

8th National Monitoring Conference
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Stormwater Management Success through Green Streets

Tim Kurtz, P.E.

City of Portland, Bureau of Environmental Services
Sustainable Stormwater Management



ENVIRONMENTAL SERVICES
CITY OF PORTLAND

working for clean rivers

Stormwater | Regulations

Clean Water Act (1972)

- Combined Sewer Overflow (CSO)
- NPDES / MS4



Endangered Species Act (1973)

- salmon
- other fish
- amphibians
- birds



Safe Drinking Water Act (1974)

- Underground Injection Control (UIC)
- drinking water well protection

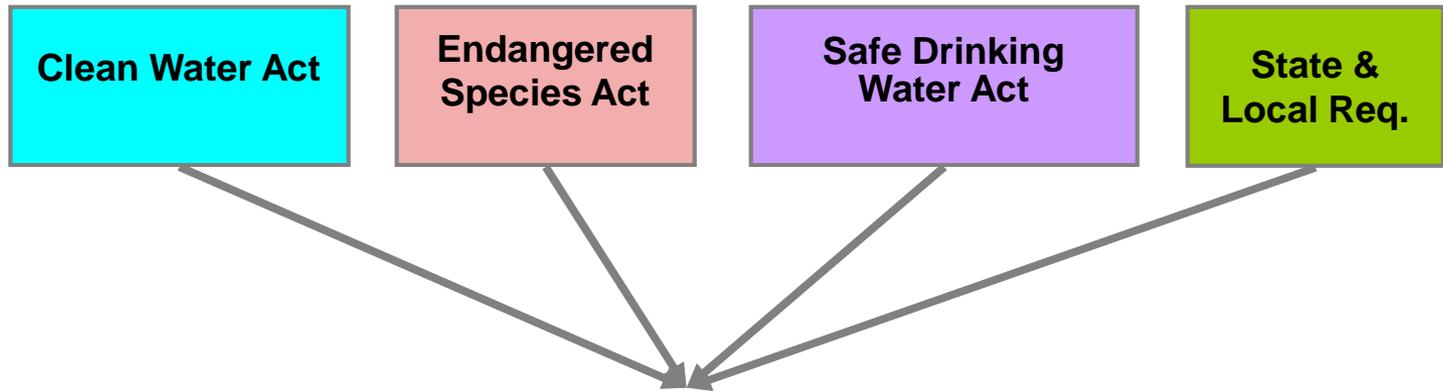


State & Local Req.

- sewer capacity
- flooding
- erosion
- development
- zoning



Stormwater | Regulations



reduce peak flows
+
reduce flow volumes
+
reduce pollutant loads



Many Names of Green

- Bioretention
- Green Solutions
- Stormwater Inflow Controls
- Sustainable Stormwater
- Low Impact Development (LID)
- Sustainable Site Development
- **Green Infrastructure**

