Promoting Green Streets

A Recipe for Integrating Water and Transportation Infrastructure Investment

What we will cover

- Green Street Overview
- Ingredients needed
- Explanation of steps
- Nashville context and experience

Inc.

Source: loomismcafee.com

Hitch your wagon to municipal priorities

Source: Overlake Village Complete Streets Plan & Guidelines, Redmond, WA

National Complete Streets Coalition

Safe Routes to School National Partnership

Source:saferoutespartnership.org

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Project Steps

1. Assess the impervious cover associated with the road system
2. Calculate stormwater runoff from the road system
3. Identify appropriate right-of-way green elements
4. Determine suitable locations
5. Quantify the volume reduction to conveyance system
6. Estimate Implementation Cost
7. Develop a master plan
8. Advocate for green streets

Source: AmericanRivers.org

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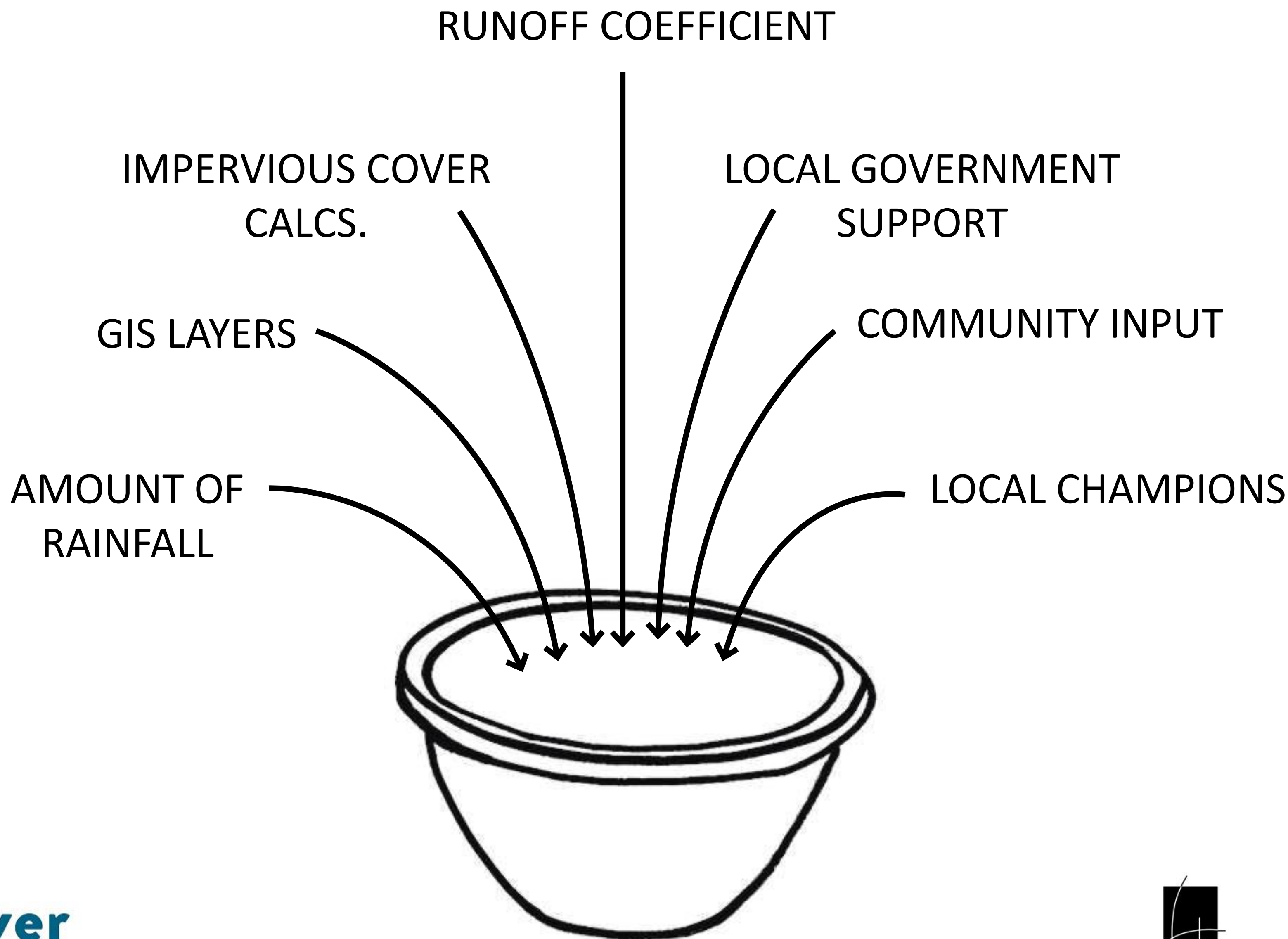
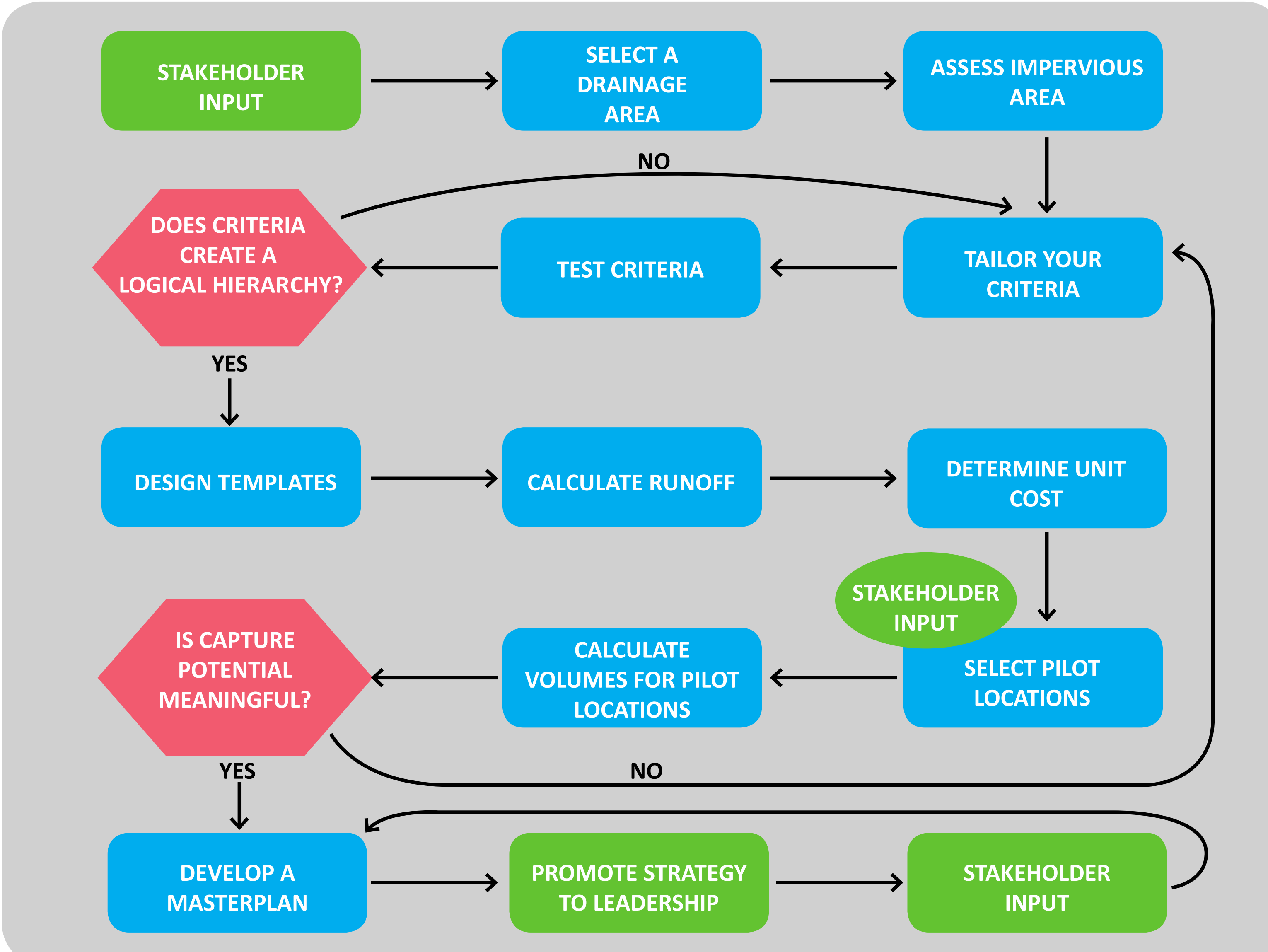
Green Street Ingredients



