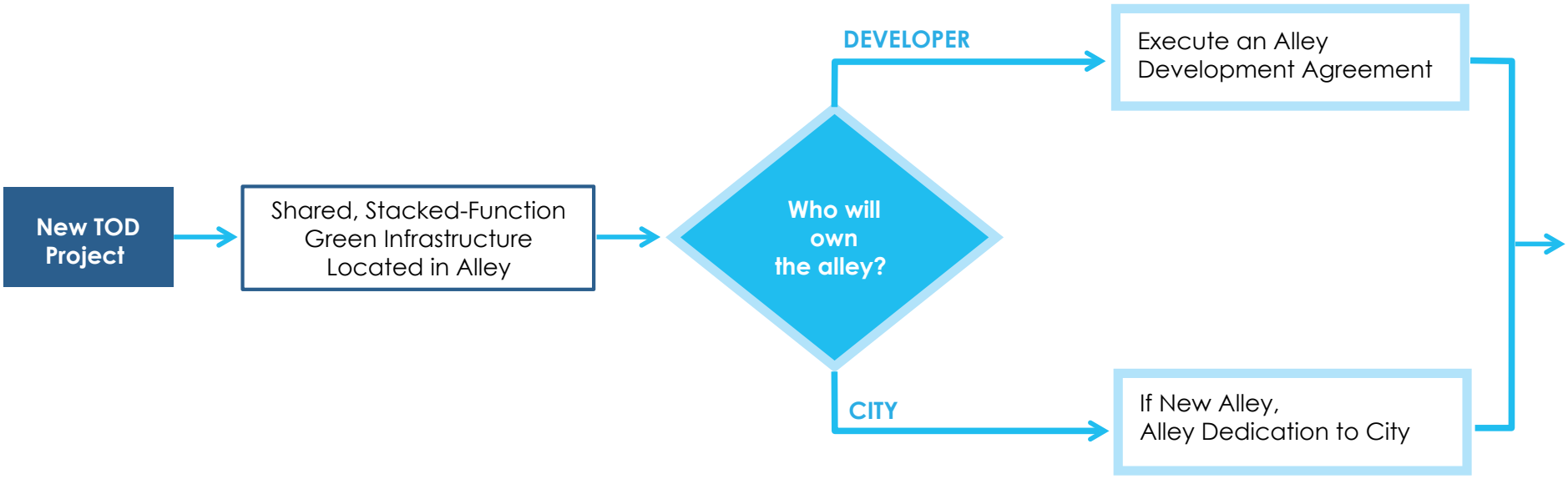


FIGURE 13 Green Alleys Sample Flowchart and Matricies

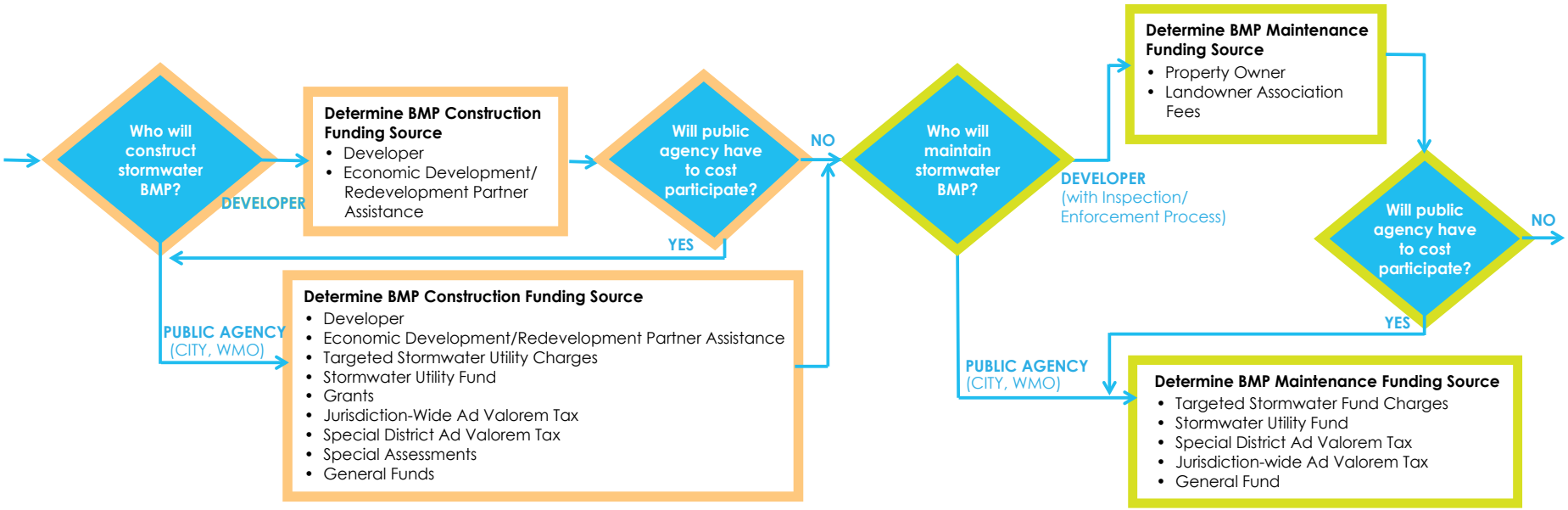


FIGURE 14 Green Alleys Sample Flowchart and Matricies, cont.

