Instructional Training:

Puget Sound Rain Garden & Bioretention Facility Assessment Protocol:

Functional Assessment Form

SAM
Stormwater Action Monitoring

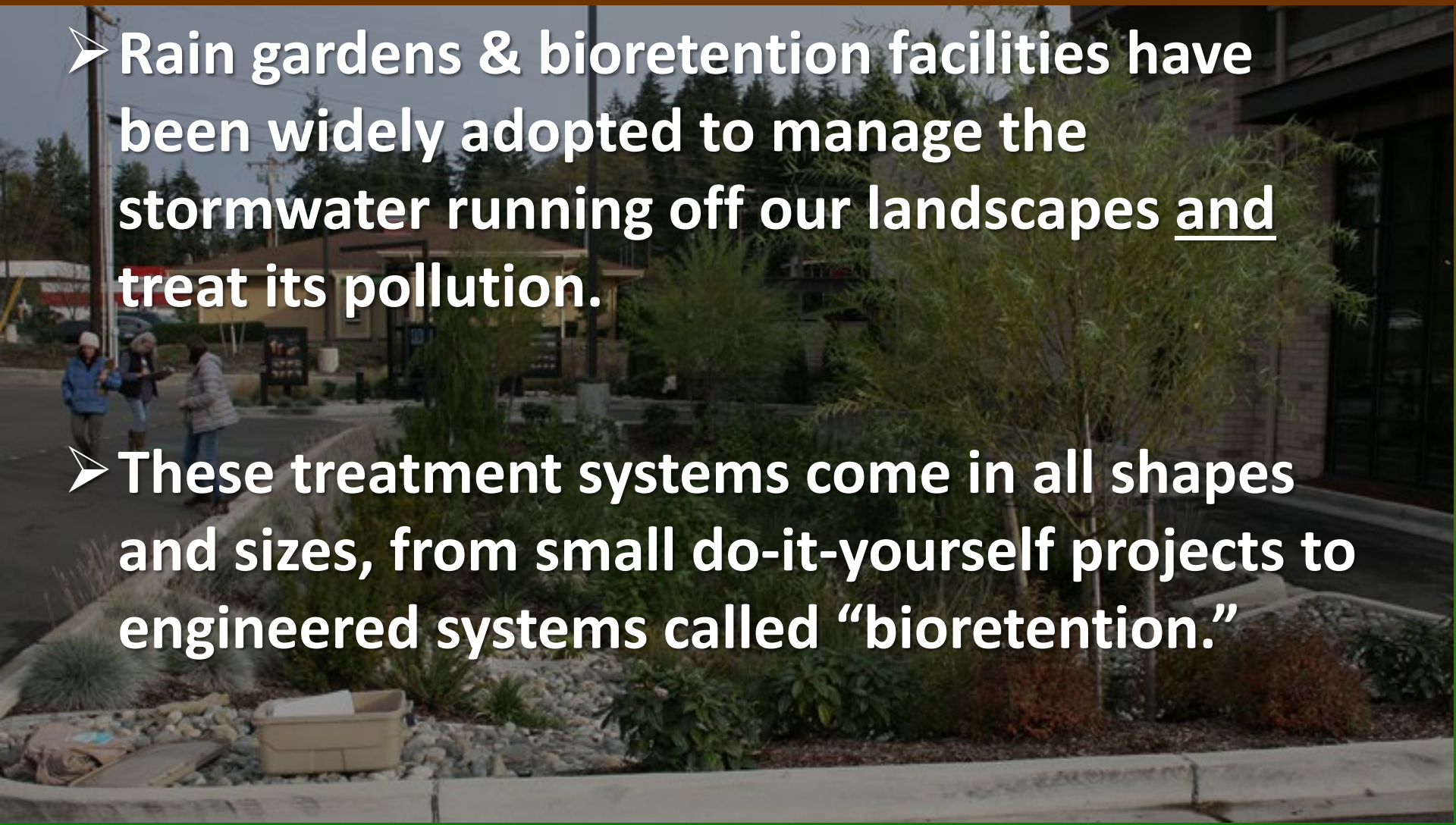
WASHINGTON STATE UNIVERSITY
EXTENSION

Stewardship Partners

Background:

Why have we created this new monitoring protocol for rain gardens & bioretention facilities?

Background: Why?



- Rain gardens & bioretention facilities have been widely adopted to manage the stormwater running off our landscapes and treat its pollution.

- These treatment systems come in all shapes and sizes, from small do-it-yourself projects to engineered systems called “bioretention.”

Background: Why?

- We want to know if individual rain gardens or bioretention facilities are working.

- Using a uniform, replicable method for assessment allows us to identify — and track over time — factors that can predict more functional success of current and future rain gardens.

“Rain Garden” vs. “Bioretention”

- Washington State Department of Ecology has created specific definitions for these two terms.
- They share the same goals: Safe *management* of the quantity of stormwater running off and effective *treatment* of the pollutants to improve water quality.
- Typically, “bioretention” applies to facilities that have been permitted and engineered.

“Rain Garden” vs. “Bioretention”

- Non-engineered.
- Compost-amended soils, but guidelines only: no required specifications.
- Removes pollutants, but not quantifiable.

Both manage & treat stormwater via adapted plants & compost-amended soil mix.

- Engineered system.
- Specified soil mix required so engineers know how long stormwater will be in system.
- Pollutant-removal can be quantified based on soil characteristics.

Getting Started

- Review supplies in monitoring kit.
- Learn to use any new equipment.
- Safety first! Use provided reflective vest & other safety equipment.
- Be sure you have everything you need, including site-specific plans/instructions, before heading to your monitoring site.
- Ensure property-owner permission prior to any site visits.

Assessment Form: Getting Started

Why Team Names & Contacts?

Might need for follow-up questions or clarifications – record **all** team members!

Bioretention and Rain Garden Assessment Program
Functional Assessment Form
FINAL

Team Names:	Cell # or email:
1. Cam Rainyday	360-555-1234
2. Sammy Gardener	206-555-1234
3. Chris Waterlover	425-555-1234
4. Jessie Greenerstorms	206-555-4321

Assessment Form: Getting Started

Note: Every page (at the bottom) requires that person recording data on that particular page is documented!

- **Rotate/share this responsibility as appropriate.**

Page Recorder Name: Chris Waterlover 3

- **If more than one person completes any given page, document all data recorders.**

Page Recorder Name: SAMMY Gardener, CAM Rainyday 4

Section I: Background

Fill out as much as possible in advance:

1. **“Site name” must be** name agreed upon with program coordinator.

Do not make up alternative name, which will lead to future confusion when processing data.

I. BACKGROUND INFORMATION: *Please fill out all information, or circle all the options that apply*

Site Name	Fairview neighborhood right-of-way bioretention facility

Section I: Background, cont.

2. Date & Time of Day:

Important to note because of:

- Season variations
- Weather records
- Length of time required to monitor

I. BACKGROUND INFORMATION: *Please fill out all information, or circle all the options that apply*

Site Name	Fairview neighborhood right-of-way bioretention facility	
Survey Date	March 30, 2021	**Start time:** 8:45 **AM** **PM**

