

# Stealth Stormwater Solutions: Allowing LID to Infiltrate Reluctant Communities in Oregon

**Robert Emanuel (AKA Dr. Developer)**  
OSU Extension &  
Oregon Sea Grant

**Derek Godwin (AKA Storm Waters)**  
OSU Extension &  
Oregon Sea Grant

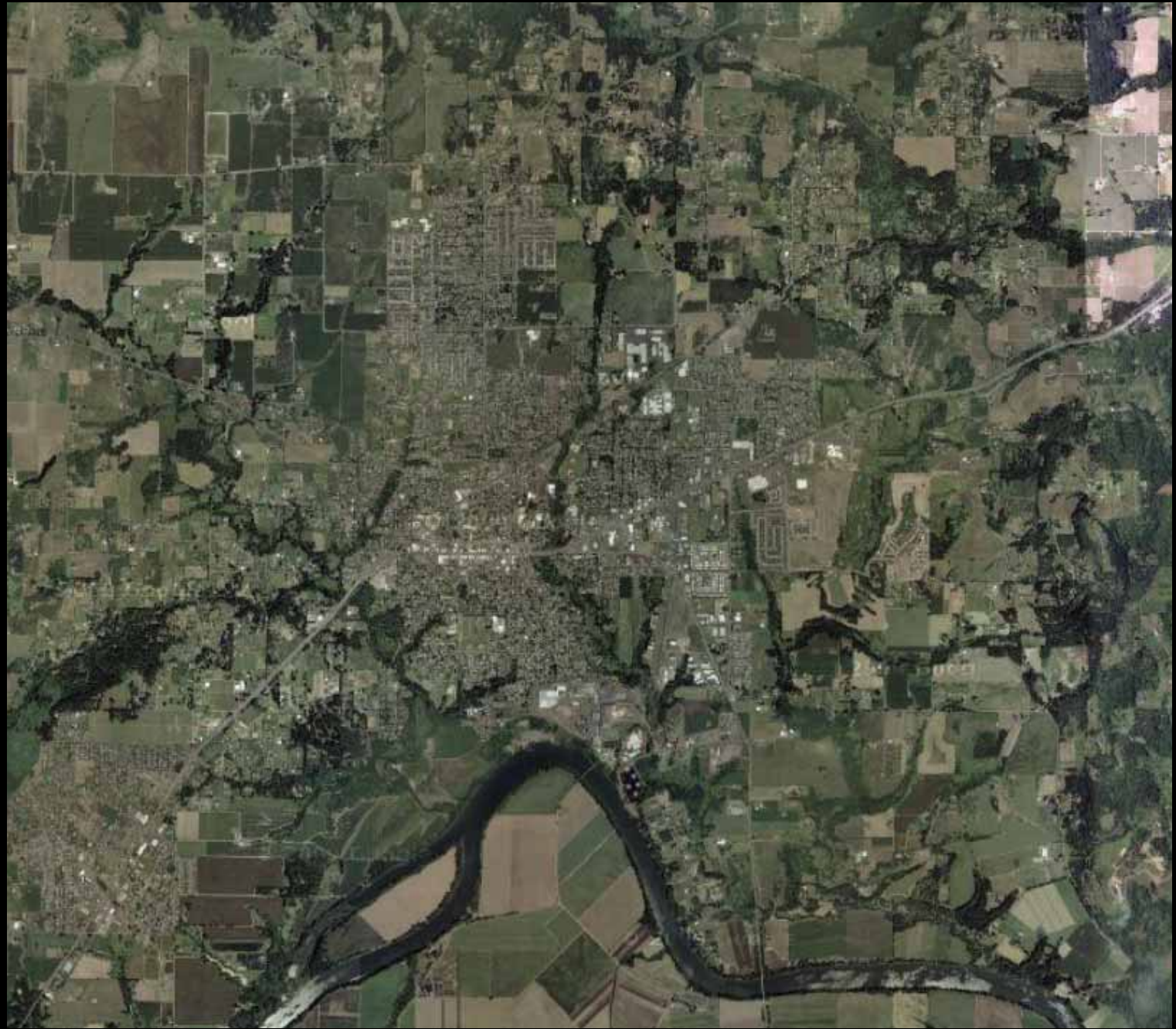
**Frank Burris (AKA Fog Pilot)**  
OSU Extension &  
Oregon Sea Grant

**Megan Kleibacker (AKA The Evaluator)**  
Oregon Sea Grant

**Teresa Huntsinger (AKA: Tree Hugger)**  
Oregon Environmental  
Council



**Oregon:** (pronounced “or-uh-gun”) a Pacific Northwest state bordered by Washington, California, Idaho and Nevada. Oregon is known for its production of timber, salmon, hazelnuts, pears, custom yeast strains, mountain bike deaths, body piercings & tattoos, laws that allow assisted suicide without a mountain bike, espresso stands, dog-friendly bars, medical (ahem) marijuana, Grateful Dead tribute bands, grass seed, atheists, and the world’s largest diversity of microbrews. West of the Cascades, Oregon also produces a lot of stormwater...























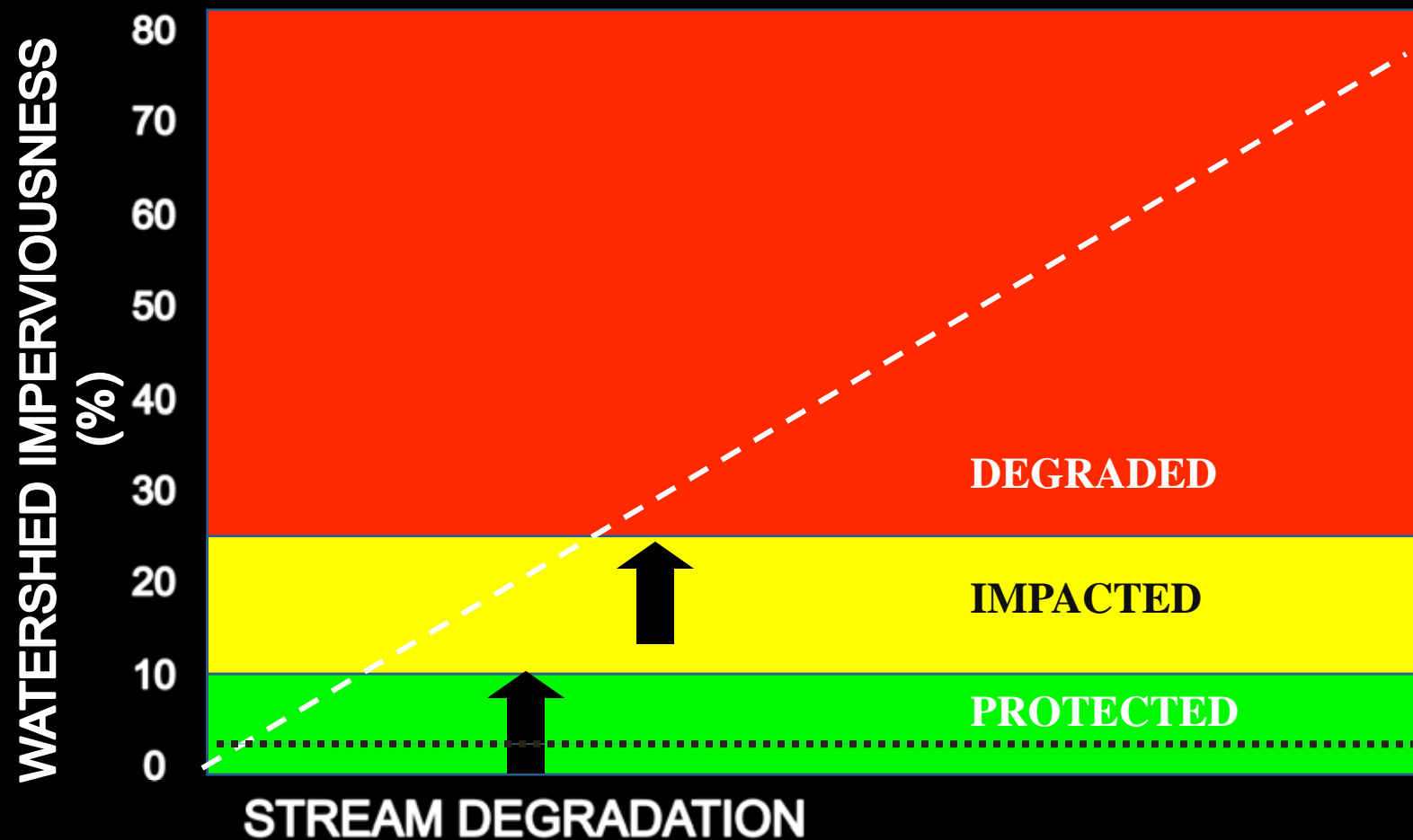




# The Plan

- 💧 Why we did it (in Her Majesty's name...)
- 💧 Initial intelligence gathering
- 💧 Covert Operations and Outreach
- 💧 Obfuscating Outcomes
- 💧 The Next Operation (never say never)...

