GATEWAY GREEN STREETS MASTER PLAN

Right of Way Stormwater Management in the Gateway Urban Renewal Area

City of Portland
Bureau of Environmental Services

February 2008

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Table of Contents

Green Street Vision

The Gateway Green Streets Master Plan provides an exciting opportunity to introduce sustainable urbanism into an evolving neighborhood of Portland. In doing so, it provides an adaptive example for the region to follow. The streets transformed as a result of this study will establish a new walkable vibrancy and a place-based identity for the Gateway district as it transforms into a sustainable urban center.

Portland is tackling pressing infrastructure needs by engaging innovative green design to provide holistic solutions that are aesthetically and functionally rooted in Portland's landscape. Green Streets include elements that address multiple challenges in an elegant way. New plants visually soften the district's streets while they help cool the area in the summer and add public landscape to the neighborhood. The street system can evolve incrementally over time, providing a cohesive system of circulation which is pedestrian friendly but encourages multi-modal circulation while calming traffic.

Green Streets represent the City's commitment to the district's redevelopment. Private developers who witness this public confidence, combined with innovative engineering and enduring, functional landscapes, may be more willing to invest in the Gateway district, bringing high-quality housing, jobs and retail to the area.

Introduction

The people of Portland recognize that healthy water quality is an essential component of this region's heralded quality of life. The City of Portland's Bureau of Environmental Services is taking steps to improve water quality by encouraging the treatment and conveyance of stormwater in innovative ways, such as green streets, in order to protect our rivers and streams. The Portland City Council recently adopted a Green Streets Policy[1], "to promote and incorporate the use of Green Streets to manage stormwater, enhance neighborhood livability, improve the function of the right of way, provide habitat corridors, and promote connectivity between Portland neighborhoods." The resolution further binds City bureaus to plan and implement Green Streets as an integral part of the City's maintenance, installation, improvement programs and future transportation plans for public rights of ways.

Work on the Green Streets Policy started several years ago when the City formed an interdisciplinary group with expertise in street planning, design, utilities and maintenance in order to move the Green Streets agenda forward. The Green Streets Cross-Bureau Team (GST)[2] identified the Gateway area as an ideal community to integrate stormwater management and Right of Way (ROW) standards for new multi-block developments. Planners and citizens envision that the Gateway area will be revitalized in the future as a pedestrian-oriented urban center. Continuing the objectives set forth by GST, Portland's Bureau of Environmental Services Watershed Services Group, in partnership with Portland Development Commission (PDC) and with support from Portland Bureau of Transportation (PDOT) and Bureau of Planning (BOP), worked together to create this Gateway Green Streets Master Plan (GGSMP), a vision for the developing Gateway Urban Renewal Area.

The GGSMP is intended to assist the development of Green Streets in new, existing and widened ROWs, incorporating stormwater management through a range of standard Green Street Details[3] within single block ROWs of varying widths. This GGSMP will serve as a set of guidelines for the sizing and configuration of stormwater swales and planters. It provides the necessary flexibility to guide site-specific design and can be implemented incrementally in single projects or in multiple block configurations.

Green Streets are primarily composed of a series of landscape swales or planters that manage stormwater at the source. Green Streets provide water quality benefits and replenish groundwater. They create attractive streetscapes that enhance neighborhood livability by enhancing the pedestrian environment and provide character and identity to neighborhoods. Green Streets can also meet broader community goals of enhanced pedestrian and bicycle connectivity and serve as green urban connectors of neighborhoods, public open spaces, schools and wildlife habitats[4].

Stormwater planters at SW 12th Ave. create a unique identity with aesthetic treatment of stormwater.

This report begins with a brief summary of the project background and context, followed by the City's Green Street Goals. The process for this effort is then summarized along with the team's approach to Green Street Design and Classifications. Typologies are presented graphically, followed by specific recommendations. Finally, a Green Street Vision for implementation is presented, along with recommended funding strategies.

1. Resolution presented to City Council on March 31st, 2007. http://www.portlandonline.com/shared/cfm/image.cfm?id=154232

2. Information about the Cross Bureau Team and their specific Phase 1 recommendations for the Gateway area can be found at http://www.portlandonline.com/shared/cfm/image.cfm?id=123793.

3. The GGSMP relied on the configuration and dimensional characteristics of swales and planters defined by the Green Street Details, found at http://www.portlandonline.com/bes/index.cfm?c=44213&.

4. More findings from the Cross Bureau Team can be found in the Cross Bureau Team Phase 2 Report http://www.portlandonline.com/shared/cfm/image.cfm?id=153974.

Figure 1: Regional Context

Typical unimproved street in Gateway Area

Background

The Gateway Urban Renewal Area is a district in East Portland. (Figure 2)[5]. The GGSMP study is bound by NE Glisan Street, SE Stark Street and I-205 (Figure 3) and is part of 'Central Gateway'. The study area for this plan sits within this urban renewal area and is located in the eastern Willamette River watershed, although water flow may not currently leave the study area. (Figure 1).

This is an area with diverse land uses – industrial and commercial, single family homes and apartment complexes. The area also features unimproved streets. With the range of land uses and proximity to I-205 and the Gateway Transit Center, the City of Portland, PDC and Metro believe the area has tremendous potential to attract a higher density of employment, commercial and residential uses.

Mitigating the water quality impacts of transportation-related development with Green Streets techniques, and implementing the City's Resolution for Green Streets is a logical step to protect the watershed, groundwater and neighborhood livability. More than a quarter of the neighborhood's stormwater run-off is collected in ROWs and in the case of this study area, most of this run-off is routed to sumps. Along with stormwater run-off entering sumps, the neighborhood has street ROWs that are not platted, not improved, and sometimes not wide enough to serve future development.

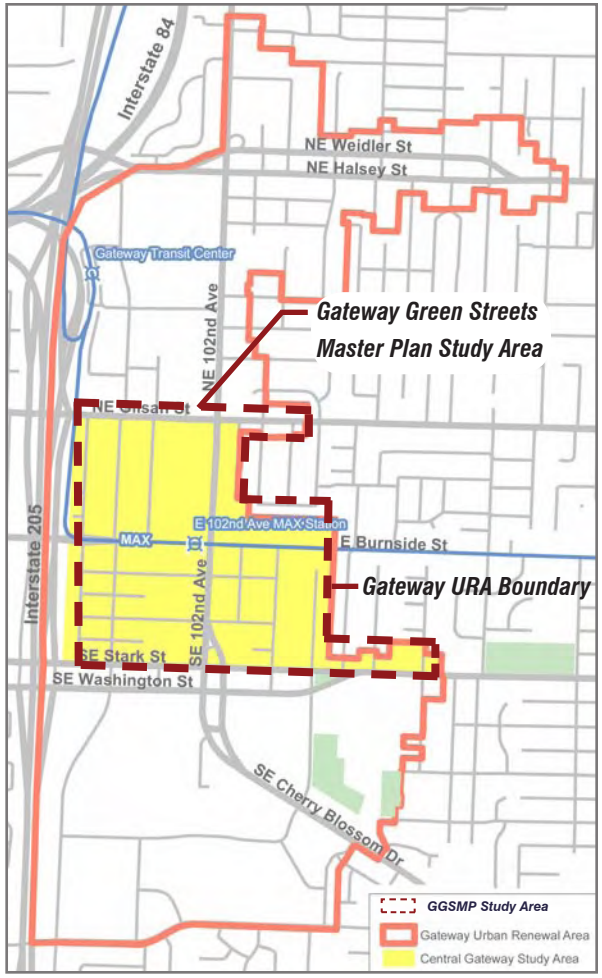


Figure 2: GGSMP Study Area within the Gateway Urban Renewal Area

5 Complete Gateway Regional Center Design Guidelines can be found at http://www.portlandonline.com/shared/cfm/image.cfm?id=65699

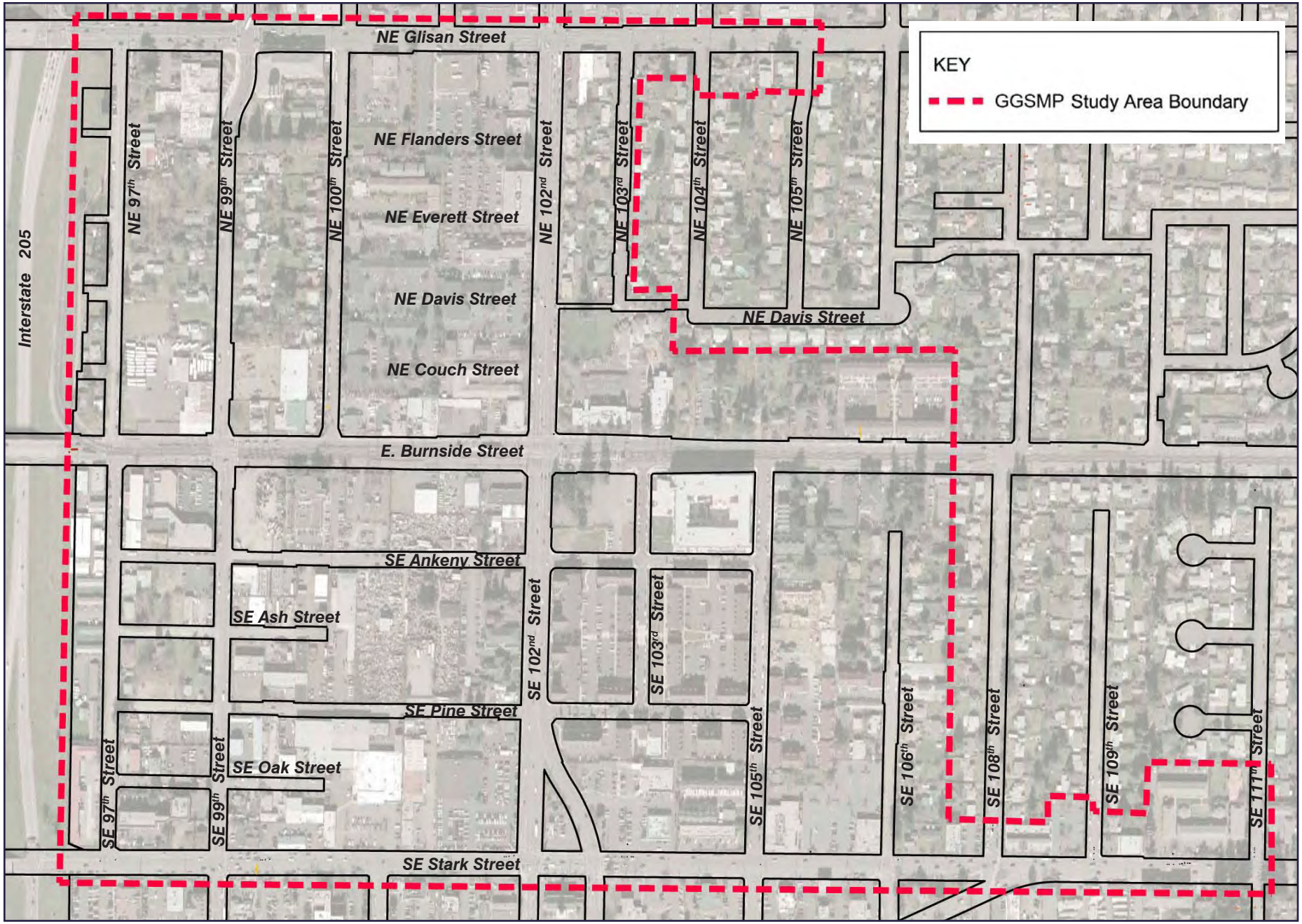


Figure 3: Gateway Green Streets Master Plan Study Area

Goals

The Gateway District, with its central location, proximity to transit and current modest level of development, has been identified by the City as a place of significant redevelopment potential. The GGSMP anticipates this redevelopment, bringing a new green approach to street construction that can greatly benefit the district's sustainability while providing Gateway with a new sense of identity. The following goals were established for the Master Plan:

Goal 1. Provide Clarity for Designers, Developers and Reviewers

Designers, developers, planners, and reviewers should be able to easily establish the GGSMP as a guideline for developing streets within the Gateway neighborhood. The approach to green street design should be easily understood, for implementation throughout the neighborhood.

Goal 2. Improve Stormwater Management and Sustainable Design

The city is dedicated to improving stormwater management where possible by implementing sustainable methods for stormwater treatment and disposal within the ROW. Vegetated swales and planters can protect existing sumps, and their effectiveness in treating, slowing, and disposing of surface run-off has proven effective on many local and regional test projects. These sustainable methods can greatly improve stormwater management within the neighborhood.

Goal 3. Improve Connectivity and Neighborhood Identity

Promote the use of green street improvements to create neighborhood identity. The redevelopment of streets will enhance the neighborhood through the addition of plant material and will improve multi-modal circulation by establishing an inviting pedestrian-friendly atmosphere. Improvements to the pedestrian circulation network that add to safety, especially at intersections, will also greatly benefit the neighborhood's vitality.

Goal 4. Develop Funding Strategies and Designs with Considerations for Lot Consolidations

Currently Green Street development funding is limited. This Master Plan further explores funding strategies for implementation of green street facilities (pp 42-45).

Existing stormwater management in the Gateway District ROW demonstrating a vegetated street swale.

Existing curb extensions in Gateway provide traffic calming and improved pedestrian connectivity. The GGSMP proposes combining these and other techniques to improve pedestrian connectivity, safety and storm water quality.

Master Plan Process

In a series of interactive meetings, the City and the consultant team analyzed the district and identified green street development parameters. The result of these efforts is this guiding document for the development of the Gateway District's stormwater strategy.

Step 1. Understanding Existing Conditions

In order to develop an understanding of the stormwater quantity and quality priorities, the consultant team reviewed existing conditions and the BES Stormwater Management Manual (SWMM), Chapter 1, General Requirements and Policies, as applied to neighborhood streets. Pre-development conditions were also considered (Fig. 4)

Step 2. Establishing a Plan

Public streets are shared by everyone and therefore need to accommodate a range of elements and modes of circulation. It is a design challenge to accommodate all the possible uses and needs in a neighborhood of narrow rights-of-ways. Both the length and width of ROWs can vary greatly from block to block. In order to establish a standard basis of comparision all the ROW typologies were given a length of 473-feet from centerline to centerline of intersections, a dimension that is commonly found in the district.

A ROW Matrix (Figure 5) was developed to identify the spatial dimensions of the neighborhood's existing and proposed ROWs. Summaries of the proposed widths of drive lanes, parking stalls and pedestrian zones were developed by PDOT in the 2002 TSP (with updates). The Matrix and associated ROW plan (Figure 6) establishes a framework in order to see the extent of proposed and existing ROWs that will change in the future. As these ROWs change Green Streets implementation can occur.

Step 3. Arriving at a Solution

Within the process of matching stormwater management requirements with the spatial demands and aesthetic considerations of the ROW, designs for Green Streets progressed. There was an overall focus on incremental development, equitable responsibility amongst parcel owners, safe streets, traffic calming, pedestrian connectivity, creating an identity for the neighborhood, and providing stormwater management[6]. The resulting GGSMP provides benefit to the district in providing improved circulation that adds greatly to the aesthetic and functional character of streets and stormwater facilities.

A curbless residential 'woonerf' street in Stuttgart, Germany that incorporates stormwater swales and grass pavers in the parking zone.

6. The GGSMP identifies stormwater facility improvements in the ROW to meet water quality and flow control up to the 10-year storm event using the Presumptive Approach for sizing as outlined in the 2004 SWMM.