Green Streets | Types



Swales



Curb Extensions

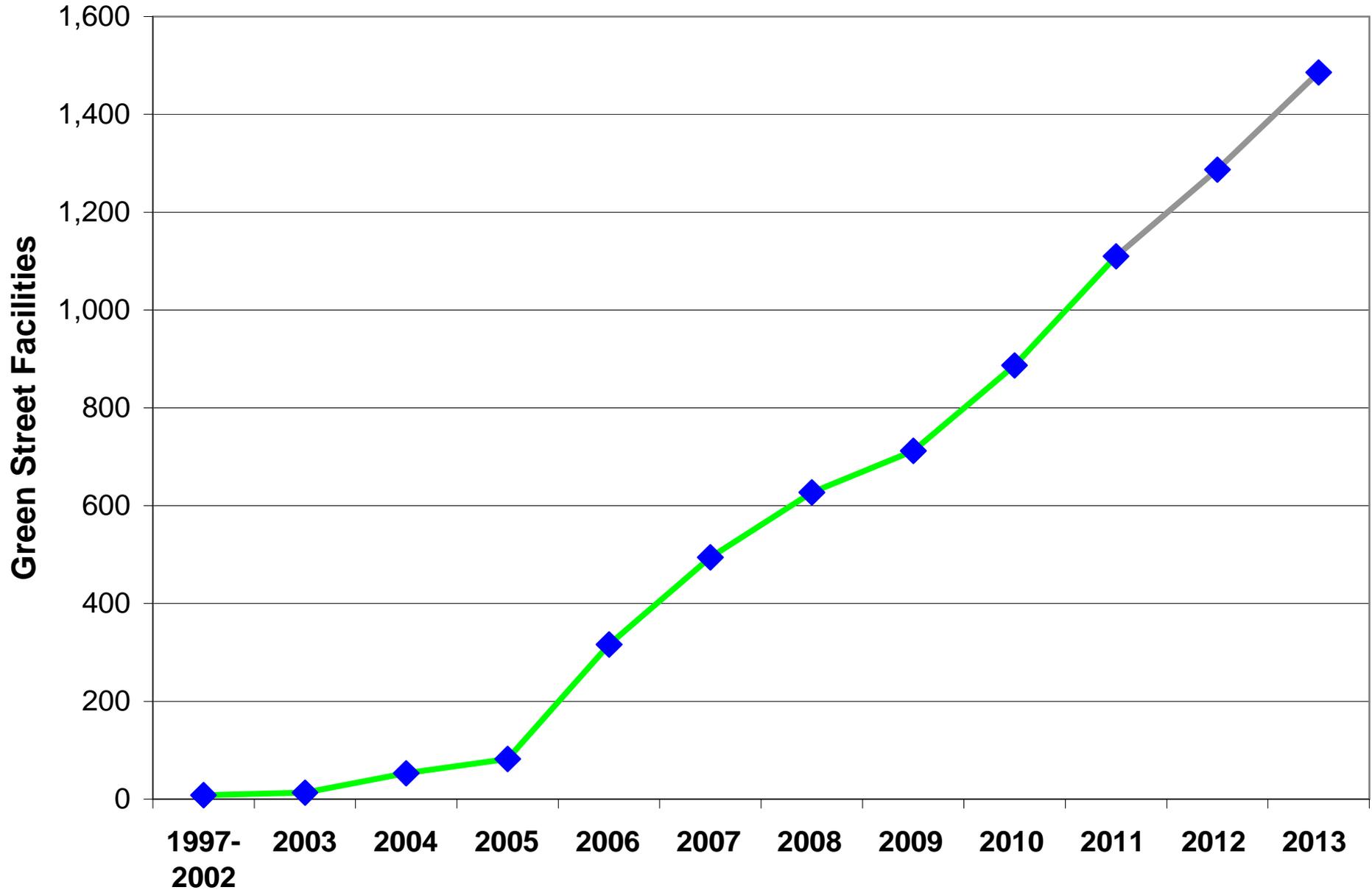


Planters



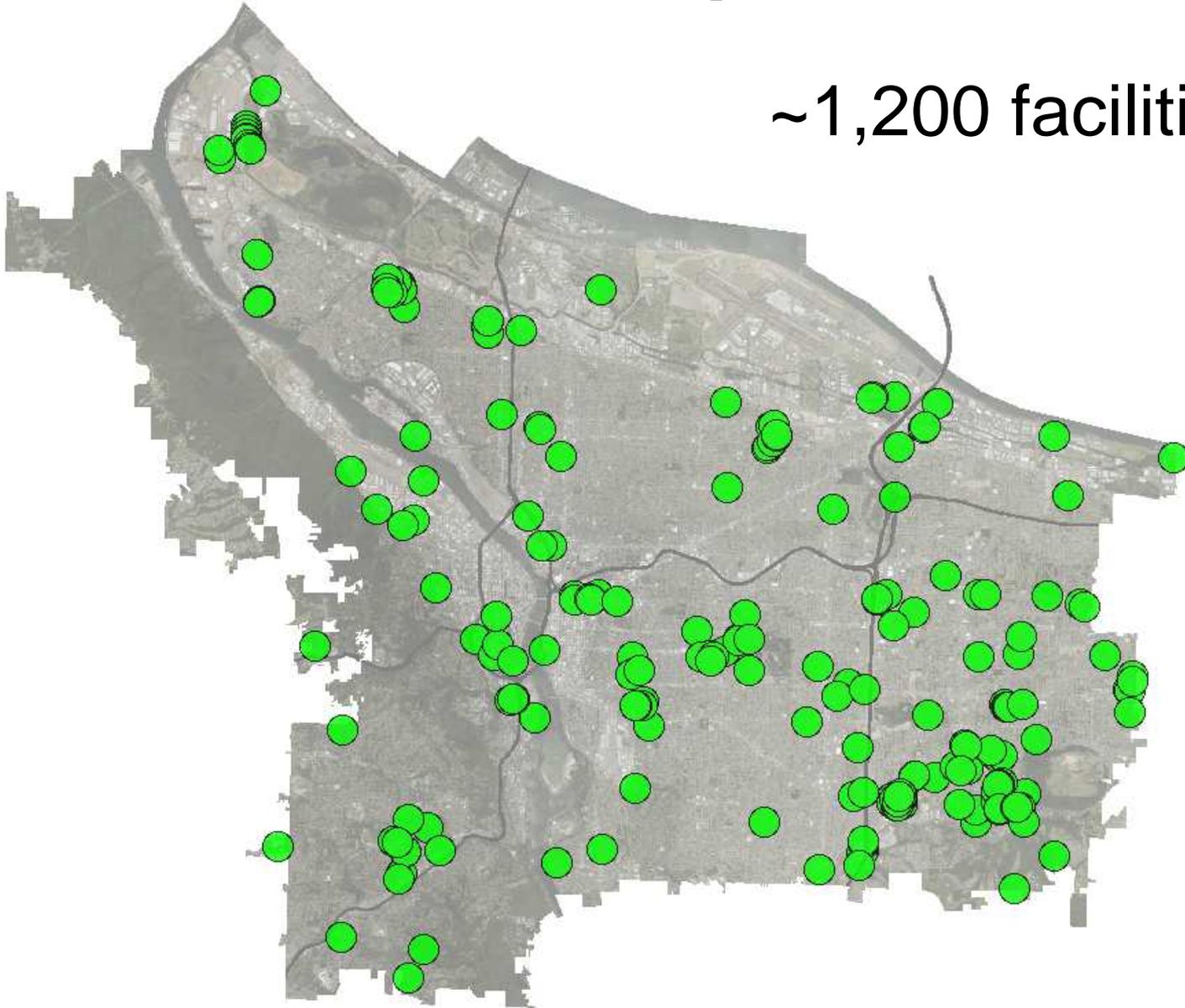
Basins

Green Streets | Facilities



Green Streets | Facility Locations

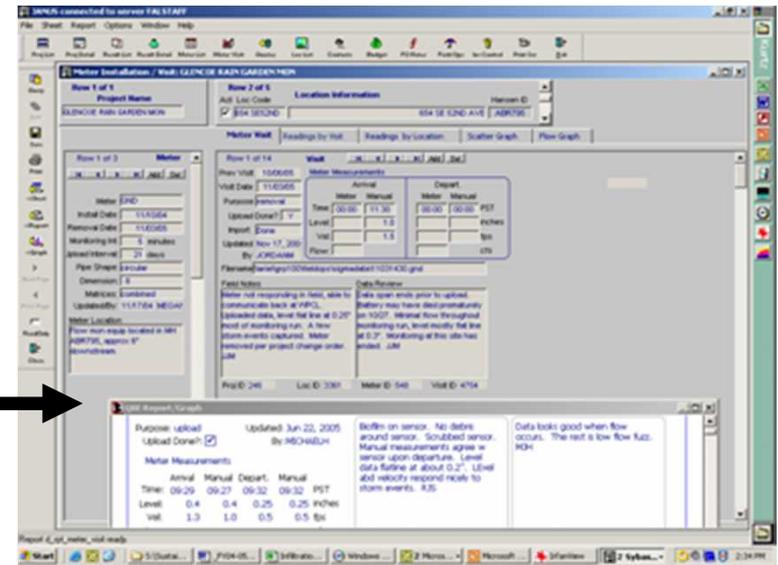
~1,200 facilities



Monitoring | Objectives

- **Quantify benefits to watersheds and sewers**
- **Identify design & maintenance issues**
 - » design variables (inlets, soils, checkdams, ...)
 - » maintenance frequency / level of effort
- **Quantify changes over time**
 - » variations with facility age, season

Monitoring | Continuous



INMIS connected to server FAI STAFF

Meter Installation: Wash GARDNER BATH GARDEN/HEIN

Row 1 of 3	Meter	Row 2 of 4	Location Information	Meter ID
Meter #	540	Proj. Name	WASH GARDNER BATH GARDEN/HEIN	
Instal Date	11/10/04	Alt. Loc. Code		
Removal Date	11/10/05	City	SEALED	
Working hrs	5 Minutes	State	WA	
Instal Interval	21 Days	Zip	98106	
Flow Unit	Gal	City	SEALED	
Flow Direction	Circle	State	WA	
Flow Rate	1.0 GPM	City	SEALED	
Flow Rate	1.0 GPM	State	WA	

Row 1 of 14	Visit	Water Measurements	Report
Visit Date	11/10/05	Annual	
Purpose	Annual	Time	09:29 09:32 PST
Opened Cover	Y	Level	1.0 0.25 inches
Input	Good	Flow	1.0 0.25 gpm
Updated Nov 17, 2005		Flow	1.0 0.25 gpm

Field Notes: Meter not recording in field, wire to communications back at WPG. Estimated data, level fell low at 0:29. Flood of water during run. A few storm events captured. Meter received per project charge order. JIM

Data Review: Data looks good when flow occurs. The rest is low flow. JIM

Meter Measurements	Manual	Depart.	Manual		
Time	09:29	09:27	09:32	09:32	PST
Level	0.4	0.4	0.25	0.25	inches
Flow	1.0	1.0	0.5	0.5	gpm

Monitoring | Continuous

- Advantages:

- » recording all the time

- » data collected for a wide variety of rain events

- Disadvantages:

- » unattended for a month at a time

- » need a raingage nearby

- » no guarantee you'll get the storm intensities / volumes you're interested in



8" / 12"
sewer
(1937)

Glencoe
Elementary

8"
sewer
(1982)