# Waterway Health & Imperviousness







## STORMWATER SOLUTIONS

Turning Oregon's Rain Back into a Resource

### EXECUTIVE SUMMARY

Flooding during storms, scours out streambanks, reduces groundwater recharge and reduces base flows, thereby increasing summer water temperatures that harm endangered salmon.

The pollution and hydrologic disruption caused by poorly managed stormwater create serious problems for the environment, our economy, and public health. These are primarily human-caused problems - raindrops are mostly clean when they fall from the sky and they generate very little runoff when they land in a natural environment.

**Water pollution.** As more stormwater runoff enters our waterways, it contributes to the build up of pollution in those waters. The Oregon Department of Environmental Quality (DEQ) is asking cities to reduce runoff pollution because it contributes to numerous water quality impairments, including the high mercury levels in resident fish in the Willamette River that make them unsafe for human consumption.

**Health advisories.** The Oregon Department of Human Services cites stormwater runoff as a common cause of the fecal bacteria that causes coastal beach health advisories.<sup>3</sup> In 2006 the department issued 13 health advisories, warning the public against swimming at beaches with high levels of fecal bacteria in the waters.<sup>4</sup>

**Property damage.** Increases in stormwater runoff can damage or degrade private and public infrastructure as property that is lost or damaged due to stream channels and unnatural flooding, washed-out roads, bridges, culverts and sewer lines, and endangered salmon. Our society continues to urbanize, degrade and pollute the watersheds that pro-



## Barriers and Opportunities for Low Impact Development: Case Studies from Three Oregon Communities

Derek Godwin, Betsy Parry, Frank Burris, Sam Chan  
Oregon Sea Grant Extension

Amanda Punton  
Oregon Department of Land Conservation and Development



[www.oeconline.org/our-work/rivers/stormwater/stormwater%20report](http://www.oeconline.org/our-work/rivers/stormwater/stormwater%20report)  
[seagrant.oregonstate.edu/sgpubs/onlinepubs/w06002.pdf](http://seagrant.oregonstate.edu/sgpubs/onlinepubs/w06002.pdf)

# Barriers

- 💧 Lack of leadership
- 💧 Few technical resources
- 💧 Few funding resources
- 💧 Few cost comparisons
- 💧 Site-specific issues
- 💧 Lack of local capacity
- 💧 Lack of regulation
- 💧 O & M
- 💧 Time



# Opportunities

- 💧 Interest in “green”
- 💧 Proactive communities
- 💧 Water quality concerns
- 💧 Outreach available
- 💧 Peer-pressure
- 💧 Salmon habitat



“Increase state **support** for local efforts and **remove barriers** to adoption of best practices”

“It would be great if we could have some kind of training for our community on how LID works and where they can apply it.” -- Coastal Community Planner, February 2006

“Develop a comprehensive **education** and **training** program for promoting sustainable stormwater management in growing communities”

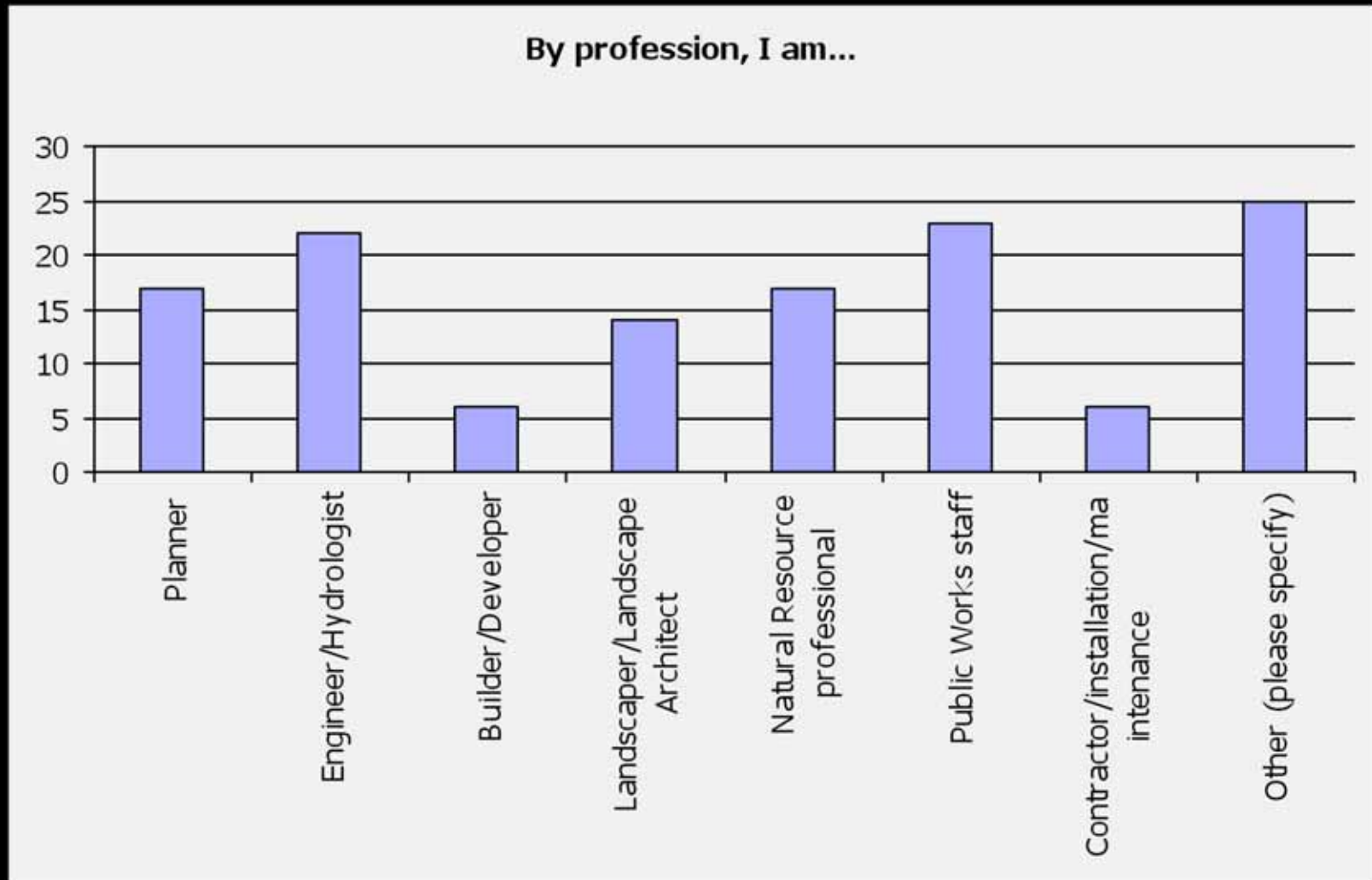




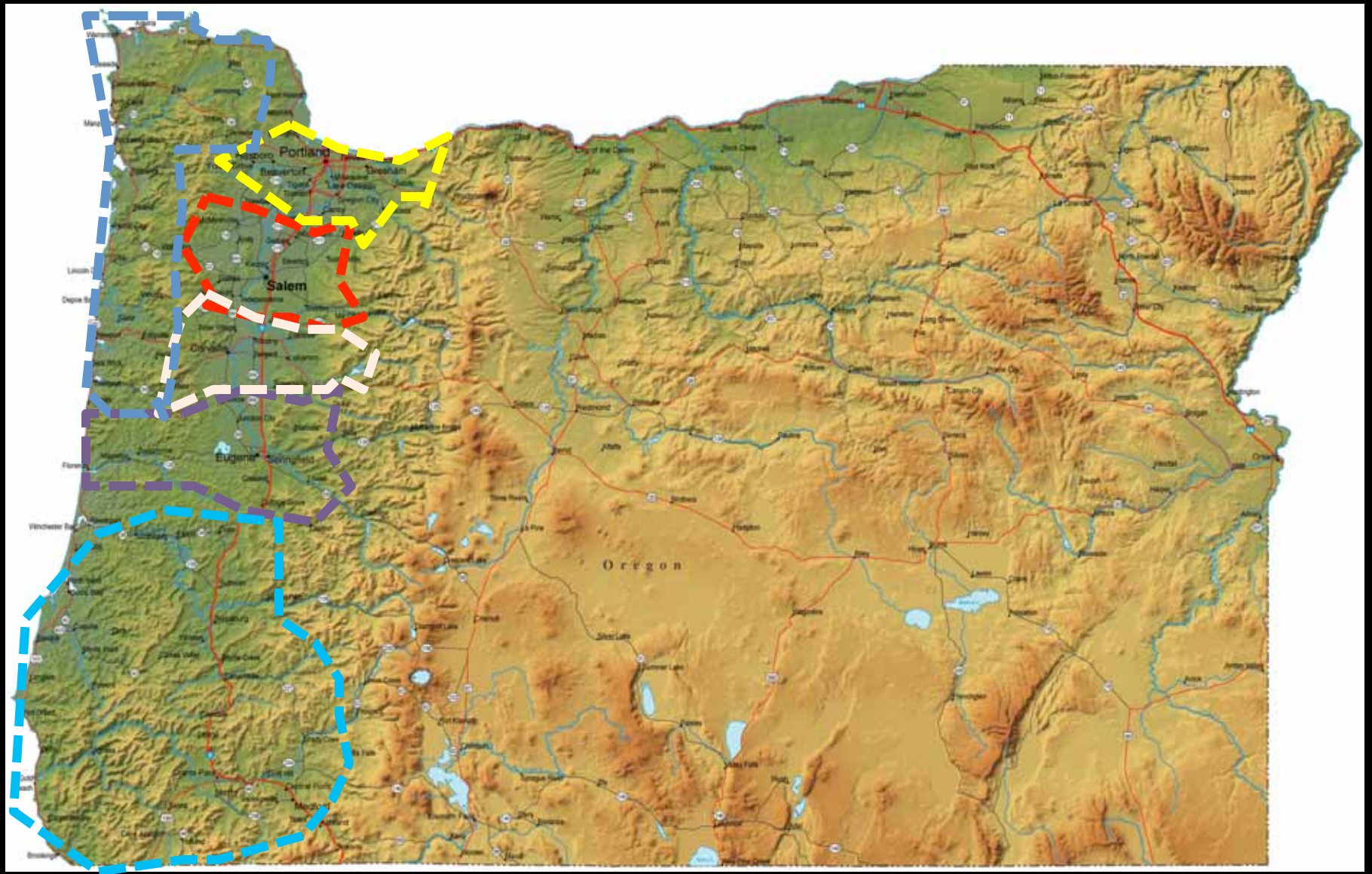
- ◆ Educate, motivate and assist developers
- ◆ Educate, motivate and assist local governments
- ◆ Engage the public in protecting water quality and hydrology
- ◆ Late-adopting or unregulated communities