Green Street Recipe



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Big Picture

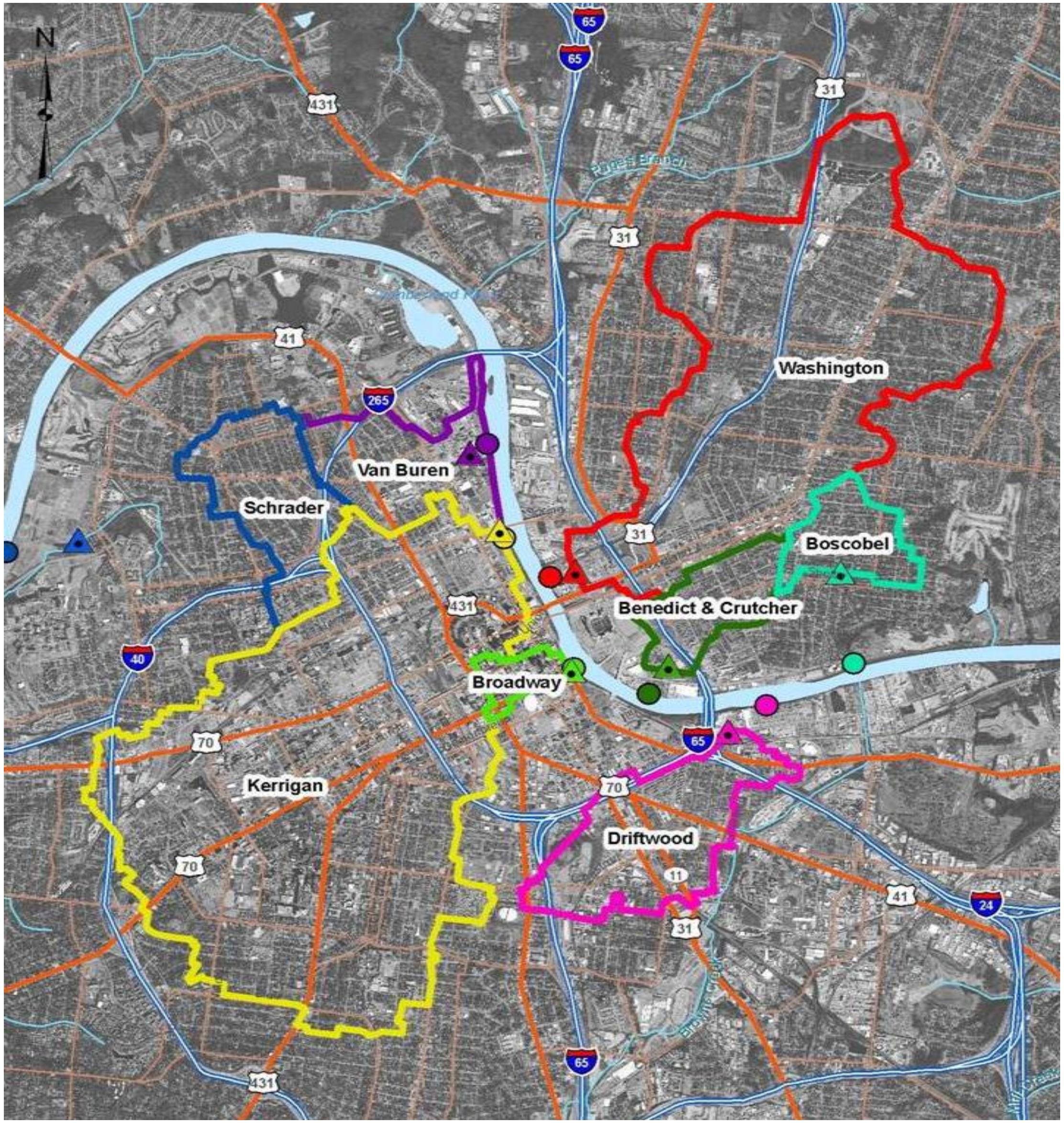

Image courtesy of AMEC

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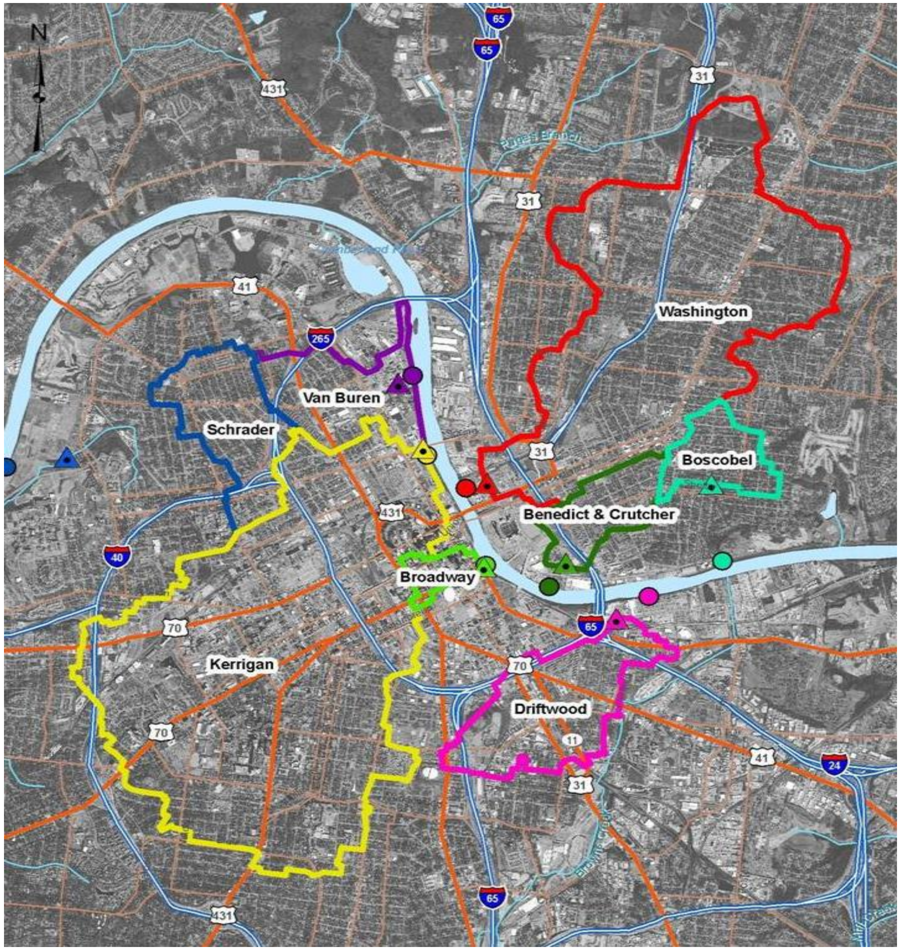
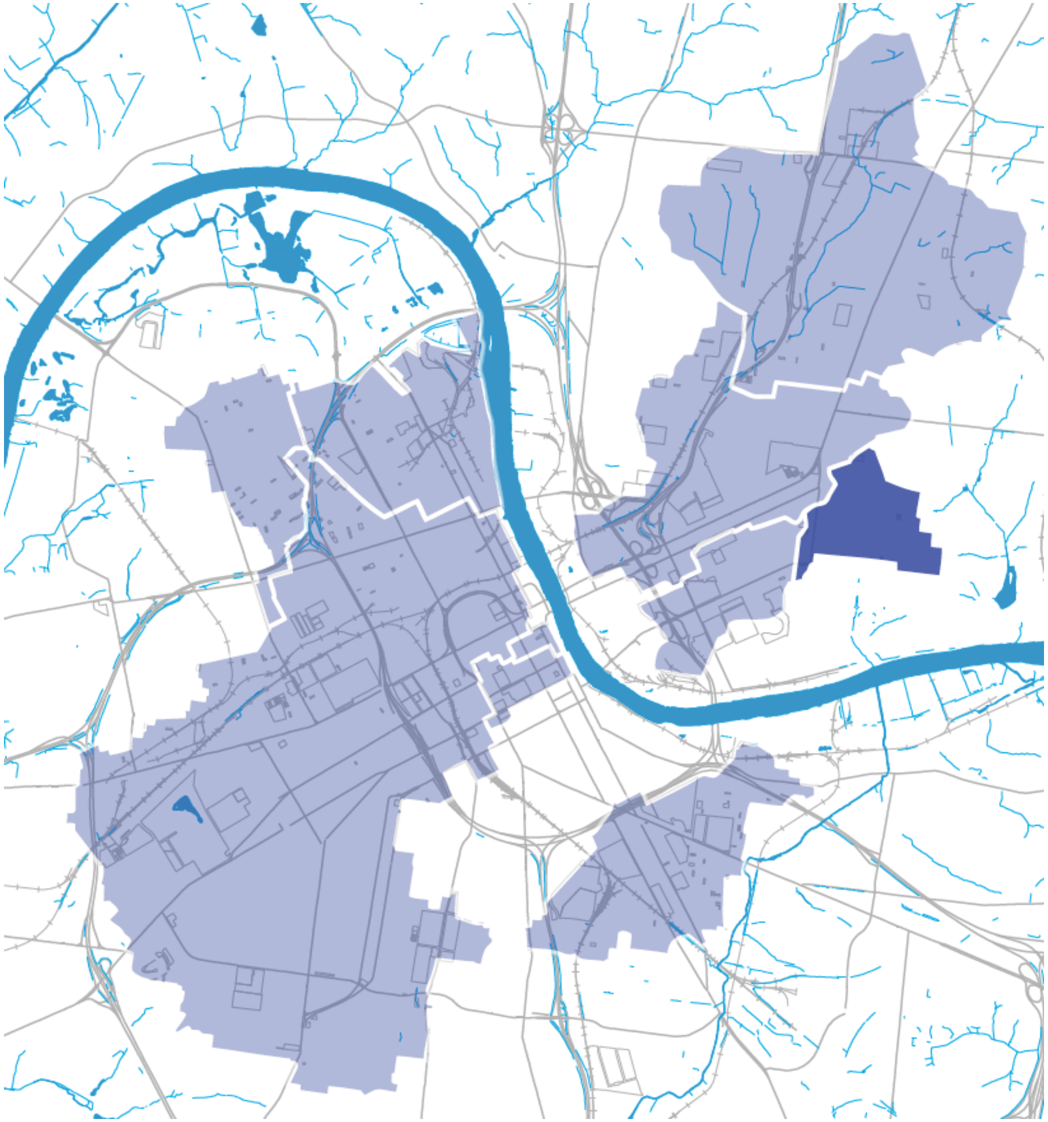
Big Picture