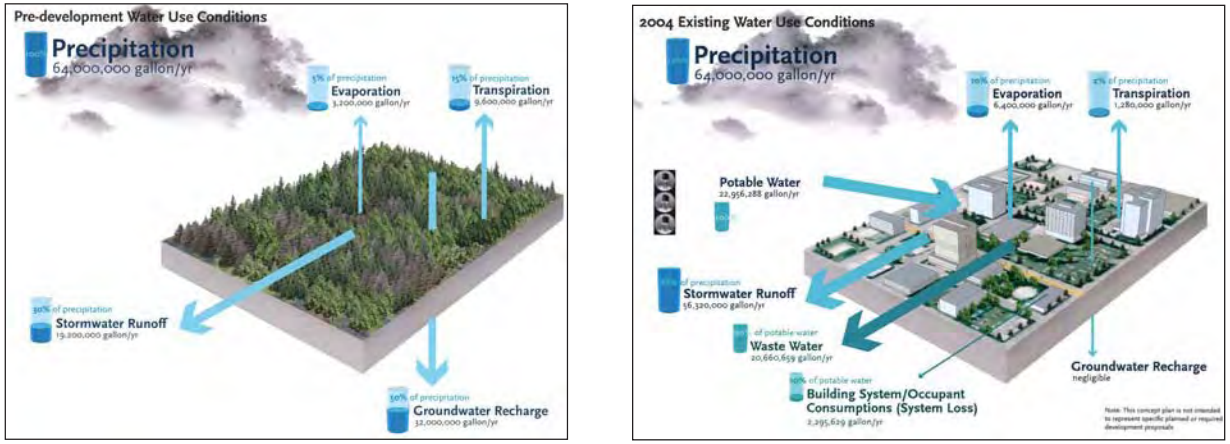


Figure 4: Illustration of Hydrologic Cycle of predevelopment conditions before introduction of impervious surface, followed by existing water use conditions. (Lloyd Crossing Sustainable Urban Design Plan, PDC 2004)

Existing Conditions of the Rights of Way

Land Use

There are many different types of development in the Gateway District, including industrial, big box commercial, single family residential and dense multi-family projects. Land use and catalyst development studies are currently under-way for the Gateway District which could ultimately lead to a variety of land uses developed within the GGSMP area. The City envisions that the Gateway Urban Renewal Area could become one of the highest-density areas outside the City Center with a broad range of uses including medical, commercial, retail, and residential. The GGSMP considers and responds to this broad range by defining multiple scenarios, or Green Street Typologies, that can be applied for areas with a variety of land uses.

Streets

Approximately 30% of the land in the GGSMP area is ROW. A review of the TSP indicates that an additional 8% of ROW area will be required in the future, either through expansion of existing ROW or acquisition of new ROW. The largest streets in the area are E. Burnside Street, NE Glisan Street, SE Stark Street, and SE 102nd Avenue.

Topography

The existing topography throughout the area generally drops in elevation from the northwest to the southeast. Longitudinal grades generally fall in one direction throughout the area with the exception of seven blocks: five such blocks have a mid-block low point and two have a mid-block high point. Longitudinal slopes were found to be flat with a majority of the streets ranging in slope between 0.2% and 1.5%. Gutter flow is typically in a single direction. The mild longitudinal slope reduces gutter flow velocity and will improve run-off collection and retention with green street applications. There are a few streets with longitudinal slopes between 2.0% and 4.5%, and one as high as 9%, but these are isolated to individual blocks or portions of block lengths. These isolated steeper road profiles will need to be evaluated individually as proposed Green Street standards are considered.

Infiltration

The USDA Soil Conservation Service soil survey indicates the Multnomah-Latourell-Urban soil complex for the area with well drained loams and silt loams. The permeability of this soil generally ranges from 0.6 inches to 2 inches per hour at a depth of 0 to 39 inches. At a depth of 39 to 60 inches the soil permeability rate increases to 6 to 20 inches per hour. A review of Geotechnical Bore Hole Log Reports from the Oregon State Water Resources Department (2001) did not provide infiltration rates but did provide a glimpse into the soil profile of the Gateway area. The reports show the area is typically composed of silt, sand and gravel to a depth of 15-feet. Staff from Bureau of Development Services (BDS) confirmed that the soil infiltration rates were good (minimum 2 inches per hour) below the top layer of compacted material.

The minimum infiltration rate recommended by the SWMM is 2 inches per hour. Therefore it appears the Gateway area meets this minimum requirement for stormwater infiltration; however, local conditions should be analyzed when Green Street projects are considered.

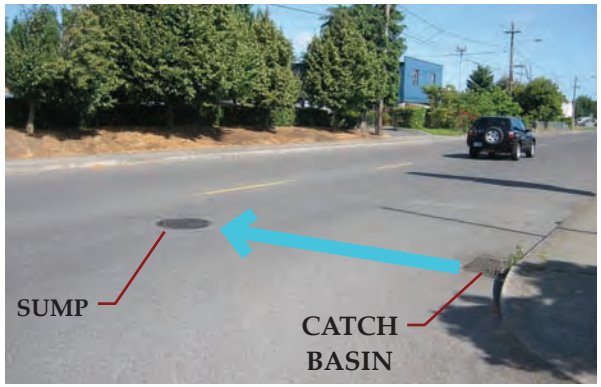
Some future street ROWs are currently blocked or non-existent (NE Flanders Street at NE 99th)

Sumps

The existing project area encompasses approximately 100 sumps. The policy for addressing the use of sumps within the ROW include:

- Manage stormwater run-off to meet the 2004 BES Stormwater Management Manual's (SWMM) Destination/ Disposal Hierarchy Category 1 (On site Infiltration with a Surface Infiltration Facility)[7]
- Emphasize stormwater management actions that ensure protection of groundwater through the use of swales, planters, and sedimentation manholes as appropriate.
- Meet the requirements and conditions for Underground Injection Control devices (UICs) defined in the Water Pollution Control Facility (WPCF) Permit.

There are limited conveyance pipes throughout the area and onsite drainage from adjacent properties commingles with run-off in the right of way. All sumps are currently regulated under DEQ permits for protection of groundwater. Typically, the sumps are located at intersections with catch basins forming a spoke pattern with the sump at the "hub." Approximately half of the sumps in the area are constructed without sedimentation manholes. BES staff note that there have been no reported flooding problems within the project area. Although not quantitatively conclusive, this would suggest that the existing sumps have sufficient capacity to infiltrate run-off draining to them. A review of the existing grades and GIS data for storm drainage infrastructure found some of the sump subbasins to be as large as an acre.



Catch basins connect to sumps in intersections; sometimes they connect to sedimentation manholes before the sump.

Half of the sumps are connected to sedimentation manholes and half are connected directly to catch basins.

The hydraulic demand on these existing sumps will be affected as future development occurs throughout the project area and private property owners are required to address stormwater drainage issues as part of their improvements. Given the highly infiltrative soils that are present throughout the project area, these new private drainage facilities will likely meet Category 1 or 2 of the SWMM Hierarchy, infiltrating the run-off from a modeled 10-year storm event onsite and reducing the release of stormwater run-off into the ROW. As a result, the Gateway Green Streets are expected to only receive run-off from the ROW.

As development occurs throughout the Master Plan area including new ROWs proposed in the 2002 TSP for NE Flanders Street, NE Davis Street, NE 100th Avenue and NE 101st Avenue, there is a potential for an increase in run-off directed toward a handful of the existing sumps. Typical Green Street typologies can provide vegetated stormwater infiltration and storage to infiltrate and mitigate the run-off generated from a 10-year storm event. However, these proposed ROWs do not already possess the infrastructure for collection and disposal of run-off from larger storms up to a 100-year modeled storm event. It will be imperative to identify the potential flow path of run-off from the storm events that exceed the Green Street infrastructure capacity. A hydrologic subbasin analysis should be undertaken for these existing sumps, to evaluate their potential hydraulic capacity. Sump flow testing will be required for individual sumps to verify hydraulic capacity and should be performed in accordance with Chapter 2 of the SWMM. Based on the results of this evaluation, it can be determined if additional sumps will need to be permitted through DEQ to handle the run-off and avoid flooding.

7. Typically when designing stormwater facilities in areas where the primary point of disposal is a sump, the pretreatment facility (swale or planter) would be sized to provide pollution reduction not detention. New or expanded ROWs may require new sumps in order to handle stormwater events greater than the 10-year storm event. http://www.portlandonline.com/shared/cfm/image.cfm?id=55769

Green Street Approach

The City of Portland is nationally recognized for its efforts in promoting and supporting sustainable development. Innovative green design is becoming a requirement for public and private infrastructure projects. To date, green street projects have occurred only as small scale demonstration projects. Considering green streets for an entire neighborhood will take cooperation, coordination and public/private relationship building. The Green Streets Cross-Bureau Team participated early in the process to forge a vision of how single and multiple block development can be unified to create a sustainable or "green" neighborhood.

Developing detailed stormwater and transportation solutions for the Gateway Study Area is beyond the scope of this master plan; however, the GGSMP seeks to demonstrate how the ROW can successfully incorporate sustainable stormwater approaches while accommodating pedestrian and vehicular requirements of each street at the scale of a block. Green Street Typologies were developed from the basic dimensions of a street (width of vehicular and pedestrian zones) at one block increments. In the future, as the Gateway Study Area begins to develop, these typologies can be used as a guide to assist with designing, documenting, and developing site and street specific implementation plans.

The Green Street Typologies are developed to allow for flexibility in implementation. Each typology can be implemented for multiple blocks, single blocks, half-streets, or incrementally as frontage improvements along a single parcel. Multiple block installations should be considered to address larger scale objectives, such as creating immediate identity in a catalyst development area. This GGSMP recommends an initial whole-street, multiple block implementation strategy to create momentum, with smaller scale implementation such as half street improvements and incremental developments to follow.

Green Street redevelopment can help address existing inconsistency of street and sidewalk improvements

Green Street redevelopment in Southeast Portland

Green Street Classifications

The Green Street Typologies include a variety of options for the proposed ROW widths to accommodate a wide range of development patterns, land uses, traffic volumes and the 10-year storm event. The neighborhood is primarily composed of Local Service Access streets with a few Neighborhood Collectors. The future ROW pattern as defined in Portland's Transportation System Plan (TSP) will require dedication of new and widened ROWs to create connections and accomodate expansion of existing ROWs to allow for on-street parking, bike lanes, street trees and sidewalks. Green Street Typologies are recommended to be applied to new and expanded ROWs throughout the Gateway area.

Local Service Access

Most of the streets in the study area are Local Service streets and connect to the large streets such as SE Burnside, NE Glisan, SE Stark and SE102nd. These streets will provide two-way traffic with on-street parking and 12' wide pedestrian/ furniture zones on both sides of the street. Green Street typologies, for Local Service Access streets, include a 56-foot wide type with stormwater curb extensions, a 56-foot wide type with consolidated lots and stormwater curb extensions, and a 63-foot wide option with linear stormwater planters.

Neighborhood Collector (Arterial)

Neighborhood Collectors provide two-way traffic with parking and 15' wide pedestrian/ furniture zones on both sides of the street. Green Street Typologies at the scale of a Neighborhood Collector include a 68-foot wide type with stormwater curb extensions, a 75-foot wide type with linear stormwater planters, and a 80-foot wide type with bike lanes and stormwater curb extensions on both sides of the street.

Streets such as East Burnside, NE Glisan, SE Stark and SE 102nd do not fit easily into the Green Street Typology goals and currently have traffic volumes that, for some periods of the day, exceed their carrying capacity. Green Street projects for these ROWs need detailed analysis and design in order to balance the green streets approach and requirements with the function of the transportation system.

Existing Local Service Access

Existing Neighborhood Collector: Two vehicular lanes, on-street parking, no bike lanes

SE Stark Street--Arterial featuring 4 vehicular lanes, on-street parking on both sides and a bicycle lane

Green Street Typologies

Considering new or expanded rights-of-way, the GGSMP recommends revising the existing standards for Local Service Access streets and Neighborhood Collectors to introduce stormwater swales and planters into the ROW for stormwater management (based on SWMM sizing requirements for disposal of a 10-year storm event.) Swales are incorporated in the curb extension and planters are located adjacent to the parking zone within the furniture zone.

There are specific considerations for each street typology. For example, curb extensions replace some parking stalls but do not require additional ROW. Linear planters require a minimum of 63′ ROW, but the number of parking stalls remains the same. The typologies (Figures 7 through 18) are rooted in City-approved standards and are reviewed here to establish an acceptable common basis for future projects. Future ROW development projects will need to go through the submittal process of a typical street development project.

Local Service Access Green Streets

56-foot Right of Way Typology

The 56-foot ROW is the narrowest Local Service Access street width allowed by City standards for the Gateway Urban Renewal District. This ROW width sets a precedent for a sustainable Green Street, with narrow drive lanes and multiple curb extensions to provide traffic calming, decreased impervious surface, and space for vegetated swales to manage stormwater. Porous unit pavers in the furnishing zone will allow infiltration, thus decreasing the amount of impervious surface within the ROW. Trees should be spaced at regular intervals to maximize the amount within each block. (Figures 7, 8)

Zone	Dimension
Travel Lanes and Parking	32′
Furnishing	4.5′
Pedestrian	6′
Building	1.5′

56-foot Right of Way with Lot Consolidation Typology

This approach incorporates the narrow street principles discussed above but consolidates development parcels for multi-family projects. This approach also consolidates stormwater curb extensions at intersections with a single mid-block stormwater curb extension. (Figures 9, 10)

Zone	Dimension
Travel Lanes and Parking	32′
Furnishing	4.5′
Pedestrian	6′
Building	1.5′

63-foot Right of Way Typology

The 63-foot ROW features the basic dimensions established for the 56-foot ROW but adds 3.5 feet to the furnishing zone on both sides of the street. The additional space allows the furnishing zone to incorporate linear stormwater planters to treat and dispose of stormwater run-off, while allowing people to exit from vehicles and circulate around parking stalls. Excluding curb extensions along the block allows for a maximum amount of on-street parking. (Where there is no on-street parking, bike lanes are possible). The hardscape surfaces, between the back of curb and face of planter, are proposed as porous unit pavers to allow infiltration, thus decreasing the amount of impervious surface and adding a pedestrian scale material to the ROW. Trees should be spaced at regular intervals to maximize the number within the ROW. This typology can also include bike lanes when on-street parking is not present. (Figures 11, 12)

Zone	Dimension
Travel Lanes and Parking	32′
Furnishing	8′
Pedestrian	6′
Building	1.5′

Neighborhood Collector Green Streets

68-foot Right of Way Typology

The 68-foot ROW typology accommodates a higher volume of traffic. Multiple stormwater curb extensions are proposed as a strategy to create identity, allow for ease of pedestrian circulation, manage stormwater, reduce impervious surface, and provide traffic calming to mitigate the additional traffic. Similar to the Local Service Access green streets, the addition of porous unit pavers in the furniture zone can allow for more infiltration, reduce the amount of impervious surface and add a pedestrian-scale material to the ROW. (Figures 13, 14)

Zone	Dimension
Travel Lanes and Parking	38′*
Furnishing	4.5′
Pedestrian	8′
Building	2.5′
** allows parking on both sides of street*	

75-foot Right of Way Typology

The 75-foot ROW begins with the dimensions established for the 68-foot ROW and adds 3.5 feet to the furnishing zone on both sides of the street. The additional space allows the furnishing zone to incorporate linear stormwater planters to treat and dispose of stormwater run-off while allowing for people to exit from vehicles and circulate around parking stalls.

