Landmark/Van Dorn Area Plan Advisory Group

Presentation:

Stormwater Management at the Master Planning Phase

June 16, 2008

Baker

Presentation Topics

1. Introduction to stormwater management
2. City legal requirements for stormwater management
3. Stormwater management practices in use today
4. How we can do a better job in the City
5. Using stormwater master planning to achieve these gains

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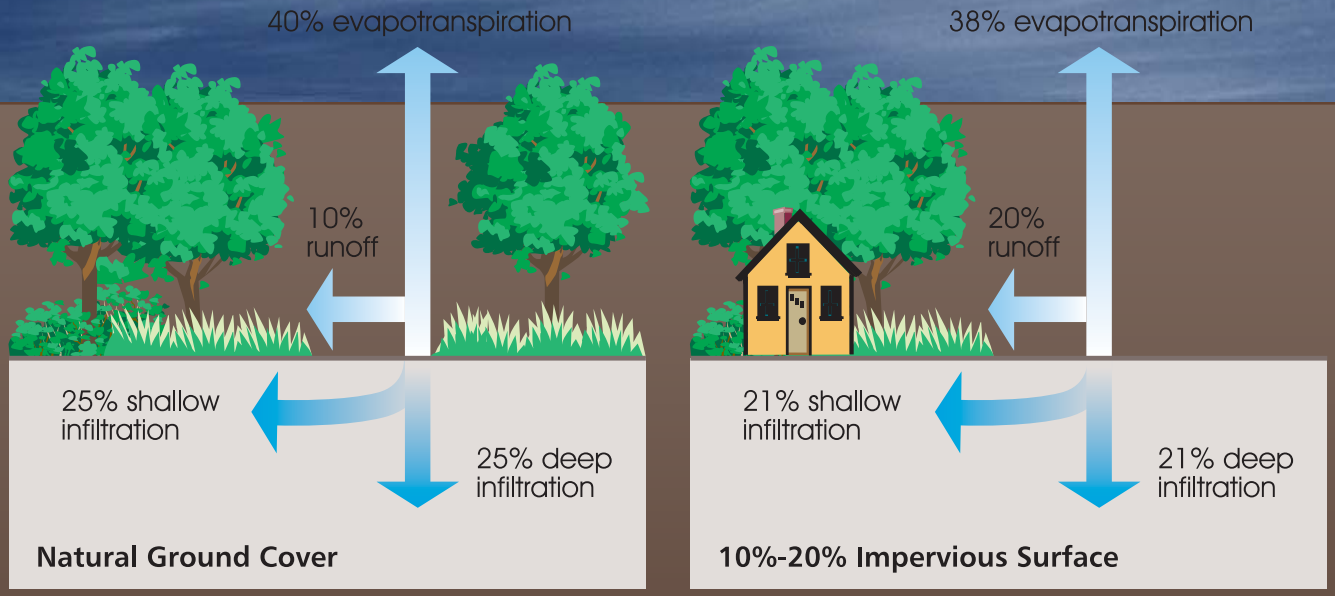
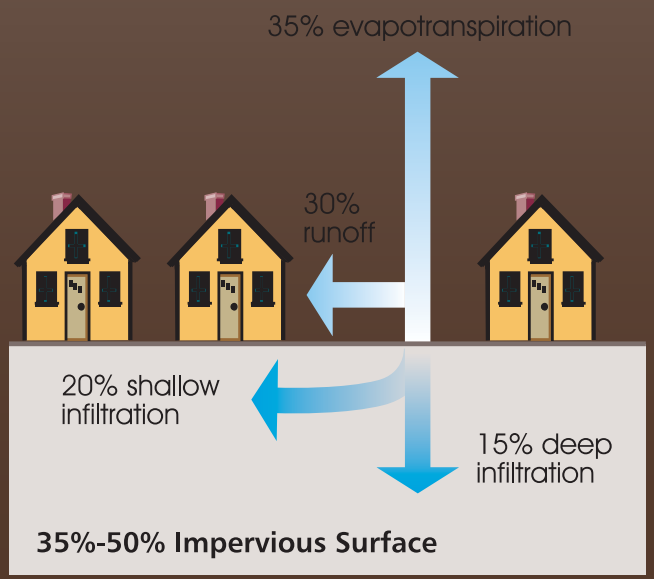
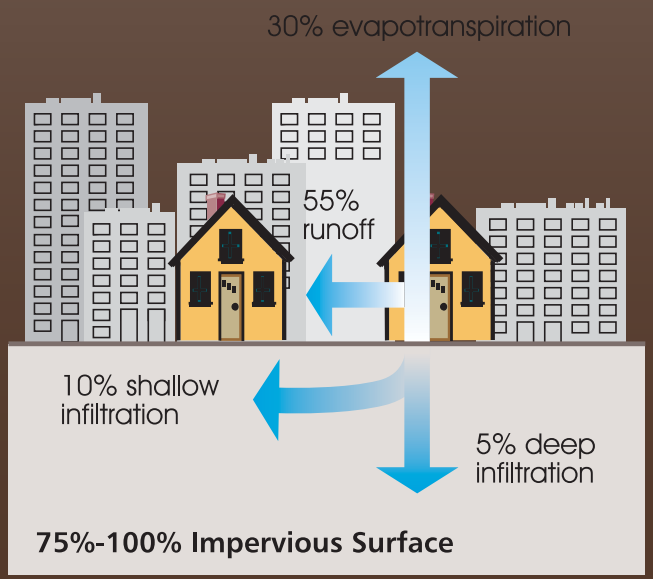
Development impacts on hydrology







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The City of Alexandria has requirements to manage stormwater impacts

- **Manage peak runoff for the 2- and 10-year frequency storms**
  - Post development peak runoff will not exceed predevelopment peak runoff
  - Excess runoff is to be detained on site
- **Phosphorous loads are to be reduced**
  - Capture a specified water quality volume
  - Select from defined best practices
- **State is currently revising laws and is considering increasing stormwater volume, infiltration, and water quality requirements**

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The City uses a tool box approach to meet stormwater requirements

- **A sample of options in the tool box include:**
  - **Stormwater BMPs (LID practices, ponds, underground storage, filter strips, etc.)**
  - **Stream restoration**
  - **Daylighting of streams**
  - **Buffer restoration**
  - **Buffer enhancement**
  - **Separation of combined sewers**
  - **Etc.**