"In 2008, which was closer to a typical rainfall year than 2009 and 2010, 37 overflows occurred which resulted in a discharge of 18.3 MG of combined wastewater."

- Nashville LTCP (2011)



Step 1: Choosing a Drainage Area



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Step 1: Choosing a Drainage Area

Step 2: Assess Impervious Area

Basin Size: 230 Acres

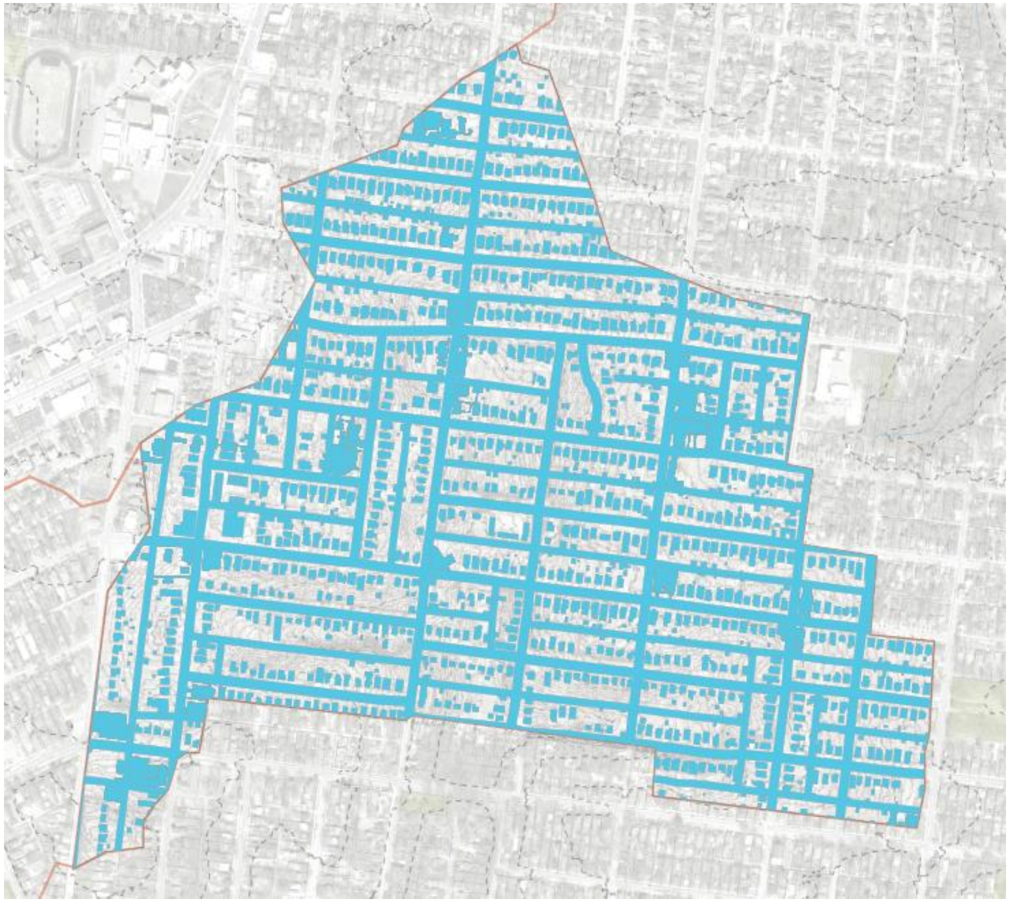
Paved road cover: 35 Acres

Building Coverage: 40 Acres

Parking Lots: 6.3 Acres

Miscellaneous: 0.06 Acres

43% percent of basin is roadway surface

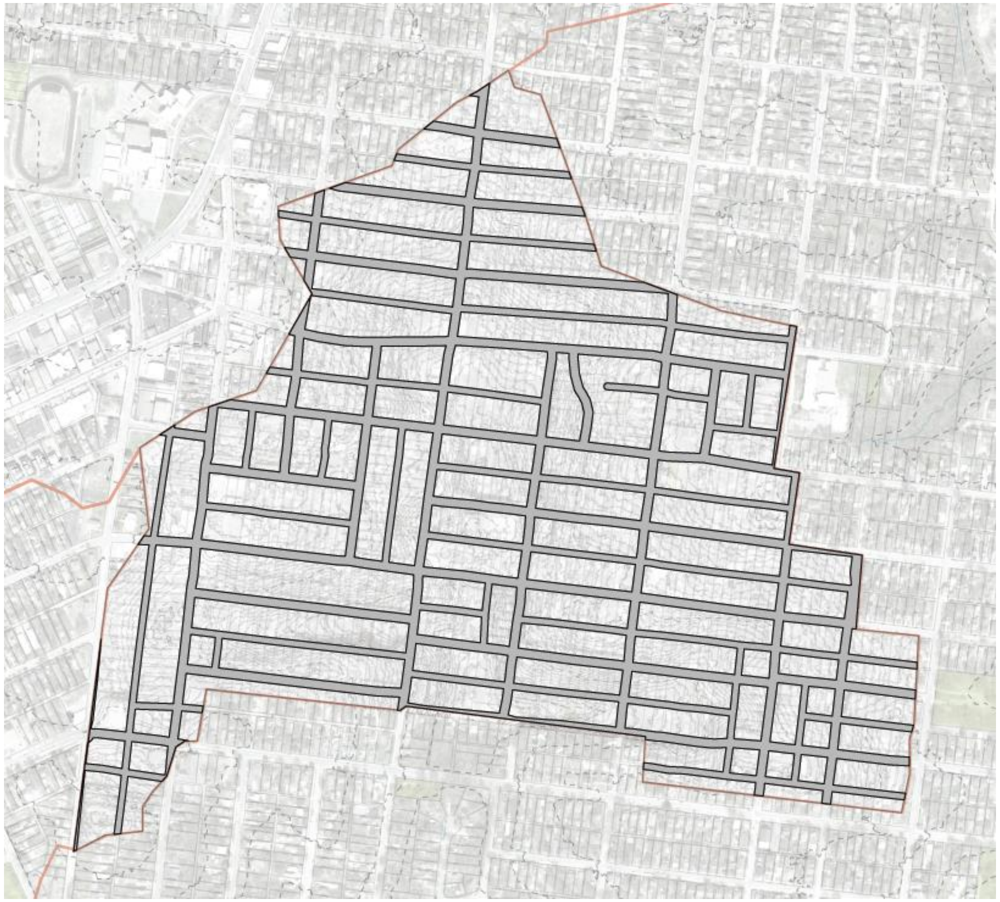


Step 2: Assess Impervious Area

Paved road cover: 35 Acres

That means approximately 43 MILLION GALLONS of rainfall run off the road network alone.