Zone	Dimension
Travel Lanes and Parking	32′
Furnishing	8′
Pedestrian	8′
Building	1.5′

Excluding curb extensions along the block allows for a maximum amount of on-street parking. Porous unit paver hardscape surfaces between the back of curb and face of planter allow infiltration, thus decreasing the amount of impervious surface and add a pedestrian scale material to the ROW. Trees should be spaced at regular intervals to maximize the number within the ROW. (Figures 15, 16)

80-foot Right of Way Typology

The 80-foot ROW Green Street Typology is essentially the same as the 75-foot ROW with additional 5-foot wide bike lanes on both sides of the street. (Figures 17, 18)

Zone	Dimension
Travel Lanes and Parking	32′
Bike Lane	5′
Furnishing	4.5′
Pedestrian	8′
Building	2.5′

SE Burnside Street and SE Glisan Street (top) are wide arterials featuring atypical ROW conditions. They deserve additional study to ensure that the Gateway District redevelops with a coordinated system of Green Street and other infrastructural improvements. The visibility and heavy use of these corridors would bring wider public attention to innovative green street approaches.

Gateway Green Street Right of Way Matrix

Street	Zoning	Max Building Height	Existing ROW Width	*ROW Width Variations*	Existing ROW Length	Total	Add'l ROW Width	Proposed ROW Width[1]	Proposed ROW Length	Proposed Total	Enhanced Pedestrian Street?	Existing Bike Lanes
		(ft)	(ft)		(lf)	(sf)	(ft)	(ft)	(ft)	(sf)		
SE 97th	EX	120	49		1230	60,270	7	56	Ø	68,880		
NE 97th	EX, RX	120	50		1,116	55,795	6	56	Ø	62,490		
SE 99th	EX, RX	120	56		1,229	68,807	12	68	Ø	83,552		
NE 99th	EX, RX	120	50		1,117	55,825	18	68	Ø	75,922		
SE 100th	EX	120	0		0	0	56	56	1,230	68,891		
NE 100th	EX, RX, CX	120, 100	50	N. of Flanders 57', 58'	1,114	55,680	6	56	Ø	62,362		
SE 101st	EX, CX	120, 100	0		0	0	56	56	1,229	68,830		
NE 101st	RX, CX	120, 100	0		0	0	56	56	1,113	62,317		
SE 102nd	EX, RX, CX, RH	100, 150	80		1,228	98,232	0	Ø	Ø	98,232	Y	No & So
NE 102nd	RX, CX, CM	150, 100, 75	88	N. of Davis 80'	1,230	108,231	0	Ø	Ø	108,231	Y	No & So
SE 103rd	CX, RH, RX	100, 150	55	60, 50	1,238	68,090	0	Ø	Ø	68,090		
NE 103rd	CX, CM, R2, R2.5	100, 75	45	40 - 50	768	34,560	7 to 16	56	Ø	43,008		
NE 104th	R2	75	50		138	6,895	6	56	Ø	7,722		
SE 105th	CO2, R1, RH	75, 100	60		1,225	73,524	0	Ø	Ø	73,524		
NE 105th	R2	75	50		126	6,305	6	Ø	Ø	6,305		
SE 106th	CO2, R1	75	45	40 - 51	1,037	46,647	6 to 16	56	Ø	58,050		
SE 108th	CO2	75	60		115	6,912	0	Ø	Ø	6,912		
SE 109th	R1	75	50		147	7,335	6	56	Ø	8,215		
SE 111th	R1	75	50		302	15,120	6	56	Ø	16,934		
Glisan	RX, CX, CS	150, 120, 100, 75	85	80 - 96	2,344	199,249	0	Ø	Ø	199,249	Y	East
NE Flanders	RX, CX, CM	120, 100, 75	0		0	0	56	56	1,586	88,827		
NE Davis	RX, CX	120, 100	36	(Ex. 142.9)	0	0	33	56	1,541	86,296		
Burnside	EX, CX, RX, RH	120, 100, 150	105	100 - 120	2,803	294,336	0	Ø	Ø	294,336	Y	We & Ea
Ankeny	EX, RH	120, 150, 100	45	40 - 50	1,706	76,770	7 to 16	56	Ø	95,536		
Ash	EX	120	42.5	40 - 45	578	24,565	12 to 16	56	Ø	32,368		
Pine	EX, CX, RH, R1	120, 100	45	40 - 50	1,702	76,590	7 to 16	56	Ø	95,312		
Oak	EX	120	40		576	23,044	16	56	Ø	32,262		
Se Stark	EX, CX, CO2, R1	120, 100, 75	80		3,827	306,160	0	Ø	Ø	306,160	Y	West
				Total (sf) =		1,768,942			Total (sf) =	2,278,812		
				Total acres =		40.6			Total acres =	52.3		

ROW Status		Total (sf)	Notes
	Existing ROW width OK per TSP	1,154,734	[1] 56-foot ROW is minimum for Local Service Access. The same
	Additional ROW width required per TSP	748,918	ROW with stormwater planter on both sides = 63 feet
	New ROW required per TSP	375,161	68-foot ROW is minimum for Neighborhood Collector. The same
	Total Study Area	7,248,450	ROW with stormwater planter on both sides = 75 feet

Figure 5: ROW Matrix

This table summarizes the spatial characteristics of the existing and proposed ROW

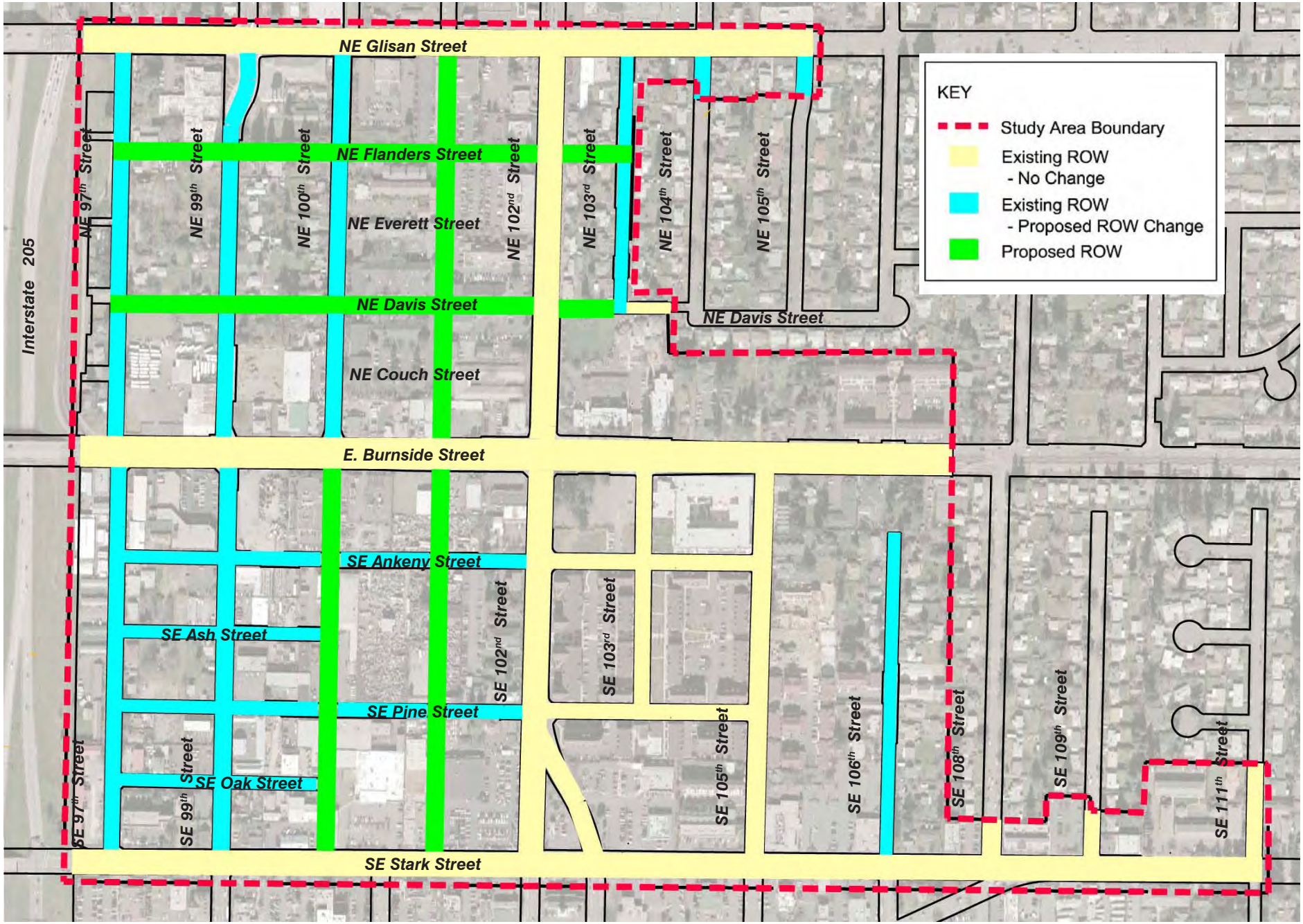


Figure 6: ROW Plan

Typology Modeling Notes

Stormwater modeling for each Green Street Typology is based on the 2004 SWMM Presumptive Approach. Drain rock storage area below the swales or planters is limited in depth to 5 feet and a width that does not extend beyond the furniture zone. The following notes refer to the stormwater modeling matrix on the following pages developed for the Green Street Typologies:

Basin Area

The square footage of a stormwater treatment drainage area within the ROW. The basins vary in size based on the stormwater treatment approach - curb extensions or linear planters – and the width of the ROW. Note: The Basin number in the models relates directly to the basin identified in the accompanying typology plans.

Pervious Surface

Includes porous unit pavers and tree wells within the proposed furnishing zone and were not used for stormwater disposal modeling.

Swale/Planter Surface Area

The plan square footage of the top or bottom of the swale. The dimensions of a stormwater planter or swale varies based on street design (curb extensions or linear planters) and available area within the ROW to accommodate parking, driveways, and driveway aprons.

Bottom of Swale

The area of the swale used for treatment. Dimensions vary due to non-symmetrical trapezoidal configuration of curb extensions.

Impervious Area

The impervious area is calculated as the Basin Area less pervious surfaces and planters.

Resultant Size

The surface area of swale or planter area divided by basin impervious area, defined as a percentage of the basin.

Swale/Planter Area

The square footage area of the stormwater planter or swale, including the bottom and side slopes of the swale.

Rock Trench Dimensions

Furnishing zone, plus the length, and width of the planter, and a constructible depth of 5 feet.

Swale/Planter Storage

The area available for water storage, taking into account a 4:1 side slope of the swales for curb extensions and a depth of 6 inches. Note: Swale side slope of 3:1 is allowed on the side of the streets without parking or pedestrians.

Trench Storage

The volume available in the drain rock storage area below the growing medium of a swale or planter. The volume assumes a 30% void space ratio within the drain rock storage area. Trench storage = Trench Length x Trench Width x Trench Depth x (.30). This equation does not take into account soil infiltration rate.

Total Storage

The area of the Swale/Planter Storage plus the Trench Storage. Note: planter storage volume differs from a swale given that a planter has vertical walls (no side slope).

Run-off Volume

The amount of stormwater run-off per basin and is based on an assumed 10 year, 24 hour storm of 3.4 inches (.28 feet). Run-off Volume =Impervious Area x (.28 feet)

Storage Variance

The excess volume or deficient volume of the swale/planter's stormwater management capacity of the 10-year storm event.

Green Street Typology Detailed Drawings

The following pages detail six green street typologies:

56' ROW, Figures 7 and 8

56' ROW WITH LOT CONSOLIDATION, Figures 9 and 10

63' ROW, Figures 11 and 12

68' ROW, Figures 13 and 14

75' ROW, Figures 15 and 16

80' ROW, Figures 17 and 18

Pennoyer Street in the South Waterfront District utilizes stormwater swales, porous pavers and an asymmetrical centerline to slow vehicles.

56' ROW Stormwater Curb Extension

Basin		Pervious Surface	Swale Surface Area	Swale Bottom Area	Impervious Area	Resultant Size	Approximate Swale Area Dimensions (ft)			Rock Trench Dimensions (ft)			Swale Storage	Trench Storage	Total Storage	Runoff Volume	Storage Variance
ID	Area (sf)	sf	sf	sf	sf	%	L	W (avg)	D	L	W	D	cf	cf	cf	cf	cf
1	2,727	172	398	159	2,157	0.18	55	7.2	0.5	55	9.5	5	139	784	923	604	319
1a	2,727	172	398	159	2,157	0.18	55	7.2	0.5	55	9.5	5	139	784	923	604	319
2	2,804	86	234	96	2,484	0.09	33	7.1	0.5	33	9.5	5	83	470	553	696	-142
2a	2,804	86	234	96	2,484	0.09	33	7.1	0.5	33	9.5	5	83	470	553	696	-142
3	2,767	86	234	96	2,447	0.10	33	7.1	0.5	33	9.5	5	83	470	553	685	-132
3a	2,767	86	234	96	2,447	0.10	33	7.1	0.5	33	9.5	5	83	470	553	685	-132
4	4,241	176	239	108	3,826	0.06	30	8.2	0.5	30	9.5	5	87	428	515	1,071	-557
4a	4,241	176	239	108	3,826	0.06	30	8.2	0.5	30	9.5	5	87	428	515	1,071	-557

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin ID	Ai (sf)	Vr (cf)
1 & 1a	2,157	**604**
2 & 2a	2,484	**696**
3 & 3a	2,447	**685**
4 & 4a	3,826	**1,071**