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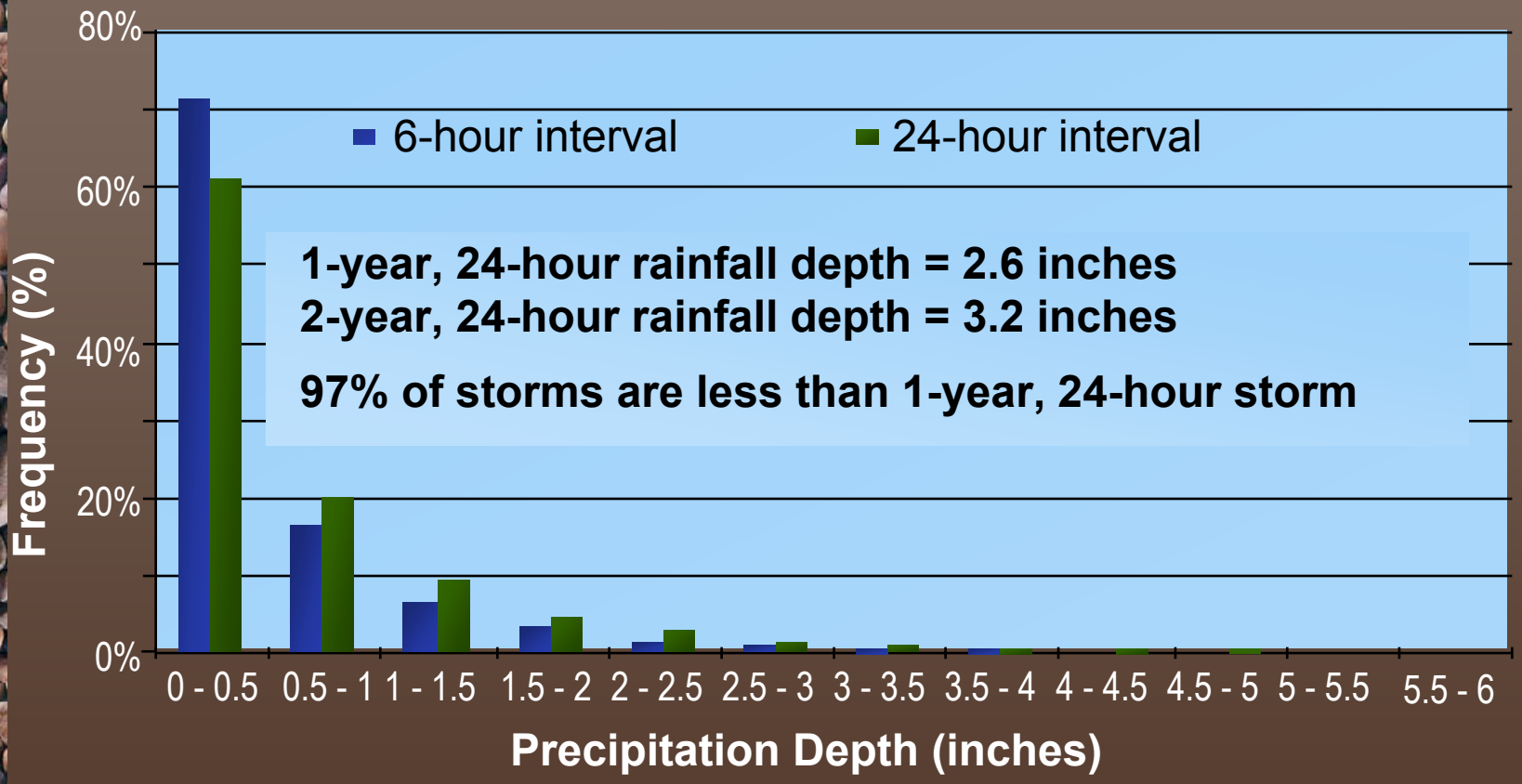
Appropriate precipitation analysis will result in correct sizing of stormwater best management practices (BMPs) and stream protection



- **Appropriate BMP treatment volumes:**
  Maximize pollutant load reduction
  Provide groundwater recharge
- Evaluate impacts on floodplains, channel stability, erosion potential, and water supplies