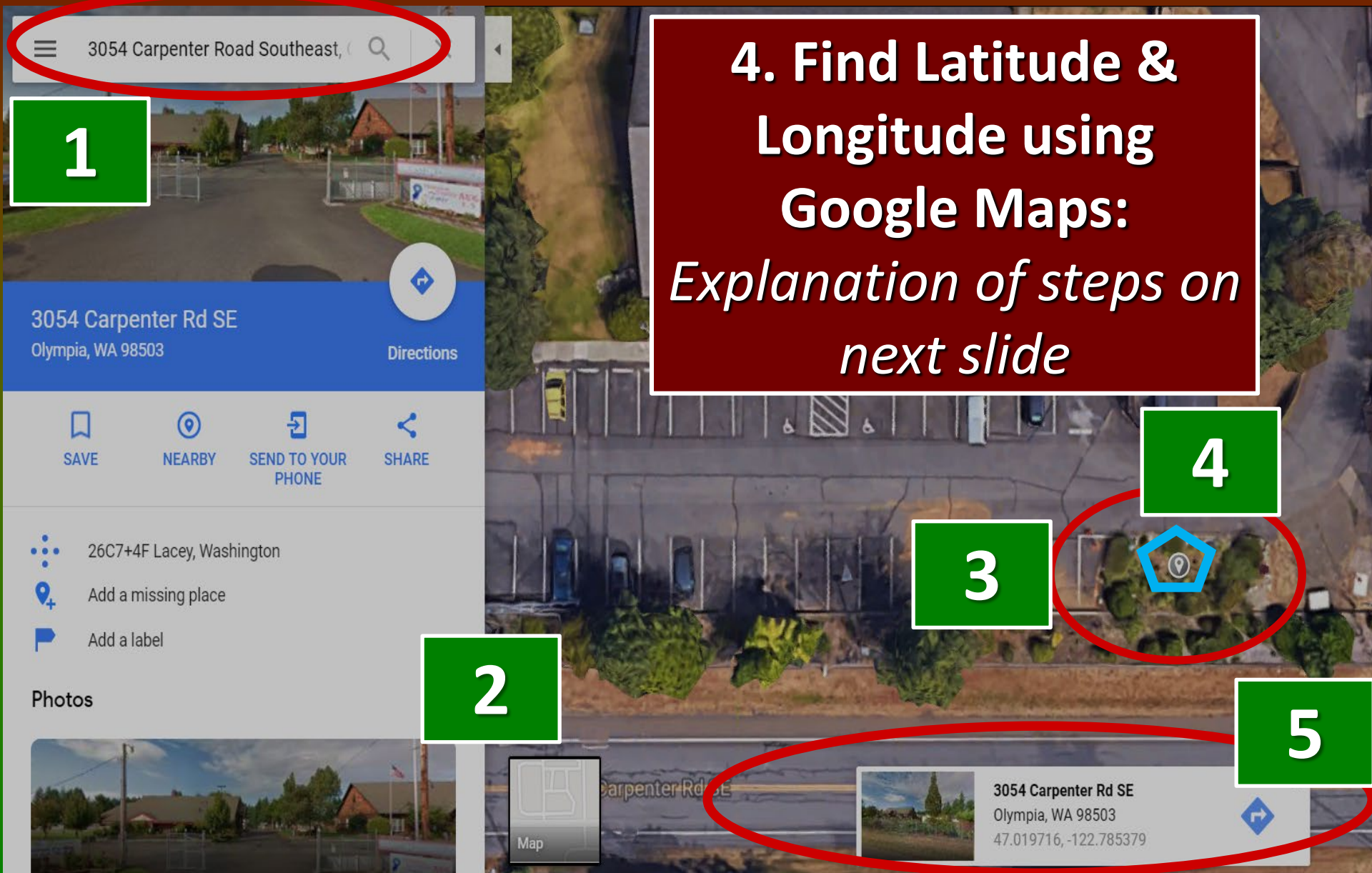
Section I: Background, cont.

3. <u>Complete address</u>: Record actual address or intersection information – even if same as "site name"

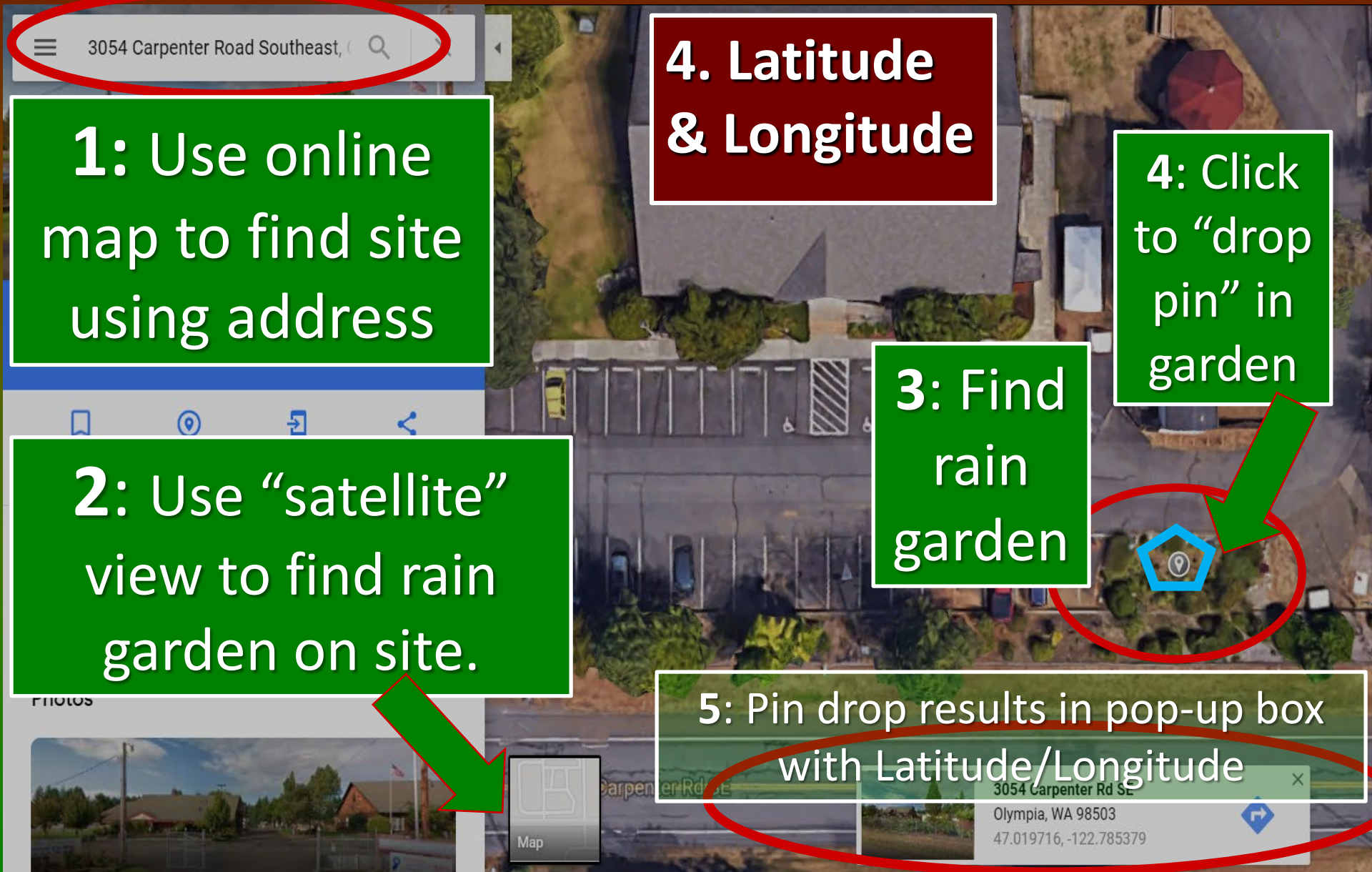
I. BACKGROUND INFORMATION: *Please fill out all information, or circle all the options that apply*

Site Name	Fairview neighborhood right-of-way bioretention facility		
Survey Date	March 30, 2021		**Start time:** 8:45 **AM** **PM**
Address	**Street Address**	**City**	**County**
	39th Avenue West & Elm St. South	New Forestland	King

Section I: Background, cont.

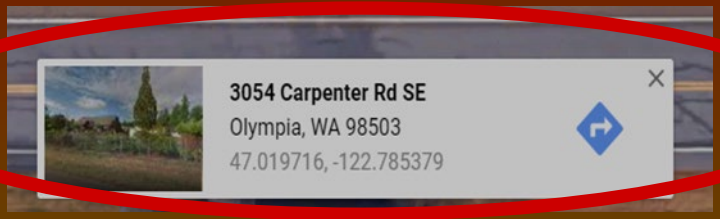


Section I: Background, cont.