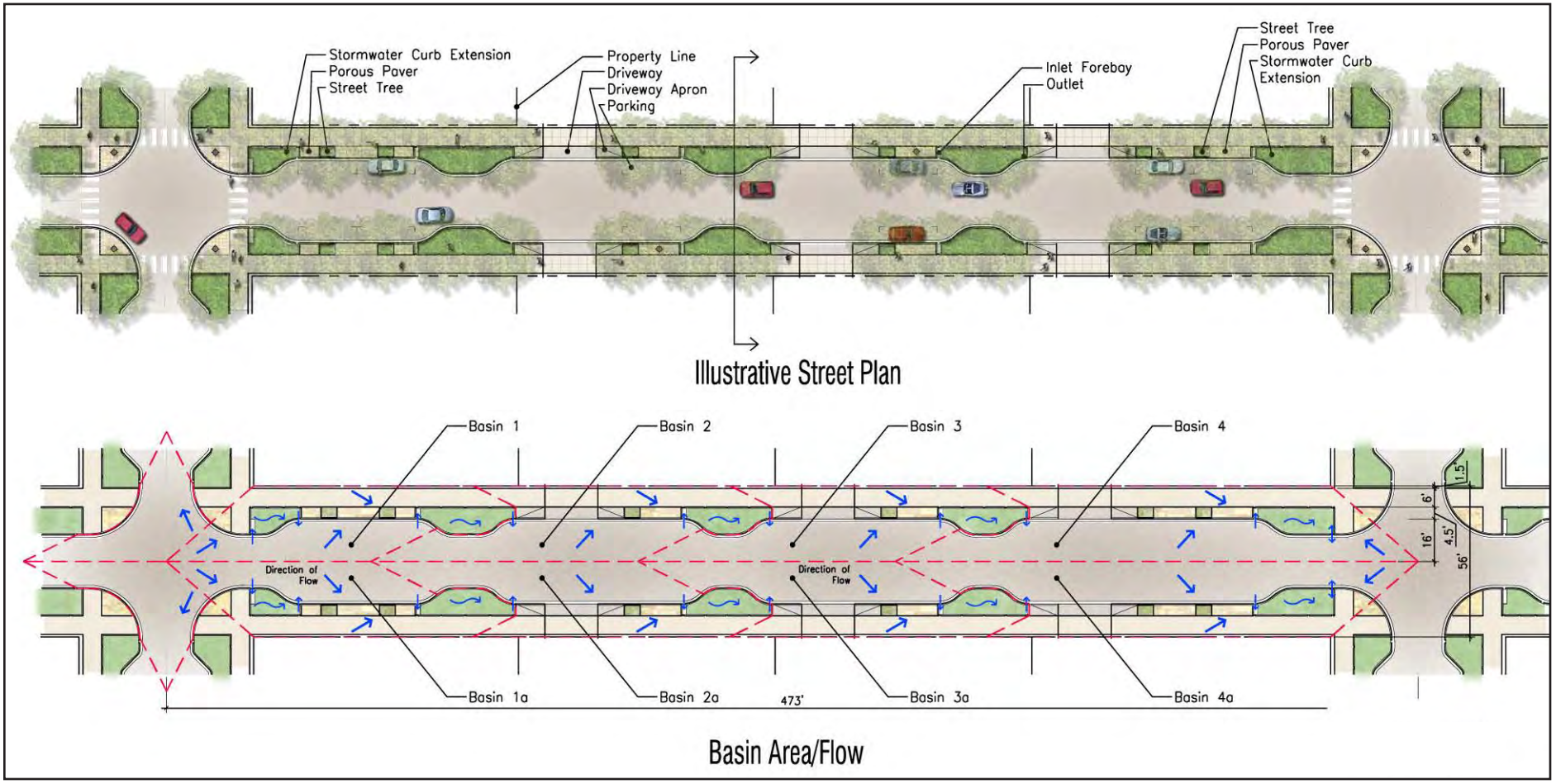
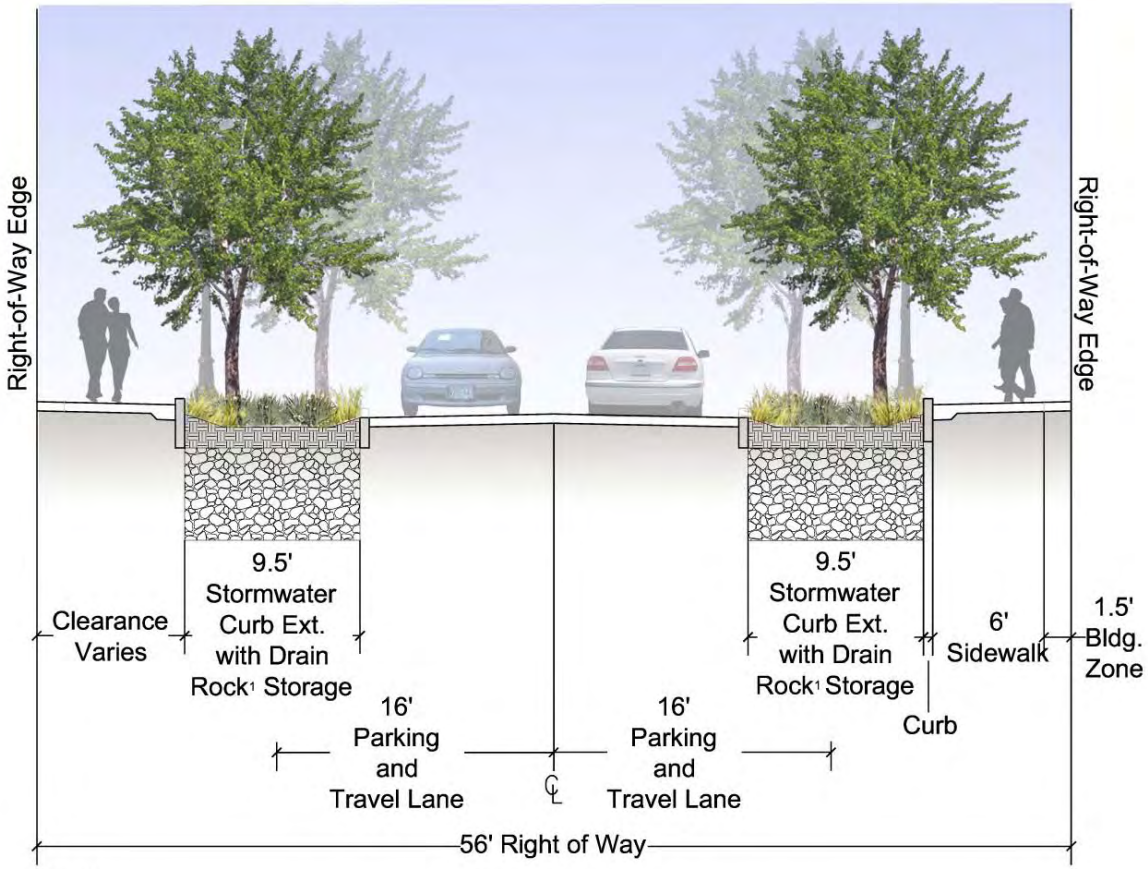


Figure 7: 56' ROW Plan



Notes:

1. Depth and width of drain rock will vary based on basin area.

56' ROW Section

Figure 8: 56' ROW Section

56' ROW (with Single Midblock Stormwater Curb Extension)

Basin		Pervious Surface	Swale Surface Area	Swale Bottom Area	Impervious Area	Resultant Size	Approximate Swale Area Dimensions (ft)			Rock Trench Dimensions (ft)			Swale Storage	Trench Storage	Total Storage	Runoff Volume	Storage Variance
ID	Area (sf)	sf	sf	sf	sf	%	L	W	D	L	W	D	cf	cf	cf	cf	cf
1	5,386	524	484	209	4,378	0.11	64	7.5	0.5	64	9.5	5	173	912	1085	1,226	-141
1a	5,386	524	484	209	4,378	0.11	64	7.5	0.5	64	9.5	5	173	912	1085	1,226	-141
2	7,157	526	320	152	6,311	0.05	39	9.0	0.5	39	9.5	5	118	556	674	1,767	-1,093
2a	7,157	526	320	152	6,311	0.05	39	9.0	0.5	39	9.5	5	118	556	674	1,767	-1,093

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin ID	Ai (sf)	Vr (cf)
1 & 1a	4,378	**1,226**
2 & 2a	6,311	**1,767**

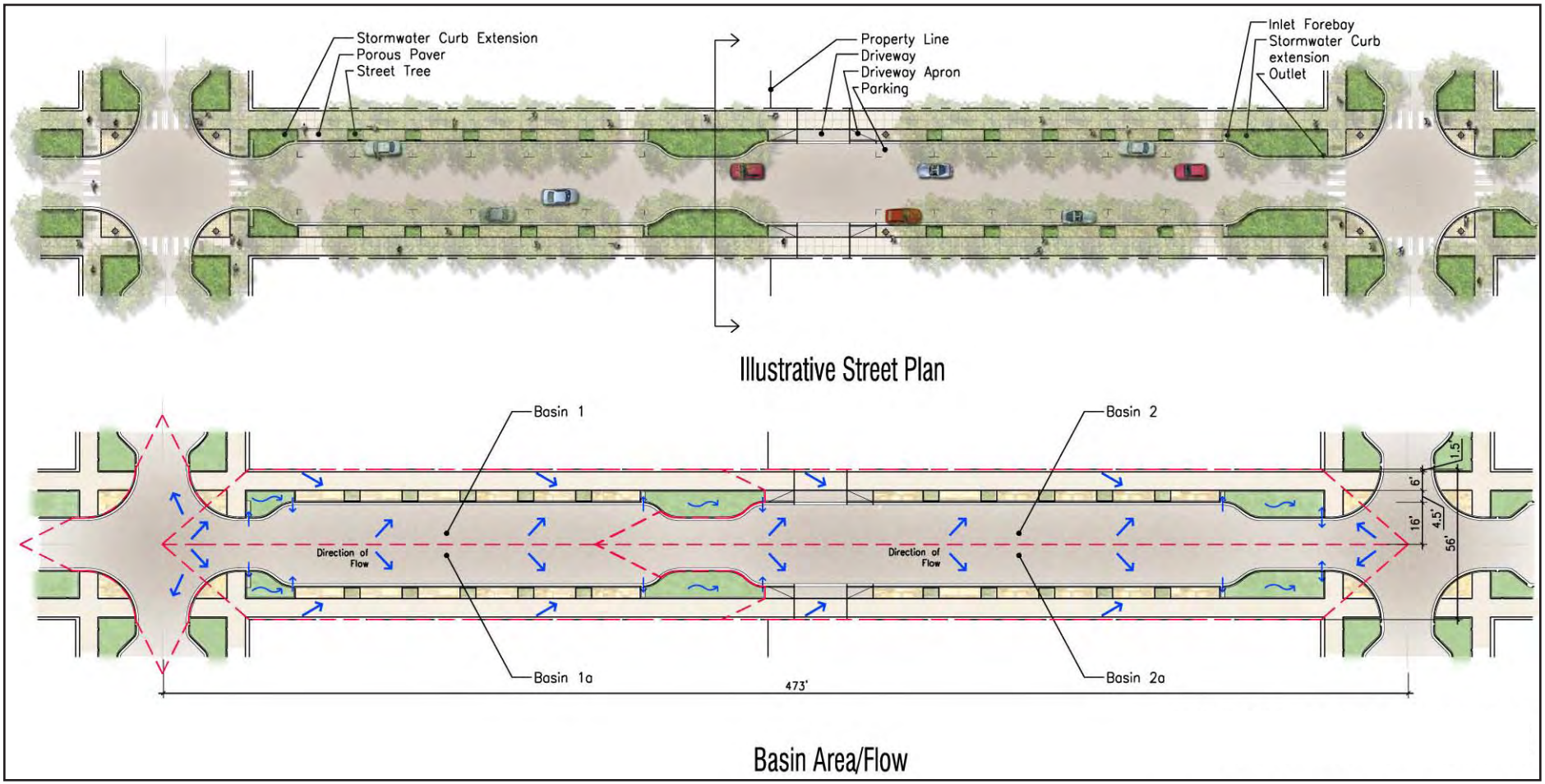


Figure 9: 56' ROW with Lot Consolidation

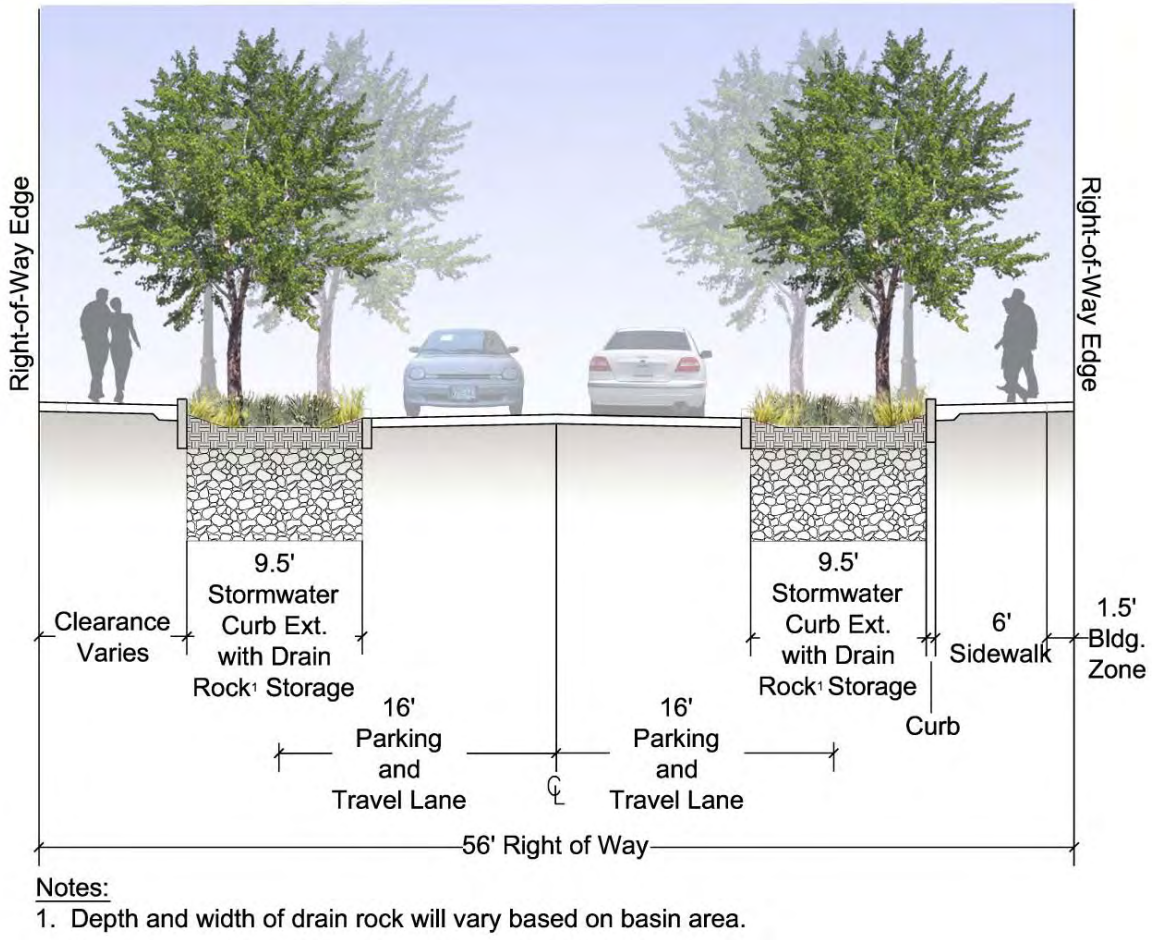


Figure 10: 56' ROW Section
(identical to page 19, included here for easy reference to plans)

63' ROW Stormwater Planter

Basin		Pervious Surface	Planter Surface Area	Impervious Area	Resultant Size	Approximate Planter Area Dimensions (ft)			Rock Trench Dimensions (ft)			Planter Storage	Trench Storage	Total Storage	Runoff Volume	Storage Variance
ID	Area (sf)	sf	sf	sf	%	L	*W (avg)	D	L	W	D	cf	cf	cf	cf	cf
1	3,035	274	380	2,381	0.16	66	5.7	0.5	66	7	5	167	693	860	667	193
1a	3,035	274	380	2,381	0.16	66	5.7	0.5	66	7	5	167	693	860	667	193
2	3,104	203	144	2,757	0.05	36	4.0	0.5	36	7	5	72	378	450	772	-322
2a	3,104	203	144	2,757	0.05	36	4.0	0.5	36	7	5	72	378	450	772	-322
3	3,113	203	144	2,766	0.05	36	4.0	0.5	36	7	5	72	378	450	774	-324
3a	3,113	203	144	2,766	0.05	36	4.0	0.5	36	7	5	72	378	450	774	-324
4	4,826	252	308	4,266	0.07	52	6.4	0.5	52	7	5	131	546	677	1,194	-517
4a	4,826	252	308	4,266	0.07	52	6.4	0.5	52	7	5	131	546	677	1,194	-517

* Basins 1 and 4 include average width of end swales.