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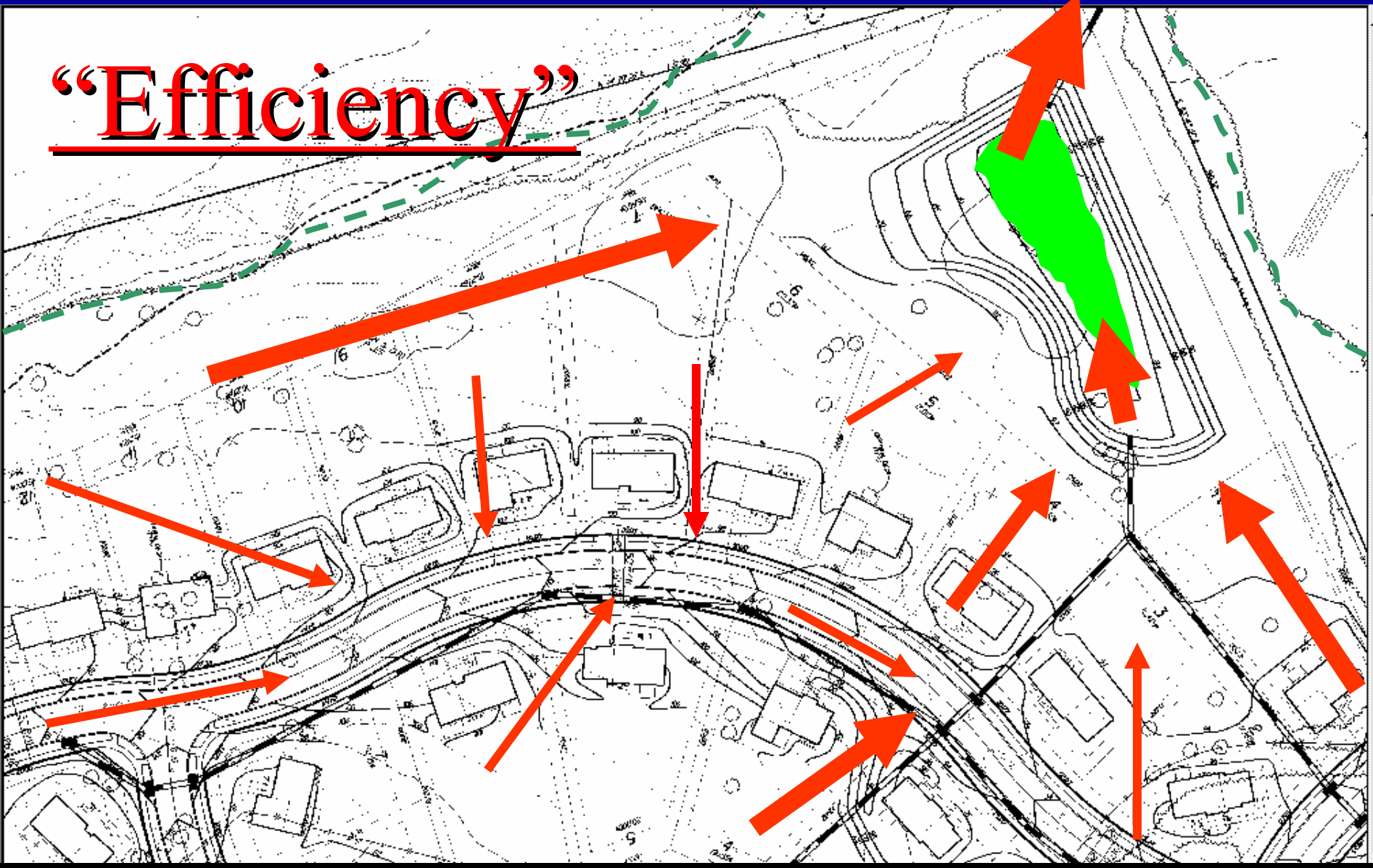
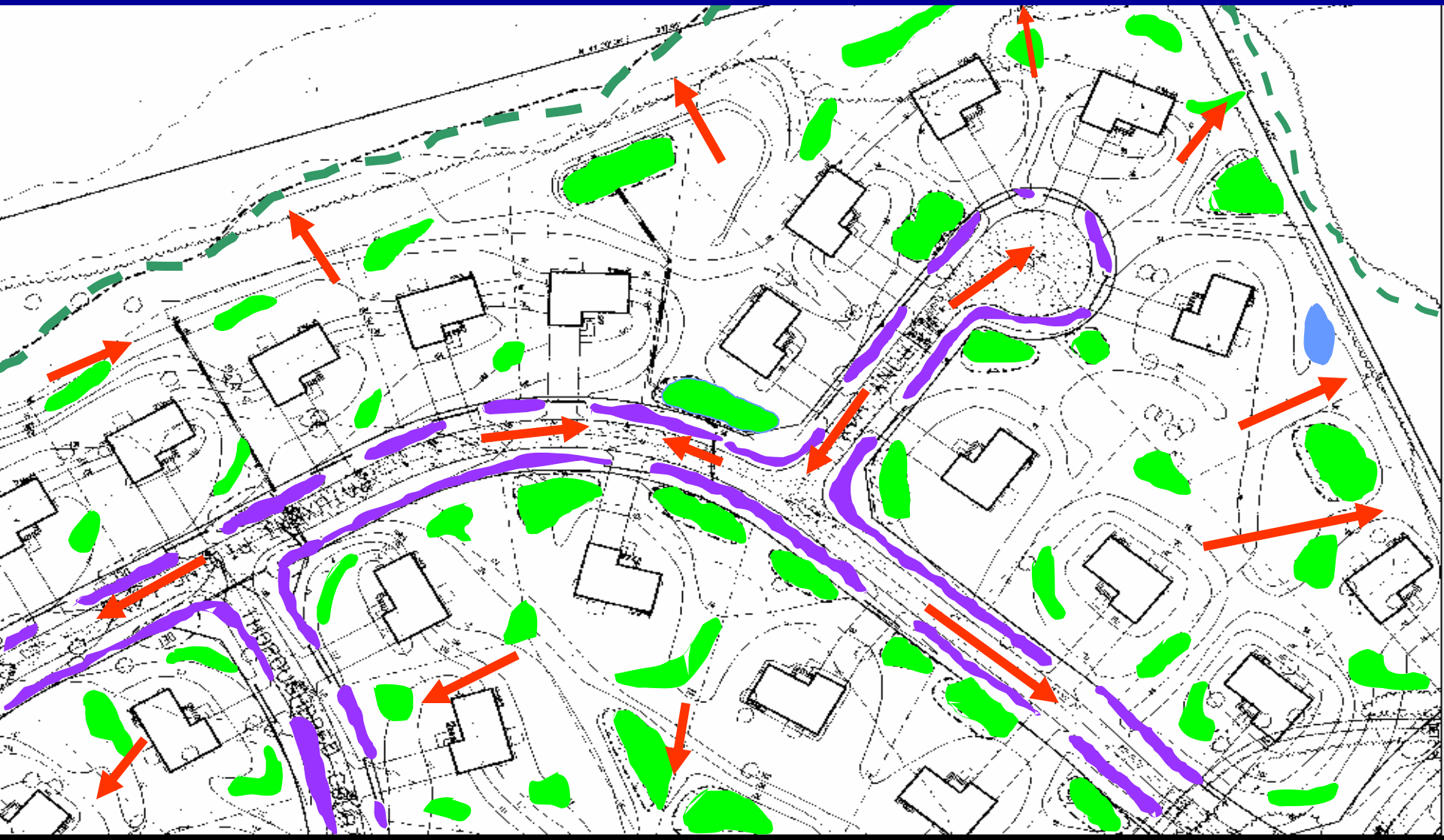
Conventional pipe and pond uses centralized control



Low Impact Development uses uniform distribution of micro controls



LID practices *(No Limit!)*

"Creative techniques to use, store, detain and recharge"