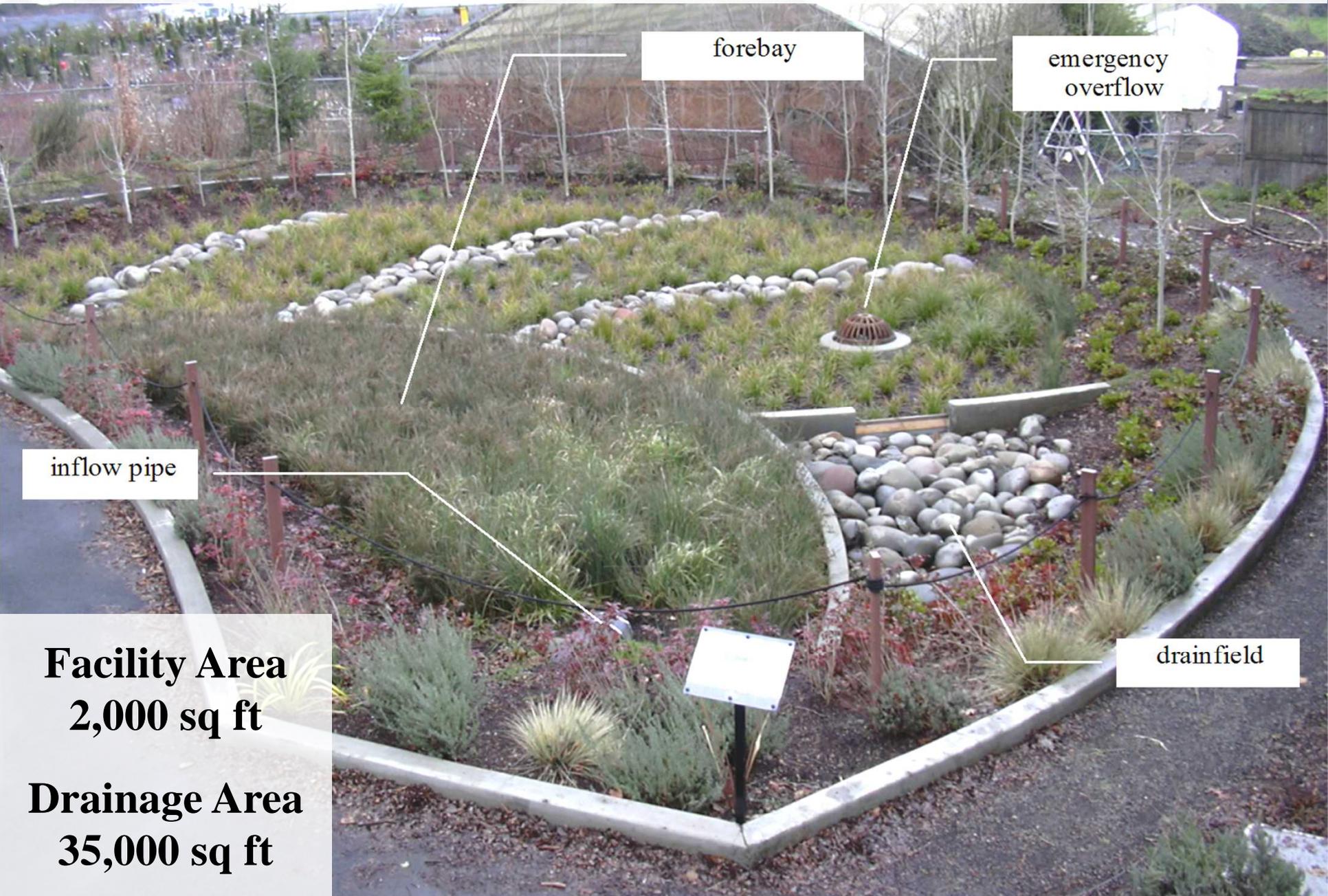


AUG 26 2002





Glencoe Rain Garden (2003)