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin ID	Ai (sf)	Vr (cf)
1 & 1a	2,381	**667**
2 & 2a	2,757	**772**
3 & 3a	2,766	**774**
4 & 4a	4,266	**1194**

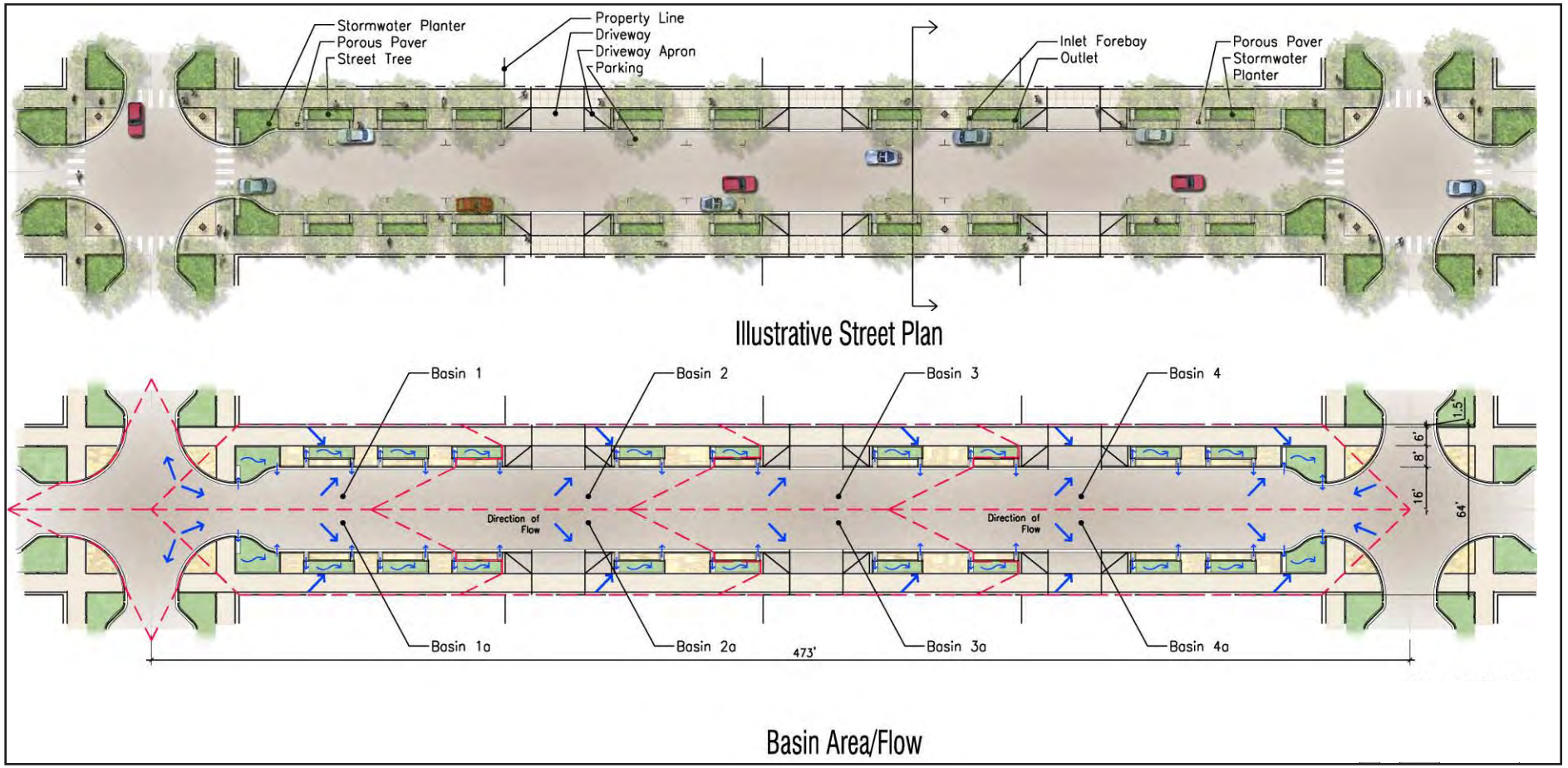


Figure 11: 63' ROW Plans

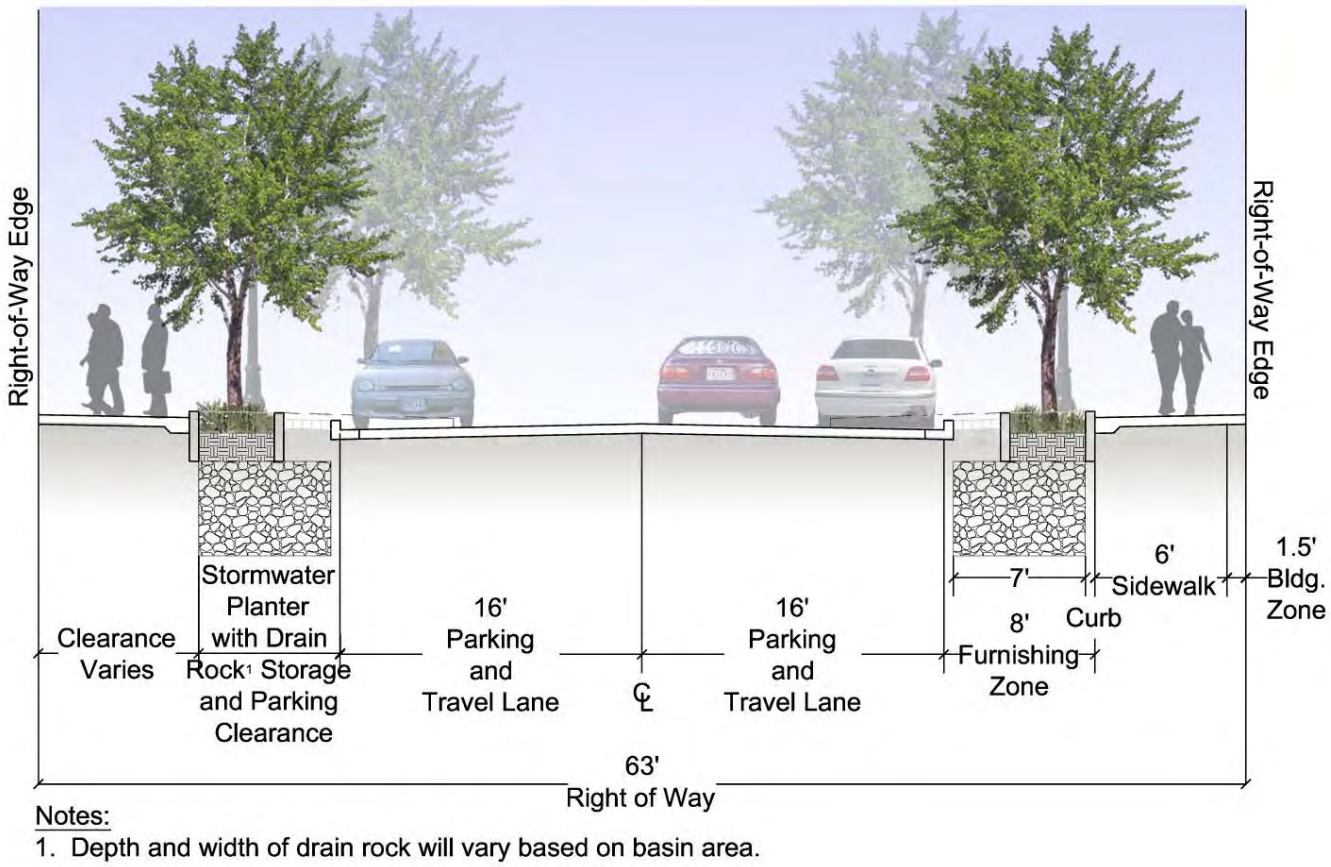


Figure 12: 63' ROW Section

68' ROW Stormwater Curb Extension

Basin		Pervious Surface	Swale Surface Area	Swale Bottom Area	Impervious Area	Resultant Size	Approximate Swale Area Dimensions (ft)			Rock Trench Dimensions (ft)			**Swale Storage**	**Trench Storage**	**Total Storage**	**Runoff Volume**	**Storage Variance**
ID	Area (sf)	sf	sf	sf	sf	%	L	W	D	L	W	D	cf	cf	cf	cf	cf
1	3,366	172	443	194	2,751	0.16	66	7.5	0.5	66	11.5	5	159	1139	1298	770	527
1a	3,366	172	443	194	2,751	0.16	66	7.5	0.5	66	11.5	5	159	1139	1298	770	527
2	3,437	86	259	117	3,092	0.08	36	7.7	0.5	36	11.5	5	94	621	715	866	-151
2a	3,437	86	259	117	3,092	0.08	36	7.7	0.5	36	11.5	5	94	621	715	866	-151
3	3,395	86	258	116	3,051	0.08	36	7.7	0.5	36	11.5	5	94	621	715	854	-139
3a	3,395	86	258	116	3,051	0.08	36	7.7	0.5	36	11.5	5	94	621	715	854	-139
4	5,202	174	280	141	4,748	0.06	48	9.5	0.5	48	11.5	5	105	828	933	1,329	-396
4a	5,202	174	280	141	4,748	0.06	48	9.5	0.5	48	11.5	5	105	828	933	1,329	-396

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin ID	Ai (sf)	**Vr (cf)**
1 & 1a	2,751	**770**
2 & 2a	3,092	**866**
3 & 3a	3,051	**854**
4 & 4a	4,748	**1329**

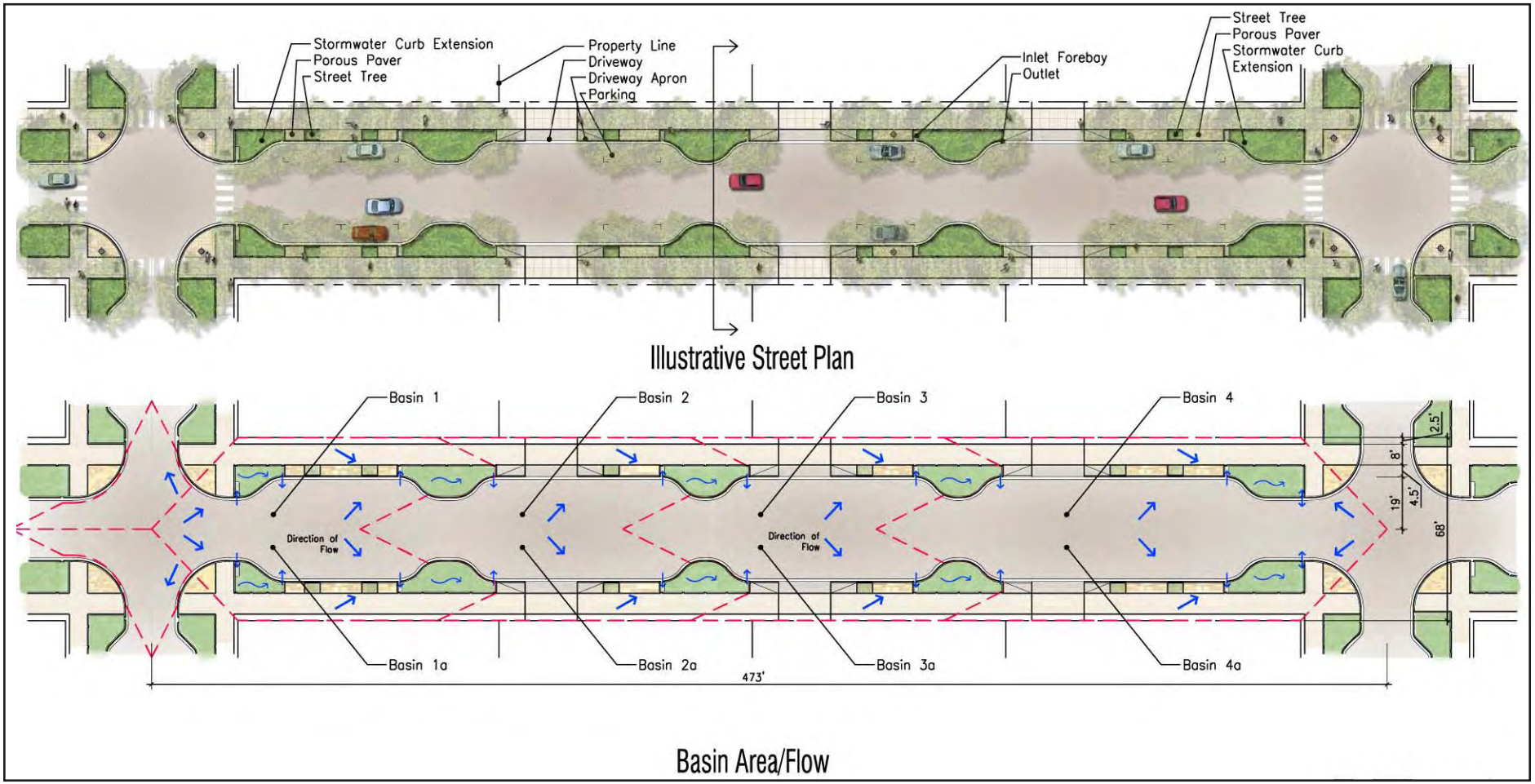
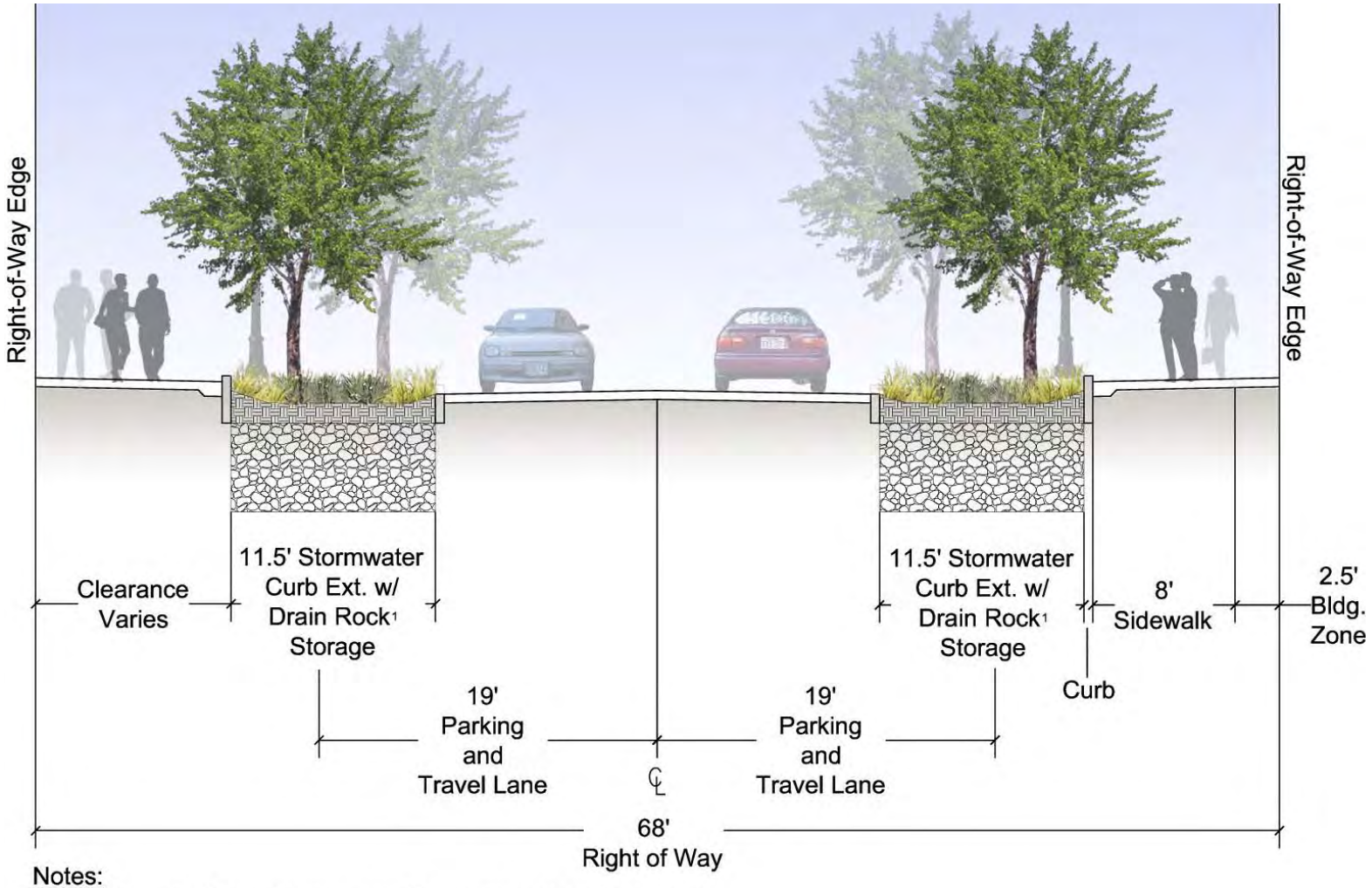


Figure 13: 68' ROW Plans.