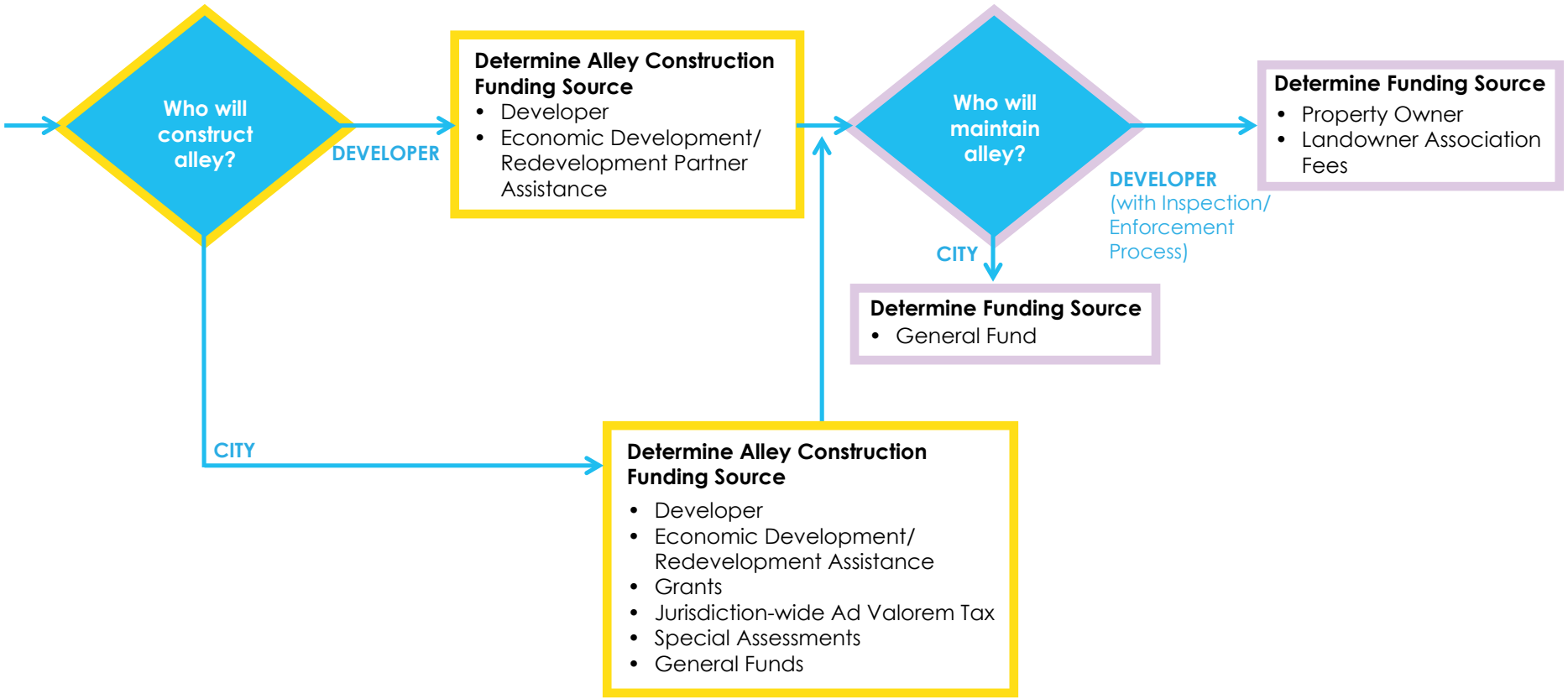


FIGURE 15 Green Alleys Sample Flowchart and Matricies, cont.

Alleys

Table 1: Shared Stormwater Facility Best Management Practice (BMP) Construction

Shared Facility	Property & BMP Ownership	Who is Responsible for BMP Construction	BMP Construction Funding Source	BMP Construction Cost Allocation Approach	Potential Issues
Alley	City	Developer	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1]	• Per development agreement • As a condition of using alley for private stormwater treatment, the developer could be required to size and construct the treatment facility to treat runoff from adjacent parcels and from the public r/w (alley and/or adjacent streets) draining to the alley. The developer could be required to cover the cost of these portions of the treatment facility	• Will developer be required to reconstruct the full alley or just that portion of the alley needed to meet stormwater treatment needs and to maintain positive drainage.
		Public Works	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 3. Targeted stormwater utility charge (connection fee)[2] 4. Stormwater utility fund[2] 5. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 6. Jurisdiction-wide ad valorem tax[3,] 7. Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 8. Special assessments[8] *a. May be requested by developer to assist with project financing* 9. General funds	• Per development agreement • As a condition of using alley for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from adjacent parcels and from public r/w (alley and/or adjacent streets) draining to the alley	
		Watershed District/WMO	1. Targeted stormwater utility charge (connection fee)[5] 2. Stormwater utility fund[5] 3. Jurisdiction-wide ad valorem tax[6] 4. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 5. Special assessments[9] *a. May be requested by developer to assist with project financing* 6. General funds	• Per agreement between City and Watershed District/MWO • As a condition of using alley for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from adjacent parcels and from public r/w (alley and/or adjacent streets) draining to the alley	

FIGURE 16 Green Alleys Sample Flowchart and Matricies, cont.

Alleys

Shared Facility	Property & BMP Ownership	Who is Responsible for BMP Construction	BMP Construction Funding Source	BMP Construction Cost Allocation Approach	Potential Issues
Alley	Developer	Developer	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1] a. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria*	• Per development agreement • As a condition of using alley for private stormwater treatment, the developer could be required to size and construct the treatment facility to treat runoff from adjacent parcels and from the public r/w (alley and/or adjacent streets) draining to the alley. The developer may be required to cover the cost of these portions of the treatment facility	• Will developer be required to reconstruct the full alley or just that portion of the alley needed to meet stormwater treatment needs and to maintain positive drainage.

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[1] See Section III.A.5
[2] See Section III.A.1.a
[3] See Section III.A.2.a
[4] See Section III.A.3.c.v
[5] See Sections III.A.1.b/c
[6] See Sections III.A.2.b/c
[7] See Sections III.A.3.c.iv/vii
[8] See Section III.A.3.a.i
[9] See Section III.A.3.a.ii

FIGURE 17 Green Alleys Sample Flowchart and Matricies, cont.