- 💧 Low Impact Development from Start to Finish —Eugene, 2009
- 💧 Untangling the Codes and Maintaining Stormwater Systems —Keizer, Medford, 2009
- 💧 Rain Garden Trainings--Salem, Medford, Newport, Eugene 2008-09
- 💧 Green Streets--Albany, 2009
- 💧 Making LID a Reality--Salem, 2009
- 💧 Stormwater Solutions —Medford, Eugene 2009
- 💧 LID for small communities—Eugene 2009
- 💧 Introduction to LID—Cannon Beach, 2010

# Who attended?











Her Majesty's  
missions...





**Rain Gardens:  
Landscaping for clean water & healthy streams  
Train-the-Trainers Workshop  
\$50 registration fee includes training materials and lunch  
Friday, Oct 30, 8:30 AM- 5:00 PM**

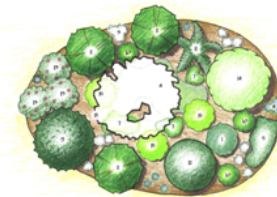
The rain brings many benefits for watersheds and residents. But it can also be a bane for both if it carries pollutants or excessively floods our local streams. Capturing, controlling and filtering some of this stormwater runoff in rain gardens is one way to help beautify our landscapes while we improve the health of our watersheds.



The purpose of the training is to help gardeners learn the skills needed to design, build and maintain rain gardens and serve as local resources to other community members interested in building rain gardens.

**Trainers:** Robert Emanuel and Derek Godwin, Oregon State University Extension Service and Oregon Sea Grant, and authors of the forthcoming Oregon Rain Garden Manual.

**What:** This is a hands-on train-the-trainers course for gardeners, landscape design professionals, and others. Dress for both indoor and outdoor training components.



**When:** Friday, Oct 30, 8:30AM - 5:00 PM  
*Please register by Monday, Oct 26\**

**Where:** Pringle Creek Community, 2110 Strong Road SE., Salem, Oregon 97305.

**For more information:**  
Teresa Huntsinger, (503) 222-1963 ext 112, [teresah@oeconline.org](mailto:teresah@oeconline.org);  
Megan Kleibacker, (541) 737-8715, [megan.kleibacker@oregonstate.edu](mailto:megan.kleibacker@oregonstate.edu)