forebay

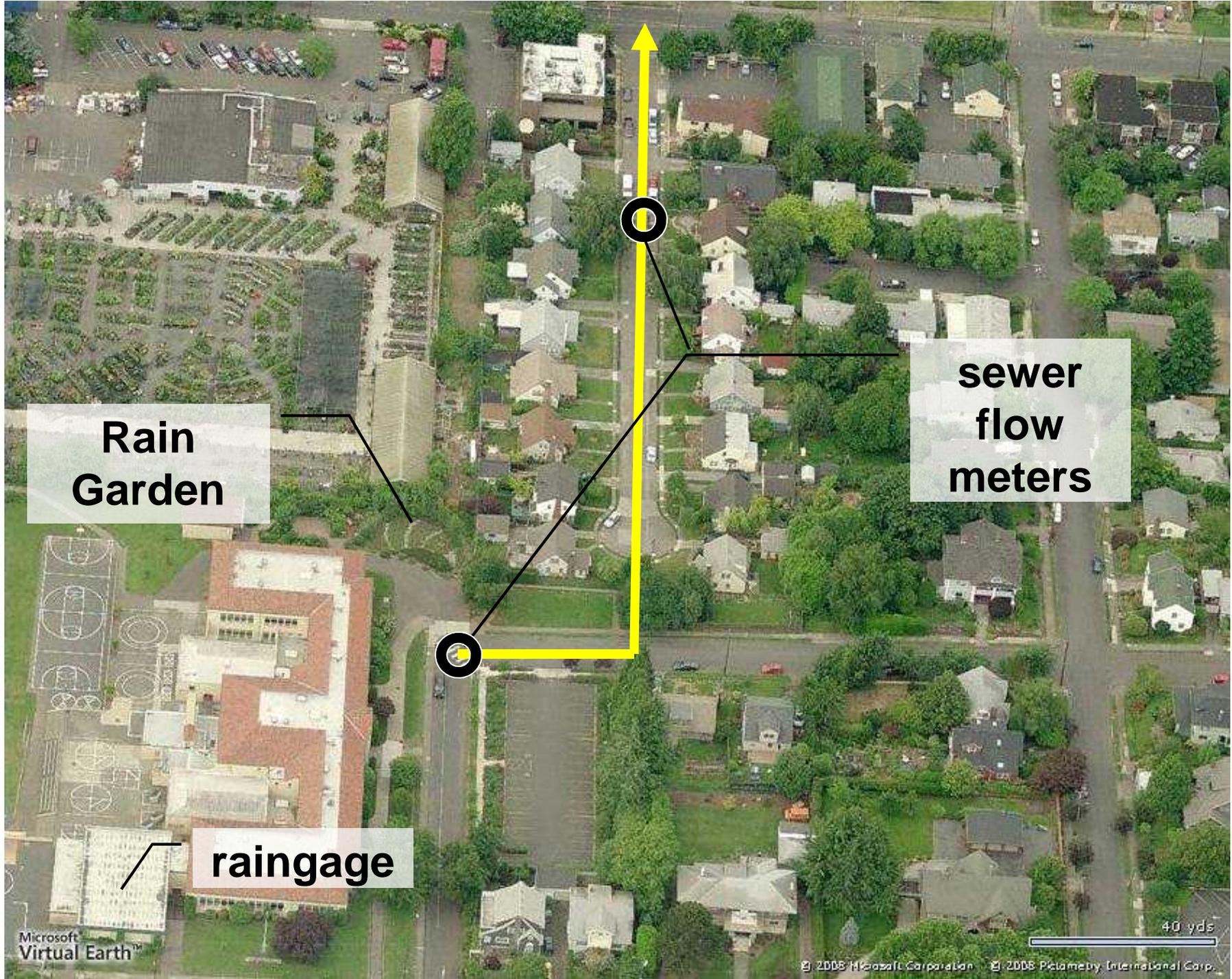
emergency
overflow

inflow pipe

drainfield

Facility Area
2,000 sq ft

Drainage Area
35,000 sq ft



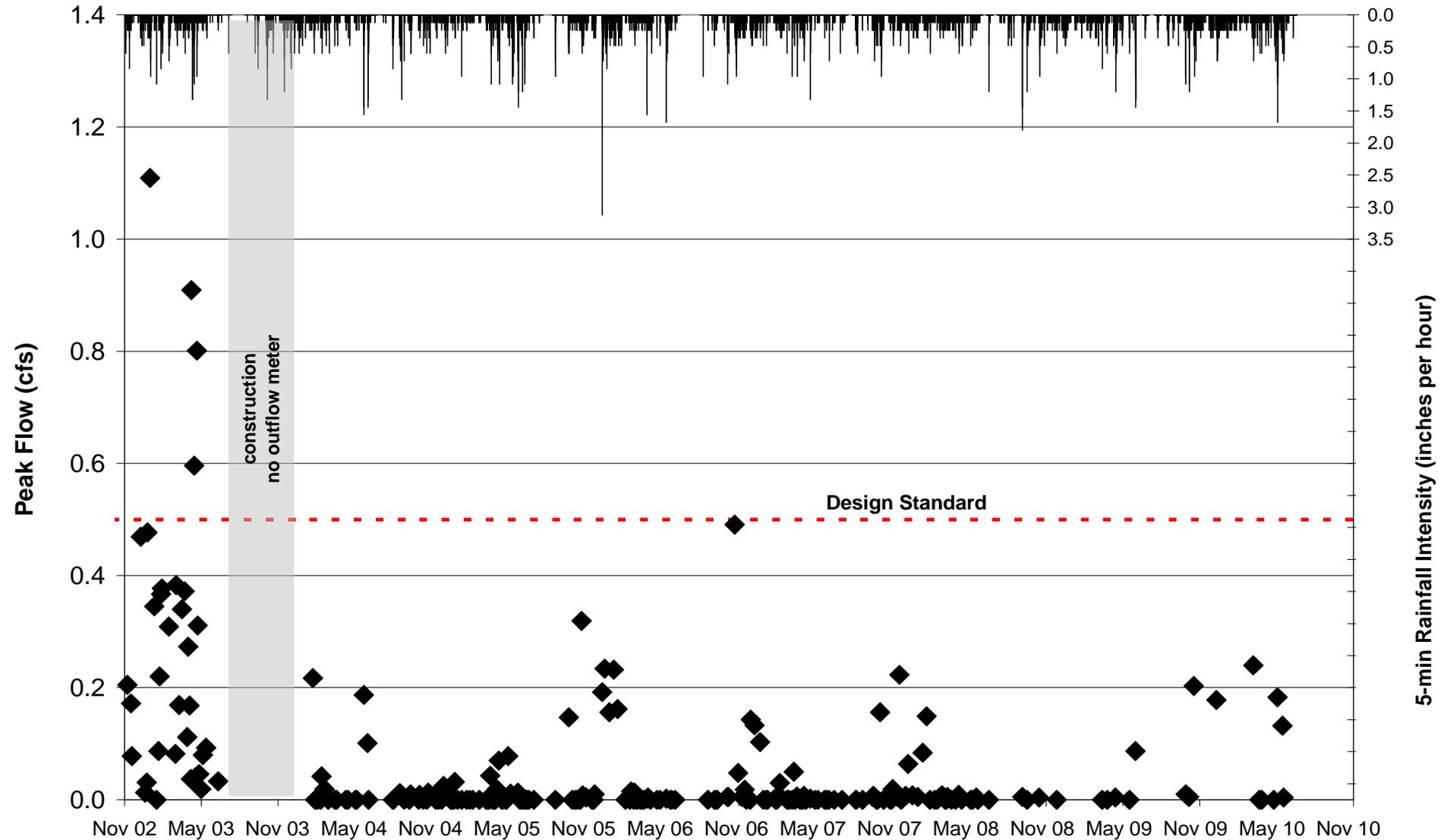
Rain Garden

sewer flow meters

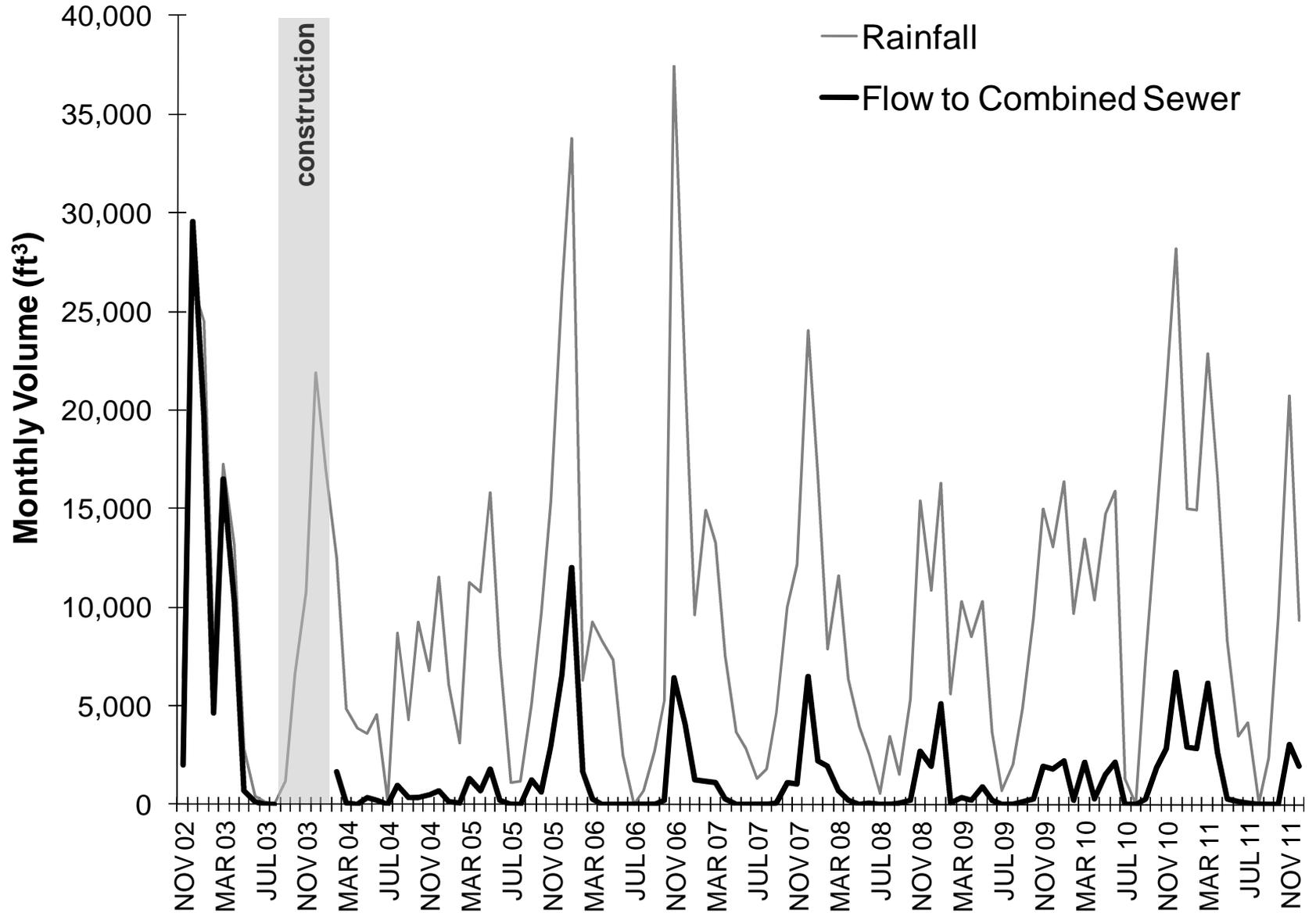
raingage

40 yds

Glencoe Rain Garden | Peak Flow



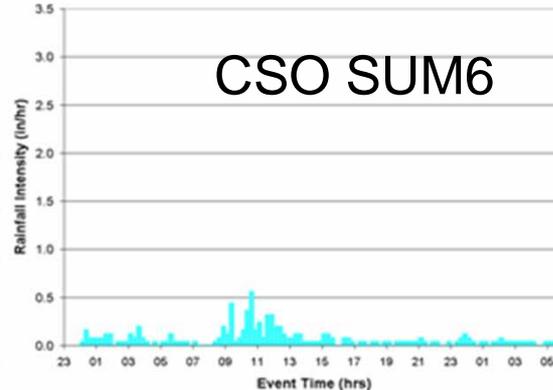
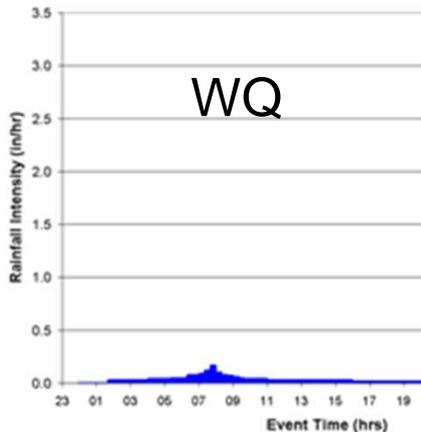
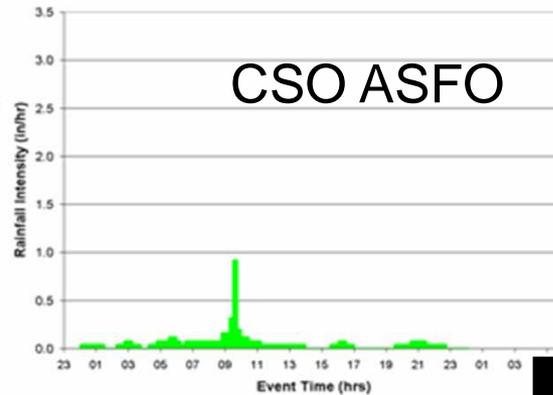
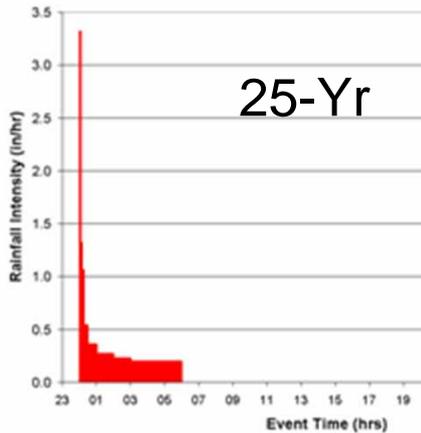
Glencoe Rain Garden | Flow Volume