Alleys

Table 2: Shared Stormwater Facility Best Management Practice (BMP) Maintenance

Shared Facility	Property & BMP Ownership	Who Maintains BMP	BMP Maintenance Funding Source	BMP Maintenance Cost Allocation Approach	Issues
Alley	City	Public Works	• Targeted stormwater utility charge (use fee)[2] • Stormwater utility fund[2] • Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* • General Fund	• As a condition of using alley for private stormwater treatment, the developer could be charged to treat runoff from developer's parcel draining to the alley	
		Watershed District/WMO	1. Targeted stormwater utility charge (use fee)[5] 2. Stormwater utility fund[5] 3. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* *4.* General Fund	• Per agreement between City and Watershed District/MWO	• WMO needs joint powers agreement from city to operate a utility[10] • An inspection/enforcement process is needed to ensure maintenance compliance
	Developer	• Property owner • Landowner association	1. Property owner 2. Landowner association fees	• Contract between City and Developer	• An inspection/enforcement process is needed to ensure maintenance compliance
		Watershed District/WMO	1. Contracted work		
		Public Works	1. Contracted work		

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[2] See Section III.A.1.a

[4] See Section III.A.3.c.v

[5] See Sections III.A.1.b/c

[6] See Sections III.A.2.b/c

[7] See Sections III.A.3.c.iv/vii

[10] See Section III.A.1.b

FIGURE 18 Green Alleys Sample Flowchart and Matricies, cont.

Alleys

Table 3: Alley Construction

Shared Facility	Property & BMP Ownership	Who is Responsible for Alley Construction	Alley Construction Funding Source	Alley Construction Cost Allocation Approach	Potential Issues
Alley	City	Developer	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1]	• Per development agreement • As a condition of using alley for private stormwater treatment, the developer could be required to cover the entire cost of the alley	• Will developer be required to reconstruct the full alley or just that portion of the alley needed to meet stormwater treatment needs and to maintain positive drainage.
		Public Works	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 3. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 4. Jurisdiction-wide ad valorem tax[3] 5. Special Assessments[8] 6. General funds	• Per development agreement • As a condition of using alley for private stormwater treatment, the developer could be required to cover the entire cost of the alley	
	Developer	Developer	1. Developer a. Economic development/ redevelopment partner assistance/incentive[1] b. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria*	• Per development agreement • As a condition of using alley for private stormwater treatment, the developer could be required to cover the entire cost of the alley	• Will developer be required to reconstruct the full alley or just that portion of the alley needed to meet stormwater treatment needs and to maintain positive drainage.

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[1] See Section III.A.5

[3] See Sections III.A.2.a

[8] See Section III.A.3.a.i

Table 4: Alley Maintenance

Shared Facility	Property & BMP Ownership	Who Maintains Alley	Alley Maintenance Funding Source	Alley Maintenance Cost Allocation Approach	Issues
Alley	City	Public Works	• Special Assessments[8] • General Fund		
	Developer	• Property owner • Landowner association	• Property owners • Landowner association fees		

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[8] See Section III.A.3.a.i

FIGURE 19 Green Alleys Sample Flowchart and Matricies, cont.