Section I: Background, cont.

Record Latitude & Longitude from Google Map Search



- 1st # shown will be ***latitude***, referring to how many degrees north of the equator the site is. In W. WA, it will range from 45 degrees N near the Oregon border up to almost 49 degrees N at the Canadian border.
- 2nd # shown will be ***longitude***, referring to how many degrees west of the Prime Meridian the site is. In W. WA, it will range from 124 degrees N near the Pacific coast to 121 near the Cascade foothills. (Note: Numbers *west* of the Prime Meridian are recorded as negative.)

Location	Lat: 47.019716	Long: -122.785379	Sound Impacts ID:

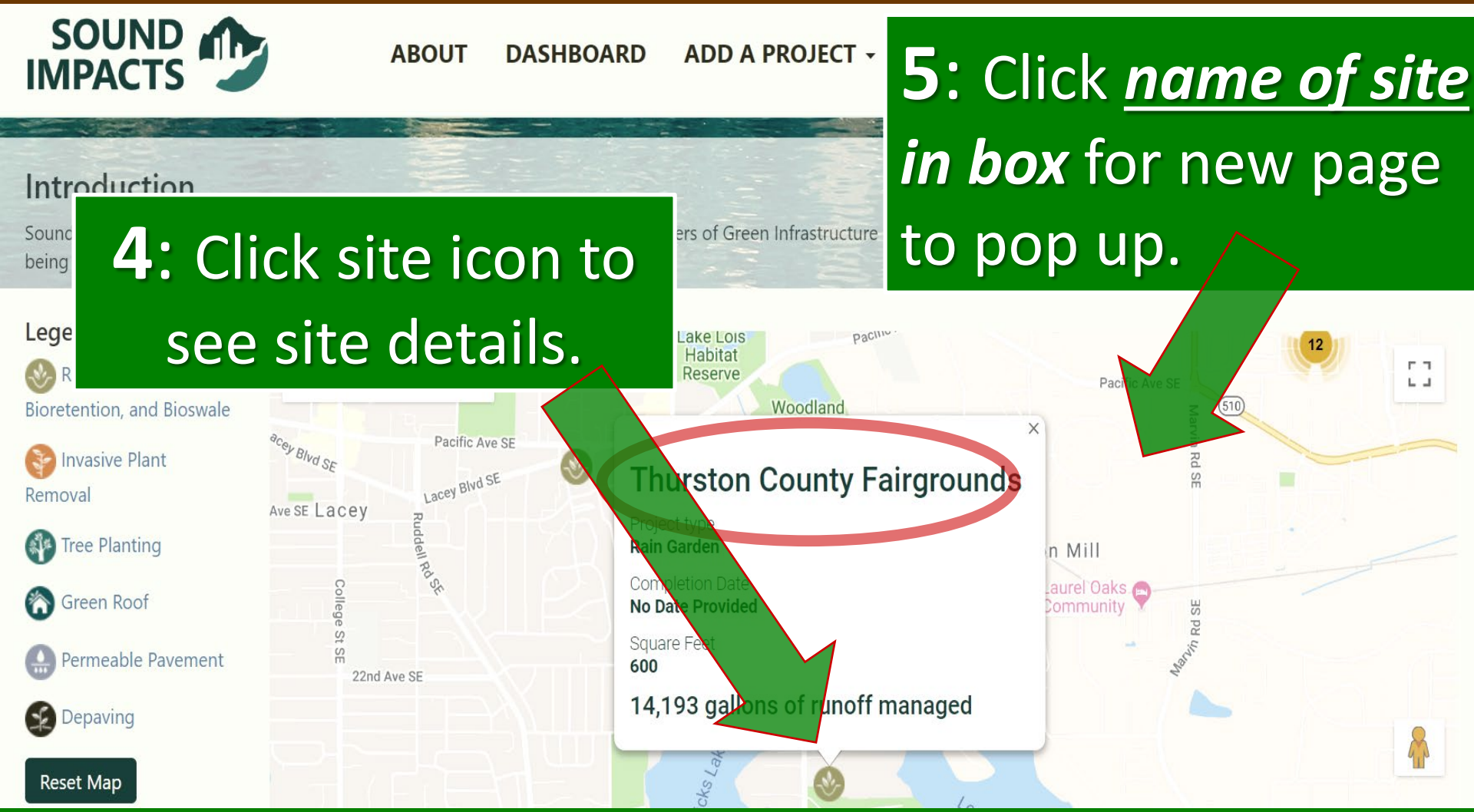
Section I: Background, cont.

5. Sound Impacts ID: Find Unique Identifier

Follow steps shown over next few slides:

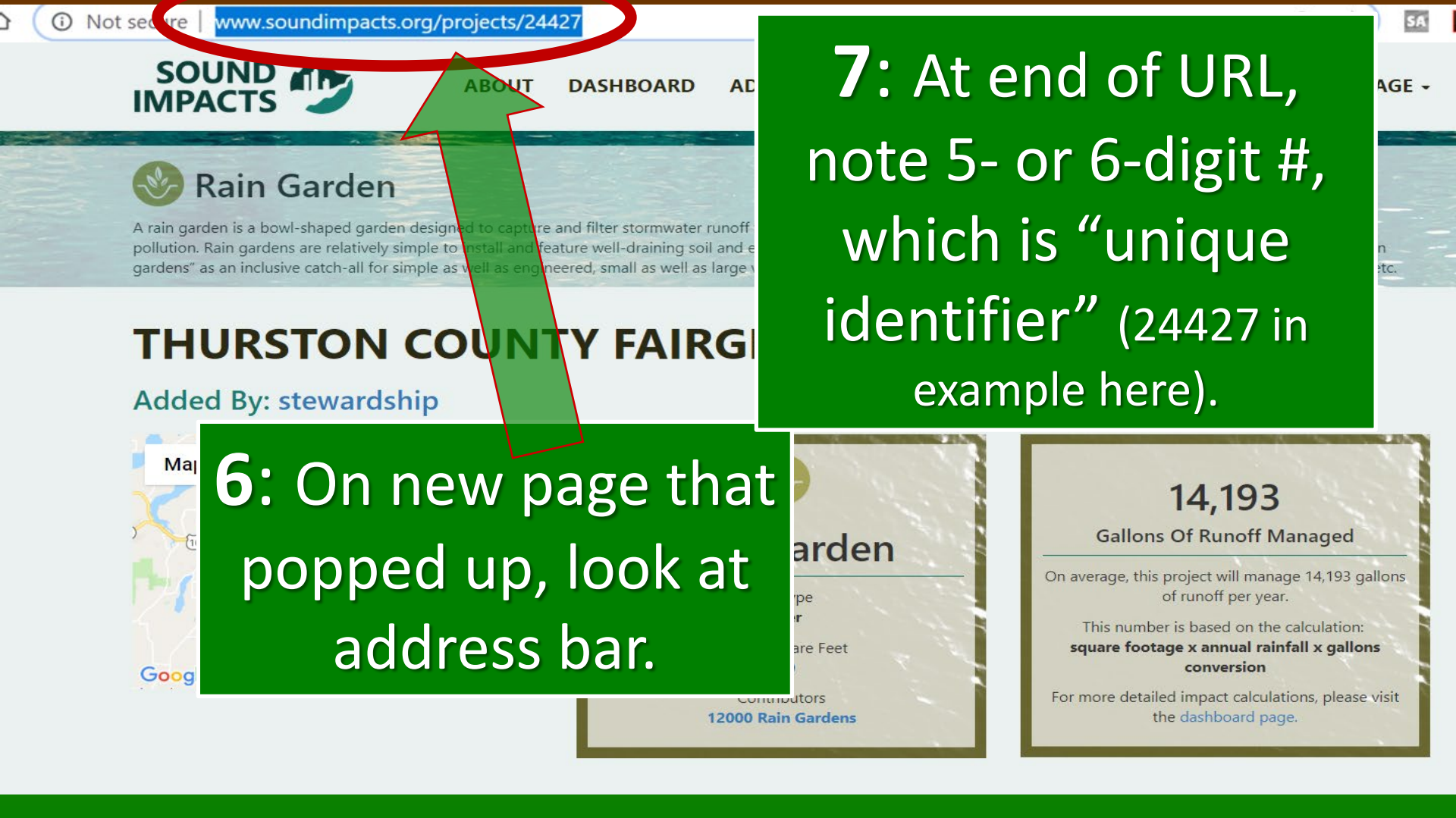
Section I: Background, cont.