Monitoring | Flow Tests



Monitoring | Flow Tests



Design Storms

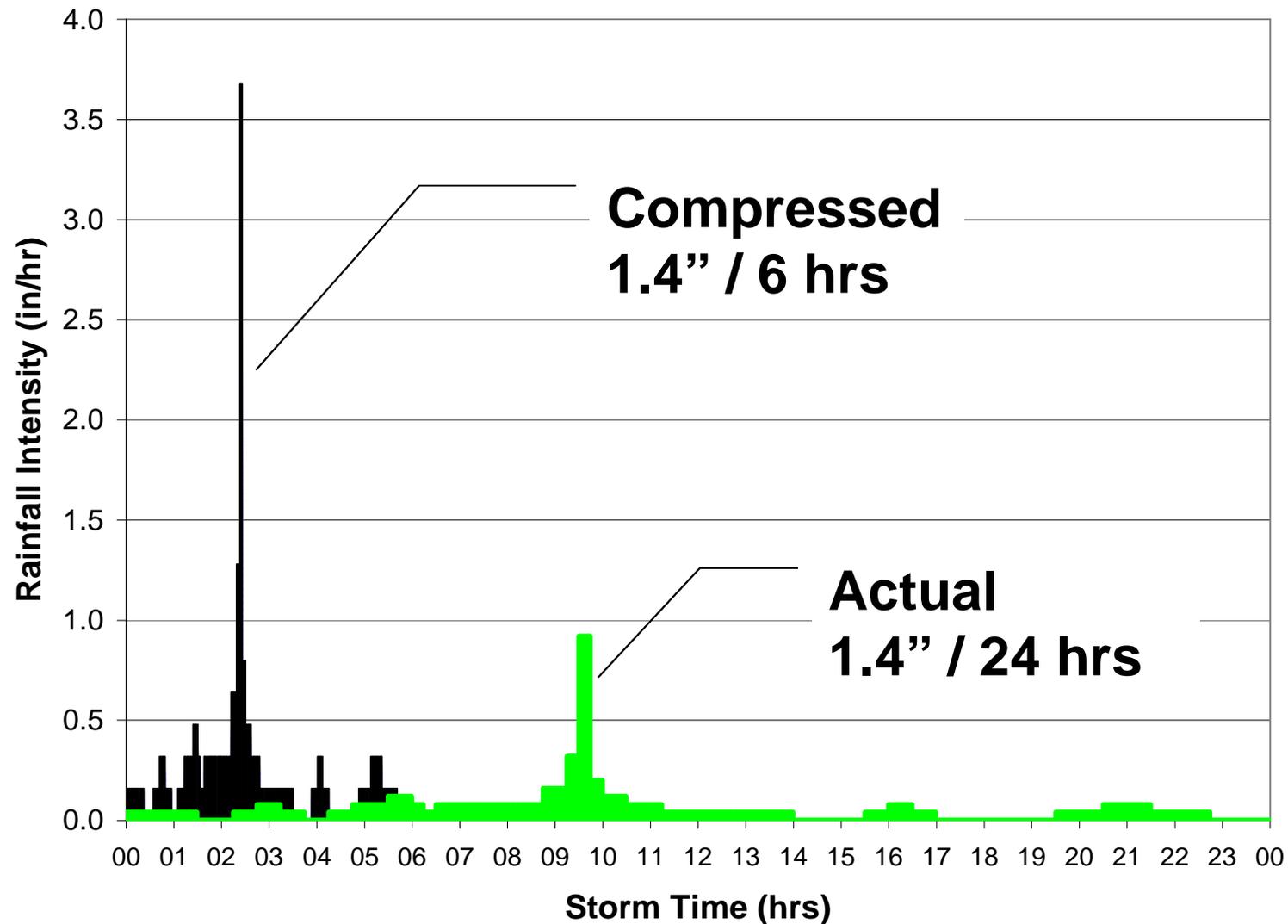
Flow Table

<i>Time interval</i>	<i>25 year Storm (gpm)</i>
0 to 5	166
5 to 10	64
10 to 15	67
15 to 20	32
20 to 25	31
25 to 30	28

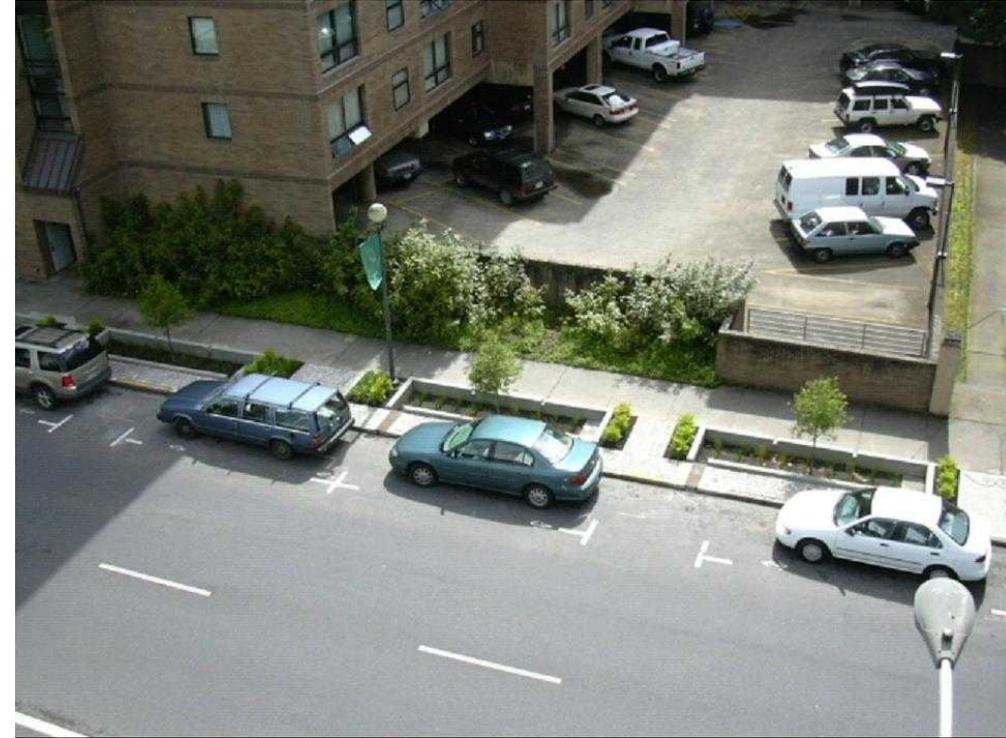
Monitoring | Flow Tests

- Advantages:
 - » you'll get data on the storm you're interested in
 - » higher data quality
- Disadvantages:
 - » simulated events
 - » time compression