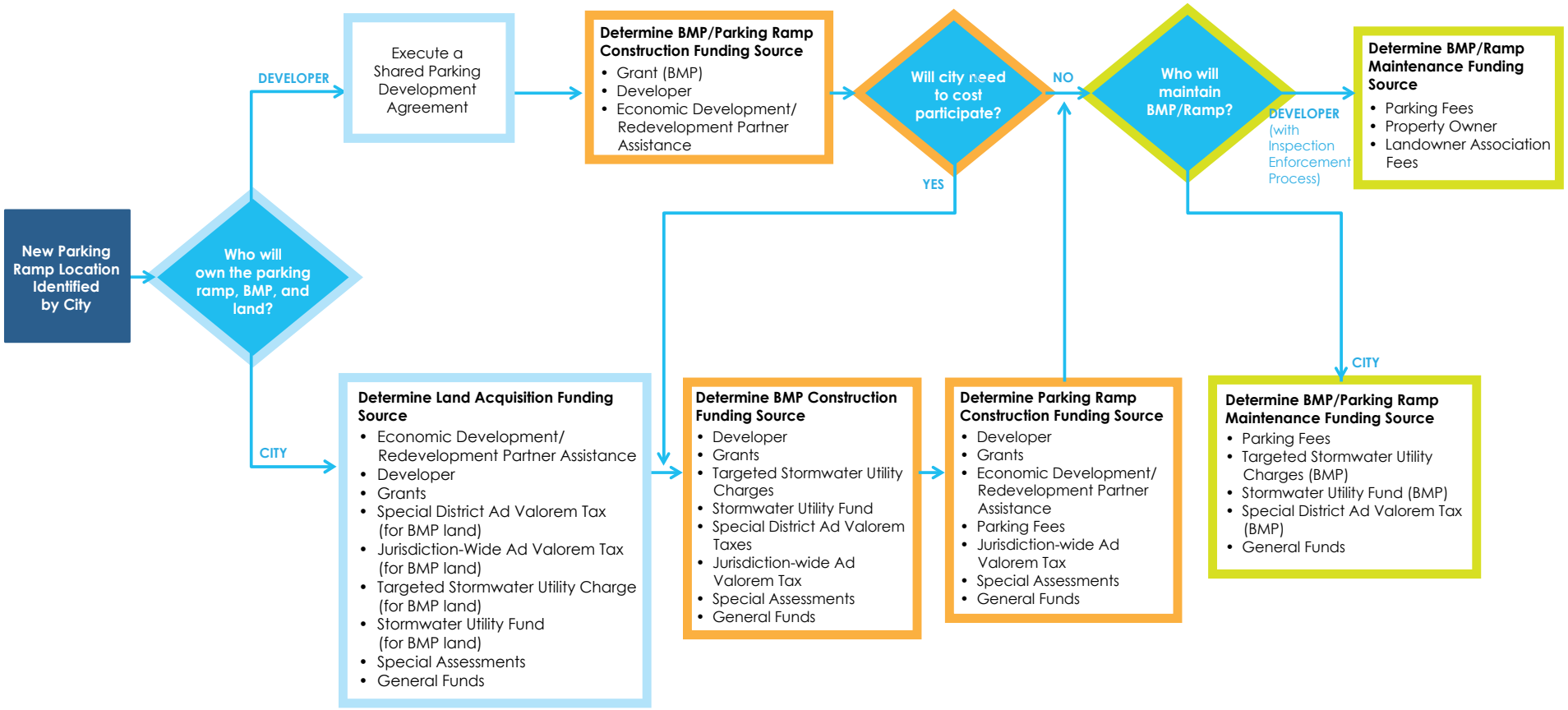


FIGURE 20 Shared Parking Facilities Sample Flowchart and Matricies

Shared Parking

Table 1: BMP & Ramp Construction

Shared Facility	Property, BMP & Ramp Ownership	Land Acquisition Funding Source	BMP & Ramp Construction Responsibility	BMP Construction Funding Source	Ramp Construction Funding Source	BMP & Ramp Construction Cost Allocation Approach	Issues
Parking Ramp	City	1. Economic development/ redevelopment partner assistance[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 2. Developer 3. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 4. Special district ad valorem tax[4] (*for BMP land)* 5. Jurisdiction-wide ad valorem tax[3,](for BMP land) 6. Targeted stormwater utility charge[2] (for BMP land) 7. Stormwater utility fund[2] (for BMP land) 8. Special Assessments[8] 9. General funds	Public Works	1. Developer 2. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 3. Targeted stormwater utility charge[2] 4. Stormwater utility fund[2] 5. Special district ad valorem tax[4] 6. Jurisdiction-wide ad valorem tax[3,] 7. Special Assessment[8] 8. General funds	1. Developer 2. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 3. Economic development/ redevelopment partner assistance[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 4. Parking fees 5. Jurisdiction-wide ad valorem tax[3] 6. Special Assessments[8] 7. General funds	• Per development agreement • As a condition of using parking ramp for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from developer's parcel and a pro-rata portion of the public r/w that is directed to the parking ramp. • As a condition of using parking ramp for private parking, developer will be required to pay the construction cost for that portion of the parking ramp that accommodates minimum (or more?) private parking stalls required per zoning code.	• Investigate the feasibility of establishing a parking dedication fee or parking development special fund through economic development/ redevelopment partners
			Watershed District/WMO (BMP only)	1. Developer 2. Targeted stormwater utility charge[5] 3. Stormwater utility fund[5] 4. Special district ad valorem tax[7] 5. Jurisdiction-wide ad valorem tax (to repay bonds)[6] 6. Special Assessment[8] 7. General funds	n/a	• Per agreement between City and Watershed District/MWO • As a condition of `using parking ramp for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from developer's parcel and a pro-rata portion of the public r/w that is directed to the parking ramp.	

FIGURE 21 Shared Parking Facilities Sample Flowchart and Matricies, cont.

Shared Parking

Shared Facility	Property, BMP & Ramp Ownership	Land Acquisition Funding Source	BMP & Ramp Construction Responsibility	BMP Construction Funding Source	Ramp Construction Funding Source	BMP & Ramp Construction Cost Allocation Approach	Issues
Parking Ramp	Developer	Developer	Developer	1. Grants (for BMP land) 2. Developer 3. Economic development/ redevelopment partner assistance[1] a. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria*	1. Developer 2. Economic development/ redevelopment partner assistance a. *May not occur frequently as project must meet economic development/ redevelopment goals and criteria*	• Per development agreement • The developer will size and construct the treatment facility to treat runoff from contributing parcels and from the public r/w directed to the parking ramp. The developer could be required to cover developer's portion of the treatment facility and a pro-rata portion of the treatment facility for the public r/w.	

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[1] See Section III.A.5
[2] See Section III.A.1.a
[3] See Section III.A.2.a
[4] See Section III.A.3.c.v
[5] See Sections III.A.1.b/c
[6] See Sections III.A.2.b/c
[7] See Sections III.A.3.c.iv/vii
[8] See Section III.A.3.a.i

FIGURE 22 Shared Parking Facilities Sample Flowchart and Matricies, cont.

Shared Parking

Table 2: BMP & Ramp Maintenance

Shared Facility	Property, BMP & Ramp Ownership	BMP & Ramp Maintenance Responsibility	BMP Maintenance Funding Source	Parking Ramp Maintenance Funding Source	BMP & Ramp Maintenance Cost Allocation Approach	Issues
Parking Ramp	City	Public Works	1. Parking Fees 2. Targeted stormwater utility charge[2] 3. Stormwater utility fund[2] 4. Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 5. General Fund	1. Parking Fees 2. General Fund	• As a condition of using parking ramp for private stormwater treatment, the developer could be charged for BMP maintenance for that portion of the treatment resulting from runoff generated from developer's parcel. • As a condition of using parking ramp for private parking, developer could be required to pay parking ramp maintenance for that portion of the parking ramp that accommodates minimum (or more?) private parking stalls required per zoning code.	• Assumes any fees generated by reuse of harvested stormwater would not generate meaningful revenue
		Watershed District/WMO (BMP only)	1. Targeted stormwater utility charge[5] 2. Stormwater utility fund[5] 3. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 4. General Fund		• As a condition of using parking ramp for private stormwater treatment, the developer could be charged for BMP maintenance for that portion of the treatment resulting from runoff generated from developer's parcel.	
	Developer	Developer	1. Parking Fees 2. Property owner 3. Landowner association fees	1. Parking Fees 2. Property owner 3. Landowner association fees		• Assumes any fees generated by reuse of harvested stormwater would not generate meaningful revenue • An inspection/enforcement process is needed to ensure maintenance compliance
		Watershed District/WMO (BMP only)	1. Contracted work			
		Public Works	1. Contracted work			

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[2] See Section III.A.1.a

[4] See Section III.A.3.c.v

[5] See Sections III.A.1.b/c

[7] See Sections III.A.3.c.iv/vii

FIGURE 23 Shared Parking Facilities Sample Flowchart and Matricies, cont.