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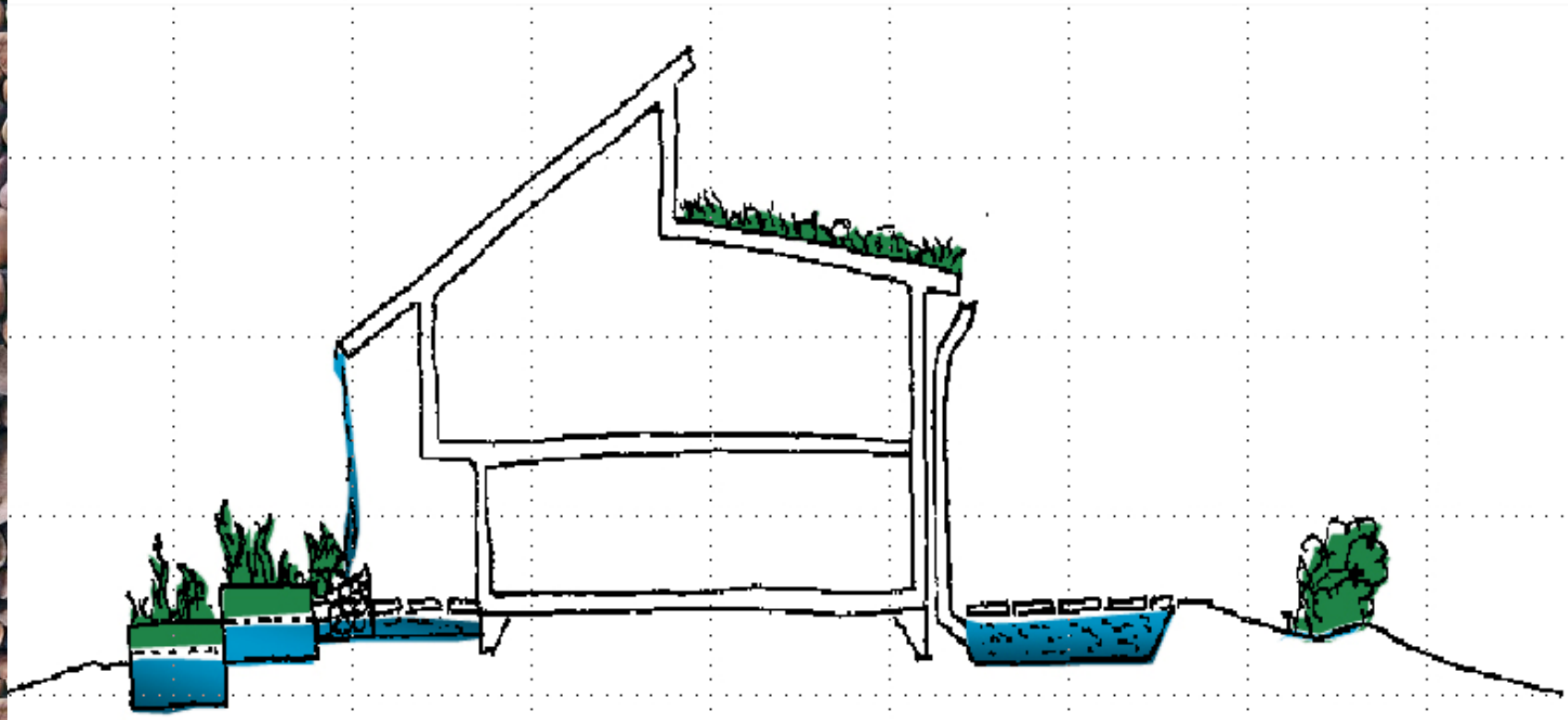
- Bioretention
- Strategic Grading
- Site Finger Printing
- Resource Conservation
- Flatter Wider Detention Swales
- Flatter Slopes
- Long Flow Paths
- Tree / Shrub Depression
- Turf Depression
- Landscape Islands Storage
- Rooftop Detention /Retention
- Roof Leader Disconnection
- Parking Lot / Street Storage
- Smaller Culverts, Pipes & Inlets
- Alternative Surfaces
- Reduce Impervious Surface
- Surface Roughness Technology
- Rain Barrels / Cisterns / Water Use
- Catch Basins / Seepage Pits
- Sidewalk Storage
- Vegetative Swales, Buffers & Strips
- Infiltration Swales & Trenches
- Eliminate Curb and Gutter
- Shoulder Vegetation
- Maximize Sheet flow
- Maintain Drainage Patterns
- Reforestation
- Pollution Prevention……..

Treatment chain - urban BMPs



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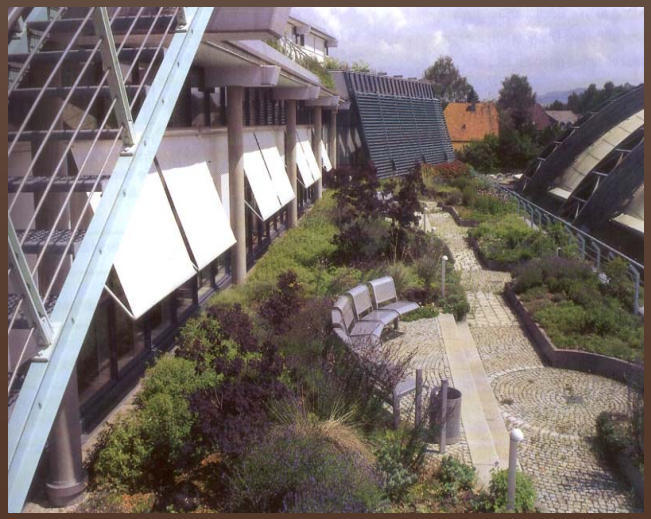
Vegetated roofs

Duncan Library

Health Department



Green islands

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Green infrastructure solutions are limited only by your creativity

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THE BIG IDEA is to interconnect a series of devices…

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…AND create a livable city.

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Baker's experience in developing green infrastructure guidelines – AWI Manual

Sidewalk- width varies

Spill Zone (min. 2'-0"I) — Priority 3

Paving
Concrete or Brick (Historic only)

Furnishings
Safety Posts
Seating & Planter boxes provided by businesses

Walkway Zone Minimum 5'-0" — Priority 1

Paving
Concrete or Brick (Historic only)

Furnishings
Access Cover

Furnishing/ Planting Zone Minimum 4'0" — Priority 2

Surface Treatments
Unit Paver to match sidewalk color

Fixtures
#18 and/or Twin 20 Teardrop Pendant

Furnishings
Seating
Trash Bin
Bike Rack
Safety Posts

Landscaping
Street Trees
Understory Planting
Mulch
Contiguous Tree Root Zone

Signage
Wayfinding
Street Attachments

Roadway - number of lanes varies

Paving
Bridges/Underpass - Concrete/Asphalt
Bus Stop Pads - Integrally colored concrete to match roadway paving
Bike Lane - Painted Lane Markings
Designated Parking Lane - Unit Pavers
Crosswalk - Regular or Thermo plastic "piano striping"

Pedestrian & Traffic Safety
Sidewalk Extension
Traffic Diversion
Rotary

Curb & Gutter
Granite Curb
Brick Gutter
Curb Cuts & Driveways - Concrete ramps, contiguous sidewalk finish
ADA Ramps - Concrete ramps with truncated dome

Other Construction
Wall Cladding - Ashlar/Regular Pattern Masonry

Median (optional) - width varies

-MAJOR URBAN STREETS ONLY-

Main Zone
Hardscape and softscape treatments

Refuge Zone
Crosswalk to be continued (ADA Accessible, Minimum 4' wide)

Protection Zone
Safety posts
Planter boxes less than 3' in height

Curb & Gutter
Granite curb
Brick Gutter
Curb cuts & driveways - concrete ramps, contiguous sidewalk finish
ADA Ramps - Concrete ramps with truncated dome