Flow Tests | Time Compression

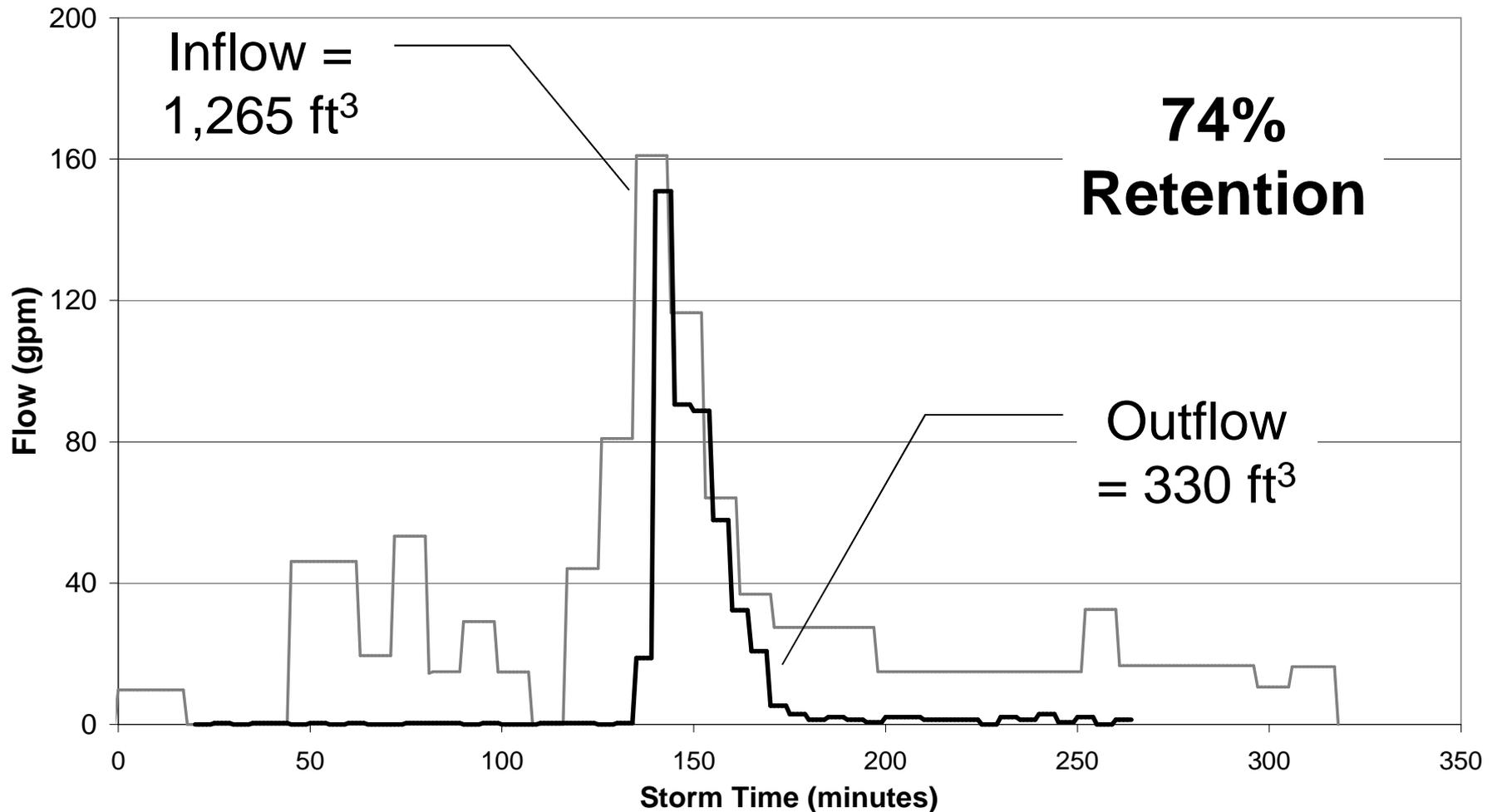


Flow Test | SW 12th & Montgomery



Flow Test | SW 12th & Montgomery

- CSO Design Storm (compressed)

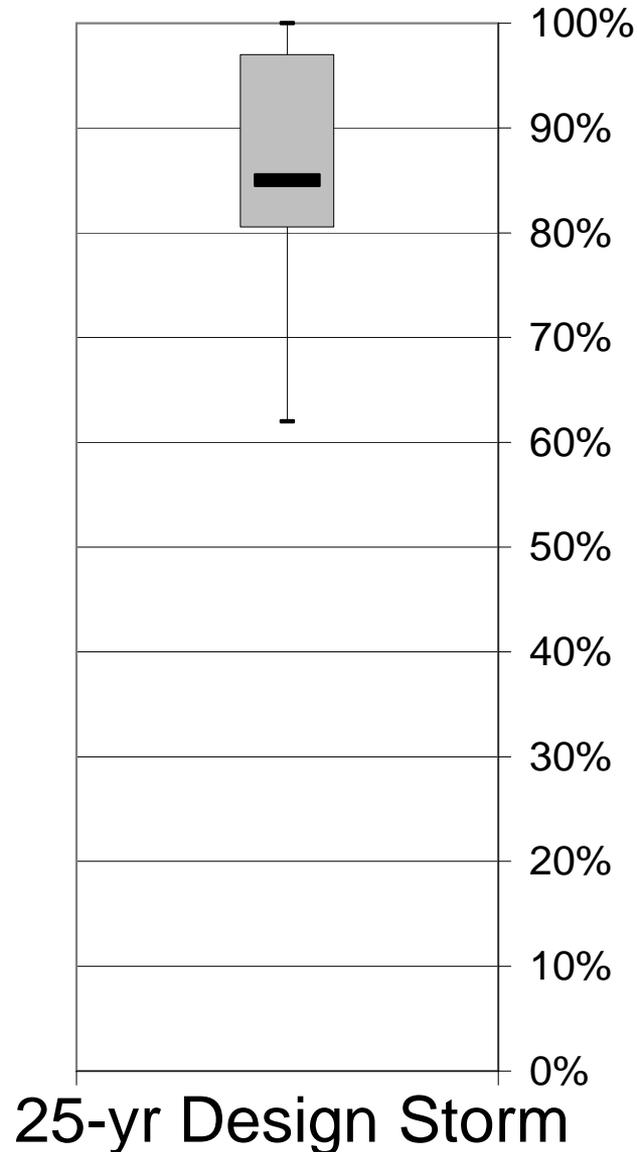


Flow Tests

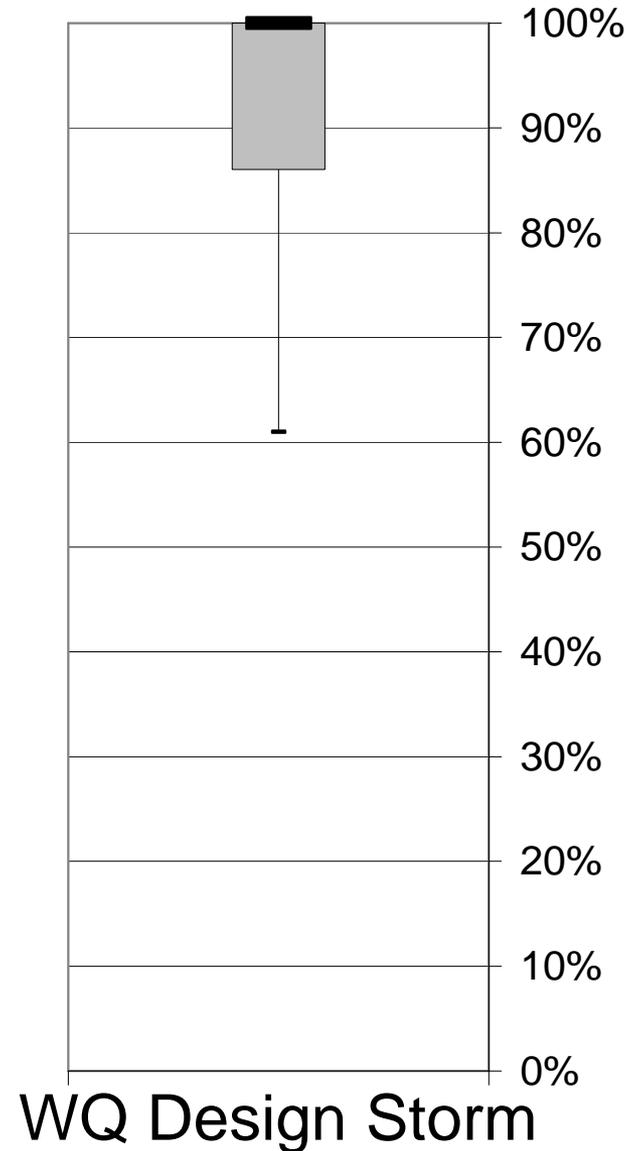
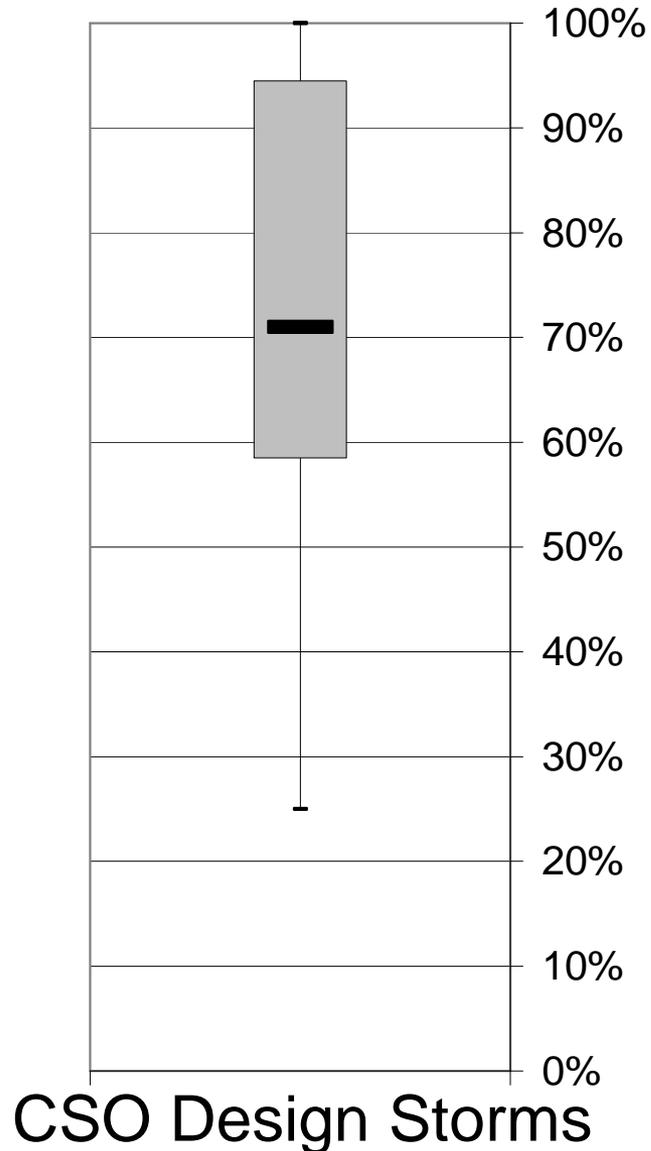
- ~60 flow tests
- 27 facilities