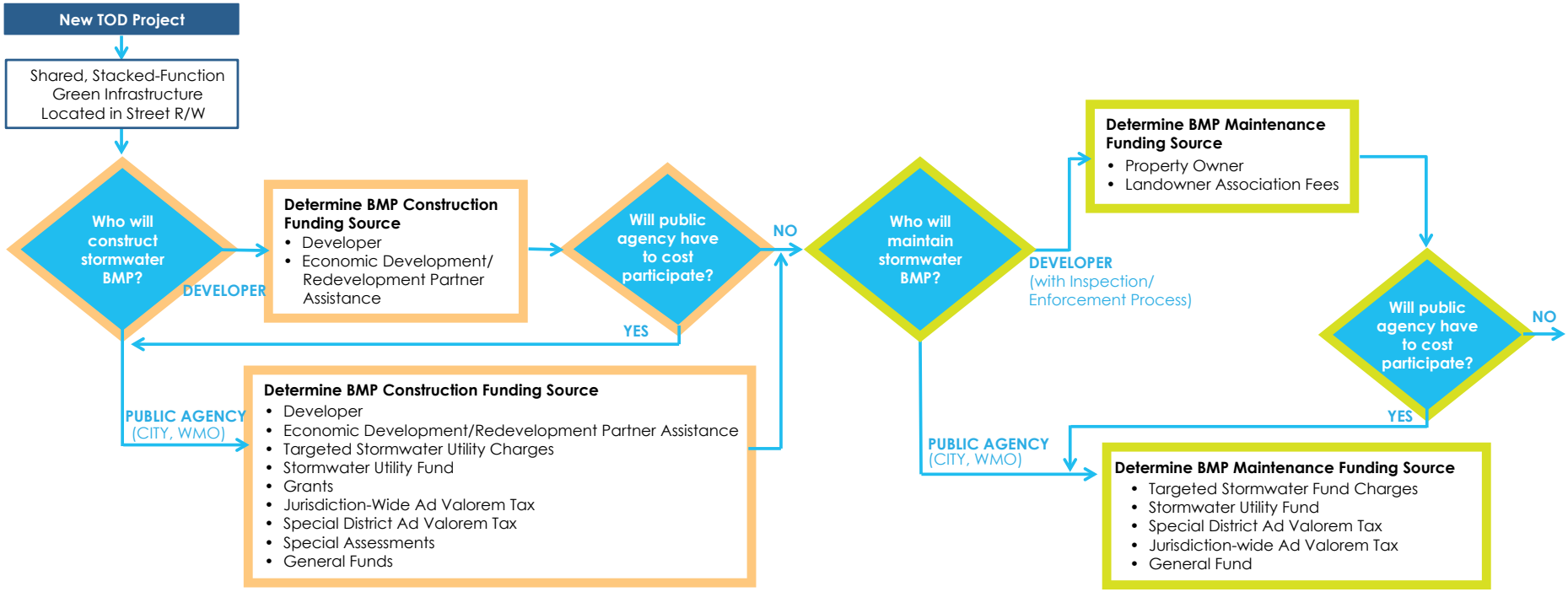


FIGURE 24 Street Right-of-Way Sample Flowchart and Matricies

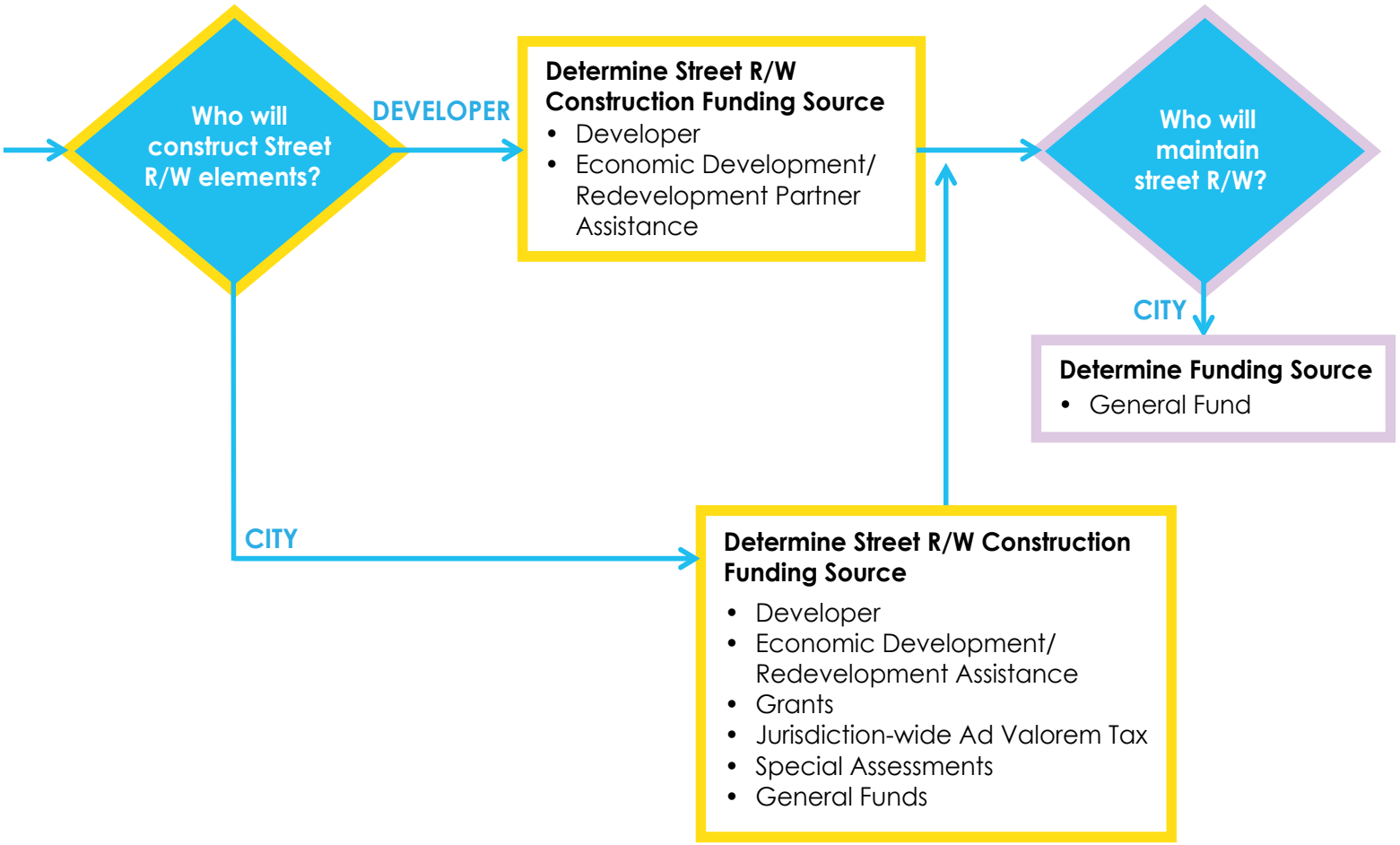


FIGURE 25 Street Right-of-Way Sample Flowchart and Matricies, cont.

Street Right-of-Way

Table 1: Shared Stormwater Facility Best Management Practice (BMP) Construction

Shared Facility	Property & BMP Ownership	Who is Responsible for BMP Construction	BMP Construction Funding Source	BMP Construction Cost Allocation Approach	Potential Issues	
Street R/W	City	Developer	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1]	• Per development agreement • As a condition of using street r/w for private stormwater treatment, the developer could be required to size and construct the treatment facility to treat runoff from the public r/w. The developer could be required to cover the cost of these portions of the treatment facility.	• Will developer be required to reconstruct the full street or just that portion of the street needed to meet stormwater treatment needs and to maintain positive drainage. • Street will need to meet City specifications and testing, and will need to be acceptable to City upon completion.	The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum: [1] See Section III.A.5 [2] See Section III.A.1.a [3] See Section III.A.2.a [4] See Section III.A.3.c.v [5] See Sections III.A.1.b/c [6] See Sections III.A.2.b/c [7] See Sections III.A.3.c.iv/vii [8] See Section III.A.3.a.i [9] See Section III.A.3.a.ii
		Public Works	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 3. Targeted stormwater utility charge (connection fee)[2] 4. Stormwater utility fund[2] 5. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 6. Jurisdiction-wide ad valorem tax[3,] 7. Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 8. Special assessments[8] *a. May be requested by developer to assist with project financing* 9. General funds	• Per development agreement • As a condition of using street r/w for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from public r/w.		
		Watershed District/WMO	1. Developer 2. Targeted stormwater utility charge (connection fee)[5] 3. Stormwater utility fund[5] 4. Jurisdiction-wide ad valorem tax[6] 4. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* *5.* Special assessments[9] *a. May be requested by developer to assist with project financing* 6. General funds	• Per agreement between City and Watershed District/MWO • As a condition of using street r/w for private stormwater treatment, developer could be required to pay the construction cost for that portion of the treatment facility that treats runoff from public r/w.	• Will developer be required to reconstruct the full street or just that portion of the street needed to meet stormwater treatment needs and to maintain positive drainage. • Street will need to meet City specifications and testing, and will need to be acceptable to City upon completion.	