Notes:

1. Depth and width of drain rock will vary based on basin area.

Figure 14: 68' ROW Section

75' ROW Stormwater Planter

Basin		Pervious Surface	Planter Surface Area	Impervious Area	Resultant Size	Approximate Planter Area Dimensions (ft)			Rock Trench Dimensions (ft)			Planter Storage	Trench Storage	Total Storage	Runoff Volume	Storage Variance
ID	Area (sf)	sf	sf	sf	%	L	W	D	L	W	D	cf	cf	cf	cf	cf
1	3,609	259	420	2,930	0.14	72	4	0.5	72	7	5	184	756	940	820	120
1a	3,609	259	420	2,930	0.14	72	4	0.5	72	7	5	184	756	940	820	120
2	3,686	203	88	3,395	0.03	36	4	0.5	36	7	5	44	378	422	951	-529
2a	3,686	203	88	3,395	0.03	36	4	0.5	36	7	5	44	378	422	951	-529
3	3,686	203	88	3,395	0.03	36	4	0.5	36	7	5	44	378	422	951	-529
3a	3,686	203	88	3,395	0.03	36	4	0.5	36	7	5	44	378	422	951	-529
4	5,743	233	352	5,158	0.07	54	4	0.5	54	7	5	149	567	716	1,444	-728
4a	5,743	233	352	5,158	0.07	54	4	0.5	54	7	5	149	567	716	1,444	-728

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin	Ai	Vr
ID	(sf)	(cf)
1 & 1a	2,930	**820**
2 & 2a	3,395	**951**
3 & 3a	3,395	**951**
4 & 4a	5,158	**1444**

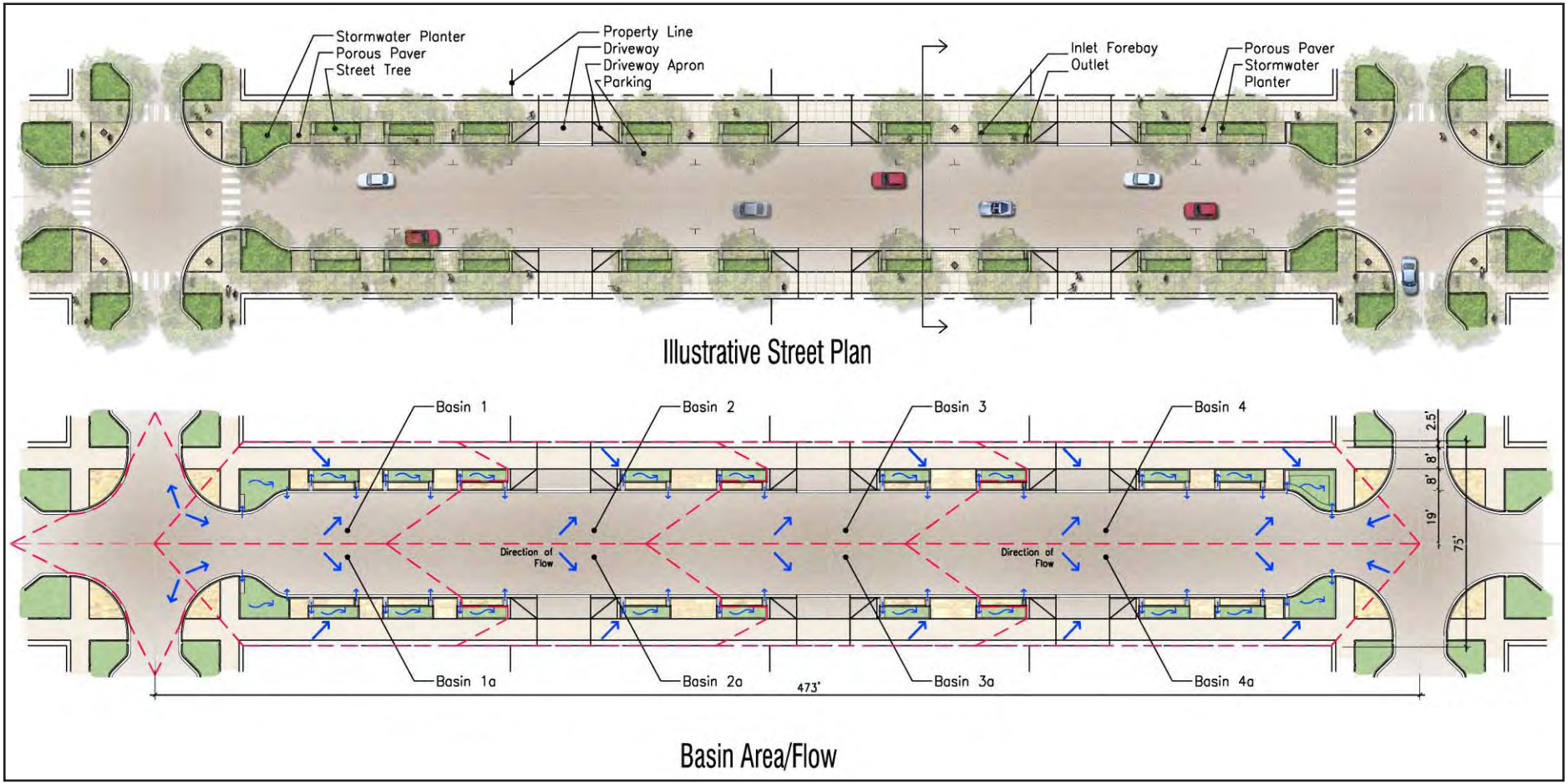


Figure 15: 75' ROW Plans

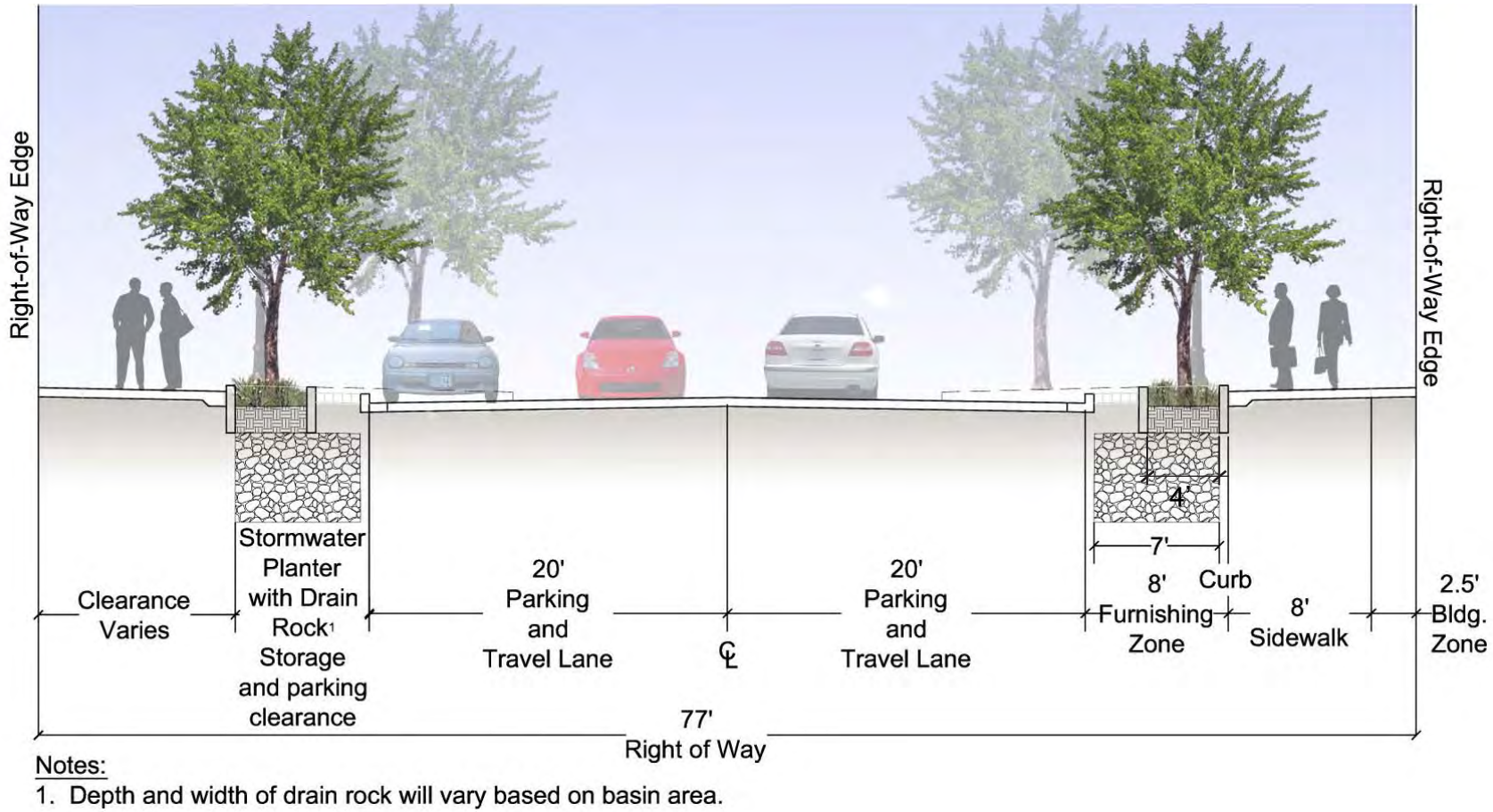


Figure 16: 75' ROW Section

80' ROW Stormwater Curb Extension

Basin		Pervious Surface	Swale Surface Area	Swale Bottom Area	Impervious Area	Resultant Size	Approximate Swale Area Dimensions (ft)			Rock Trench Dimensions (ft)			Swale Storage	Trench Storage	Total Storage	Runoff Volume	Storage Variance
ID	Area (sf)	sf	sf	sf	sf	%	L	W (avg)	D	L	W	D	cf	cf	cf	cf	cf
1	3,657	172	443	194	3,042	0.15	56	7.9	0.5	56	11.5	5	159	966	1125	852	273
1a	3,657	172	443	194	3,042	0.15	56	7.9	0.5	56	11.5	5	159	966	1125	852	273
2	3,940	86	259	117	3,595	0.07	34	7.7	0.5	34	11.5	5	94	587	681	1,007	-326
2a	3,940	86	259	117	3,595	0.07	34	7.7	0.5	34	11.5	5	94	587	681	1,007	-326
3	3,880	86	258	116	3,536	0.07	34	7.7	0.5	34	11.5	5	94	587	681	990	-310
3a	3,880	86	258	116	3,536	0.07	34	7.7	0.5	34	11.5	5	94	587	681	990	-310
4	6,123	174	280	141	5,669	0.05	30	9.5	0.5	30	11.5	5	105	518	623	1,587	-965
4a	6,123	174	280	141	5,669	0.05	30	9.5	0.5	30	11.5	5	105	518	623	1,587	-965

Runoff

Vr (runoff Volume) = Ai*P
Ai = Impervious Surface
P = 3.4 inches (10-yr Design Storm)

Basin ID	Ai (sf)	Vr (cf)
1 & 1a	3,042	**852**
2 & 2a	3,595	**1,007**
3 & 3a	3,536	**990**
4 & 4a	5,669	**1,587**

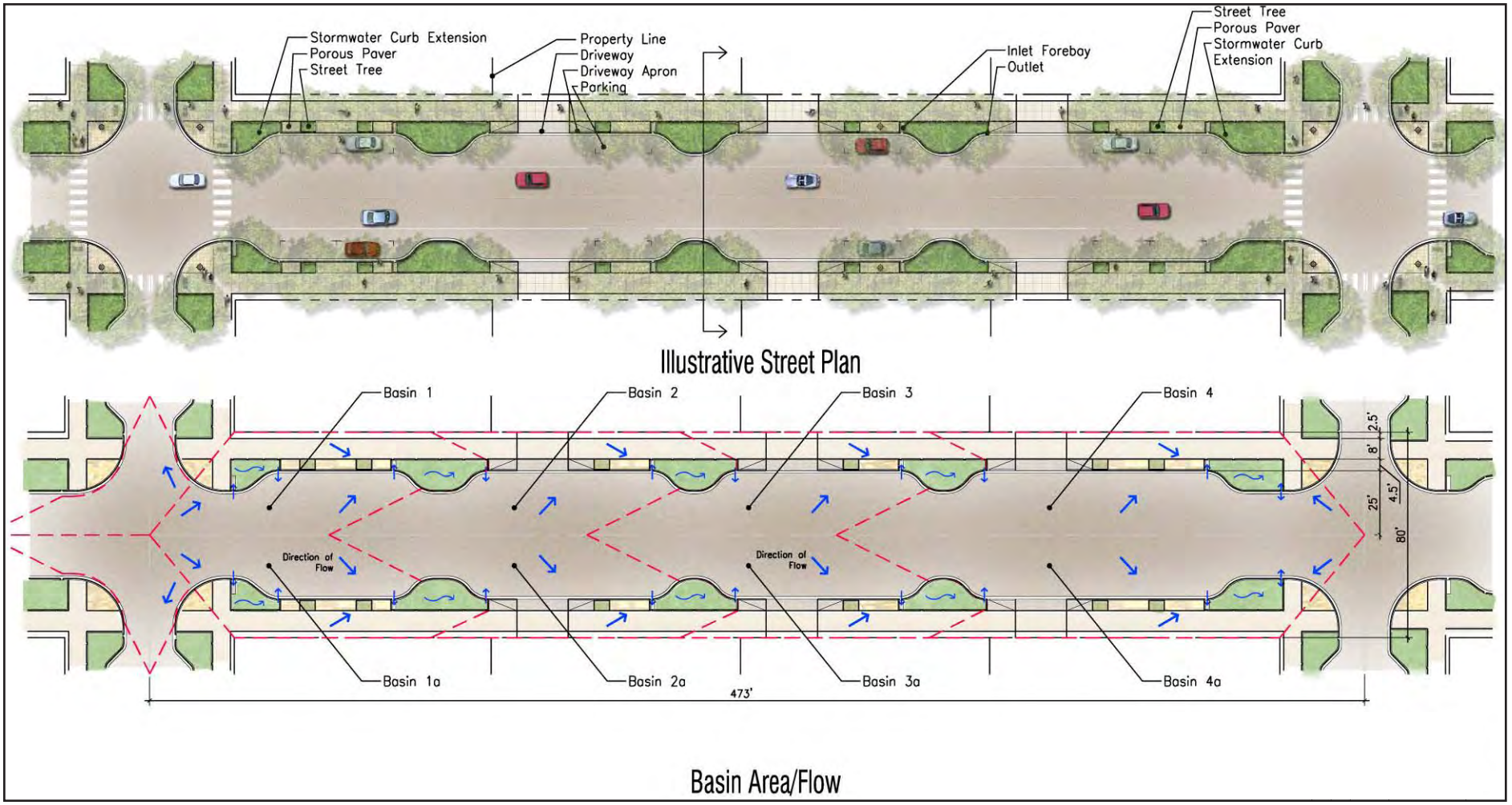
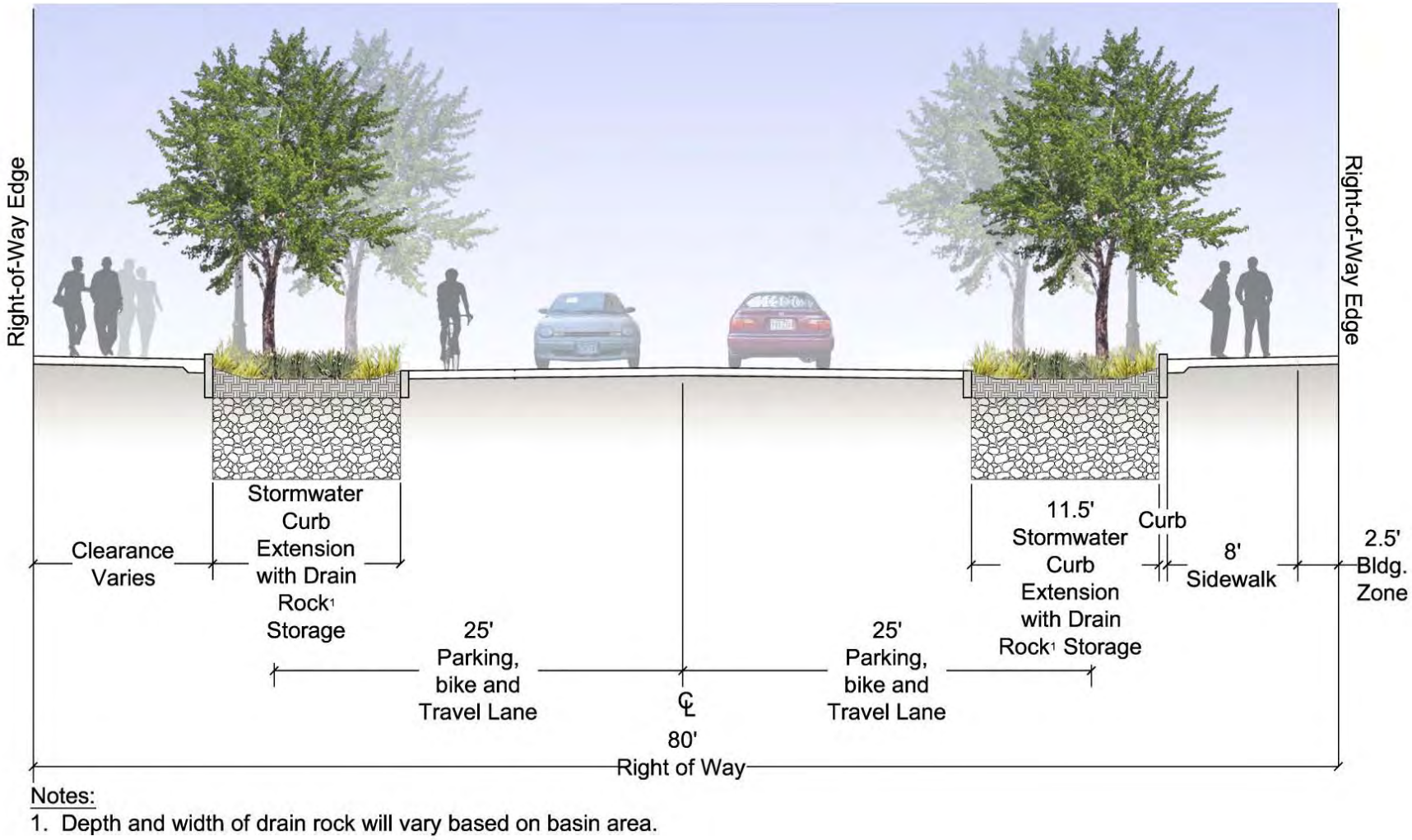