**\*To register visit** <http://www.oeconline.org/our-work/rivers/stormwater/low-impact-development/lid-workshops>

**Scholarships available! Contact Teresa Huntsinger for more information.**



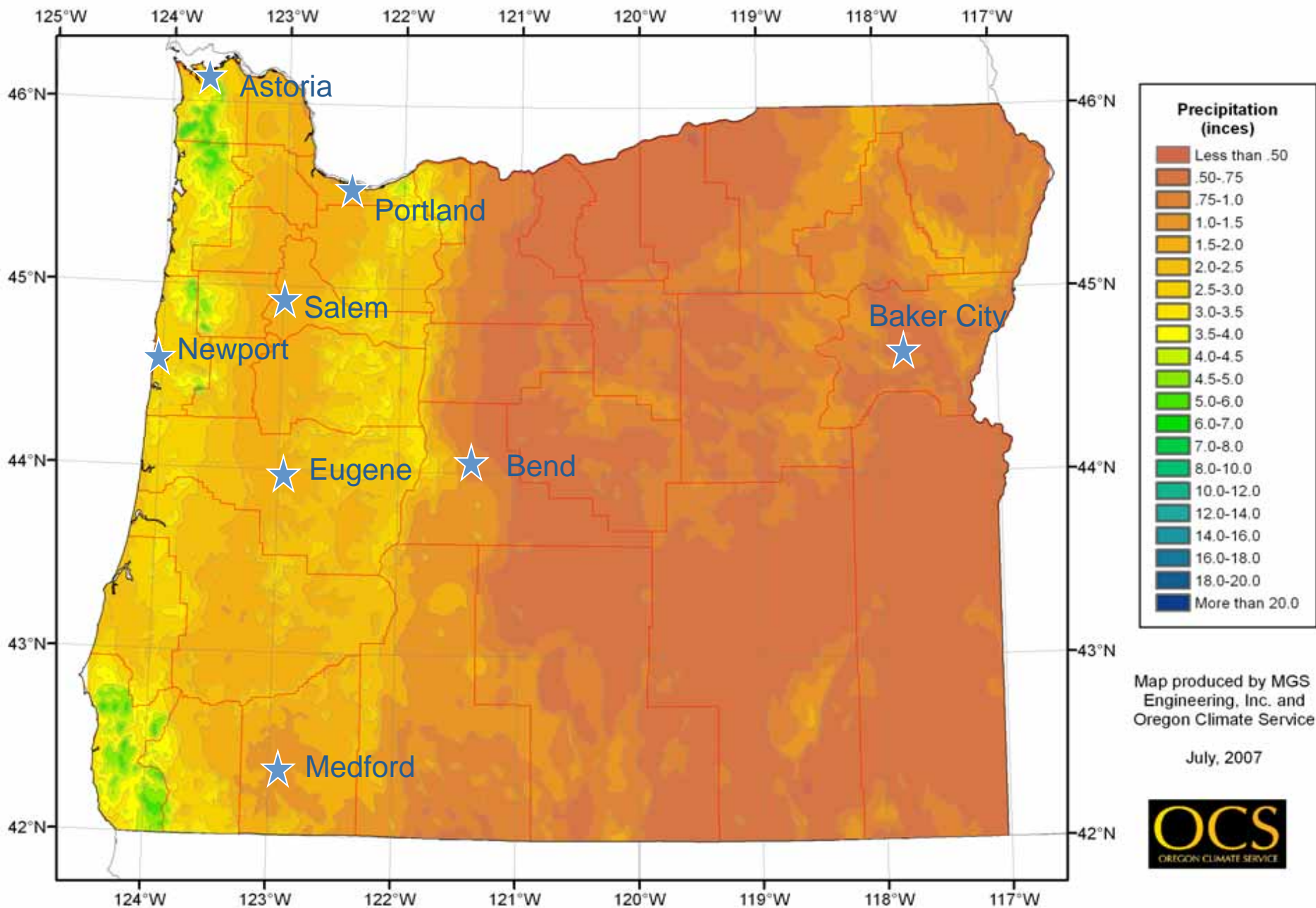


THE OREGON  
*Rain Garden Guide*

A STEP-BY-STEP GUIDE TO  
Landscaping FOR Clean Water AND Healthy Streams



# 24-Hour Precipitation for meeting typical Water Quality Treatment Goals in Oregon\*



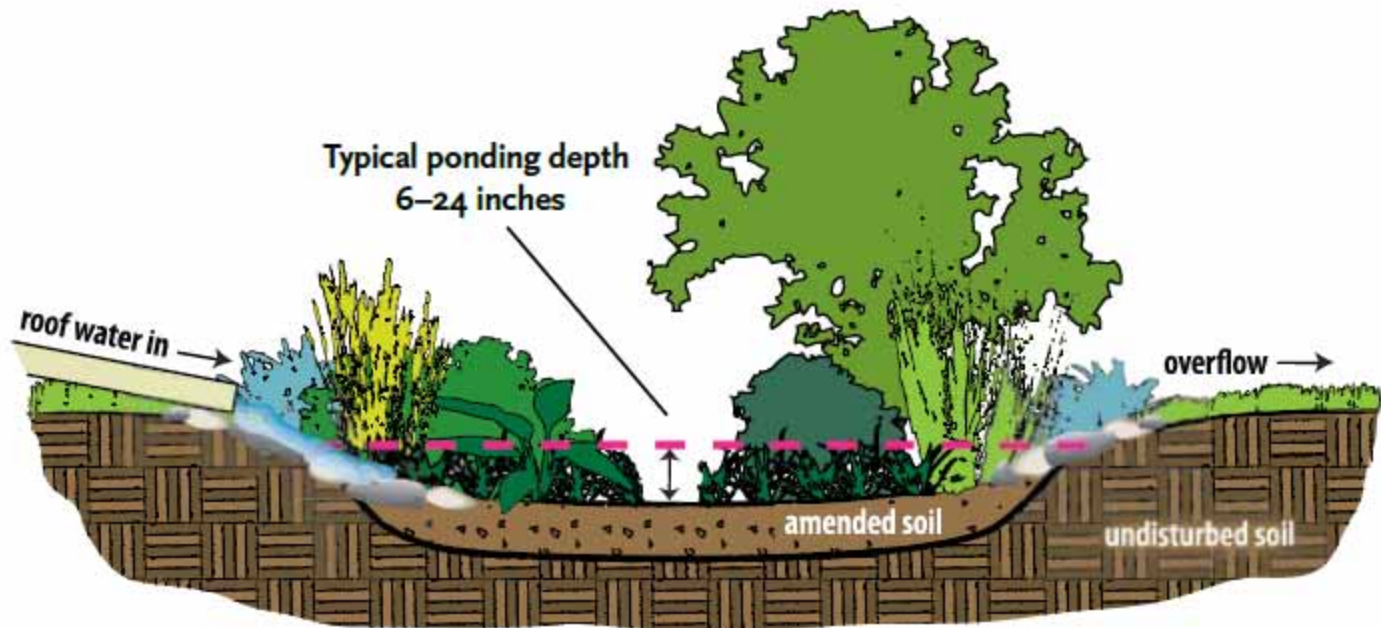
\*6-month return interval/200% chance of being equaled or exceeded annually. Use in lieu of specific design storm provided by a local jurisdiction

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**Figure 8:** Ponding surface is denoted by the dotted line.  
(Graphic: EMSWCD)



**(Length of surface area x Width of surface area)  
x .10 = total rain garden area**

An example: 30 feet x 12 feet = 360 square feet  
x .10 = 36 square feet of rain garden

The more impervious area you want to treat, the bigger your garden. The size of your rain garden

**Note:** remember to account for the addition of mulch when you plan for your finished depth (see "Mulching" on page 23). For example, if you are adding 3 inches of mulch to your final planted garden and it needs to be at least 12 inches deep, you must excavate to a depth of 15 inches from grade.

## Interpreting the infiltration test

Drainage rate	Recommendation
Less than 1/2 inch per hour	Do not build a rain garden on this site without professional assistance.
Between 1/2 and 1 inch/hour	Low infiltration for a rain garden. Homeowners may want to build a larger or deeper garden, or likewise plan for additional overflow during high-rainfall storms.
Between 1 and 1 1/2 inches/hour	Adequate infiltration for a rain garden. Plan for sufficient overflow during high-rainfall storms.
Between 1 1/2 and 2 inches/hour	Adequate infiltration for a rain garden. Plan for sufficient overflow during high-rainfall storms.
Faster than 2 inches/hour	High infiltration for a rain garden. Design should feature fewer moisture-loving and more drought-tolerant plants. The rain garden may also be sized to hold smaller amounts of water, have a deeper mulch layer, or have denser plantings.

Drainage rate	Suggested rain garden ponding depth
Between 1/2 and 1 inch/hour	12–24 inches
Between 1 and 2 inches/hour	6–8 inches
Faster than 2 inches/hour	6 inches

### Disconnecting downspouts

Disconnecting downspouts is an important part of rain garden construction. Avoid creating safety and structural problems when disconnecting any downspouts from your storm sewer by following these safety guidelines:

- Don't disconnect a downspout in an area that is too small to drain the water properly.
- Disconnected downspouts must be extended to discharge water at least 6 feet from a structure with a basement or 2 feet from a crawl space or slab foundation.
- Direct water away from your structure, a retaining wall (by at least 10 feet), a septic drain field, or an underground storage tank.
- The end of the downspout extension must be at least 5 feet away from a neighboring property and 3 feet from a public sidewalk. Do not direct water toward a neighboring property, especially on a steep slope.

#### Steps for disconnecting:

1. Measure the existing downspout from the top of the standpipe, and mark it at least 9 inches above the standpipe. A standpipe is the pipe leading into the below-ground storm sewer.
2. Cut the existing downspout with a hacksaw at the mark. Remove the cut piece.
3. Plug or cap the standpipe. Do not use concrete or another permanent sealant.
4. Attach an elbow to the newly cut downspout by inserting the elbow over the downspout. Then use at least two sheet-metal screws to secure the two pieces.
5. Measure and cut the downspout extension so that when it is attached, you will be following the safety guideline above. Fit the extension over the elbow and attach it with sheet-metal screws.
6. If the extension does not connect directly to a below-ground pipe or lead into a rain garden, use a splash block or gravel to prevent soil erosion.

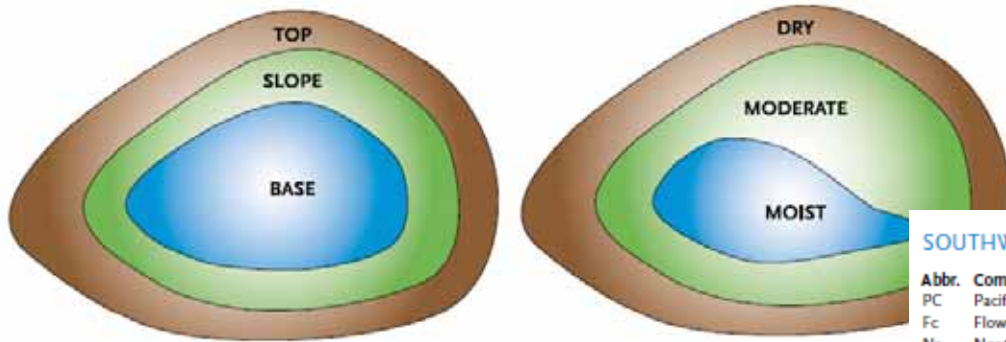
7. Remember that each section should funnel into the one below it. All parts should be securely fastened together with sheet-metal screws.

Be sure to maintain your gutter system. Inspect it regularly for leaks, sagging, holes, or other problems. It is a good idea to annually inspect and clear debris from gutters, elbows, and other connections before the rains arrive.

*This material is condensed from "How to Manage Stormwater: Downspout Disconnection," City of Portland Bureau of Environmental Services publication BS 0709. It is used here with permission of the City of Portland, BES. The full document can be found at [www.portlandonline.com/bes/index.cfm?o=46962&a=18853](http://www.portlandonline.com/bes/index.cfm?o=46962&a=18853).*



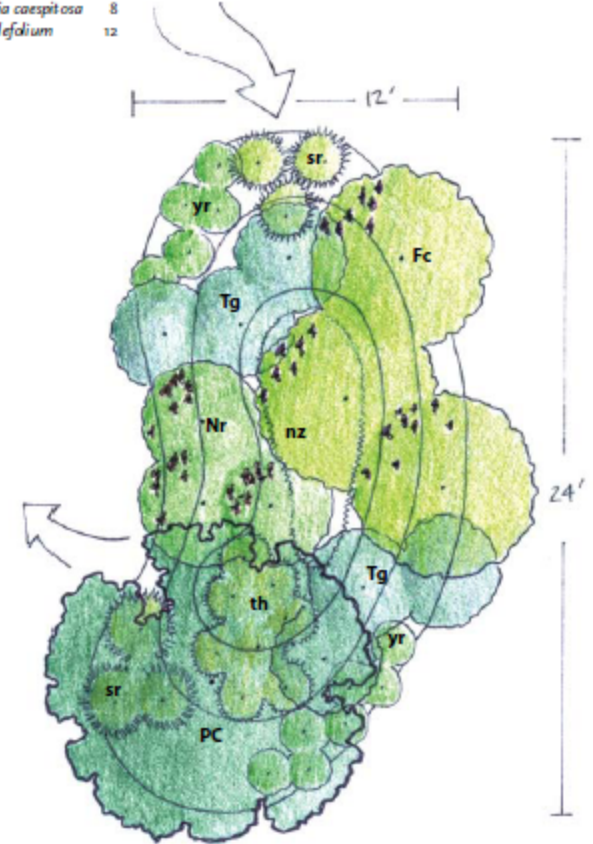
**Figure 14.** Downspout connected to downspout extension that directs flow away from a building's foundation. Note sheet-metal screws.  
(Photo: Robert Emanuel, OSU)