FIGURE 26 Street Right-of-Way Sample Flowchart and Matricies, cont.

Street Right-of-Way

Table 2: Shared Stormwater Facility Best Management Practice (BMP) Maintenance

Shared Facility	Property & BMP Ownership	Who Maintains BMP	BMP Maintenance Funding Source	BMP Maintenance Cost Allocation Approach	Issues
Street R/W	City	Public Works	1. Targeted stormwater utility charge (use fee)[2] 2. Stormwater utility fund[2] 3. Special district ad valorem tax[4] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* 4. General Fund	• As a condition of using street r/w for private stormwater treatment, the developer could be charged to treat runoff from developer's parcel draining to the street r/w.	
		Watershed District/WMO	1. Targeted stormwater utility charge (use fee)[5] 2. Stormwater utility fund[5] 3. Special district ad valorem tax[7] *a. Can be met with opposition if all properties in sub area do not perceive a direct benefit* *4.* General Fund	• Per agreement between City and Watershed District/MWO • As a condition of using street r/w for private stormwater treatment, the developer could be charged to treat runoff from developer's parcel draining to the street r/w.	• WMO needs joint powers agreement from city to operate a utility[10] • An inspection/enforcement process is needed to ensure maintenance compliance
		Developer	1. Property owner 2. Landowner association fees	• Contract between City and Developer	• An inspection/enforcement process is needed to ensure maintenance compliance

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[2] See Section III.A.1.a
[4] See Section III.A.3.c.v
[5] See Sections III.A.1.b/c
[6] See Sections III.A.2.b/c
[7] See Sections III.A.3.c.iv/vii
[10] See Section III.A.1.b

FIGURE 27 Street Right-of-Way Sample Flowchart and Matricies, cont.

Street Right-of-Way

Table 3: Street Right-of-Way Construction

Shared Facility	Property & BMP Ownership	Who is Responsible for Street R/W Construction	Street R/W Construction Funding Source	Street R/W Construction Cost Allocation Approach	Potential Issues
Street R/W	City	Developer	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1]	• Per development agreement • As a condition of using street r/w for private stormwater treatment, the developer could be required to cover the entire cost of the street construction	
		Public Works	1. Developer 2. Economic development/ redevelopment partner assistance/incentive[1] *a. May not occur frequently as project must meet economic development/ redevelopment goals and criteria* 3. Grant(s) *a. May not occur frequently as grants are generally awarded through a competitive process* 4. Jurisdiction-wide ad valorem tax[3] 5. Special Assessments[8] 6. General funds	• Per development agreement • As a condition of using street r/w for private stormwater treatment, the developer could be required to cover the entire cost of the street construction	