Roadway - number of lanes varies

Paving
Bridges/Underpass - Asphalt or concrete
Bus Stop Pads - Integrally colored concrete to match roadway paving
Bike Lane - Painted Lane Markings
Designated Parking Lane - Unit pavers
Crosswalk - Regular or Thermo plastic "piano striping"

Pedestrian & Traffic Safety
Sidewalk Extension
Traffic Diversion
Rotary

Curb & Gutter
Granite Curb
Brick Gutter
Curb Cuts & Driveways - Concrete ramps, contiguous sidewalk finish
ADA Ramps - Concrete ramps with truncated dome

Other Construction
Wall Cladding - Ashlar/Regular Pattern Masonry

Sidewalk- width varies

Furnishing/ Planting Zone Minimum 4'0" — Priority 2

Surface Treatments
Understory Planting
Unit Pavers
Turf Area

Fixtures
#18 and/or Twin 20 Teardrop Pendant

Furnishings
Trash Bin
Bike Rack
Safety Posts

Landscaping & LID
Street Trees
Understory Planting
Planter Edging
Mulch
Contiguous Tree Root Zone

Walkway Zone Minimum 5'-0" — Priority 1

Paving
Concrete or Brick (Historic only)

Furnishings
Access Cover

Figure 4.3: Typical Elements/ Items of Major Urban Streets and Local Roads

DRAFT - Contents Subject to Change

Green infrastructure integrated in the public realm - parking lanes

Source: Washington, DC AWI Manual

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Section 1: Roadway Paving & Treatment Materials

Element:	Designated Parking Lanes	**Reference:**	1.4(1)
Item:	Unit Pavers		
Classification:	Principal Arterial, Minor Arterial, Collector, Local, Alley, Symbolic Corridor, Designated Transit Corridor, Special Segment, Park Road	**Area Type:**	Mixed-Use & Residential
Location:	Curbside designated parking lanes		

Purpose

Designated parking lanes should be clearly defined. Distinctive materials, such as unit pavers, can be used to achieve this. A change in material between travel lanes and parking lanes visually reduces the roadway width. Color of pavers for Designated Parking Lanes should comply with the latest laws and regulations of the Americans with Disabilities Act. Installation should be coordinated with utilities to avoid conflicts.

Application

- **Restriction:** Restricted parking lanes that become travel lanes during peak hours should not be given this treatment.
- **Color**: Salmon/charcoal blend.
- **Size:** 6" x 9"

Reference

- Unit pavers should be used in accordance with ASTM C 936-01 "Standard Specification for Solid Concrete Interlocking Paving Units".

Items

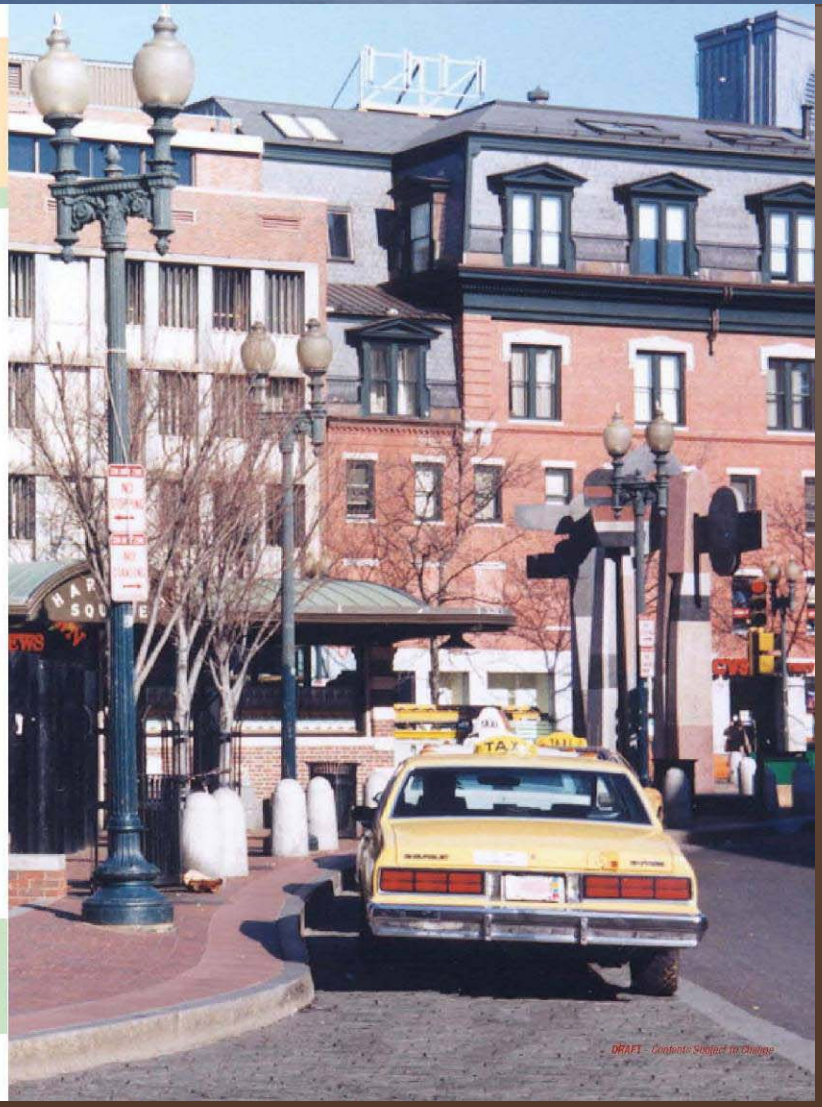
AWI Specific Guideline - Refer to DDOT Standard Specifications and Standard Drawings for Highways and Structures 2007 - Specification Section 806.02

Refer to Chapter 6 Item 3b. for additional information on proposed guideline.

Low Impact Development (LID) Opportunity

- Refer to Chapter 5. Option 7

4-14



Green infrastructure integrated in the public realm - street trees

Source: Washington, DC AWI Manual

Section 11: Planting / Furnishing Zone - Surface Treatments

Element:	Unit Pavers	**Reference:**	11.2(1)
Item:	Cobblestone		
Classification:	Principal Arterial, Minor Arterial, Collector, Local, Alley, Symbolic Corridor, Designated Transit Corridor, Special Segment	**Area Type:**	Mixed-Use & Residential
Location:	Furnishing/planting zone		

Purpose

Unit Pavers set over the contiguous root zone maximize the planting soil area allowing for better root growth. Using cobblestone in the Furnishing/Planting Zone promotes stormwater percolation and discourages pedestrians from walking over the planting zone, therefore reducing the possibility for compaction.

Application

- **Color:** Light gray or as determined by DDOT on a project by project basis from the manufacturer's standard colors.

reducing the possibility for compaction.