What if we could capture 80, 90, or 95% percent of that volume before it reaches the conveyance system???



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Step 3: Calculate Volumes From Roadway Impervious Cover

Catchment Area (ft2) X Avg Rainfall (ft) X Runoff Coefficient = TOTAL RUNOFF (ft3)

Boscobel's roadway represent approximately 35 acres or 1,525,000 sq. ft. of impervious surface

Average rainfall in Nashville is 48 inches or 4ft.

The accepted runoff coefficient in Nashville for impervious surfaces is 0.95. This means that 95% of water falling on a paved surface moves off-site. The remaining 5% evaporates or clings to a material surface.

1,525,000 (ft2) X 4.0 (ft) X 0.95 = 5,795,000 (ft3) OF RUNOFF

Step 3: Calculate Volumes

Total Runoff Volume (ft3) X 7.48 gallons per cubic foot = TOTAL RAINWATER (GAL)

5,795,000 (ft3) X 7.48 gal/ft3 = 45,200,000 gallons

Step 4a: Potential Treatments

For Streets
1. Curb Bump-outs
2. Linear Bioretention

For Alleys
3. Permeable Pavement

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So how do we assess suitability?

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Step 4: Tailor Suitability Criteria to your area

Who comes to the table is up to you:
Officials, engineers, designers, citizens

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Step 4: Tailor Suitability to your area

SLOPE

ROW WIDTH

SOIL COMPOSITION

UTILITY CONFLICTS

STORMWATER COMPLAINT DATA

HOUSE FRONTAGE / ON STREET PARKING

PROXIMITY TO NODES OF PEDESTRIAN ACTIVITY

Step 4: Tailor Suitability to your area

Block #	Slope	ROW Width	< 1/3 mile of Park/School	Hydrologic Soil Group	Utility Conflict	Flooding Complaints	House Frontage	**TOTAL**
1	2	2	0	1	1	0	0	**6**
2	1	2	0	1	1	0	0	5
3	2	2	1	1	0	0	0	**6**
4	1	2	0	1	2	0	1	**7**

Our process produced a suitability matrix

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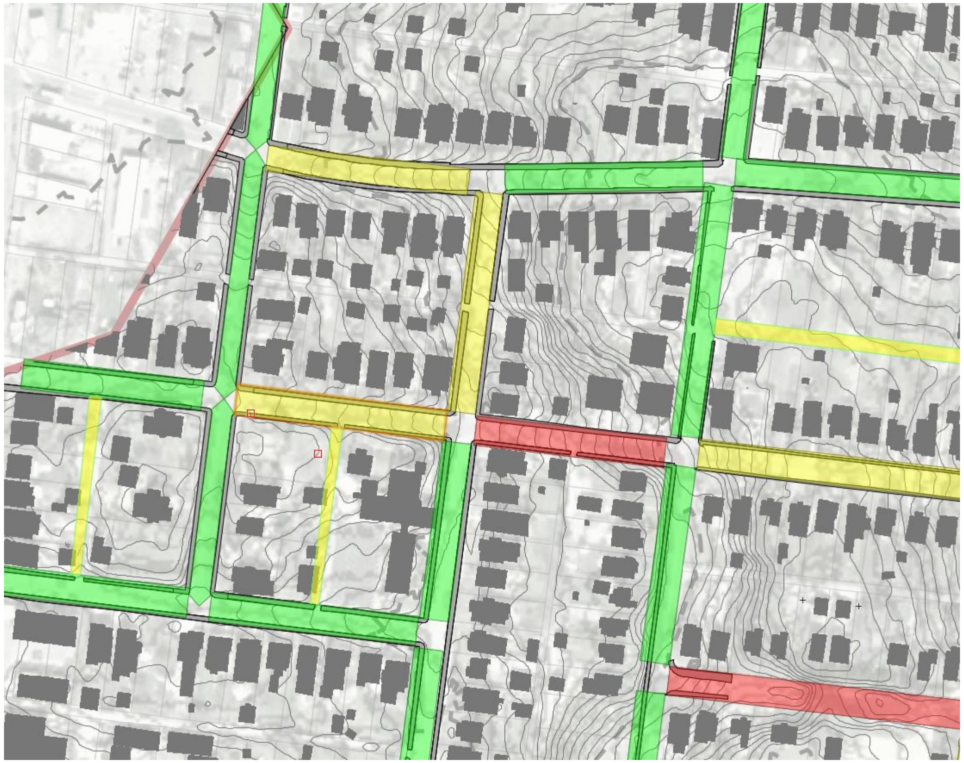
Step 4: Tailor Suitability to your area

Block #	Slope	ROW Width	<1/3 mile of Park/School	Hydrologic Soil Group	Utility Conflict	Flooding Complaints	House Frontage	TOTAL
1	2	2	0	1	1	0	0	**6**
2	1	2	0	1	1	0	0	5
3	2	2	1	1	0	0	0	**6**
4	1	2	0	1	2	0	1	**7**
5	2	2	0	1	**2**	0	1	**8**
6	2	2	1	1	0	0	0	**6**
7	2	2	1	1	0	0	0	**6**
8	2	2	0	1	0	0	0	5
9	0	1	0	1		0		2
10	2	2	0	1	1	0	0	**6**
11	2	2	1	1	1	0	1	**8**
12	2	2	1	1	1	0	0	**7**



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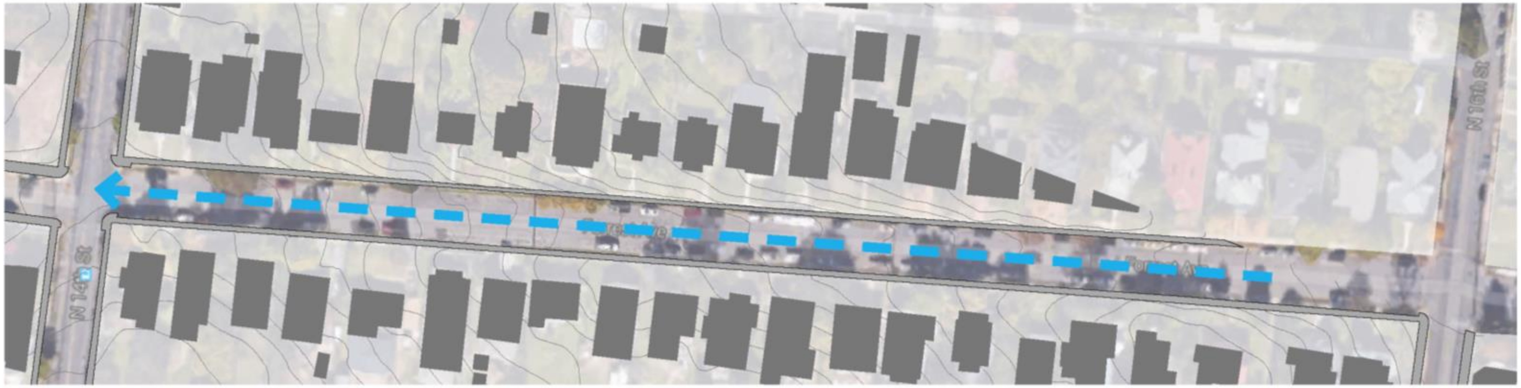
Step 5: Apply to your test area

Forrester Ave.