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[1] See Section III.A.5

[3] See Sections III.A.2.a

[8] See Section III.A.3.a.i

Table 4: Street Right-of-Way Maintenance

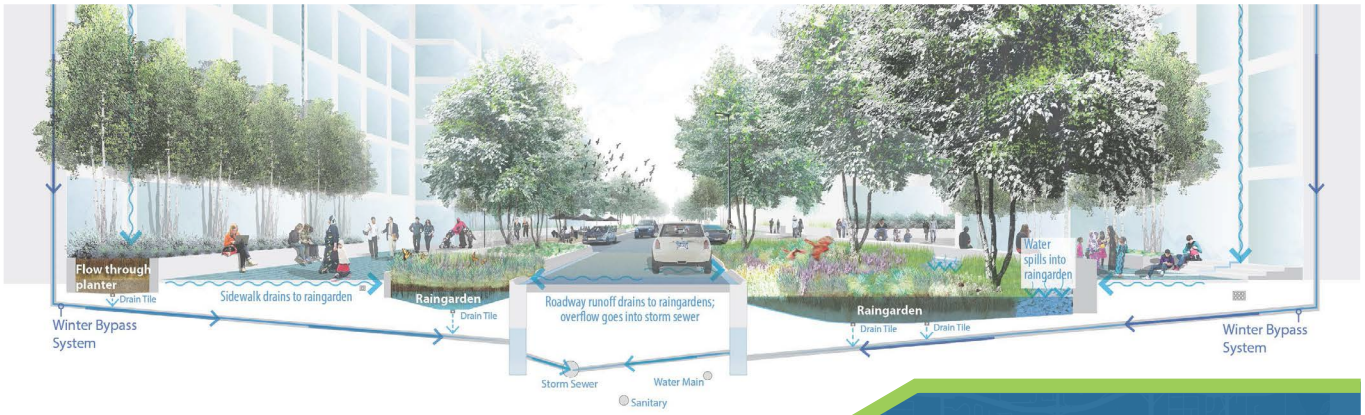
Shared Facility	Property & BMP Ownership	Who Maintains Street	Street Maintenance Funding Source	Street Maintenance Cost Allocation Approach	Issues
Street R/W	City	Public Works	• Special Assessments[8] • General Fund		
	Developer	• Property owner • Landowner association	• Property owners • Landowner association fees		

The following notes reference Attachment B, *Central Corridor Stormwater and Green Infrastructure Plan: Governmental Authority Relating to Stormwater Infrastructure* memorandum:

[8] See Section III.A.3.a.i

FIGURE 28 Street Right-of-Way Sample Flowchart and Matricies, cont.

FIGURE 29 Sample Brochure (Z-fold) Side A



A system where stormwater from multiple parcels is directed to shared, stacked-function green infrastructure (SSGI) supports economic, environmental, and social benefits.

With SSGI we can "Think Blue" on the Green Line.

THINK BLUE

What is the Value of SSGI?

- Shared green infrastructure systems can result in reduced capital costs for both public and private sectors.
- Green infrastructure can be integrated (stacked) with other land uses including parks, plazas, gardens or boulevards to attain multiple community functions, including public art.
- Stacked green infrastructure provides a "triple bottom line" benefit of economic, environmental and social improvements that support community livability and increase sustainability.
- Enhanced community livability attracts new development and economic growth.

Case Studies

SSGI and the 'Think Blue' approach are not new or specific to the Green line. Here are three local examples of shared stacked stormwater facilities that create community features and amenities.

Trout Brook Nature Sanctuary
City of Saint Paul, MN & Capitol Region Watershed District

Benefits: Harvests and cleanses runoff from adjacent parcels • education • interpretation • public art integration • ecosystem restoration • recreation • wildlife habitat

Biofiltration Basin, Tartan Crossing Development
City of Oakdale, MN & Wellington Management, Inc.

Benefits: Volume control and water quality treatment for 15-acre drainage area • education • interpretation • public art integration • development gateway feature • recreation • wildlife habitat

Hamline Library Green Alley
Saint Paul Public Library & City of Saint Paul, MN

Benefits: Provides stacked-function of circulation and stormwater management for multiple public and private parcels

Last Revised: January 28, 2014

FIGURE 30 Sample Brochure (Z-fold) Side B

FIGURE 31 Applicable SSGI Implementation Approaches

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CENTRAL CORRIDOR STORMWATER
& GREEN INFRASTRUCTURE PLAN

PUBLIC ART INTEGRATION RECOMMENDATIONS

Prepared by Craig David
September 10, 2013

PUBLIC ART FUNDING, DEVELOPMENT AND ADMINISTRATION of "FLUXion ≈≈ gARTens"

A Discussion of Development and Administrative Next Steps
and Compendium of Potential Funding Sources
for
Public Art as Green Infrastructure on the Central Corridor

Stacy Levy, 'Straw Garden', Architecture Daily Facebook Page, KNOT RAIN-GARDEN

What does the future hold for the 'FLUXion gARTens' Network ?

The concept of the 'FLUXion gARTens' Network was conceived of through a collaborative process between the City of St. Paul, SRF Consulting Group, Inc. and public artist Craig David. The memo, 'FLUXion gARTens', dated July 8, 2013, delineates public art integration recommendations for the *Strategic Stormwater Solutions for Transit-Oriented Development* study. Yet, with conception, does not necessarily come birth, or growth. The implementation of the 'FLUXion gARTens' concept along the Central Corridor is contingent upon establishing community buy-in and support for the concept, along with the commitment from an arts organization to facilitate and coordinate its implementation.

Critical to implementation of FLUXion gARTens is the development of educational and outreach materials to inform the community about the stacked-function benefits that FLUXion gARTens can provide to the Green Line and surrounding community and to develop community support for voluntary implementation.

With the City of Saint Paul's adoption of the public art ordinance in 2009, a mechanism is in place to implement artworks into Saint Paul public projects. Key sections of the ordinance read as follows:

> Sec. 12.03. - Funding.
>
> (1) Initial funding. For all capital projects funded by eligible sources resulting in a property to be operated by the city; the city shall dedicate one (1) percent of the eligible project costs, as determined by the office of financial services, to be used for public art.
>
> If the director of the department responsible for the capital project determines that this use of funds cannot or should not be included in a specific project, he/she shall seek approval of the city council to use the funds described above to supplement other public art projects, or public art maintenance, within that department. The specific use shall be as determined by said director and consistent with the public art plan.
>
> (2) Ongoing maintenance. Maintenance and restoration costs in an amount equal to one-half (½) of one percent of total capital maintenance projects approved as part of the capital improvement budget shall be appropriated to support maintenance and restoration of the city's public art collection. All public art donated to the city must come with a plan to fund and deliver ongoing maintenance or the resolution accepting the public art must identify how maintenance of the donated public art will be funded.