Low Impact Development (LID) Opportunity

- Refer to Chapter 5. Options 1, 2, 7

AWI Specific Guideline - Refer to DDOT Standard Specifications and Standard Drawings for Highways and Structures 2007 - Specification Section 806

Refer to Chapter 6 Item 2k. and 3a. for additional information on proposed guideline.

Items

4-95

Green infrastructure integrated in the public realm – increase soil volume

Source: Washington, DC AWI Manual

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Section 12: Planting Zone - Subsurface Treatments

Element:	Increase Planting Space	**Reference:**	12.1(1)
Item:	Contiguous Root Area with Pavers		
Classification:	Principal Arterial, Minor Arterial, Collector, Local, Symbolic Corridor, Designated Transit Corridor, Special Segment,	**Area Type:**	Mixed-Used & Residential
Location:	Furnishing/planting zone within the sidewalk.		

Purpose

The growth and life span of urban trees is shortened due to the increased environmental stress in an urban setting. Stress on urban trees includes air pollution, lack of fertile soils, poor drainage and vandalism. A contiguous root area allows drainage in the planting zone.

Application

The Furnishing/Planting Zone should provide a 4' 0" or 6' 0" wide contiguous underground root zone depending on the total width of the sidewalk between the curbline and the pedestrian clear zone to maximize the volume of soil and encourage the uninterrupted growth of tree roots. Furnishing/Planting Zone may be less than 4'-0" only if the entire sidewalk width is less than 8'-0". In general, provide 750 cubic feet of planting soil per tree.

- In addition to a contiguous root area, the following options are encouraged to provide better growing conditions for trees:
  - Option 1: Aeration Strip under sidewalk
  - Option 2: Structural Soil under sidewalk
  - Option 3: Spanning sidewalk (and Structural Cell)
- **Restriction:**
  - Trees should not be planted in sidewalks less than 6'6" wide.
- **Option:**
  - Sidewalks 8'0" or wider: Modifications to pavements on walkway zone may be optional when sidewalks are 8'0" or wider.

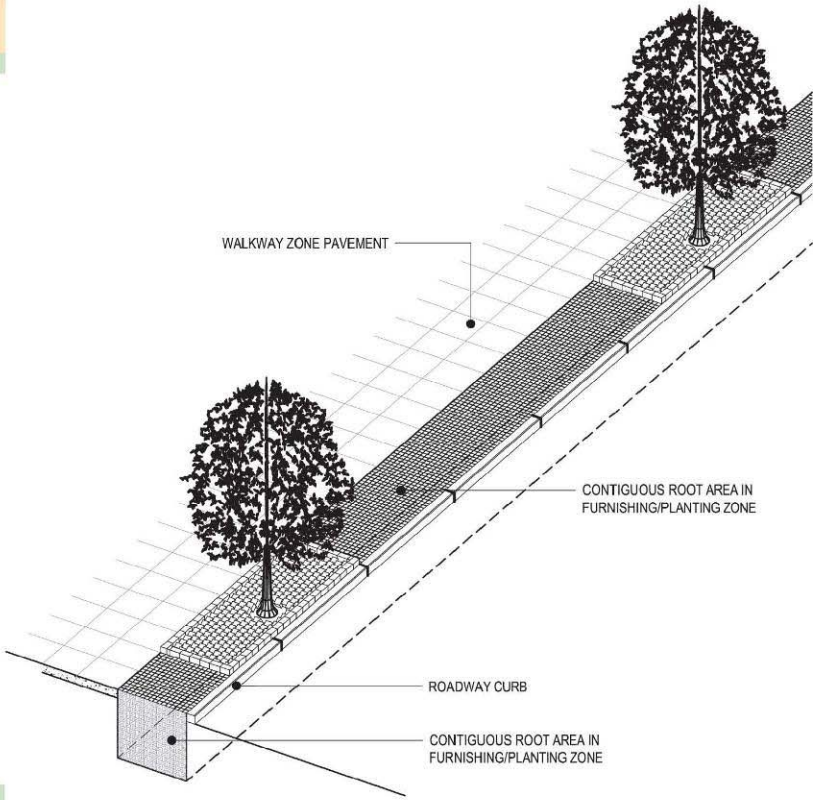
Items

AFI Specific Guideline -

Refer to Chapter 6 Item 2o., 2q., and 2r. for information on proposed guideline.

Low Impact Development (LID) Opportunity

- Refer to Chapter 5. Option 2



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Green infrastructure integrated in the public realm – bioretention cells

Source: Washington, DC AWI Manual

Low Impact Development

Element:	Structural Approach	**Reference:**	Option 17
Item:	Bioretention Cell		
Classification:	Interstate, Freeway, Principal Arterial, Minor Arterial, Collector, Local, Greenway, Symbolic Corridor, Designated Transit Corridor, Special Segment, Waterfront Promenade, Park Road	**Area Type:**	Mixed-Used & Residential
Location:	Unpaved median, roadway setback, sidewalk planting zone, green spaces		

Bioretention cells are small scale soil and plant-based devices located in shallow depressions. The bioretention cells remove pollutants and control runoff volume and peak rates through a variety of physical, biological, and chemical treatment processes. The primary elements of a bioretention cell are vegetation that can withstand fluctuations in soil moisture and temporary ponding, a highly permeable engineered soil media, a gravel layer, and an underdrain that is connected to the main storm drain system. Bioretention cells improve water quality for small, frequently occurring storms by filtering stormwater runoff through the soil media, biological and chemical reactions in the soil and root zone, plant uptake, and infiltration into the lower soil layers. In addition, bioretention cells can contribute to neighborhood and roadway beautification, habitat creation, reduce heat island effects, and can potentially reduce maintenance costs for existing stormwater infrastructure. To this end, bioretention cells can enhance the livability of the urban environment and may increase property values by beautifying open spaces.

Required Maintenance:

- Trash removal
- Weeding and removal of invasive plants
- Periodic removal of sediments around vegetation
- Replacement of dead vegetation

Applications:

- Thoroughfare: Bioretention cells can be incorporated along the side of roadways, curb extensions, and adjacent public space.
- Major Urban Street: Bioretention cells can be incorporated into the sidewalk planting zone or roadway edges.
- Local: Bioretention cells can be incorporated into the sidewalk planting zone.
- Alley: N/A.

Stormwater Management Effectiveness: Bioretention cells are especially useful for treating the "first flush" of stormwater. They can remove 75-95% of common urban pollutants.