Flow Tests | Peak Flow Reduction



Flow Tests | Flow Volume Reduction

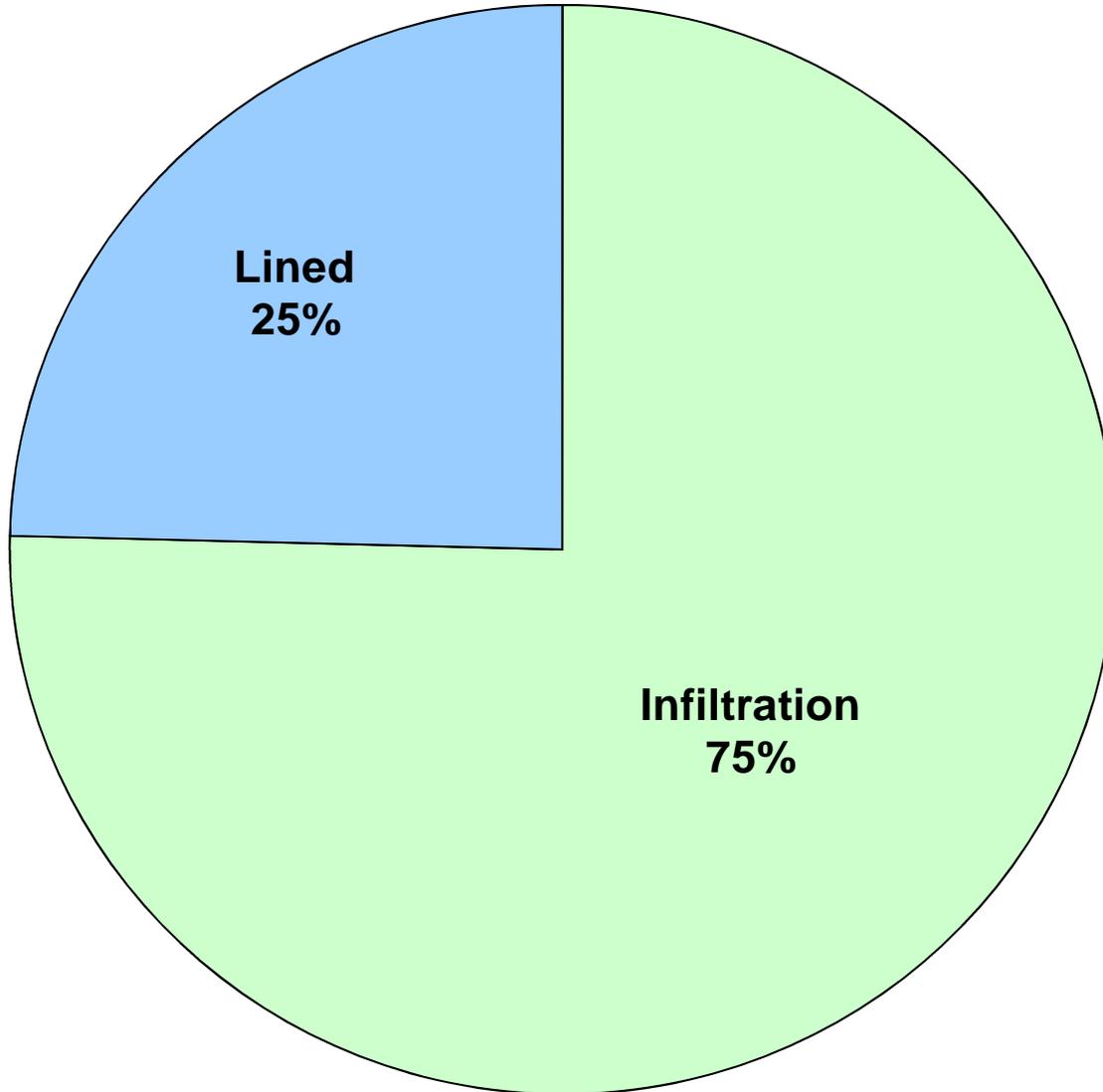


Lined Facilities | Why?

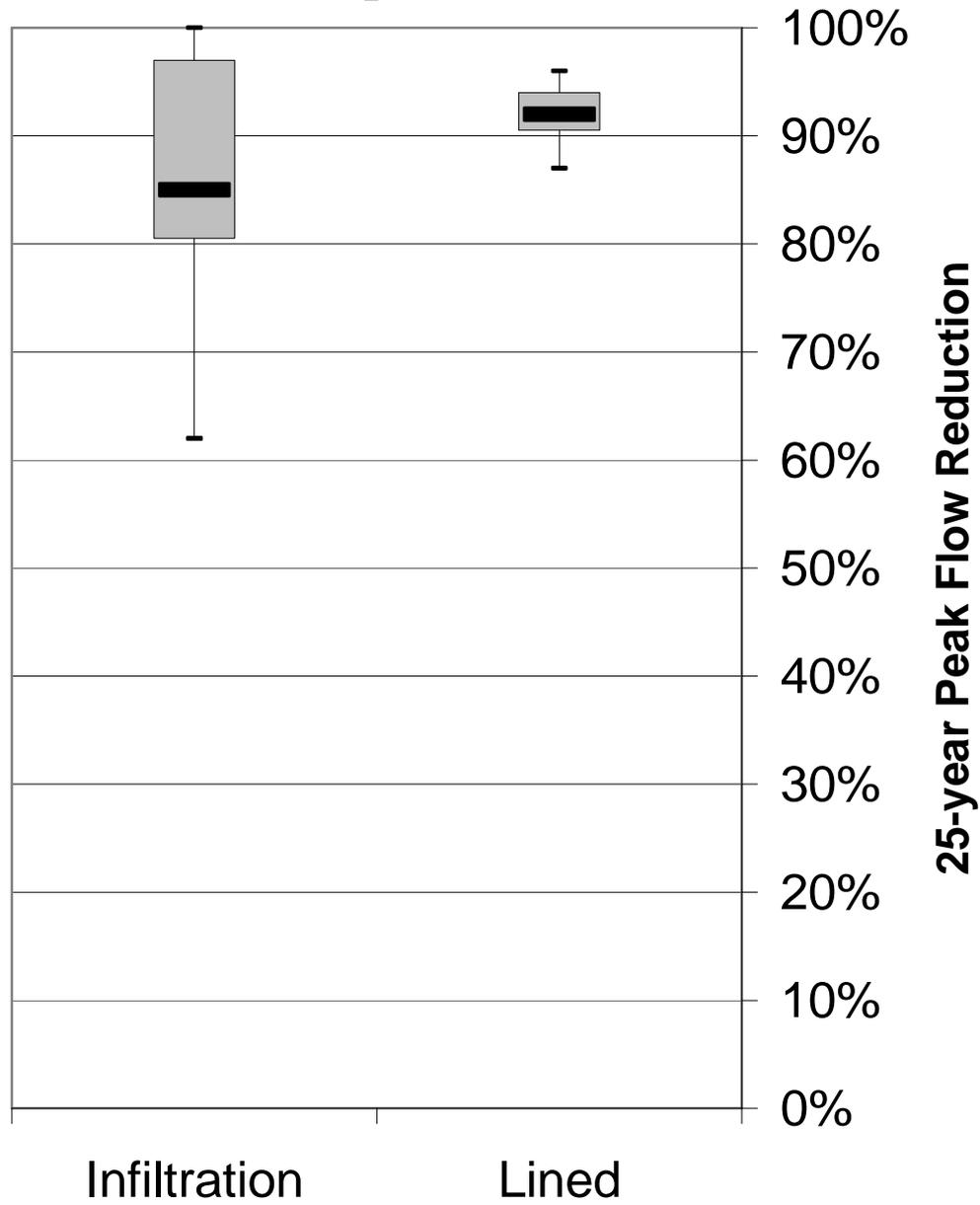
- Soils
- Setbacks from structures
- Depth to groundwater
- Steep slopes
- Utility Conflicts
- Wellhead Protection Area
- Contaminated soils
- Source control