Forrester and Lockeland

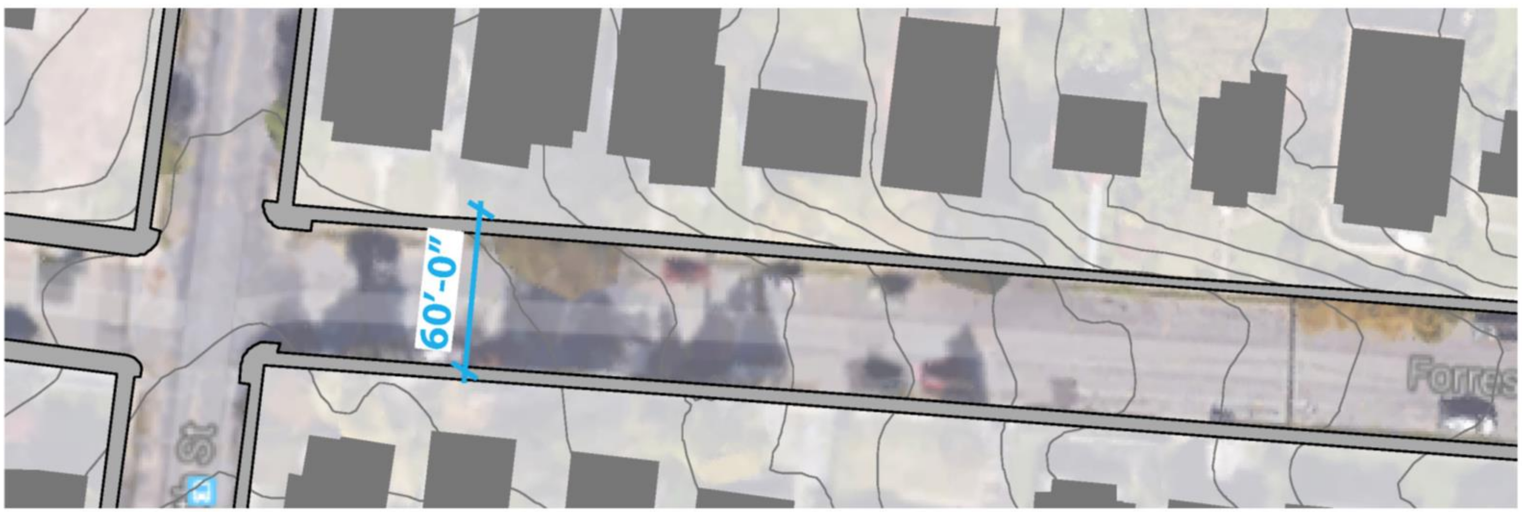
Lockland Springs Elementary

Step 5: Apply to your test area



SLOPE ASSESSMENT

The slope on this block averages 3.8% from the high point at the right of the image to the low point at the left.



RIGHT OF WAY ASSESSMENT

ROW width is approximately 60'-0". Nashville's Metro Public Works department defines this road as a *Medium Density Local Road* with a minimum standard with of 50'-0".

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Step 5: Apply to your test area

This block has as slope of less than 2%.

The figure above shows a block with a slope of over 9%.

This block has a 50 foot Right of Way, letting us reduced drive lanes to create room for stormwater features

This block has a 46 foot Right of Way, the minimum width for installing green features and maintaining standard drive lanes.

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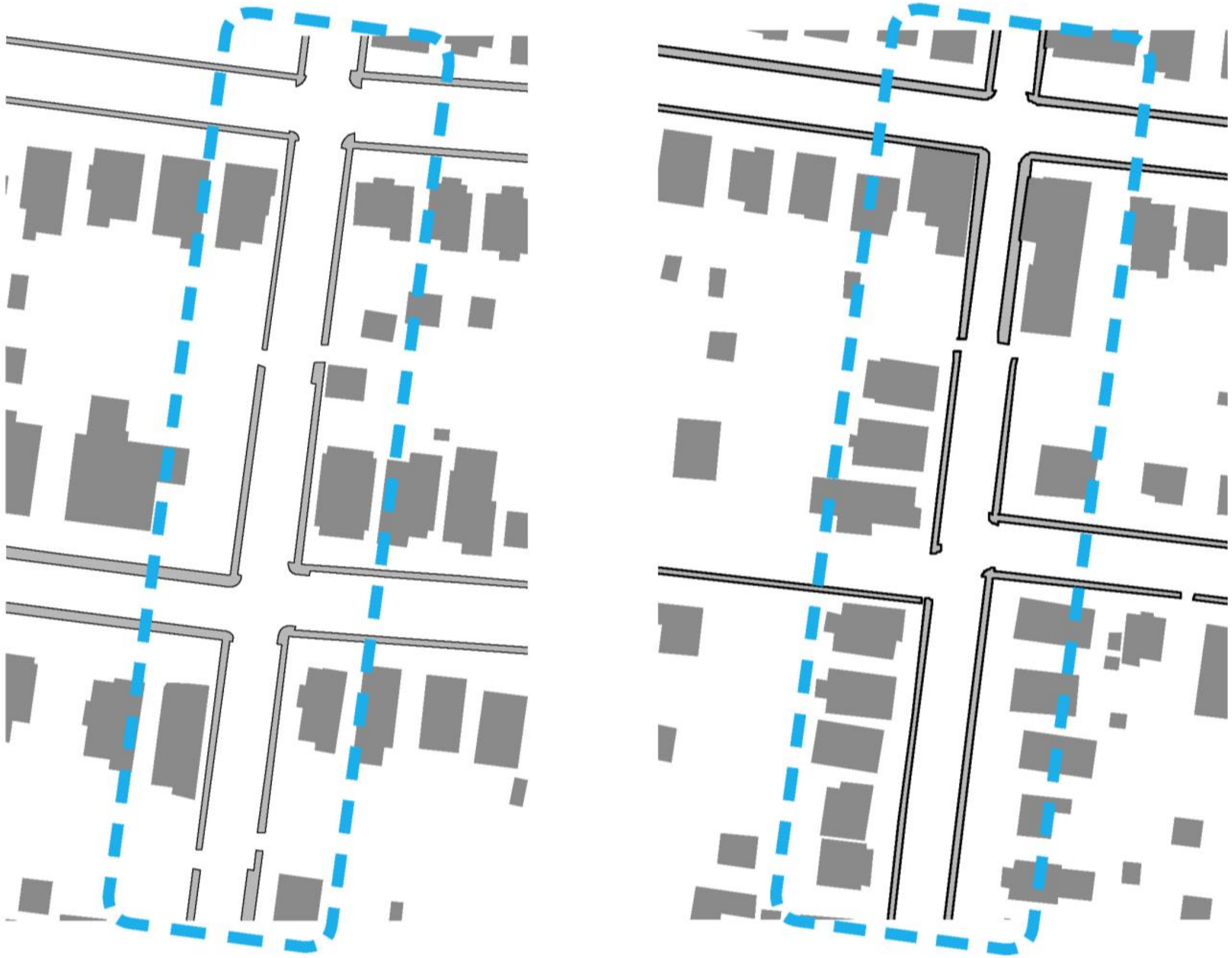
Step 5: Apply to your test area



LOT FRONTAGE ASSESSMENT

In this neighborhood many of the street frontages are narrow and deep, with the short side (typically 50'-0" wide) fronting the street, This means most homeowners do not have drive-ways and therefore park a vehicle on these street with quick access to their front door. The north-south street have longer frontages and would not displace as much parking.