5. Sound Impacts ID: Find Unique Identifier, cont.



Section I: Background, cont.

5. Sound Impacts ID: Find Unique Identifier, cont.

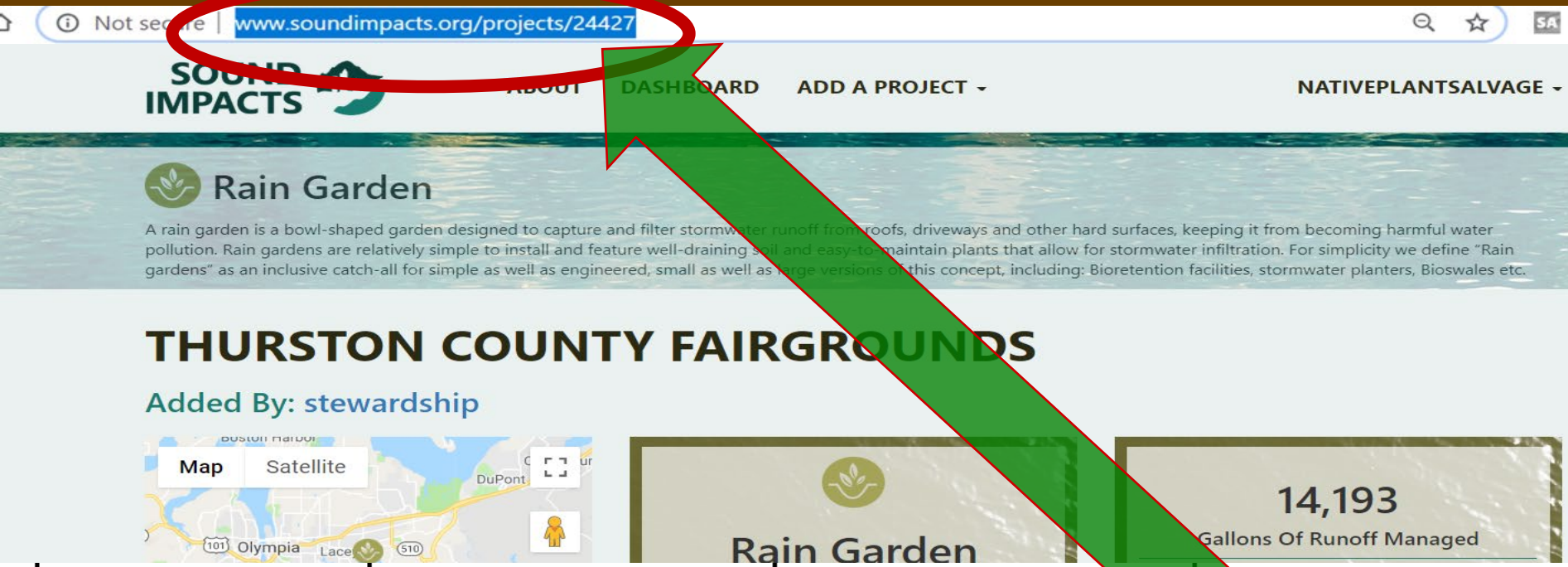


7: At end of URL, note 5- or 6-digit #, which is "unique identifier" (24427 in example here).

6: On new page that popped up, look at address bar.

Section I: Background, cont.

5. <u>Sound Impacts ID</u>: Record "Unique Identifier" number from URL in final pop-up.



Location	Lat: 47.019716	Long: -122.785379	Sound Impacts ID: 24427

Section I: Background, cont.

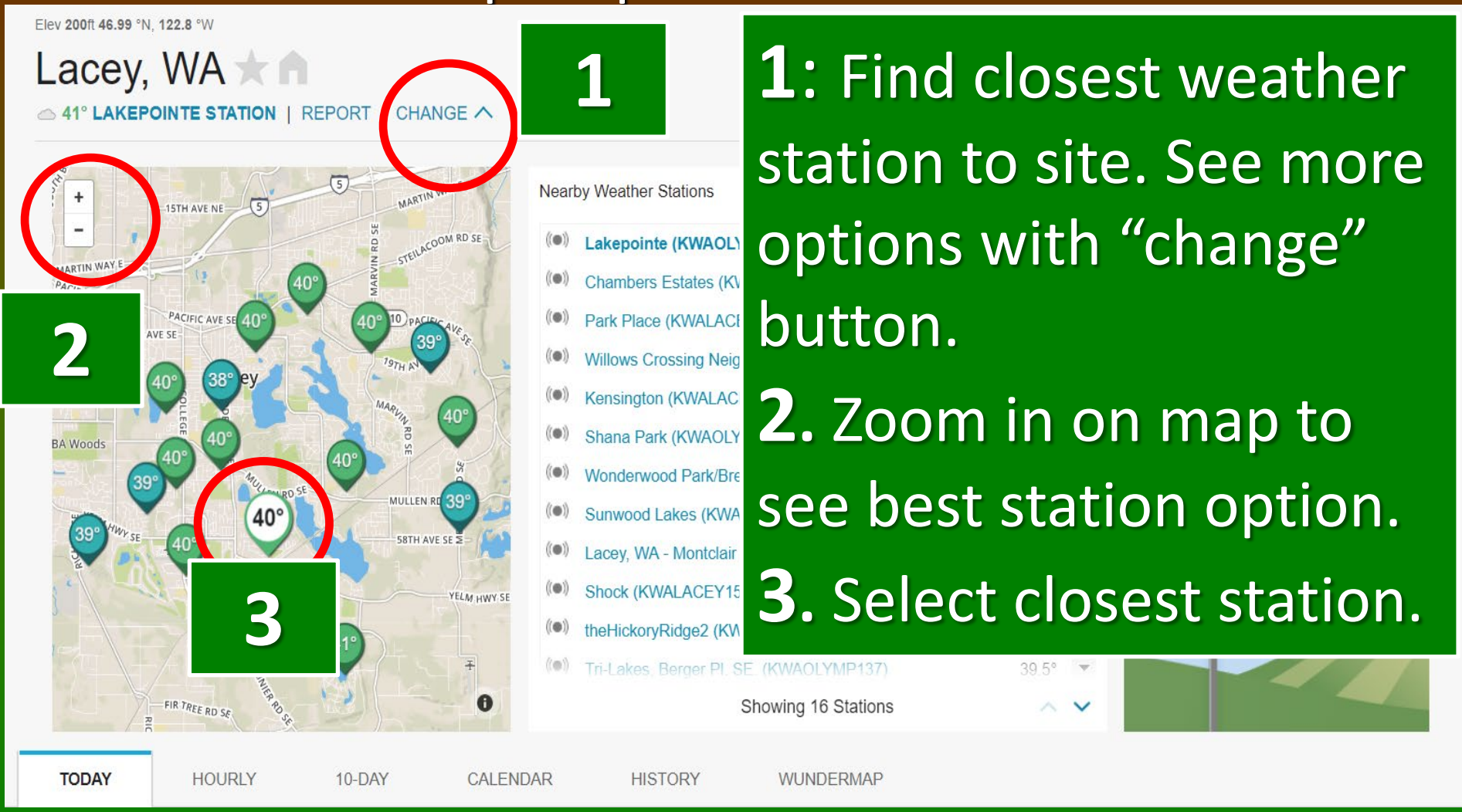
6. Rainfall records: Upon return, or in advance, use "wunderground.com" website to note *actual* precipitation for 3 days.