Reference	LID Management Practice	Volume	Frequency	Duration	Peak Discharge	Water Quality
Option 17	Bioretention Cell	⦿	●	⦿	⦿	●

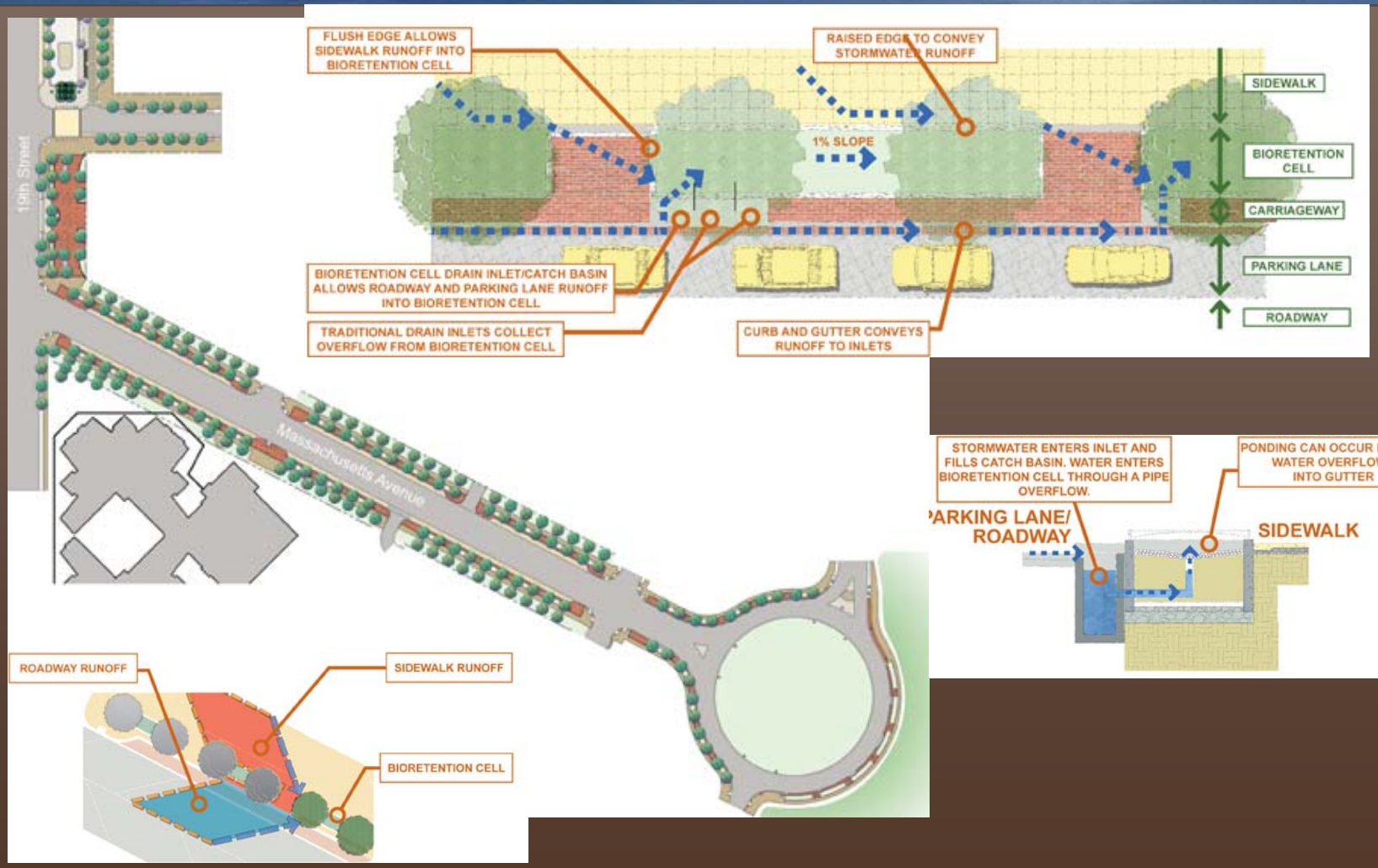
Bioretention Cell in Greenspace.

Hill East interim parking lots Washington, DC

Permeable pavers in the northern lot

Vegetative devices in the southern lot

Hill East Waterfront: The Mass. Ave. bioretention cell final design



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There are achievable gains when stormwater is considered early in the master planning process

- Green space can serve multiple purposes
- Stormwater can be aesthetically woven into roads, rights-of-way and open space
- Areas of increased and decreased opportunities for stormwater management can be identified early
- Balances can be defined to address variable stormwater management opportunities
- City guidelines and land use practices can be developed to accommodate change
- Phased development can be linked
- Flexibility is increased for future site planning

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Baker's is to incorporate stormwater planning into the master planning process

- **Deliverables will include:**
  - **Existing conditions plan**
  - **Site analysis plan**
  - **Phasing plan**
  - **Conceptual implementation plan for green infrastructure**
  - **Conceptual image library for green infrastructure elements**