The City of Minneapolis funds public art projects through the Art in Public Places program, which is funded through the City's Capital Improvement Program.

Yet, in order for FLUXion gARTens to be successfully implemented, gardens in the network must be implemented beyond public projects. The development community must see the value FLUXion gARTens will provide for their properties and want to participate using their own funds or through a competitive grant process.

What are the possibilities for funding the development and management of the 'FLUXion gARTens' Network?

Many cities around the country utilize different ways of funding public art projects. Interesting and unique examples are listed here: (Program descriptions taken from organizations' internet sites)

- **Houston, TX:** The Houston Arts Alliance (HAA) is a nonprofit public/private partnership that manages the City of Houston's civic art collection and distributes grants. HAA receives a majority of its funding through the City of Houston Hotel Occupancy Tax. Additional funding sources include grants, private donations, and foundation support. http://www.houstonartsalliance.com

- **New Orleans, LA**: The Arts Council of New Orleans is a private, non-profit organization designated as the City of New Orleans' official arts agency. The Arts Council serves as one of eight regional distributing agencies for state arts funds and administers the City's Percent for Art program and municipal arts grants. The Percent for Art Program is supported through funds generated equaling one percent of eligible municipal capital bonds. The Arts Council of New Orleans also received support from national and state grants. http://www.artscouncilofneworleans.org/index.php

- **Phoenix, AZ:** The Phoenix Office of Arts and Culture Public Art Program receives public art funding equal to one percent of the City's Capital Improvement Program. Each year, the Phoenix Office of Arts and Culture works with funding city departments, the Mayor and City Council to develop the annual Public Art Project Plan that identifies capital improvement projects that offer the greatest opportunity for artist involvement and public accessibility. The total budget for each project includes the artist's contract amount (which generally covers design, fabrication and installation) and the administrative costs for the project. Art projects are funded in part through the sale of city-issued bonds, which are repaid with revenue from the city's secondary property tax and enterprise funds http://phoenix.gov/arts/publicart/index.html

- **San Antonio, TX**: Public Art San Antonio (PASA) serves as the public art program for all City departments, capital projects and public art initiatives, and is a division of the Office of Cultural Affairs (OCA).City capital improvement projects, whether financed with City bond proceeds or City monies from any other source, include one percent of eligible appropriations to be used for design services of artists, for the selection, acquisition, fabrication, installation, conservation, and display of artworks, and for PASA administration of the public art projects.

  In addition, City departments include in every a capital improvement project grant application an amount for artists' services and artworks. Artwork is also financed through private contributions. http://www.publicartsa.com/index.php?option=com_content&view=article&id=50&Itemid=79

- **San Diego, CA:** The public art program in San Diego is a department of the San Diego Commission for Arts and Culture. A two percent (2%) set-aside for art is applied to the City's capital improvement projects. Of this two percent set-aside, 20 percent is allocated for Public Art Program administration and community participation activities. Another 10 percent is allocated for curatorial services and the preservation and maintenance of Artworks in the public art collection.

  For non-residential development projects with a total building permit valuation of $5 million or more, a mandatory set-aside of 1 percent (1%) for art and/or space for cultural use is required. Private development projects can elect to contribute a one-half of one percent (0.5%) in-lieu fee to the City's Public Art Fund instead of incorporating the required artwork into their project.

  All City departments and agencies include an amount equal to two percent of Eligible Project Funds for Artworks in all Capital Improvement Project grant applications. http://www.sandiego.gov/arts-culture/pdf/pubartmasterplan.pdf

The following is a compendium of potential funding sources for the implementation of FLUXion gARTens:

- Legacy Fund (MN State Arts Board Grant)
  - Cultural Community Partnership (artists of color)
  - Artist Initiative (artists)
  - Arts Access (nonprofit arts orgs)
  - MN Festival Support (community based festivals)
  - Partners in Arts Participation (social/human services orgs)
  - Folk/Traditional Arts (cultural groups within community)
- Environmental Organizations (Watershed Districts, Community Gardens)
- Independent Community / Non Profit Organizations (District Councils, Social Organizations)
- Foundations:

- The Bush Foundation
- The McKnight Foundation
- General Mills Foundation
- Medtronic Foundation

- Developers
- Corporations
- National Endowment for the Arts
- National Endowment for the Humanities
- Private Sponsorship

Research could be performed to determine if the following are potential implementation funding sources:

- Metropolitan Council (Transportation, Wastewater and Water)
- Ramsey/Hennepin County
- Saint Paul Port Authority

In addition to traditional arts funding foundations and existing arts grant programs, the stacked-function of FLUXion gARTens (i.e., stormwater management, plant identification, stormwater education, and urban agriculture) may open up other potential construction and maintenance funding sources such as health improvement grants, job training programs, Waste Management Operations, or educational institutions. Additional alternative public art funding approaches are identified on the Project for Public Places' website http://www.pps.org/reference/artfunding/

Finally, an arts organization must find value in the concept and take leadership to market, secure funding, and oversee its implementation. Following is a list of local arts organizations that may find value in FLUXion gARTens and desire to propel this vision forward:

- Public Art St. Paul
- FORECAST Public Art
- Springboard for the Arts
- COMPAS

It is envisioned that the broad sweep of ideas within FLUXion gARTens gives birth, and grows in many ways beyond the *Strategic Stormwater Solutions for Transit-Oriented Development* study.

FLUXion gARTens is envisioned to bring together businesses and developers (small and large, existing and future), city departments, organizations, community groups, neighbors and artists. The concept of FLUXion gARTens is just a beginning.