Figure 17: 80' ROW Plans



Notes:

1. Depth and width of drain rock will vary based on basin area.

Figure 18: 80' ROW Section

Recommendations

In addition to the detailed typologies proposed in the preceding pages, the following are actions that the City of Portland should consider to contribute to the successful implementation of Green Streets in the Gateway District and citywide:

Green Street Typology adoption

Revise the TSP to include the guidelines of the GGSMP and endorse the Green Street typologies. The TSP indicates that an additional 8% of ROW area will be required in the future, either through expansion of existing ROW or acquisition of new ROW. This will require detailed survey and analysis in a subsequent study, in order to determine what type of stormwater management options can be employed in each street, particularly streets such as E Burnside, NE Glisan, SE Stark and SE 102nd.

Invest Resources to achieve full-block development

Right-of-way development adjacent to small parcels (50 to 70 feet wide) and acquisition of future ROW are the greatest challenges for Green Streets implementation in the Gateway Neighborhood. Encouraging development to occur in full block increments, preferably on both sides of the ROW, will create the greatest positive impact for stormwater management goals as well as provide a continuity of design and a unified street system.

Maintain flexibility for block by block solutions

Projects that cannot coalesce into large development parcels will likely be implemented as half-street improvements immediately adjacent to individual parcels. Implementing the Green Street vision on this small scale will face a variety of conditions related to each site, i.e., location of existing utilities, and amount of additional ROW that needs to be dedicated. When projects with small ROW frontages apply for a building permit, consider dedicating the required ROW. For all project scales, it should be a priority to install a stormwater facility to protect existing sumps.

Update current city planning documents

The Gateway Regional Center Design Guidelines should address Green Streets and sustainable stormwater management. Related plans and guidelines for the district can help promote consistent Green Streets implementation.

Plantings

Owners adjacent to swales and planters should be encouraged to participate in choosing their preferred plants, with consideration and support from BES, in order to foster stewardship of the swale or planter. Evaluate allowing owners to purchase swales or planters to help foster the responsibility of maintenance and defer some of the cost incurred by the City. The City should continue to remove sediment from the forebays and the bottom of the swales and planters as necessary.

Infiltration sizing

Include infiltration rates of existing native soils in the sizing of Category 1 stormwater infiltration facilities, to reduce the size of the rock trench and related construction costs.

Minimize pollutants

Encourage the use of concrete or metal instead of treated wood utility poles in order to reduce migration of associated pollutants into the stormwater planters and swales.

Corner light poles

Consider a single light pole on street corners to free-up space for stormwater curb extensions and other site furnishings.

Minimize driveway aprons

Encourage smaller driveway aprons, (which ease turning radii into driveways), when located immediately adjacent to stormwater curb extensions. This approach will provide additional opportunity to meet GGSMP goals. Driveways 20-feet or wider do not need such an apron.

Share points of disposal

Design certain local street intersections to allow water to flow across the street (not typically allowed) so that blocks can be linked together and share points of disposal thus avoiding conflicts with other buried utilities, accommodating outlet elevation requirements and saving money.

Considerations for major arterials

Conduct special design analyses to incorporate Green Streets creatively and effectively into heavily traveled, automobile-oriented arterials such as E Burnside, NE Glisan, SE Stark, and SE 102nd. Green Streets along these major arterials can serve as distinctive entry ways into the area and help create a vibrant identity for Gateway.

Green Street Vision Implemented

The pages that follow further illustrate the vision of the Gateway Green Streets Master Plan. (Illustrations are designed to convey this vision and may not precisely reflect current City street standards.)

56’ Green Streets

The sketch in Figure 20 shows a 56’ Green Street Typology with stormwater swales in curb extensions. This typology can be implemented in areas zoned CX, EX or RX, providing the potential for Green Street development associated with a wide range of land uses. Evidence of successful, flexible green streets in such a variety of contexts is an important step in ensuring citywide public support for the concept.

In this illustration, buildings (some on consolidated lots) are set back from the ROW line, allowing ground-level residential activities within the building to be buffered from the sidewalk with structural landscape plantings, courtyards and additional trees. This setback could also allow for on-site sustainable stormwater management such as drainage swales, perhaps connected to downspouts or green roof systems.

The sketch shows uniform setbacks of 10 feet, but the actual setbacks would vary, from 0 feet to 10 feet as different developers assess their respective site’s potential in a variety of ways. This variety ensures a diverse streetscape with a modulation of facades providing more visual interest to the pedestrian, cyclist and driver and avoiding a monotonous ‘wall’ of buildings. Residential uses close to the street can encourage visual monitoring of the ROW, improving the sense of the neighborhood’s security and in turn increasing pedestrian traffic.

The stormwater curb extensions enhance visual and physical connections between the street, sidewalk and the experience of the pedestrian by providing additional space for landscape trees, shrubs and groundcover. In a CX zone, the curb extensions form a gateway to each street, adding to that street’s individual identity and signaling to traffic that pedestrians have priority on a mixed-use main street with narrow lanes or a queuing configuration.

NE 100th Ave., an existing ROW with the potential for application of the 56’ Green Street Typology.

Existing ROWs in the Gateway area are excessively wide with narrow sidewalks. The pedestrian environment and traffic safety will be improved with wider sidewalks, curb extensions and associated slower vehicle speeds thanks to the 56’ Green Street Typology.

Figure 19: 56' Green Street

An intersection with stormwater curb extensions within an area zoned EX or RX.

Figure 20: 56' Green Street

An intersection with stormwater curb extensions within an area zoned CX.

63' Green Streets

Figure 21 at right is a view of a Green Street with stormwater planters in an area zoned CX. This typology is well-suited to a commercial, urban zone and offers a new paradigm and aesthetic character for a range of ROW widths in Gateway.

Buildings are immediately adjacent to the ROW, offering a dense urban character and supporting a walkable retail environment. Sidewalks feel wider than 6', due in part to the furnishing zone allowance between stormwater planters. The spaces between the stormwater planters are an extension of the sidewalk and can accommodate public benches or tables and chairs associated with a coffee shop or cafe.

For such 'main-street' retail, on-street parking is desireable. In this typology, curb extensions are minimized to provide as many on-street parking spaces as possible. A narrow strip of hardscape in the furnishing zone, directly adjacent to the curb, allows for passengers to exit parked cars unimpeded by the stormwater planter. This typology requires greater ROW width, resulting in more impervious surface and subsequently higher quantities of stormwater runoff.

Visibility to storefronts from the street is important to retail's success so stormwater planter design and plant selections, including street trees, should be chosen to maintain visibility to the buildings. Building frontages are typically located directly on ROW lines, creating street 'rooms', so there must be careful consideration of shade on plantings. Design guidelines for future storefronts should consider how retail entries, canopies and windows relate to adjacent stormwater facilities.

Although half-street improvement approaches are possible for all typologies, the future commercial mixed-use character of this typology in particular allows for half-street improvements, reflecting the incremental nature of growth on successful retail streets.

An existing ROW with the potential for application of the 63' Green Street Typology. Newer building in photo shows potential urban character of this area and an example of half-street improvements as this street is converted to green infrastructure incrementally.

Figure 21: 63' Green Street

A main street retail area, zoned CX, with stormwater planters and on-street parking

66’ Green Street With Median

Some streets in this study area feature excessive ROW width, reflecting an outdated approach to roadway engineering that aimed to move autos at the expense of creating more complete, multimodal streets.

This excessive width allows for a retrofit of the ROW to include a stormwater swale in a center landscape median. Based on the preceding 56’ ROW Green Street Typology, the addition of a 10’ wide stormwater median with street trees removes one travel lane and reallocates ROW space.

The resulting street signals a unique neighborhood identity, perhaps even a gateway to a new neighborhood, while hinting at a more robust approach to sustainable stormwater management in the particular ROW, trading vehicular space for greenspace.

Implementation of this concept is not based on existing zoning, but rather where excessive street width is not compatible with neighborhood planning visions for slower speed residential or pedestrian-oriented commercial main streets.

The existing NE 102nd Avenue ROW has sufficient width to allow a future retrofit that includes a new median. NE 99th Avenue may also have sufficient width for such a median.

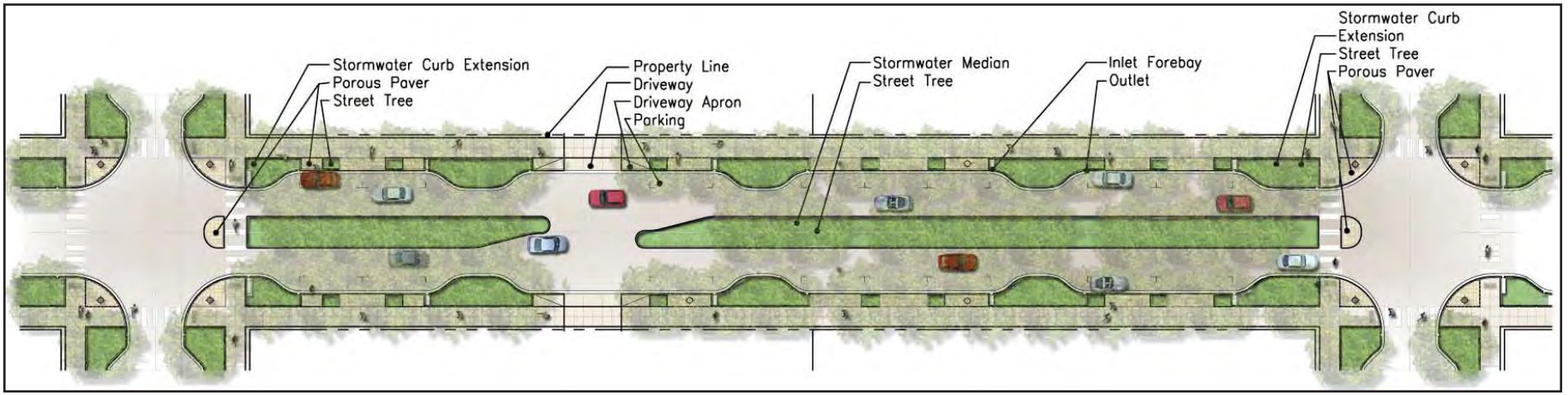


Figure 22: Illustrative Plan for a 66’ Green Street with Median

Figure 23: 66' Green Street

The addition of a central median mitigates excessive ROW and vehicular space in urbanizing neighborhoods with a pedestrian-friendly orientation. Buildings shown above feature a setback from the edge of the ROW; this option could include buildings flush to the sidewalk, and still allow stormwater curb extensions.

Neighborhood Collector Green Streets

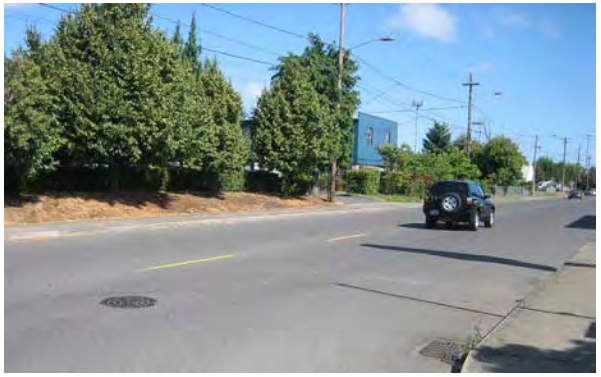
Wider collector streets in the Gateway area could feature a range of Green Street Typologies with variations based on the widths of furnishing zones and bike lanes. All of these typology variations will feature stormwater curb extensions and can be implemented in a variety of zoning conditions.

Buildings are immediately adjacent to the ROW, creating a dense urban character. Planning goals and guidelines for the Gateway district and other city revitalization districts recommend a variety of building frontage conditions, stepping buildings back in some instances to create pedestrian pockets, perhaps around entries, or to mark building corners or to enhance the pedestrian experience in areas of heavier foot traffic. Plant selections for such urban conditions should consider the effects of building shade on the health of stormwater planters.