Note day of monitoring *only prior* to completion of monitoring.

Rain Fall (from wunderground.com)	Today: 0.0 inches	Yesterday: 0.25 inches	Two Days Ago: 0.40 inches

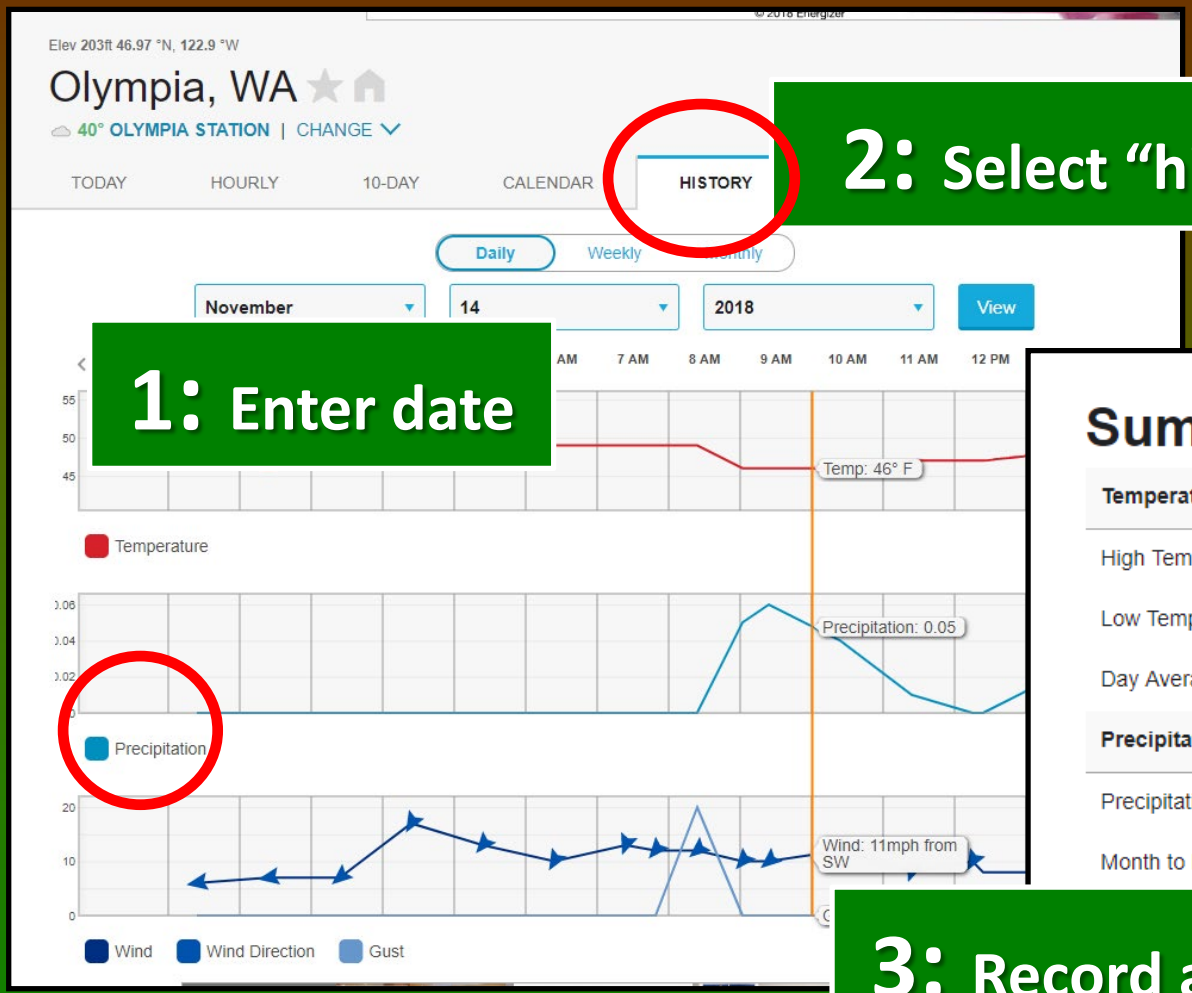
Section I: Background, cont.

6. **<u>Rainfall records</u>:** Follow steps below to get most accurate precipitation data.



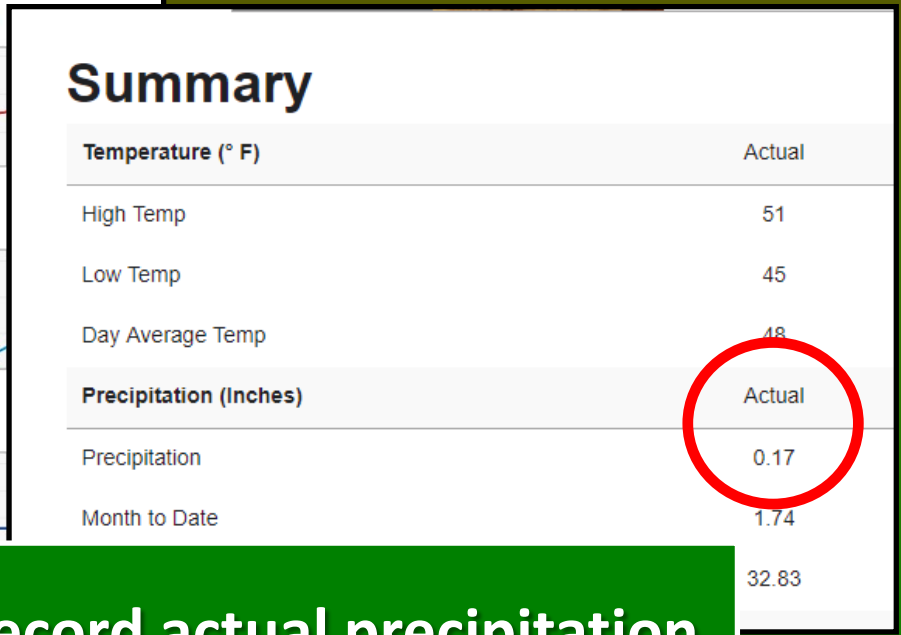
Section I: Background, cont.

6. **Rainfall records:** Record data for previous 2 days.



1: Enter date

2: Select "history" tab



Summary

Temperature (° F)	Actual
High Temp	51
Low Temp	45
Day Average Temp	48
Precipitation (Inches)	**Actual**
Precipitation	0.17
Month to Date	1.74
	32.83

3: Record actual precipitation

Section I: Background, cont.

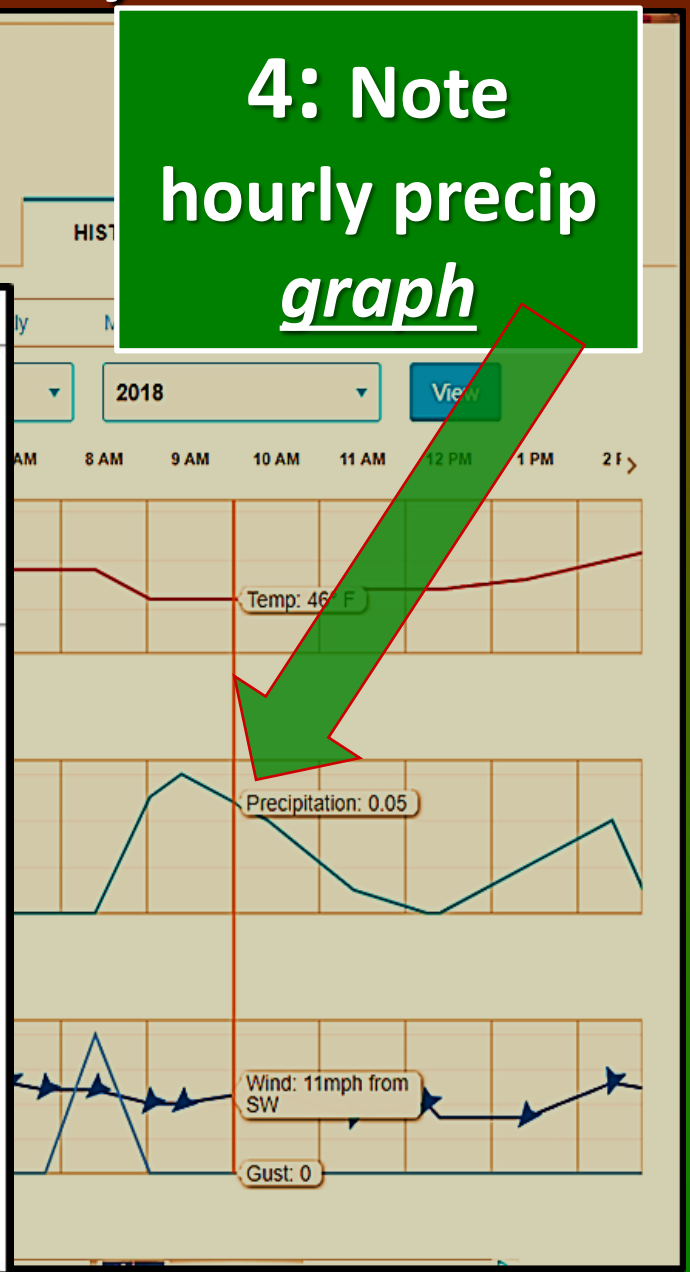
6. <u>Rainfall records</u>: Record data for <u>assessment day</u>, *prior to & during assessment, only.*