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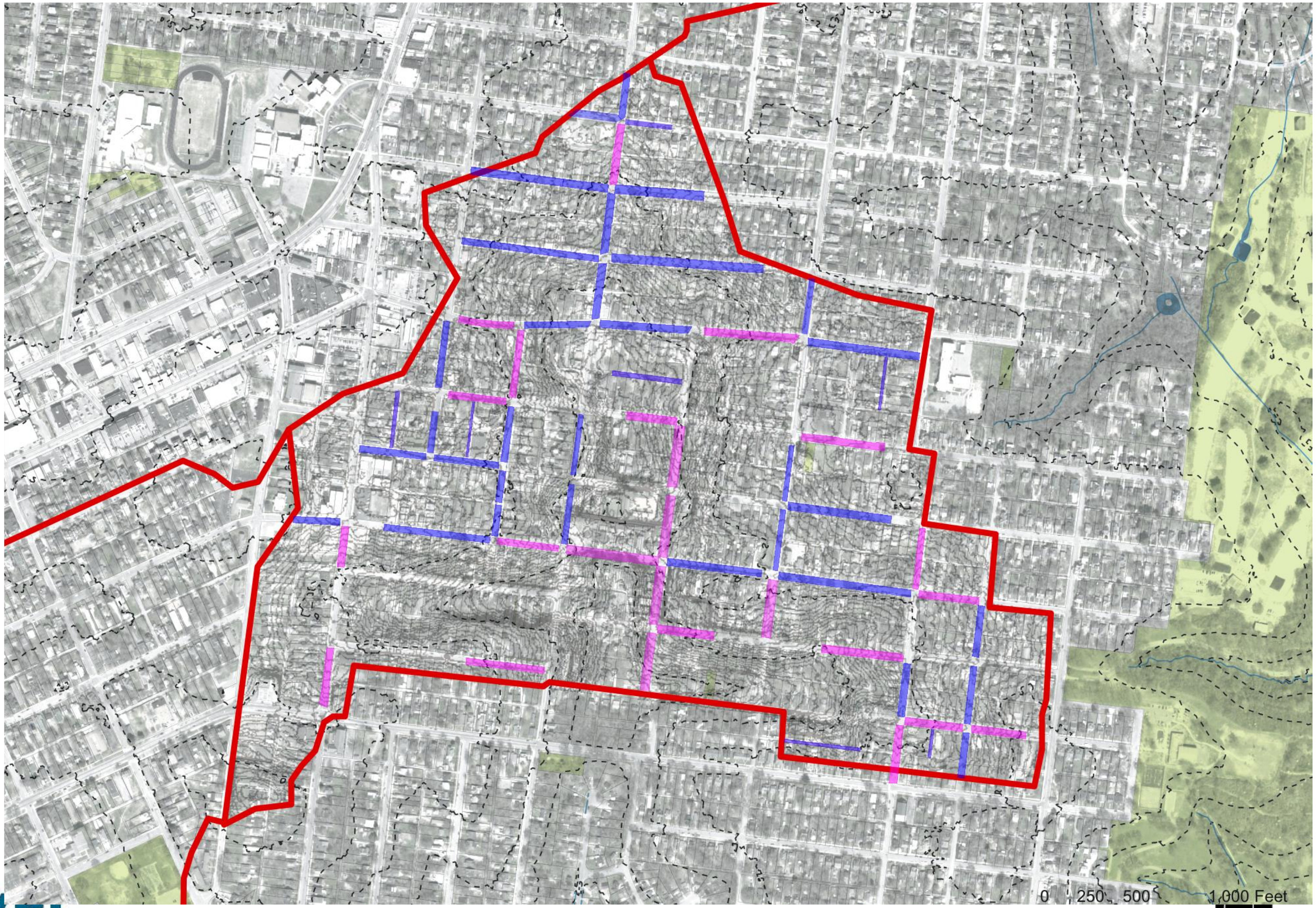
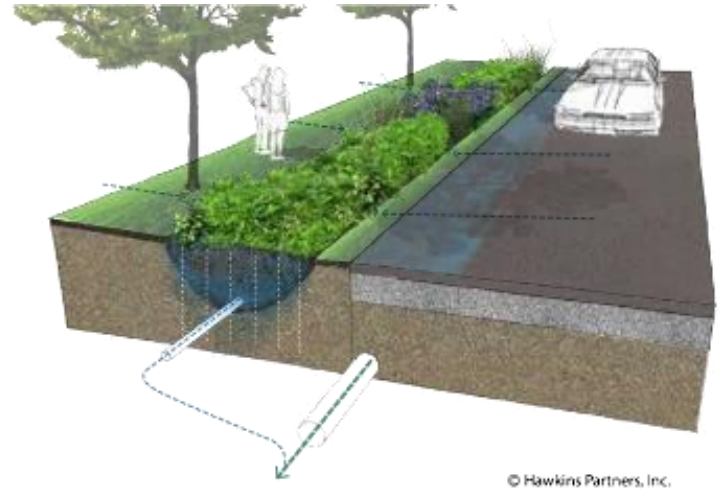
Suitable and Potential Blocks



Step 6: Develop Templates

Curb Bumpout



Vegetated Swale

Tree Trench

Pervious Pavement

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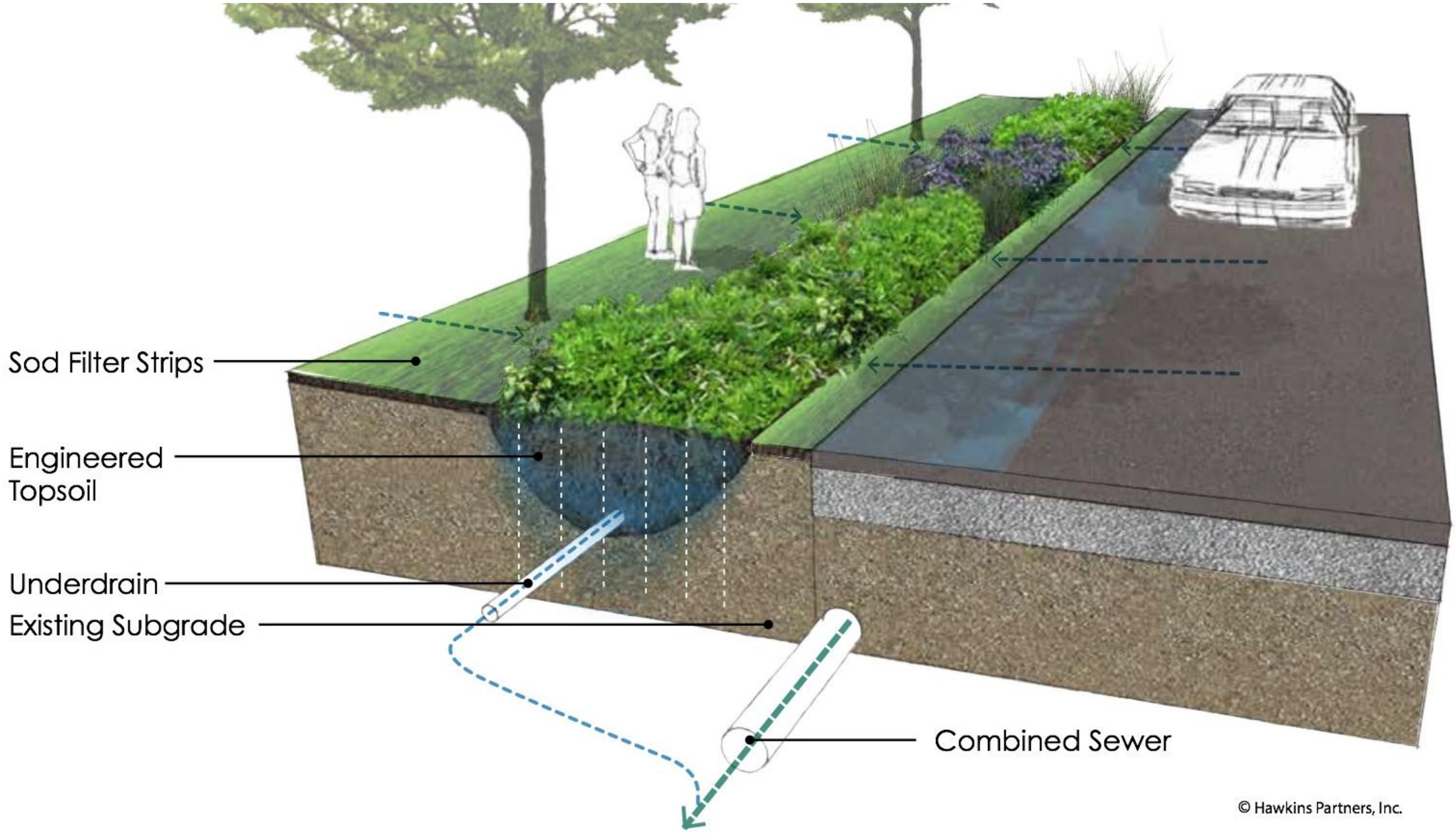
Step 6: Develop Templates



WATER QUALITY SWALES

Components:
- Best on slopes of less than 2%
- Level spreaders needed every 50 feet
- Filter Bed of engineered soils
- Underdrain for impermeable soils.