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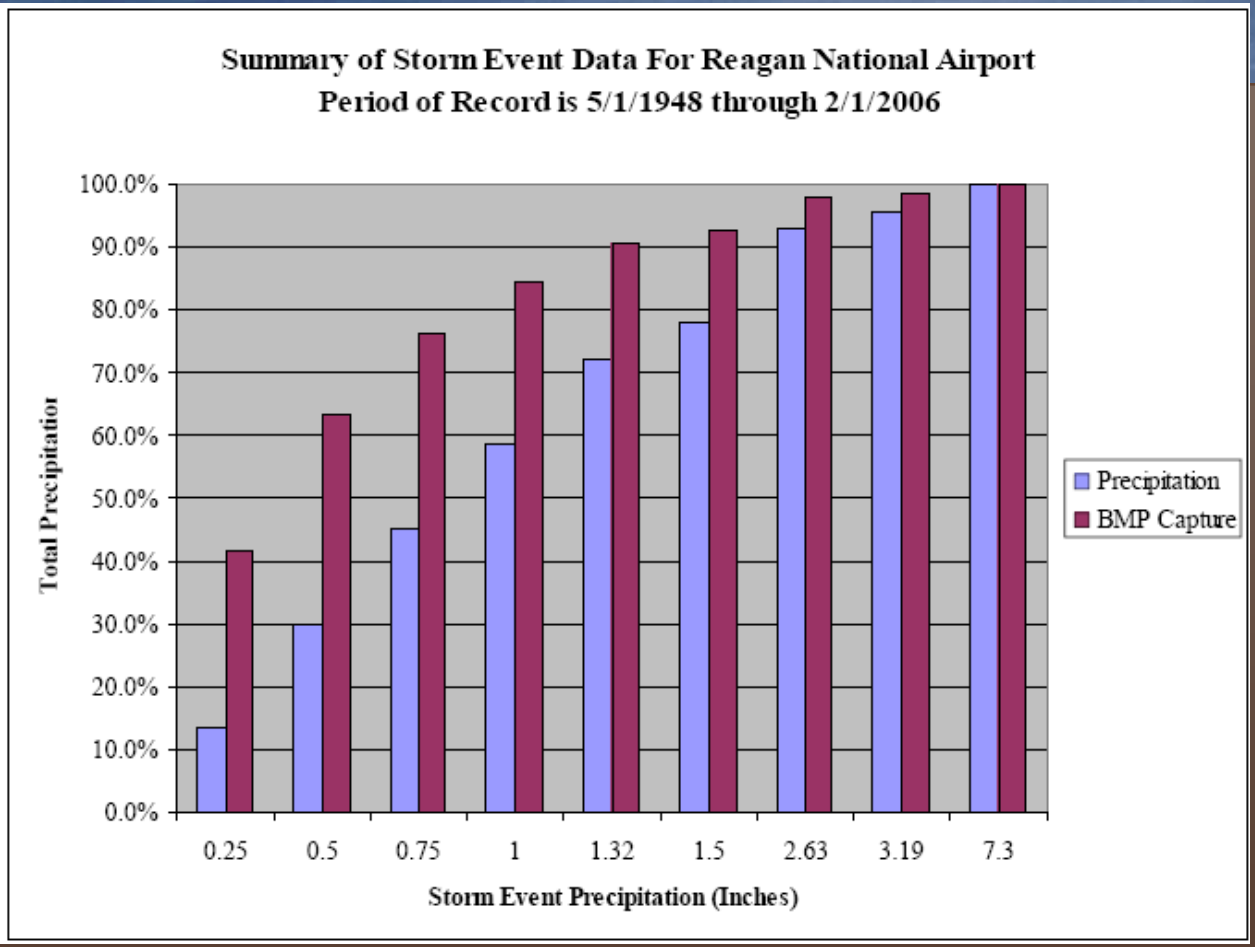
QUESTIONS?

Sustainable Stormwater Management
A Green Street Project

Use Precipitation Analysis to Guide Sizing of BMPs and Protection of Streams



- **Appropriate BMP treatment volumes:**
  Maximize pollutant load reduction
  Provide groundwater recharge
- Evaluate impacts on floodplains and channel stability

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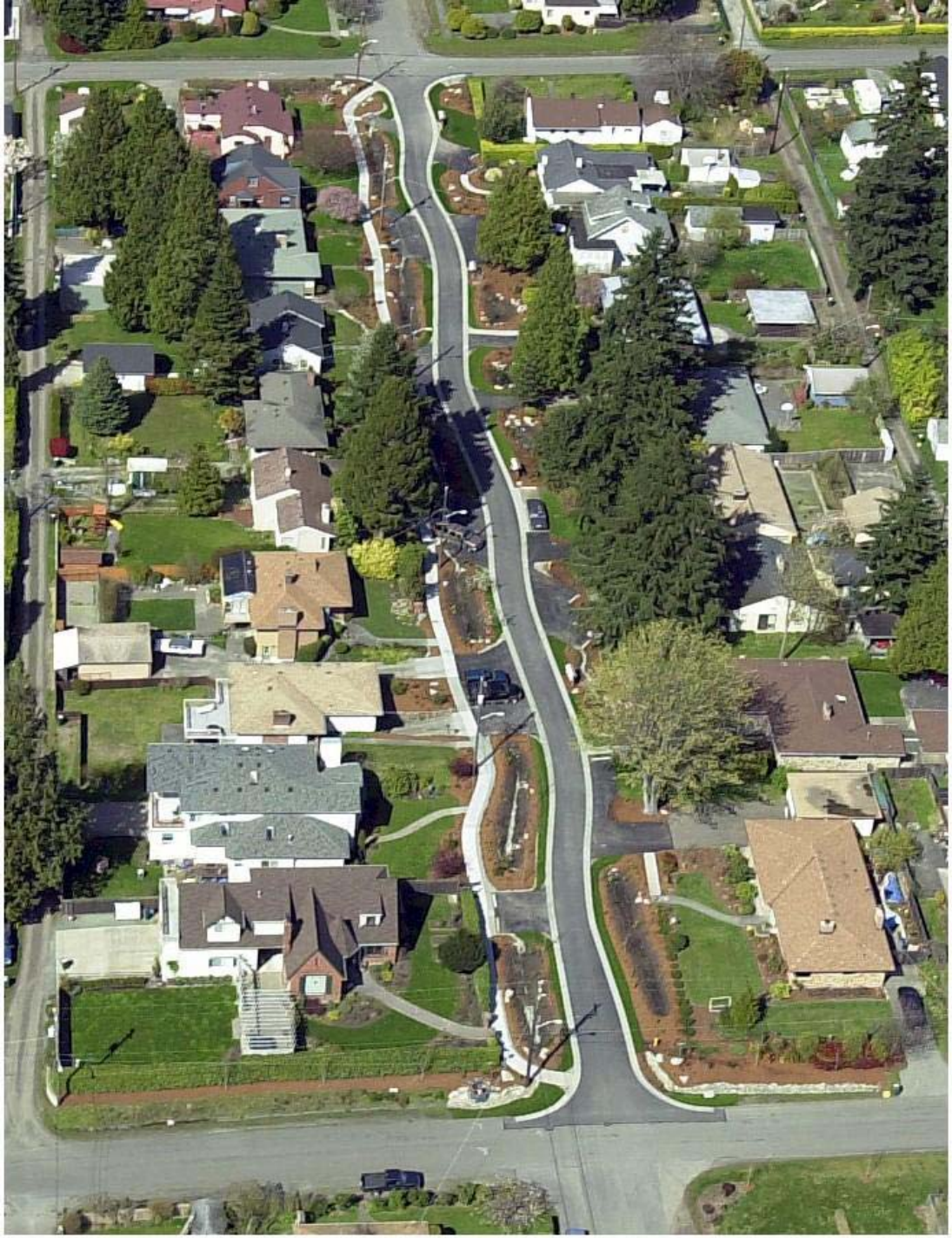

Urban Street Retrofit

(Seattle, WA)

How much water is collected?

- The system collects the 1 inch of runoff.
- Each bioretention cell collects sidewalk and roadway runoff and can retain 600 cf of water.
- That's enough water to fill 60 regular bathtubs each time it rains more than one inch.
- There are 45 bioretention cells on Mass. Ave.
- That's a total of 27,000 cubic feet of water!!!!

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