4: Note hourly precip *<u>graph</u>*

5: Note hourly precip *<u>chart</u>*

Daily Observations

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum	Condition
12:54 AM	47 °F	34 °F	61 %	W	6 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
1:54 AM	46 °F	34 °F	63 %	W	7 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
2:54 AM	47 °F	34 °F	61 %	SW	7 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
3:54 AM	50 °F	34 °F	54 %	SSW	17 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
4:54 AM	49 °F						30.1 in	0.0 in	0.0 in	Cloudy
5:54 AM	49 °F						30.1 in	0.0 in	0.0 in	Cloudy
6:54 AM	49 °F						30.0 in	0.0 in	0.0 in	Cloudy
7:19 AM	49 °F						30.1 in	0.0 in	0.0 in	Light Rain
7:54 AM	49 °F						30.1 in	0.0 in	0.0 in	Haze
8:32 AM	48 °F						30.1 in	0.1 in	0.0 in	Light Rain
8:54 AM	48 °F						30.1 in	0.1 in	0.0 in	Light Rain
9:54 AM	48 °F						30.1 in	0.0 in	0.0 in	Light Rain
10:54 AM	47 °F						30.1 in	0.0 in	0.0 in	Light Rain
11:45 AM	47 °F						30.1 in	0.0 in	0.0 in	Cloudy
11:54 AM	47 °F						30.1 in	0.0 in	0.0 in	Cloudy
12:54 PM	48 °F						30.1 in	0.0 in	0.0 in	Light Rain
1:54 PM	50 °F						30.1 in	0.0 in	0.0 in	Mostly Cloudy
2:23 PM	51 °F						30.1 in	0.0 in	0.0 in	Mostly Cloudy
2:54 PM	50 °F	46 °F	86 %	VAR	5 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
3:54 PM	49 °F	47 °F	93 %	WSW	8 mph	0 mph	30.1 in	0.0 in	0.0 in	Partly Cloudy
4:54 PM	48 °F	46 °F	93 %	SW	9 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
5:54 PM	47 °F	45 °F	93 %	SW	6 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
6:09 PM	47 °F	45 °F	93 %	SSW	7 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
6:35 PM	46 °F	45 °F	96 %	S	7 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
6:54 PM	46 °F	45 °F	96 %	SSW	7 mph	0 mph	30.1 in	0.0 in	0.0 in	Cloudy
7:45 PM	46 °F	44 °F	93 %	S	10 mph	0 mph	30.1 in	0.0 in	0.0 in	Partly Cloudy
7:54 PM	46 °F	44 °F	93 %	S	8 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
8:22 PM	47 °F	44 °F	90 %	SSW	9 mph	0 mph	30.1 in	0.0 in	0.0 in	Mostly Cloudy
8:54 PM	47 °F	45 °F	93 %	SW	5 mph	0 mph	30.2 in	0.0 in	0.0 in	Cloudy
9:54 PM	47 °F	45 °F	93 %	WSW	3 mph	0 mph	30.2 in	0.0 in	0.0 in	Cloudy
10:46 PM	47 °F	45 °F	93 %	W	7 mph	0 mph	30.2 in	0.0 in	0.0 in	Cloudy
10:54 PM	46 °F	44 °F	93 %	W	7 mph	0 mph	30.2 in	0.0 in	0.0 in	Cloudy
11:54 PM	45 °F	43 °F	93 %	WSW	7 mph	0 mph	30.2 in	0.0 in	0.0 in	Cloudy



II. Site Overview

Rain garden or bioretention or unknown?

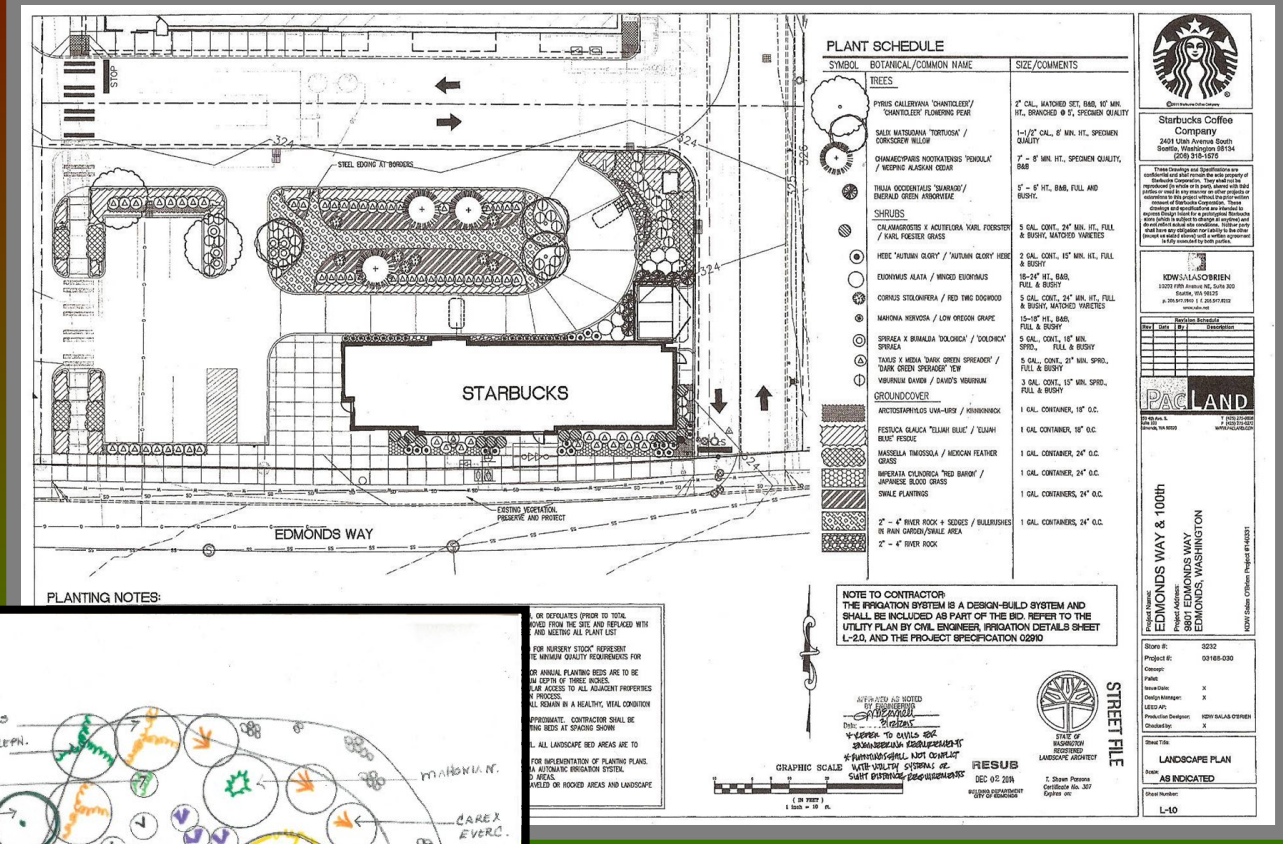
- **Bioretention** typically required by permit
- **Bioretention** likely has an official plan as part of stormwater permit
- **Bioretention** might have Professional Engineer's Stamp on plan