Advantages:
- Less expensive than curb and gutter
- Reduces Runoff Velocity
- Promotes Infiltration
- Conveyance and stormwater treatment

Limitations:
- Cannot be used on steep slopes
- Higher land requirement
- Higher maintenance than curb / gutter

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Step 7: Price Templates

Vegetated Swale (100 ft long x 6 ft wide, typ.)				
Traditional Infrastructure Improvements				
Utilities				
New single sump inlet with casting	ea.	$2,500.00	1	$2,500.00
Water line 6" CI	l.f.	$145.00	50	$7,250.00
Sub-total				$9,750.00
Contingency (30%)				$2,925.00
Traditional Total				**$12,675.00**
Green Infrastructure Improvements				
Planting				
Trees 3"	ea.	$500.00	2	$1,000.00
Bioswale Planting	s.f.	$6.00	600	$3,600.00
Sod	s.y.	$6.00	55	$330.00
Misc				
Engineered Soil	c.y.	$40.00	50	$2,000.00
6" perforated underdrains	l.f.	$5.00	150	$750.00
Mulch	c.y.	$40.00	7	$280.00
2' deep linear gravel diaphragm	c.y.	$25.00	8	$200.00
Sub-total				$8,160.00
Contingency(30%)				$2,448.00
GI total				**$10,608.00**
TOTAL				**$23,283.00**
PRICE PER SQUARE FOOT	s.f.		600	$38.81

Step 8: Select Appropriate Pilot Locations

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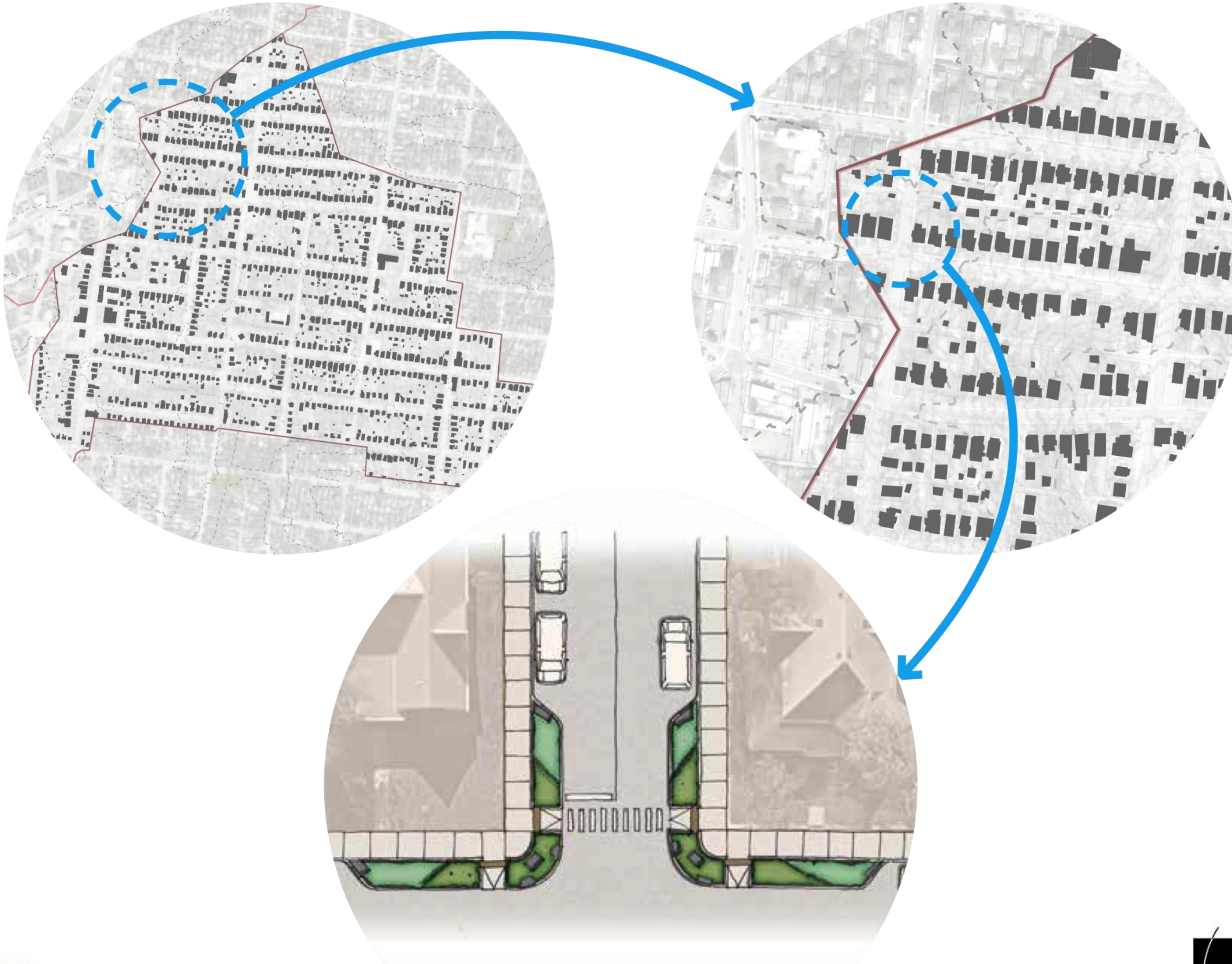
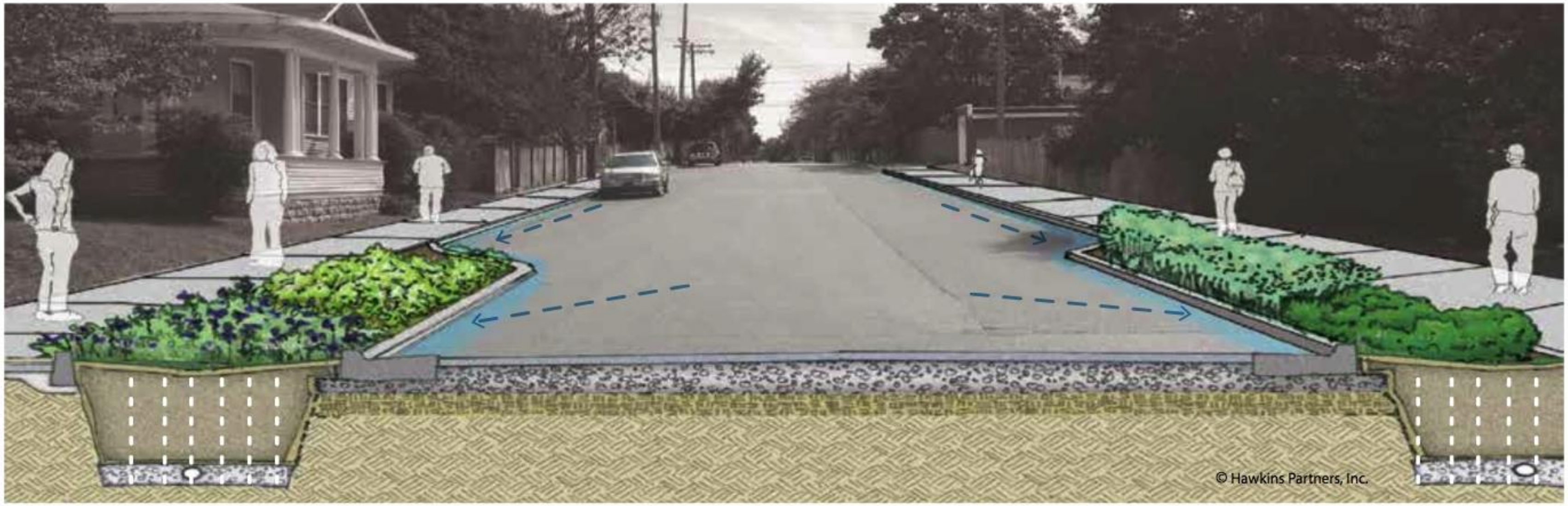


Step 8: Select Appropriate Pilot Locations



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Step 9: Assess Capture Potential

Rainfall depth (in) X Runoff Coefficient X Contributing Drainage Area (SF) / 12 inches = TOTAL RUNOFF

The design team used a 1.2” storm volume for this equation (90th percentile storm)

Again, the design team used a 0.95 runoff coefficient.