**Figure 26:** Planting zones reflect the areas where the garden will have the most and least water when full as well as during the dry season. The graphic on the left illustrates the topographic zones of the rain garden, the graphic on the right illustrates zones of high and low soil moisture during the dry season.  
(Graphic: Robert Emanuel, OSU)

### SOUTHWEST OREGON SUN

Abbr.	Common name	Scientific name	Qty.
PC	Pacific crabapple	<i>Malus fusca</i>	1
Fc	Flowering currant	<i>Ribes sanguineum</i>	3
Nr	Nootka rose	<i>Rosa nutkana</i>	3
Tg	Tall Oregon grape	<i>Mahonia aquifolium</i>	6
nz	New Zealand sedge	<i>Carex testacea</i>	14
sr	Spreading rush	<i>Juncus patens</i>	6
th	Tufted hairgrass	<i>Deschampsia caespitosa</i>	8
yr	Yarrow	<i>Achillea millefolium</i>	12





# GardenSmart Oregon

a guide to  
non-invasive  
plants



**S**tem-  
**W**ater  
**A**ssessment &  
**M**anagement decision-support  
**P**rocess

*An on-line tool for assisting planning departments, public works departments and real estate professionals*



# SWAMPs: On-line tools

The screenshot displays the SWAMPs Watershed Tools software interface. The main window is titled "SWAMPs Watershed Tools" and contains a map of a watershed area. The map is color-coded according to the "Swale application" legend, which is located in the bottom-left corner of the map area. The legend includes five categories: "Wet or dry" (dark green), "Wet or dry with drain" (light green), "Wet or dry with checkdams" (yellow), "Wet or dry with underdrain and checkdams" (orange), and "None" (white). The map shows a network of swales and drainage paths across a terrain. To the left of the map, there are five instructional text boxes. The top window title bar reads "SWAMPs Tools" and includes a "Main Menu" dropdown and various navigation icons. The bottom window title bar reads "SWAMPs Watershed Tools".

Use the drop down arrow and select a county. The map will redraw and focus on the county you select.

After selecting a county, you'll need to choose a location on the map from which to base your drainage area. Use the create point tool for this.

Choose this button to create the drainage area. Please be patient as the processing may take a few moments.

Choose this button to get drainage area. The layer you want should be moved to the top of the map list.

Choose this button to add land cover and maximum rainfall data to your drainage area.

**Swale application**

- Wet or dry
- Wet or dry with drain
- Wet or dry with checkdams
- Wet or dry with underdrain and checkdams
- None

# SWAMPS interface

The screenshot displays the SWAMPS interface within a Mozilla Firefox browser window. The browser's address bar shows the URL <http://meridian.forestry.oregonstate.edu/swamp%20rogu%20basin/>. The page title is "SWAMP Rogue Basin".

The interface includes a navigation bar with the following links: "SWAMP information and tools", "Runoff reduction calculator", and "Help". Below this, there are four main action buttons: "Create Plot Statistics from Polygon", "Create Watershed Statistics from Point", "Create Watershed Statistics from Polygon", and "Create Map".

The main content area is divided into two sections:

- Results:** Contains a "Clear All" link, a checked item "Create Plot Statistics from Polygon" with a "Download" link for "ws\_output.txt", and a "Check Task Results" link.
- Map Contents:** A list of map layers with checkboxes:
  - SWAMP\_Rogue\_Basemap
    - Rivers
    - Highways
    - Rogue boundary
    - City limits
    - Urban growth boundary
    - 2005 aerial photography
    - Watersheds (6th field HUC)
    - Contours 40 ft
    - Soil water infiltration (ksat in)
    - Landcover
    - Hydrologic soil group
    - Elevation (ft)
    - 24-hr 6-month precipitation (in)
    - 24-hr 2-year precipitation (in)
    - 24-hr 10-year precipitation (in)
    - 24-hr 25-year precipitation (in)
    - 24-hr 50-year precipitation (in)
    - Vegetated basins and swales
    - SWAMP boundary
    - County borders
    - Oregon boundary

The map itself shows an aerial view of a residential and commercial area. A cyan-colored polygon is overlaid on a portion of the map, representing a selected area for analysis. Various colored lines (red, blue, green) delineate different boundaries and features as defined in the Map Contents list.

At the bottom of the browser window, a status bar indicates "Transferring data from meridian.forestry.oregonstate.edu..."



# Runoff Reduction Calculator

Step 1: Upload **cover** data

Step 2: Modify surfaces  
& calculate runoff

Step 3: Choose **practices**  
to treat runoff

**Stormwater Runoff Reduction Tool**

Upload File  Browse...

Reset to Uploaded Table | Clear Modified Table | Clear Reduction Table | Clear Tables

Add Row To Modifiable Table

Available runoff to treat:  
0

Enter target runoff amount to treat:

Submit Runoff

---

**Runoff Reduction Table**

Define runoff reduction practices to apply to the modified table land covers:

Land Information:	Reduction Practice:	Results of Practice:
		Total Runoff (Cubic Ft): 0
		Target Runoff (Cubic Ft): 0
		Runoff left to Treat (Cubic Ft): 0
		Add Row To Reduction Table

---

Done

Curve Number:  
0

	Total Area (Sq Ft):	Total Acreage (Ac):	Highest Rainfall (Ac):	Total Runoff (Cubic Ft):
Modified Totals:	0	0	0	0
Uploaded Totals:	0	0	0	0
Differences:	0	0	0	0

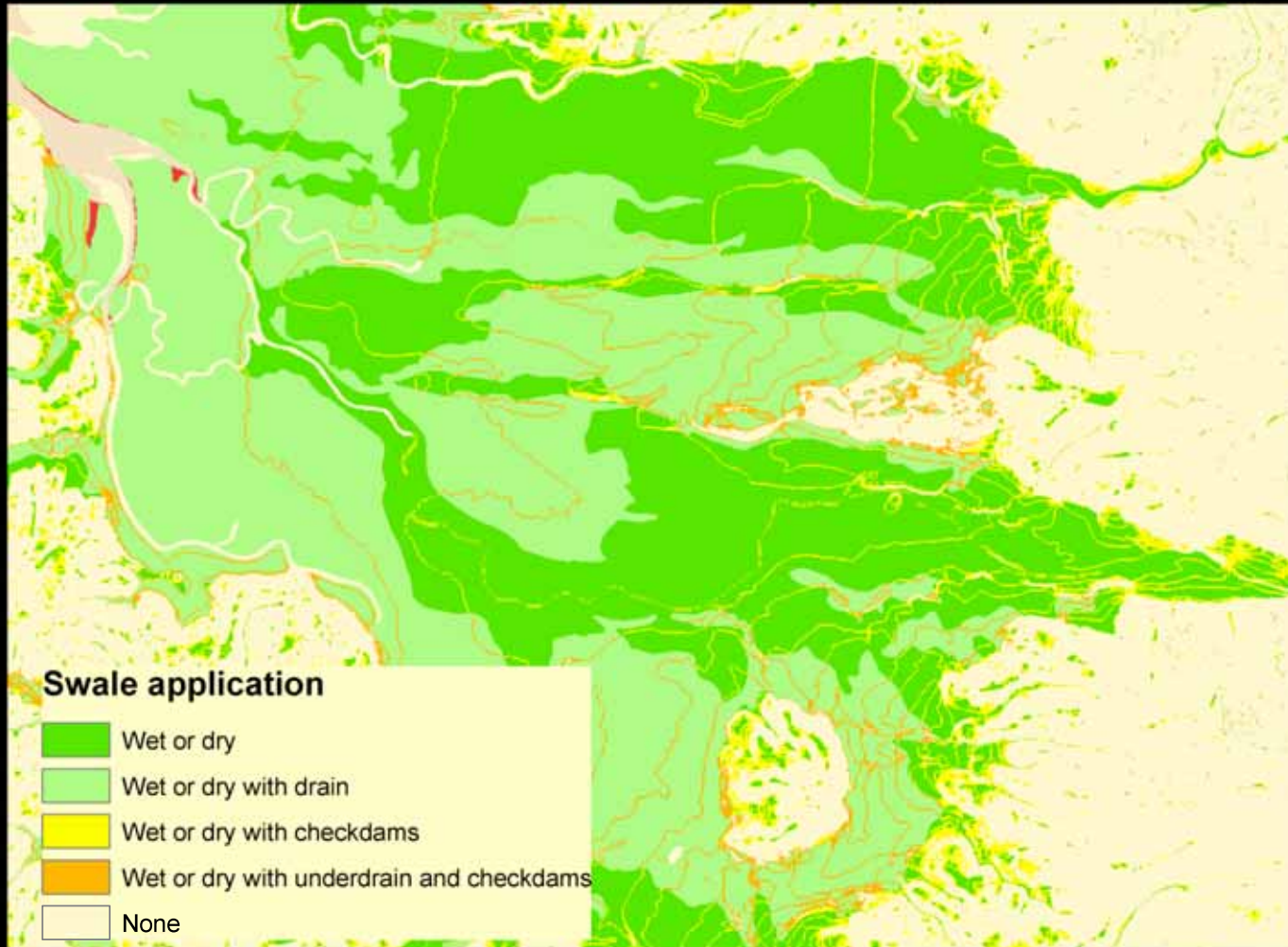
Add Row To Modifiable Table

Available runoff to treat:  
0

Enter target runoff amount to treat:

Done

# LID Suitability Maps



# Vegetated Infiltration LID Calculator

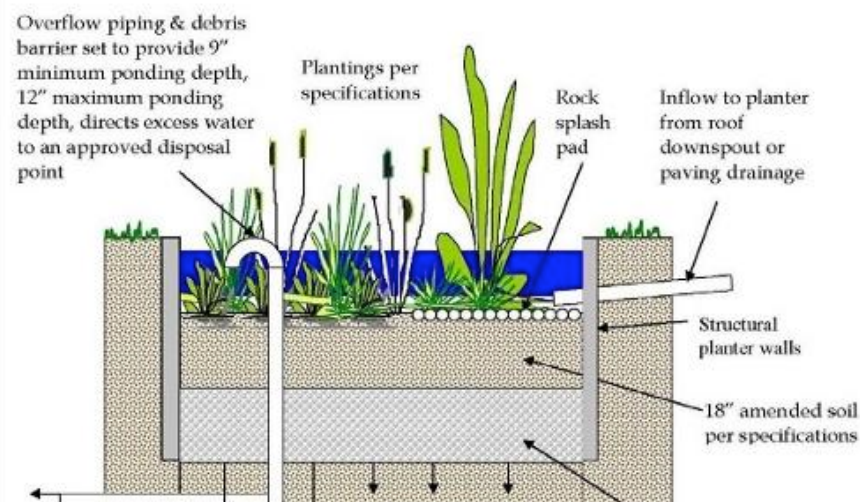
1. Choose basin, planter or swale
2. Enter rainfall amount
3. Enter impervious surface and runoff coefficient
4. Enter soil infiltration rate
5. Choose target size or ponding depth
6. Gravel underlayer?
7. Calculate

**Vegetated Basin**



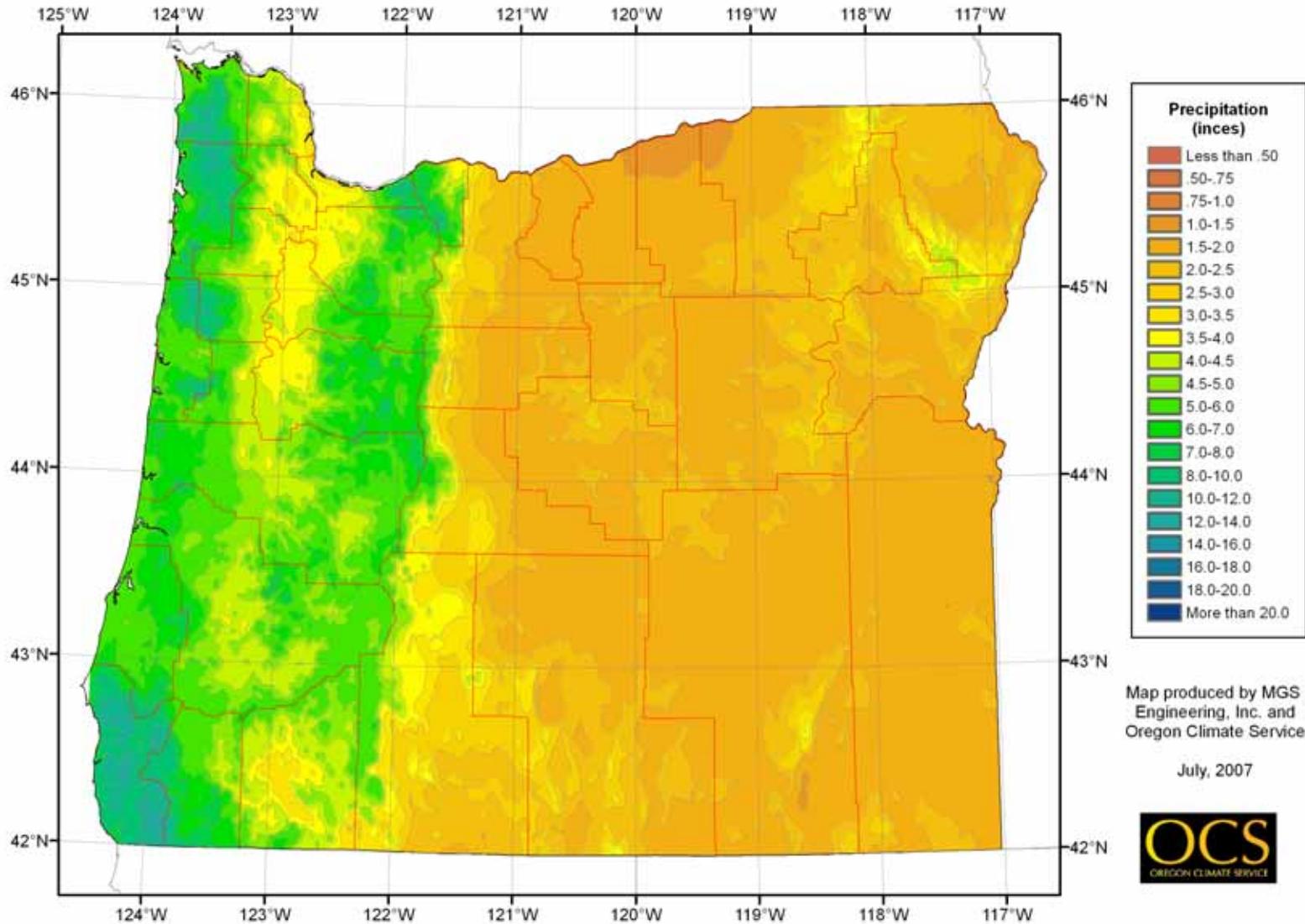
Graphic: East Multnomah Soil and Water Conservation District

**Stormwater Planter**



# Precipitation Maps

## 24-hour 25-year Precipitation, Oregon



# Plants for stormwater facilities

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Common name	Latin name	OR Native	Light	Wtld Stat	Water Needs	Height	Width	E/D	Blooms	Growth Period	Descrip	Valley	Coast	Central/E OR	SW OR	Growth Rate	Life Span	Resprt Ability
1	Vine maple	<i>Acer circinatum</i>	Y	FS/PS/SH	FAC-	uplands, underwater during floods	20'	15-20'	D	Spr	Spr/Sum	Tree/ Shrub/Vine	X	X		X	Mod	short	Yes
2	Paperbark maple	<i>Acer griseum</i>	N	FS/PS/Sh		Zone B of PSMM: Moist to Mesic?	30'		D			Tree	X						
3	Yarrow	<i>Achillea millefolium</i>	Y	FS	FACU		0.75-3'		D	Early Sum	Spr	Perennial, Forb	X	X	X	X	Mod	Mod	No
4	Spike Bentgrass	<i>Agrostis exarata</i> Trin.	Y	FS/PS/SH	FACW	moist, seas. Wet, peren wet.	3'			Late Spr	Spr/Sum/F all	Perennial, Graminoid	X	X	X	X	Mod	Mod	No
5	Narrowleaf water plantain	<i>Alisma gramineum</i> Lej.	Y	FS/PS	OBL	Seas -peren wet	1.5'			Mid Sum	Spr/Sum	Perennial, Forb/Herb	X		X		Mod	Shor t	No
6	European water-plantain	<i>Alisma plantago-</i>	N?Y?	Sh	OBL	Wet-sat	2-3'			Fall	Spr/Fall	Perennial, Forb/Herb					Mod	Mod	No
7	tapertip or Hooker's Onion	<i>Allium acuminatum</i> Hook.	Y	FS	None	dry	.5-1'			Sum	Spr/Sum	perennial, Forb/Herb	X		X	X	Rap	Shor t	No
8	Pacific Onion	<i>Allium validum</i> S. Watson	Y	PS	OBL					Late Spr	Sum	perennial, Forb/Herb	X	X	X	X	Mod	Shor t	No
9	Sitka Alder	<i>Alnus crispa</i> spp. <i>Sinuata</i>	Y	FS/PS	FACW		3-15'		D	Sum	Spr/Sum	Perennial Tree/Shrub	X	X	X	X	Slow	Long	Yes
10												Perenial, Graminoid							