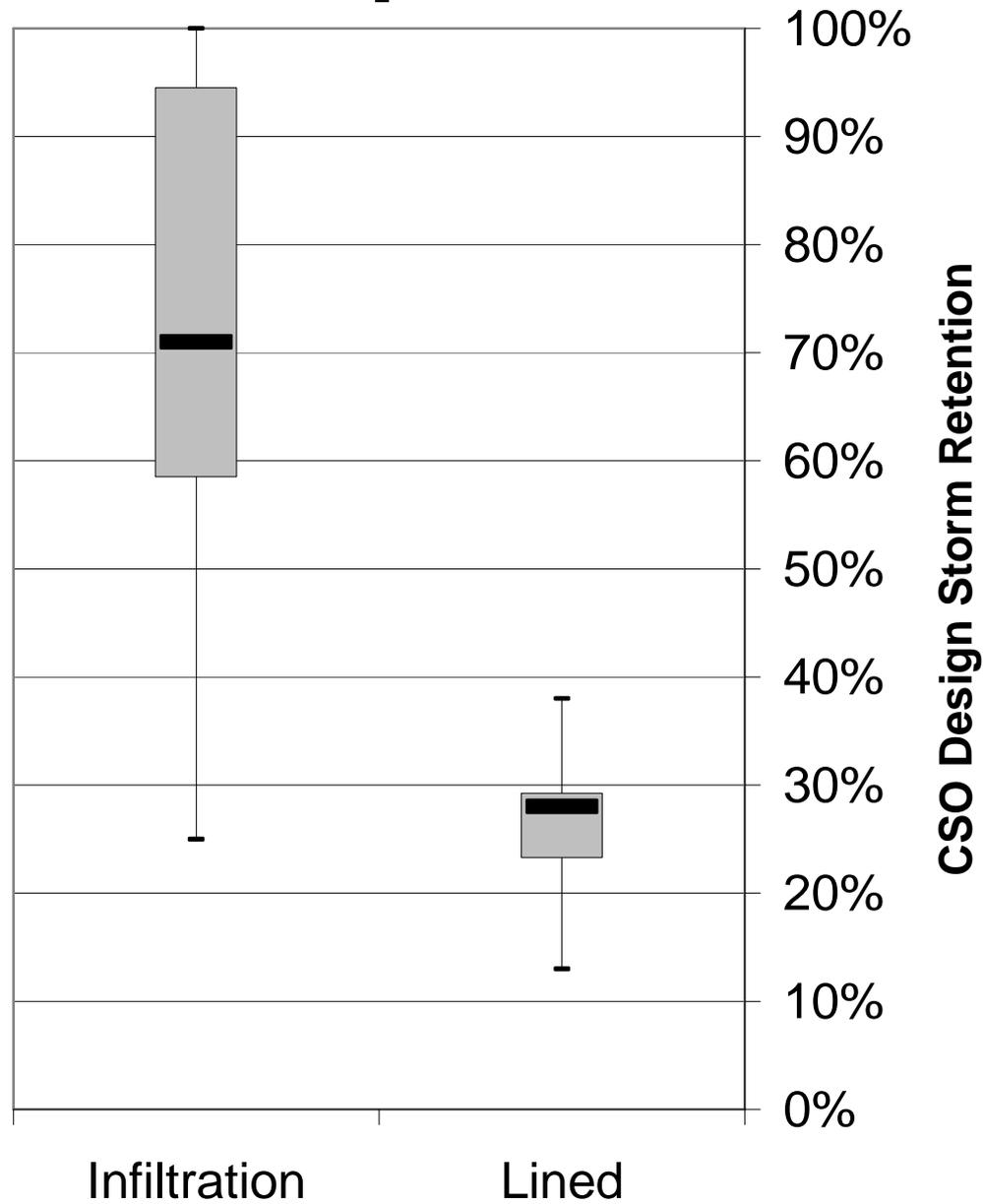
Green Streets | Infiltration or Lined?



Comparison | Infiltration vs. Lined



Comparison | Infiltration vs. Lined

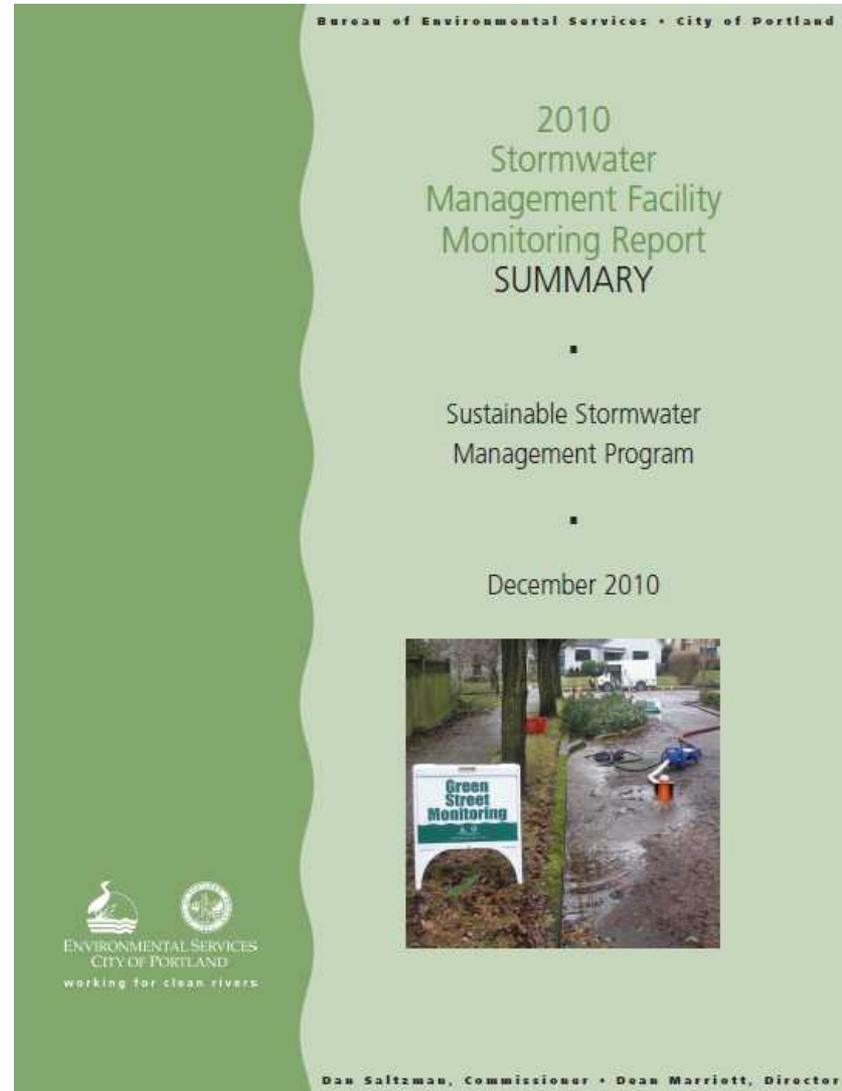


Green Streets | Other Monitoring

- soil pollutant accumulation
- sediment accumulation
- vegetation performance
- groundwater impacts
- lined facility export
 - » dissolved copper, phosphorus

Monitoring | Reports

- Monitoring Report
 - updated every 2 years





Tim Kurtz
tim.kurtz@portlandoregon.gov
www.cleanriverspdx.org
503/823-5418