The total contributing drainage area for ideal and potential roadway segments is 1.2 million SF

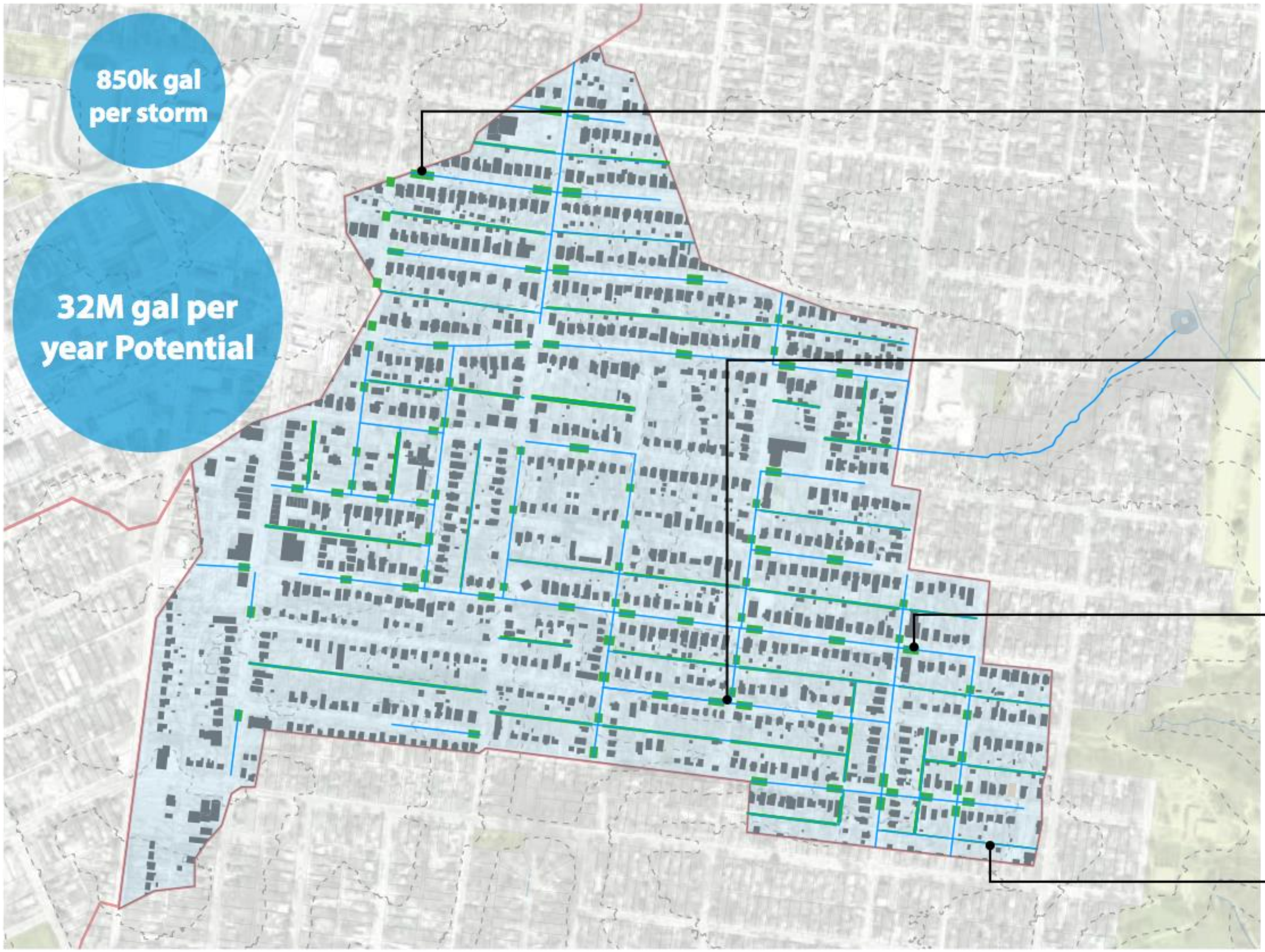
1.2 x 0.95 x 1,200,000 / 12 = 114,000 cubic feet of runoff

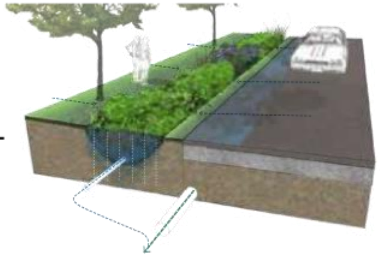
Step 9: Assess Capture Potential

Total Runoff Volume (ft3) X 7.48 gallons per cubic foot = TOTAL RAINWATER (GAL)

114,000 (ft3) X 7.48 gal/ft3 = 852,700 gallons

Step 10: Develop a Master Plan





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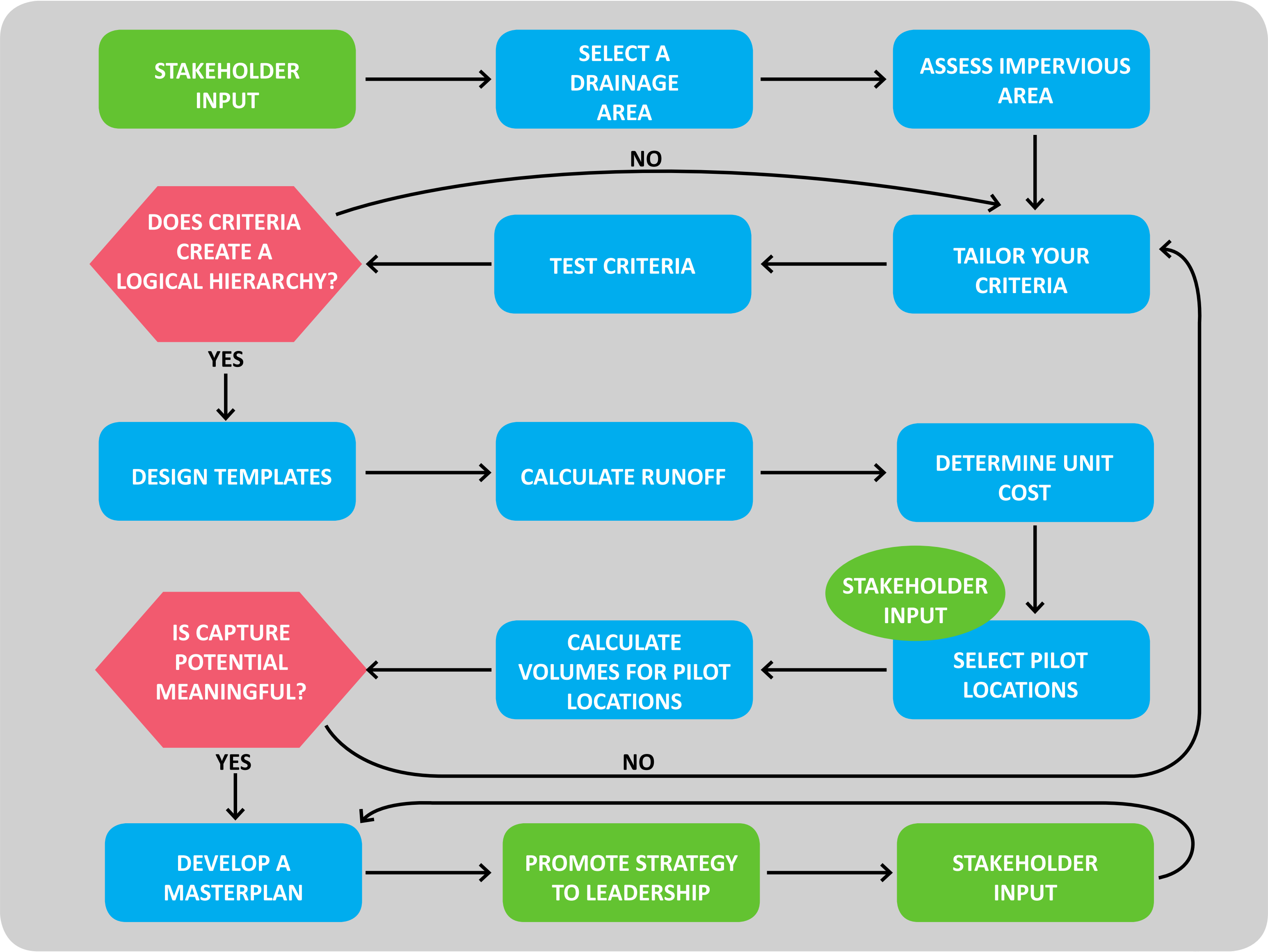
Recipe Review



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Thank you!

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