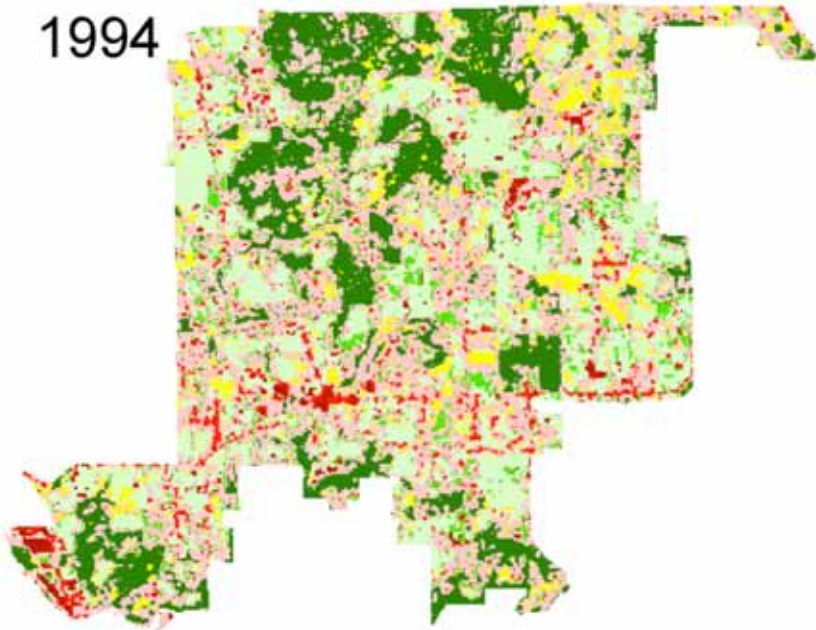


FREMO  
(AKA FORIT)

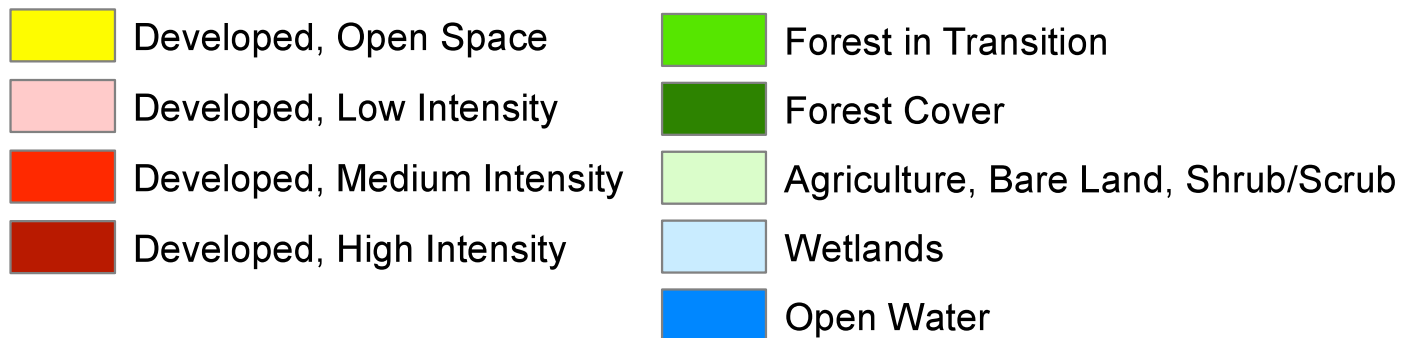
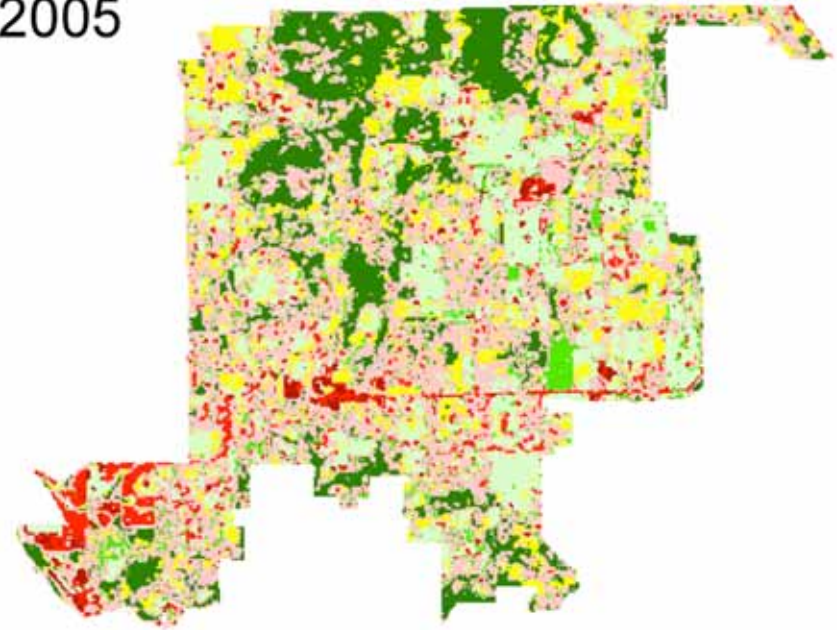


# Damascus, Portland area

1994



2005



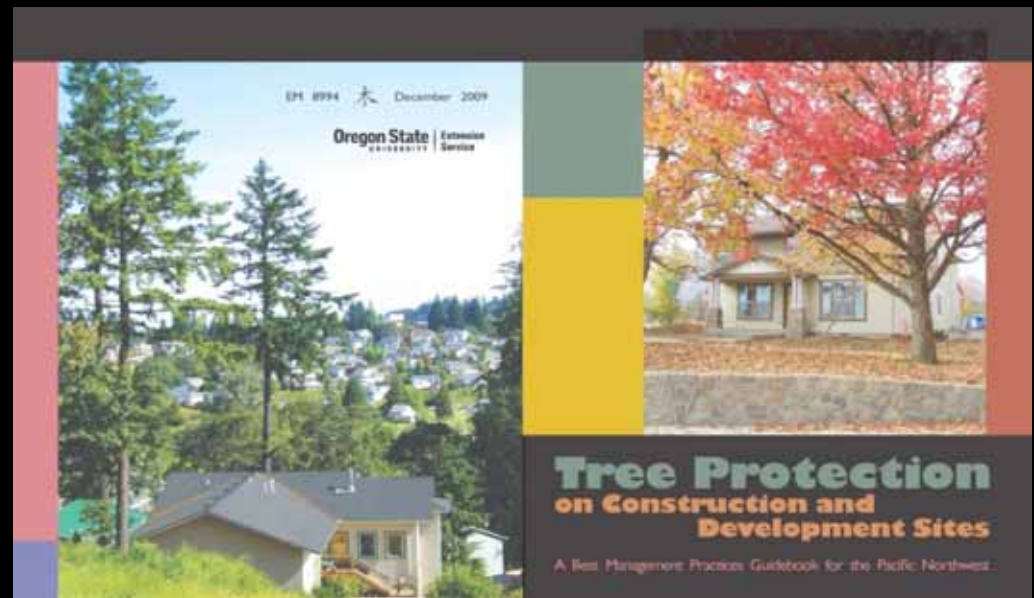
# Buildable Land with Potential to Meet Leaf-Out Goals





# Resource Materials

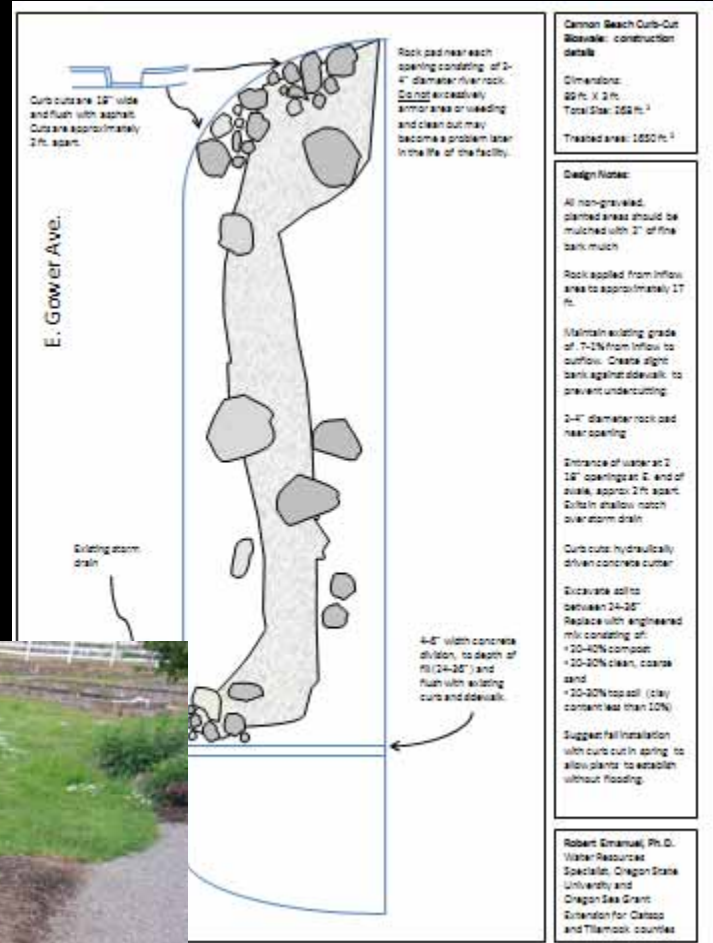
- CD Compendium of Papers, Presentations, Research Summaries
- Best Management Practices Guide for Tree Protection on Construction & Development Sites