In the widest typology (80') bike lanes are added, recognizing that these streets will feature heavier traffic, so bicycles will need a protected lane, whereas in slower traffic situations they can share lanes. The City could even consider 'sharrows' or bike boulevards in appropriate low-traffic conditions, depending on the desired regional network of bike routes.

Perceptual linkage of the stormwater curb extension swales along both sides of the street through consistent planting choices can help create a unique pedestrian-scale landscape identity for these streets.

Green roofs in district buildings offer additional opportunities for heat island reduction and stormwater management and can be integrated with the stormwater planters.



Wider Neighborhood Collector ROW with potential for a range of Green Street typology applications.

Figure 24: Neighborhood Collector Green Street

Stormwater curb extensions in a dense urban condition, indicative of the full eventual build-out of the Gateway District in several decades.

Woonerf or Chicane Green Streets

In order to accommodate urban design strategies for pedestrian and family-friendly residential redevelopment (RX zone) patterns, woonerfs and streets with 'chicane' features can be incorporated into the district street plan.

Woonerfs and chicanes are functional street designs that indicate to vehicles that they are travelling through a pedestrian oriented area. Originating in The Netherlands, they are gaining wider acceptance in North America, with distinctive regional variations, in this case stormwater planters.

Some woonerfs are curbless and entirely surfaced with permeable pavers to further slow vehicles through a transition in textures. Some feature raised planters to provide visual constriction and necessitate a level of care by drivers to avoid bicyclists, pedestrians, and damage to their vehicles. Planters can also be used as stormwater management.

As Figures 25 and 26 show, vehicles are encouraged to slow down with the use of curb extensions at intersections and a chicane or offset drive lane. Low profile curbs reduce the physical barrier for pedestrian crossings. During festivals, markets or performances, these streets can be transformed into programmable space for the neighborhood.

A prototypical Dutch Woonerf street

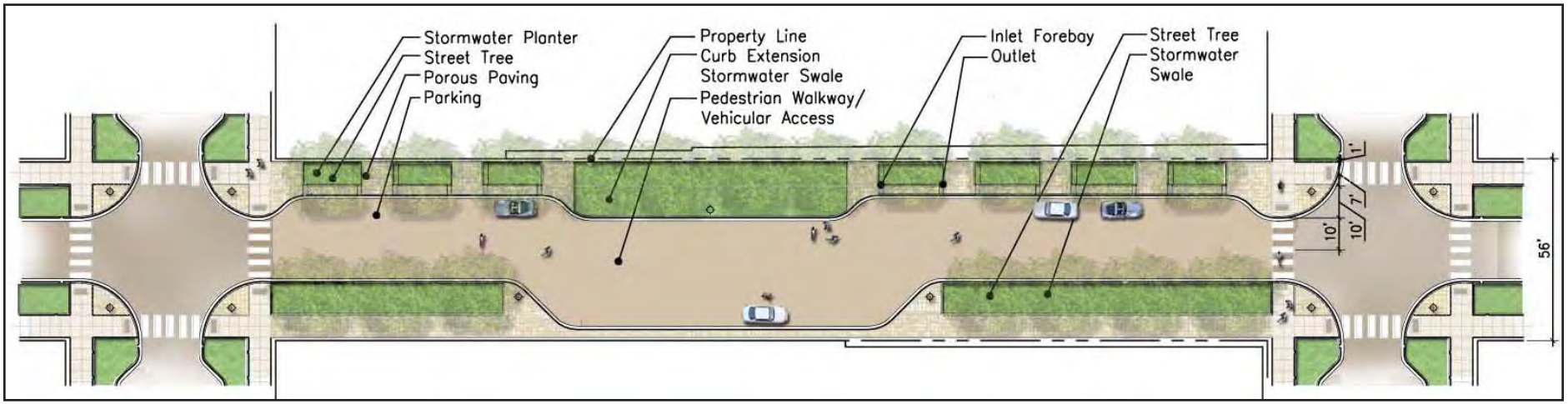


Figure 25: Woonerf/Chicane Plan

Figure 26: Woonerf or Chicane

Longer stormwater swales in a mixed-use residential condition, adding to the visual diversity of the neighborhood's street pattern and slowing traffic where pedestrians and families are prevalent.

Funding Strategies

BES is implementing Green Streets as a viable option to the conventional infrastructure of buried pipes. Working closely with PDOT, BOP, and PDC, BES has identified Green Streets as a technique to increase livability and improve water quality as existing ROWs are maintained and new ROWs are developed. The following potential funding strategies for the construction of green streets in the Central Gateway area are based on discussions with City of Portland staff and representatives of ODOT and FHWA, as well as with the National Association of Clean Water Agencies. It also included a review of web sites for HUD, EPA, and FHWA.

A Range of Funding Sources

The two federal agencies from which funding may be most available are Federal Highway Administration (FHWA) and the Environmental Protection Agency (EPA). FHWA has programs to develop environmentally sensitive and community oriented roadway programs. EPA is currently actively involved in support of green street projects. Very recent congressional action as well as EPA interest may make new sources of revenue available for use on the Gateway green streets projects within the next few years.

The following funding sources are applicable to area wide street projects:

Transportation Enhancement Funds (TE) and Transportation, Community and System Preservation (TCSP) Programs

Both of these funding programs are part of the Federal transportation authorization act called SAFETEA-LU. Funds from both these programs could be used to fund parts of a Green Streets program in Gateway. These are competitive grants that are meant to improve transportation systems and facilities; they are more applicable to improvements along a roadway or corridor. The Transportation Enhancement program provides federal highway funds for projects that strengthen the cultural, aesthetic, or environmental value of our transportation system. The TCSP funds projects that strengthen and integrate transportation and land use. Both these programs can be used to cover ROW acquisition and construction, and non-arterial streets are eligible as long as they support the goals of the grant programs.

Business/Community Improvement Districts (BID/CID)

This is a tool used in other states that is similar to what are called Economic Improvement Districts (EID) in Oregon. This EID tool allows the establishment of districts for the purpose of planning or management of development or improvement activities including:

- Landscaping or other maintenance of public areas.
- Promotion of commercial activity or public events.
- Activities in support of business recruitment and development.
- Improvements in parking systems or parking enforcement.

- Any other economic improvement activity for which an assessment may be made on property specially benefitting.

An EID is different from an LID in that property owners can be assessed costs for operations and maintenance of services instead of capital improvements. It should be noted that the existence of local improvement districts or urban renewal districts in a city does not affect the creation of economic improvement districts.

Tax Increment Financing (TIF)

This is the funding that is generated by increased taxes from improvements in an Urban Renewal District. Gateway is an URD that generates tax increment financing. This area has the smallest amount of revenue of any of the Portland city districts because it has the smallest tax base. PDC has committed this funding to several projects and will only have limited funding over the next several years. According to PDC's five year budget however, it is anticipated that $1.2 M will be available for a range of programs including Green Streets development in 2011.

Local Improvement Districts (LID) & Super LID

This is a geographically-defined area in which a majority of the property owners agree to tax themselves to pay for public improvements such as streets, streetscape improvements, or other infrastructure improvements. Based on the cost of the necessary improvements, a financing methodology is developed in which each of the property owners pays a portion of the costs. A variety of methods is used to determine the share each property owner owes, including property square footage, linear footage or equivalent dwelling unit. Sometimes a combination of these methods is used, but property square footage is most common for projects in residential areas.

The term super LID refers to the development of a joint LID/EID. There is no restriction in Oregon law for developing both types of districts in the same geographic area. Property owners have the right to withdraw from an EID, but not from an LID.

Section 108 Loan Guarantee Program

This is the loan guarantee provision of the Community Development Block Grant (CDBG) program. Section 108 provides communities with a source of financing for economic development, housing rehabilitation, public facilities, and large-scale physical development projects. There is a cap on this funding; Portland has about $15 million remaining. Benefits of this loan program include creative payback schedules and a low interest rate. This source of funding should be applied to a large project and not an individual property. The City would need to guarantee Section 108 loans with their current and future CDBG allocations as security for the loan amount.

Economic Development Administration Grants

These grants, such as the Public Works and Economic Development Program, assist communities experiencing chronic high unemployment and low per capita income to foster innovation, promote entrepreneurship, and attract increased private capital investment. This grant source does not seem appropriate for funding green streets development in Gateway.

Incentive-Based Approaches for Private Redevelopment

Incentives for redevelopment can include relaxing zoning regulations (such as density or parking) in exchange for building green street infrastructure. In other instances, there can be property tax relief for committing to redevelop in accordance with a set of guidelines.

H.R. 720 (revolving fund to address stormwater management)

H.R. 720 is legislation funding an EPA grant program that would allow local municipalities to use the money for green infrastructure technologies. Previously, the grant money has been limited to funding traditional stormwater management systems such as sewer pipes. However, it may take several years before this funding is available because this is new legislation. EPA is becoming increasingly interested in funding green street technology and construction. In the meantime, specific EPA programs may provide funding opportunities.

EPA Targeted Watershed Grant Program

(See details on page 45)

New residential development in the Gateway District

Funding Strategies Applicable To Green Streets

This section discusses the funding strategies that are the most likely candidates for purchase of ROW and construction of Green Streets in the Central Gateway area. The most likely funding mechanism for Green Streets is a package of funding sources including:

- TIF
- LID
- Transportation Enhancement Funds
- Transportation, Community and System Preservation Program
- EPA Targeted Watershed Grant (TWG) program
- Safe and Sound Green Streets

Tax Increment Financing

Tax increment financing (TIF) is expected to contribute only a portion of local improvement costs, according to the PDC. This district will generate only about $4.8M in 2007-08, down from $5.6 in the last fiscal year. The TIF budget projections for Gateway have decreased in part because much of the development occurring now is covered by tax abatement programs. Much of the existing revenue stream is being used to pay back loans for already completed projects. However by 2011 there will be about $12M, some of which can be allocated to Green Street development. The Gateway Master Plan does not identify loans as a funding source because they must be backed by a revenue stream. However, Section 108 Loan Guarantee Program offers loans that can be used to construct Gateway green streets in the more immediate future than other sources might be able to.

Local Improvement District

Local Improvement Districts (LID) divide the costs of improvements among property owners in a way that reflects the benefits they will receive from the project. Green Streets in Gateway could be developed using one LID or several. The Portland Development Commission (PDC) has identified LIDs as a proposed funding strategy for the area. However it notes that before forming an area-wide LID, there needs to be resolution of the final street plan for Central Gateway expected in 2008.

An LID must be approved by the Portland City Council. They will be looking for a proposal that has significantly more than the legally required 50% support from property owners. Therefore, green streets development must show a benefit to the property owners for which they will be willing to pay. If it can be shown that green streets will decrease the cost of sewer systems development more than the cost of developing and constructing green streets, it will no doubt gain strong support. There should also be a clear aesthetic benefit to the property from additional landscape in the adjacent ROW.

City staff notes other important factors that lead to the success of an LID:

- The LID should not finance the entire or even the major part of the costs of the proposed improvements.
- Cost of the project to the value of the properties should be no more than 33%.
- LIDs are easier to implement with consolidated property ownership in the proposed district, however there may be additional charges when there are less than three owners.

The City has a number of current LID projects, such as the SW Texas Green Street LID. Property owners are funding this LID, with additional funding from BES and PDOT.

Transportation Enhancements

This ODOT-administered competitive grant program uses revenues from SAFETEA, the federal transportation appropriations act. The GGSMP project would be eligible in two categories: environmental mitigation to address water pollution due to highway run-off, and landscaping and other scenic beautification. Transportation Enhancement grants will pay for the "margin of betterment" over what is required or routine.

For example, this source will not pay for a standard gutter, but would pay for swales and curb treatments to encourage stormwater to run into the swales. The funds can be used to pay for ROW acquisition and construction as long as they meet the "margin of betterment" rule. Grant awards range from $200,000 to $1.2M. There is a 10.27% local match. Grants have already been awarded for 2010 construction projects. ODOT will be accepting grant applications in spring 2008 for the 2011-12 construction season. There is no certainty of winning a grant as there are more applicants than available funding.

Examples of grants awarded in ODOT Region 1 include: $800,000 for Gresham-Fairview Trail Overpass at Powell Blvd; $920,000 for HCRH State Trail extension at Starvation Creek in Viento SP; $1.1M for Park St. & Main St. Sidewalk Connections in Gaston. Most of the grants were for pedestrian, bicycle and trail improvements or for historic facility restoration. The City of Portland would have the greatest potential for success if it applied for improvements for one or more streets.

Transportation Community Systems and Preservation

The Transportation, Community, and System Preservation (TCSP) Program awards discretionary grants to carry out eligible projects to integrate transportation, community, and system preservation plans and practices that:

- Improve the efficiency of the US transportation system
- Reduce environmental impacts of transportation.
- Reduce the need for costly future public infrastructure investments.
- Ensure efficient access to jobs, services, and centers of trade.
- Examine community development patterns and identify strategies to encourage private sector development patterns and investments that support these.

The grant requirements and goals indicate that construction of innovative improvements in a designated Regional Center would be a good candidate project. The Federal Highway Administration (FHWA) awards these grants although in the past they have been earmarked by members of Congress. Grants awards range from $400,000 to $1M. In 2006 ODOT received $430,000 for the Newberg-Dundee Transportation Improvement Project. This was the only project in Oregon that year. In 2005, Oregon received no awards. Projects requesting funding should have construction projects that are ready to be built. This funding source could be used to fund a discrete part of the green streets ROW acquisition and construction.

EPA Targeted Watersheds Grant Program (TWG)

The Targeted Watersheds Grant program is a competitive grant program that provides funding to community-driven, environmental results-oriented watershed projects. To date, more than $37 million has been awarded to 46 watershed organizations throughout the U.S. focusing on protection, preservation and restoration of watersheds. Applicant projects must be well developed and produce measurable environmental outcomes. TWG won't pay for activities required under the Clean Water Act, but will pay for projects that help eliminate non-point source pollution. The project and the watershed must be nominated by the governor, but there is no longer any cap on the number of projects the governor can nominate. There is a 25 percent required local match. Local and state governments, as well as other types of entities, are eligible to apply. Awards range from approximately $600,000 to $900,000 each and have a project period of three to five years.

In 2005, the Willamette Partnership received a TWG grant to institute a water quality trading program to address temperature problems within the basin. The Willamette Partnership created a marketplace for investments that implement the temperature Total Maximum Daily Load, or TMDL. Trading and banking programs provide the necessary mechanisms and incentives to direct financial and in-kind resources to priority projects at critical locations. The marketplace conducts business in several individual credit "currencies," such as pollutant units or environmental services (e.g., flood plain or habitat restoration), and works toward developing a common "currency."

Safe and Sound Streets

The Safe, Sound and Green Streets Project is a funding proposal over the next ten years to address Portland's most critical transportation needs - maintenance of the most deficient roads and bridges - and key safety projects. There are a number of projects where collaboration with Green Streets is possible. These include: maintaining arterial streets in poor condition, addressing safety at high crash intersections, funding safe routes to school services, and developing safe pedestrian and bicycle routes as alternatives to busy streets. This proposal also includes an annual allocation of $50,000 per district coalition for safety improvements or related services identified by the district coalition. Strong public support is necessary to move proposed projects forward. More information about the program can be found at www.safeandsoundstreets.com.

Summary

It will take a coordinated approach to fund Green Street development in Gateway. No one source will be able to cover the costs of ROW acquisition and construction. This package of funding sources could include:

- TIF funds
- Development of an LID/EID
- Grants from Transportation Enhancements and Transportation Community Systems and Preservation programs
- Targeted Watersheds Grant program
- Safe and Sound Street Projects