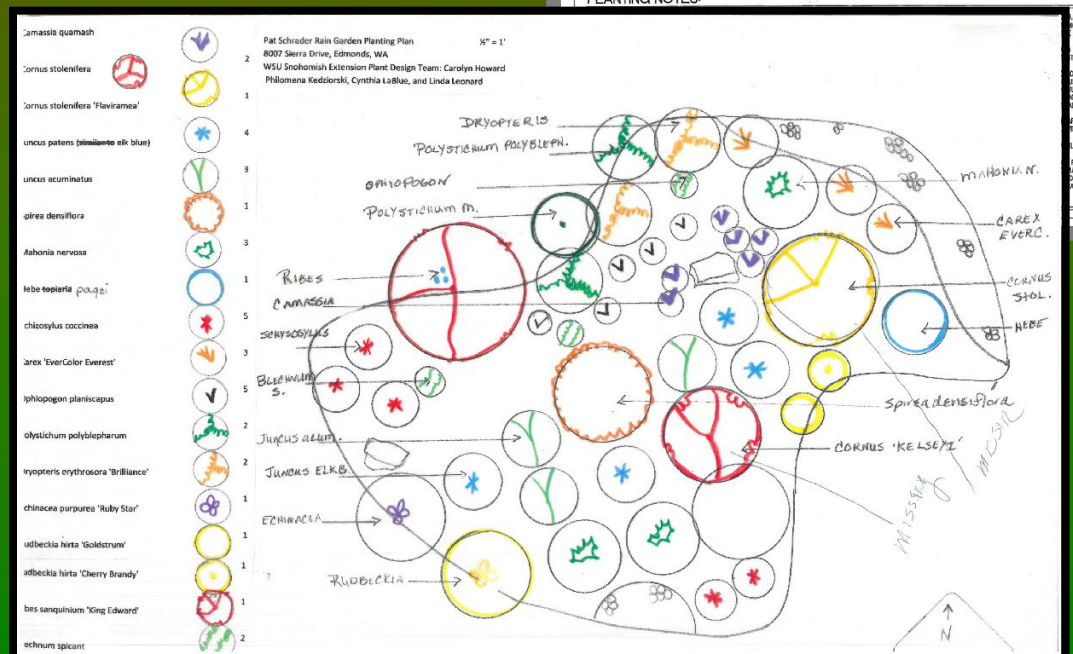
II. SITE OVERVIEW:

Type of Site (check one)	Rain Garden	Bioretention ✓	Unknown		
Age of Site (circle one)	<1 year	1 - 3 yr	3 - 5 yr	>5 years	unknown
Source of 'Age' (Check One)	Verifiable Source: ✓ Describe: Plans provided		Estimate ____ Describe:		

Professional Plan vs. DIY Plan

Professional engineer's plan: Bioretention





Homeowners' DIY plan: Rain Garden

II. Site Overview

Rain garden or bioretention or unknown? (Continued)

Bioretention usually found in:

- Rights-of-way, especially multiple addresses
- Recent/new construction (large)
- **NOT** "DIY" (typically)
- Commercial sites

Practice with Examples on Next Slides!

Bioretention or Rain Garden or Unknown?

- Jurisdictional right-of-way facility
- Lines whole street, not just one address
- Almost certainly "Bioretention," designed and installed under direction of local governmental stormwater program

Bioretention or Rain Garden or Unknown?

- Right-of-way facility
- Commercial location
- Retrofit, **not** new construction (buildings older than facility)
- Likely **not** installed as part of permit requirement
- Boulders as border suggest **not** part of engineered project, which would likely use bollards or concrete edging
- **Likely "Rain Garden"**

Bioretention or Rain Garden or Unknown?

- Right-of-way, but just one address
- Professionally designed/installed
- Residential, not commercial
- Likely “Rain Garden,” but “Unknown” could apply without further investigation or plans

II. Site Overview, continued

Determine Age of Facility, if possible. How?

- **Verified Sources** include: plans, direct communication with owner, builder, or record-keepers (**note source as in example below**).
- **Estimates** can be made based on plant growth, team-members' knowledge of location history.
- **If completely unsure**, check "unknown."

II. SITE OVERVIEW:

Type of Site (check one)	Rain Garden	Bioretention ✓	Unknown		
Age of Site (circle one)	<1 year	1 - 3 yr	3 - 5 yr	>5 years	unknown
Source of 'Age' (Check One)	Verifiable Source: ✓ Describe: Plans provided		Estimate ____ Describe:		

III. Contributing Area & Hydrology

Review Terms First!

1. Contributing Area – AKA "drainage area" – Refers to area that will drain into rain garden:

- Sections of rooftops
- Driveways
- Roadways
- Sidewalks
- Lawns & landscape areas
- Other impervious surfaces

III. Contributing Area & Hydrology

Review Terms First!

2. Inflow or Inflows: The means to convey stormwater from contributing area into the rain garden/bioretention facility via:

- *Pipe* (e.g., from downspout or other source)
- *Curb cuts* into facility in parking lot or ROW
- *Open-channel Swale*
- *Sheet flow* – overland flow as a continuous film over relatively smooth surfaces
- *Rain chain* or other artistic mechanism

III. Contributing Area & Hydrology

Review Terms First!

3. Overflow(s): Prescribed exit location(s) for times when more stormwater is entering rain garden or bioretention facility than can be safely managed/infiltrated.

- **Overflow(s)** ensure excess stormwater flows to an appropriate **discharge location**.
- **Overflow(s)** may send excess to another rain garden, back to original stormwater infrastructure, natural areas, planting beds or other Green Stormwater mechanism