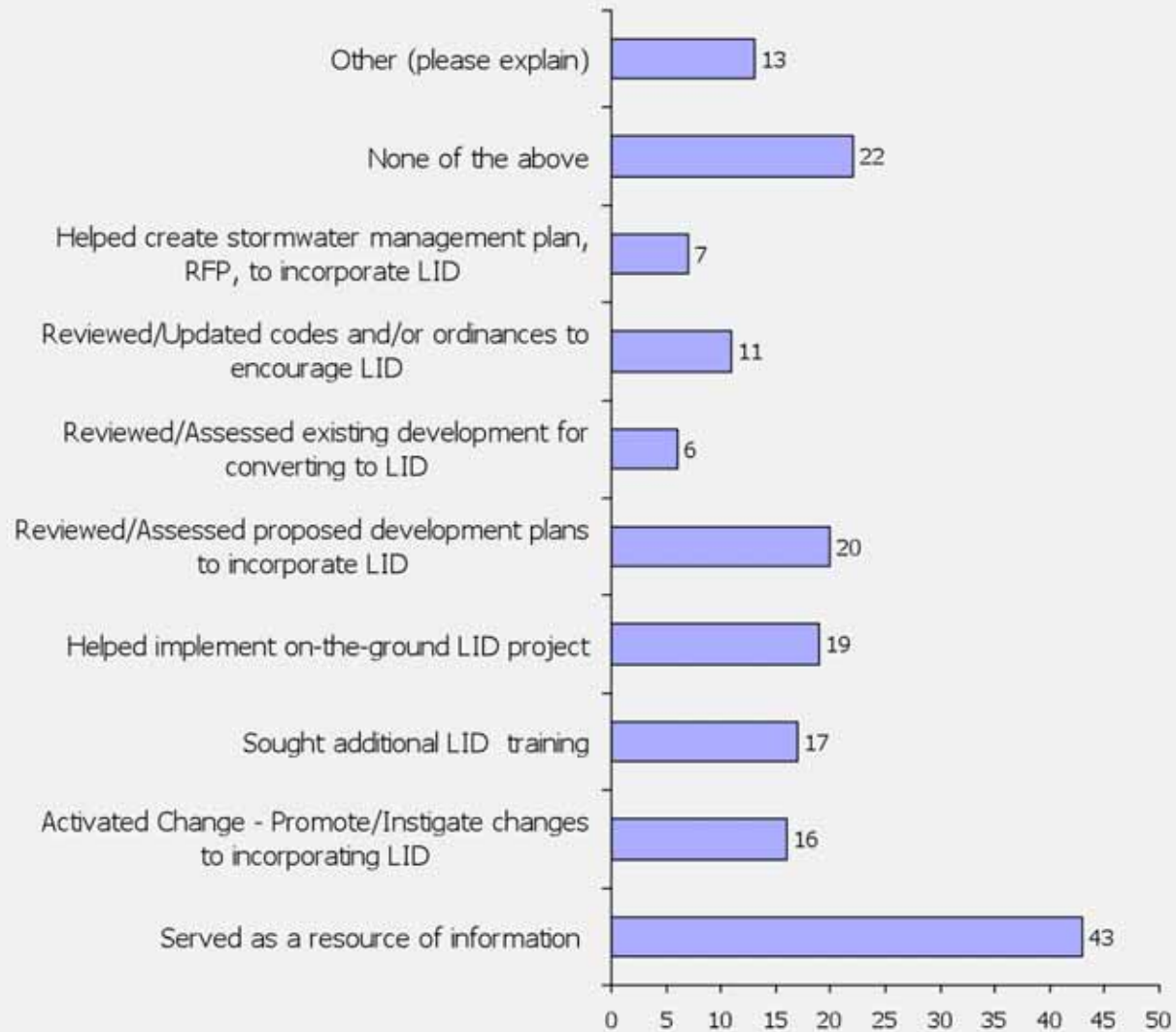
Intelligence  
gathered...



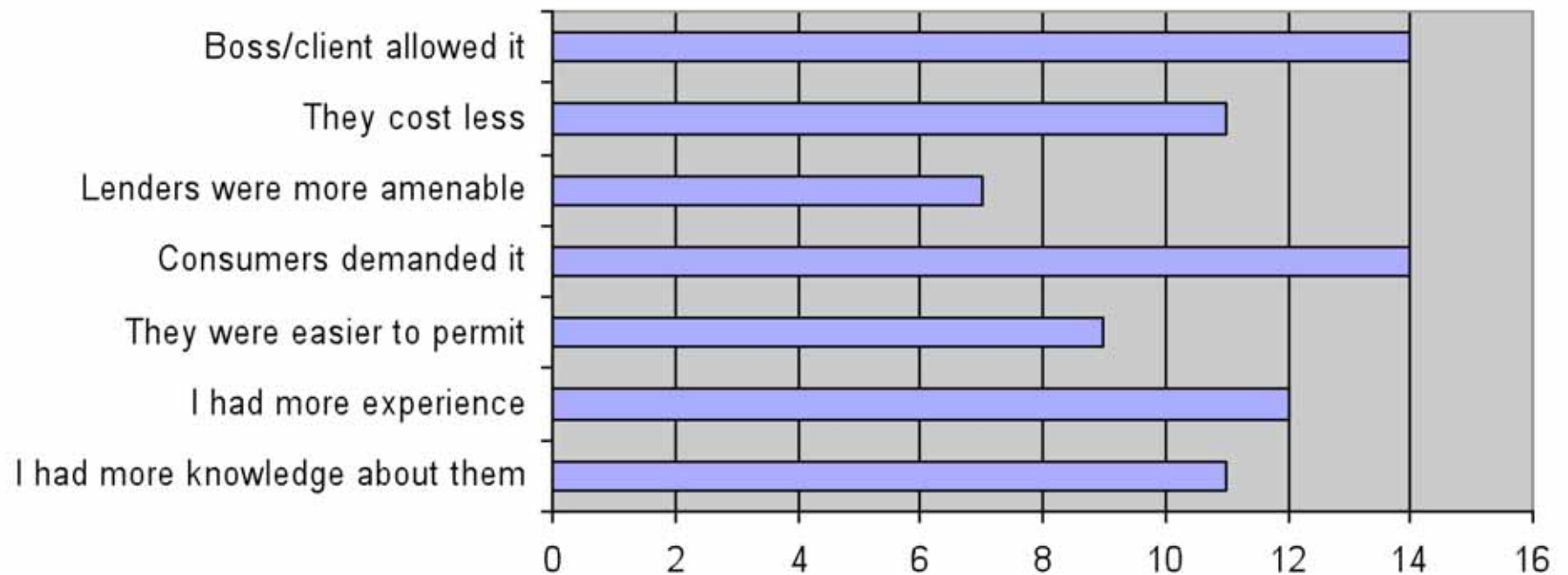




Since attending the Stormwater Solutions workshop(s), I have (choose all that apply)...



## I would use green street practices more often if...



Tips for covert mooovements in rural areas...



# Tips for the secret agent in the less regulated area

- 💧 Be persistent, not forceful.
- 💧 Find an ally.
- 💧 Be present and speak up wherever possible.
- 💧 Follow-through.



# Tips for the secret agent in the less regulated area

- 💧 Changes will cost somebody something.
- 💧 Publicly praise good work.
- 💧 Show the money.
- 💧 Think ahead.





Future Missions...



# Next Missions

- 💧 Intensive Rain Garden Train the Trainer
- 💧 LID Academy for the Willamette Valley
- 💧 Integrate FREMO concepts
- 💧 Central Oregon Stormwater Solutions
- 💧 Central & Eastern Oregon Rain Garden Guide
- 💧 Operations and Maintenance Guide
- 💧 Possible IDDE training

# Learn More

[extension.oregonstate.edu/watershed](http://extension.oregonstate.edu/watershed)

- 💧 SWAMP Project
- 💧 Urban Forestry
- 💧 Rain Gardens

[www.oconline.org/stormwater](http://www.oconline.org/stormwater)

- 💧 Stormwater Solutions workshops
- 💧 Case studies of LID projects in Oregon
- 💧 LID technical resources
- 💧 OregonStormwater listserv

[blogs.oregonstate.edu/h2onc/](http://blogs.oregonstate.edu/h2onc/)

[bit.ly/lid4or](http://bit.ly/lid4or)







So, maybe see you all in the OTHER Portland...(AKA: Beervana)



**Dr. Developer (AKA Robert M. Emanuel)**  
**Water Resources & Community Development Specialist**  
**Clatsop & Tillamook counties**  
**[robert.emanuel@oregonstate.edu](mailto:robert.emanuel@oregonstate.edu)**

**Storm Waters (AKA Derek Godwin)**  
**Watershed Management Specialist**  
**Marion and Polk Counties Staff Chair**  
**[derek.godwin@oregonstate.edu](mailto:derek.godwin@oregonstate.edu)**