III. Contributing Area & Hydrology

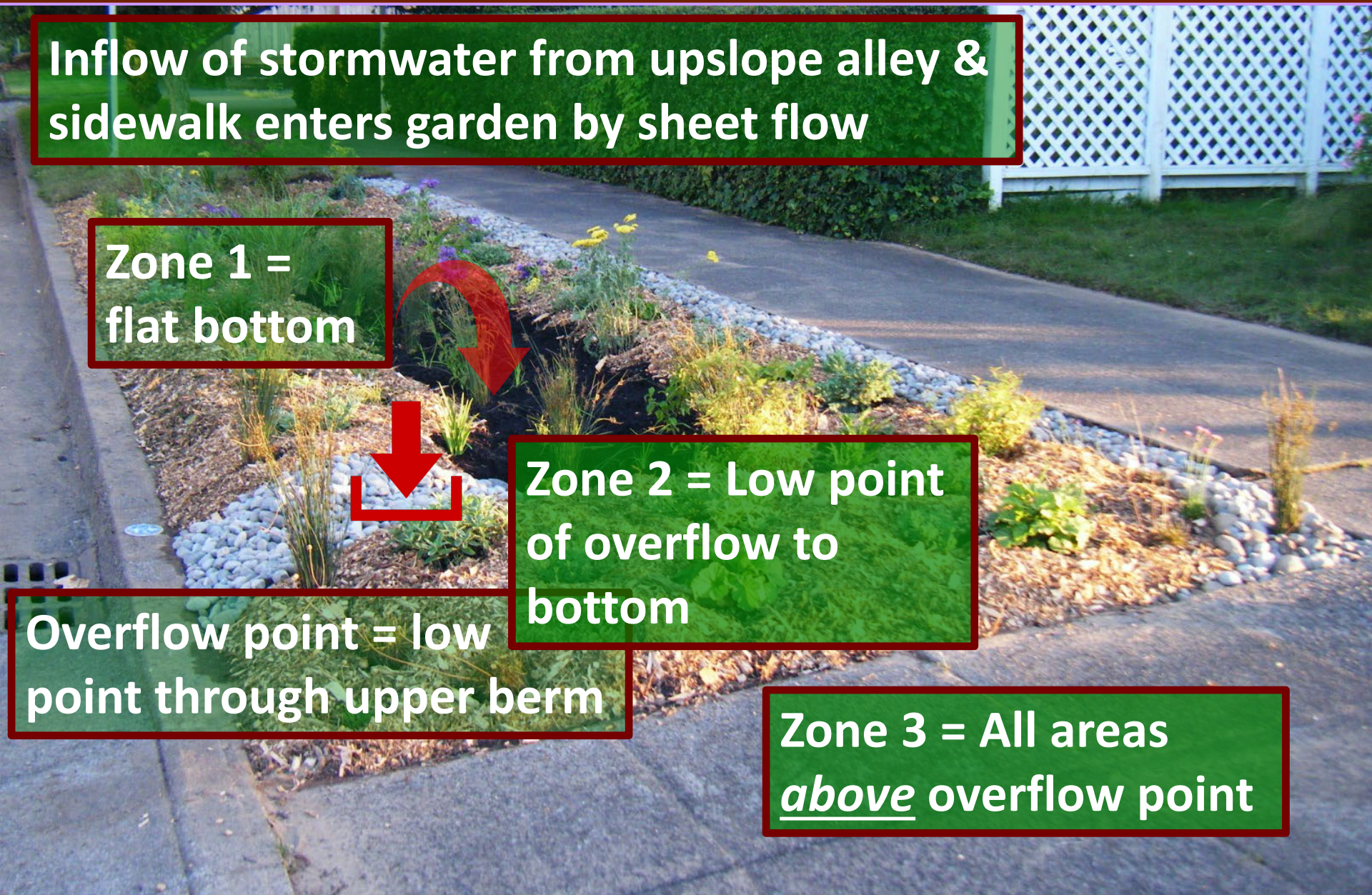
Review Terms First!

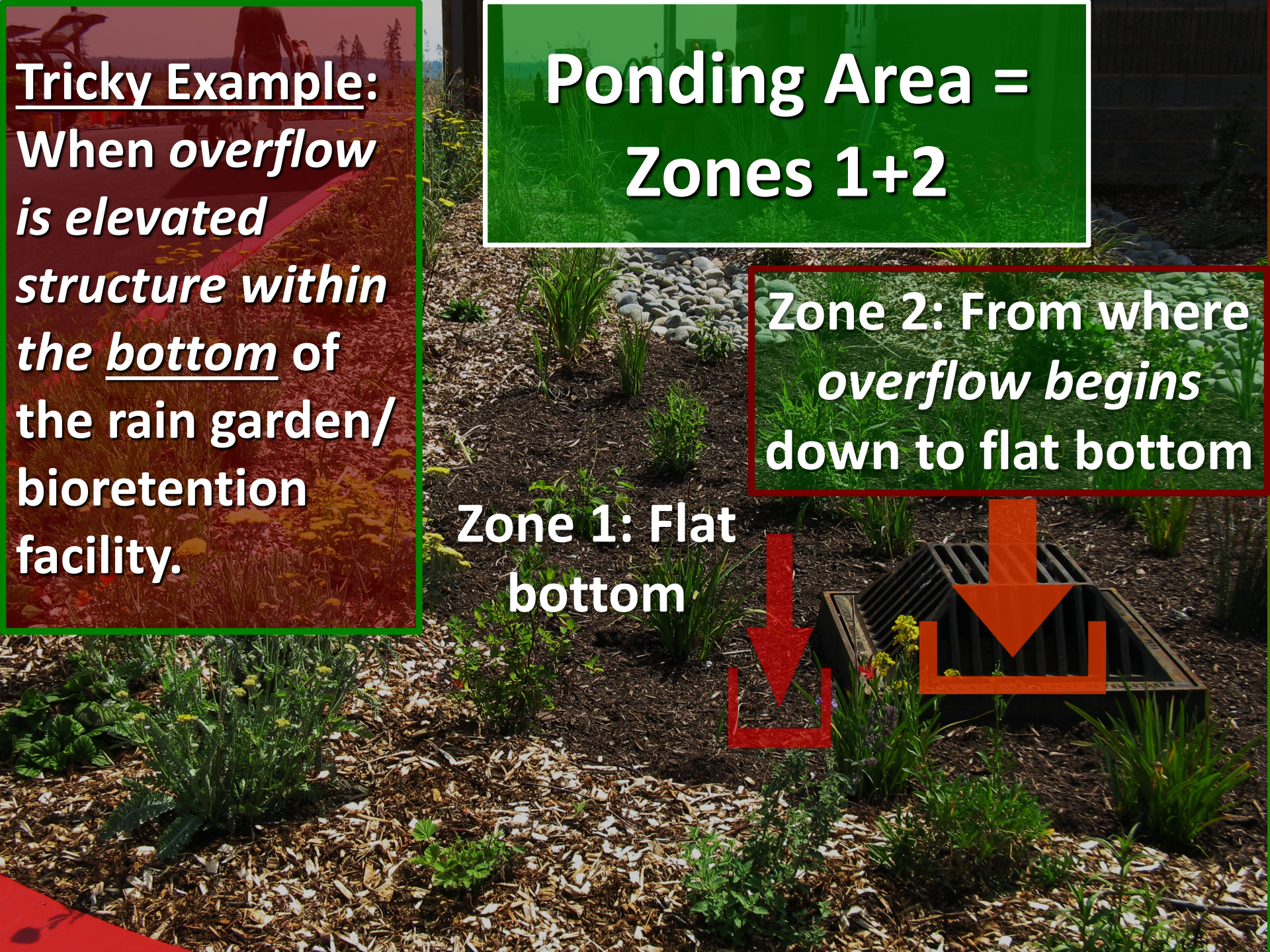
4. Zones: Rain Garden or Bioretention zones refer to *location on the gradient* in relation to where water is *infiltrating or ponding*.

- **Zone 3 is outside of the area of infiltration** but still a key part of rain garden structure.
- **Next slides define zones hydrologically** & *offer examples* where definition isn't clear cut at first glance.

- **<u>Zone 1</u>**: Flat bottom
- **<u>Zone 2</u>**: From the *bottom/low point* of the *overflow* <u>down</u> to Zone 1.
- **<u>Zone 3</u>**: From the *bottom of the overflow* <u>up</u> to defined edge of garden. If no defined edge, garden ends 1 meter beyond the highest points.

Tricky Example: Limited Zone 3




Tricky Example:
When *overflow is elevated structure within the bottom* of the rain garden/ bioretention facility.
Ponding Area = Zones 1+2
Zone 2: From where *overflow begins* down to flat bottom
Zone 1: Flat bottom

III-1. Contributing Water Source

Identify contributing area: Where is stormwater flowing from?

In our form's example, "moderate-use street"

III. CONTRIBUTING AREA/HYDROLOGY

Before beginning, the team should identify where each zone of the rain garden begins and ends. Identify the outside edges of the rain garden and the different zones.

- Zone 1 is the flat area on bottom. Zone 1 will be divided up into thirds and called Sections 1A, 1B and 1C.
- Zone 2 is bottom of overflow to top of Zone 1
- Zone 3 is from bottom of overflow up to defined edge. If the edge is unclear, zone 3 ends one meter out from the level of the overflow water level.

III-1. Contributing water source (check all that apply):	
O Rooftop	O Driveway
O Lawn	O Maintained Pasture
O Residential Street, low use parking lot	✓ Moderate use street, high use parking lot
O High use street, livestock confinement area	O Industrial or other high contaminant area

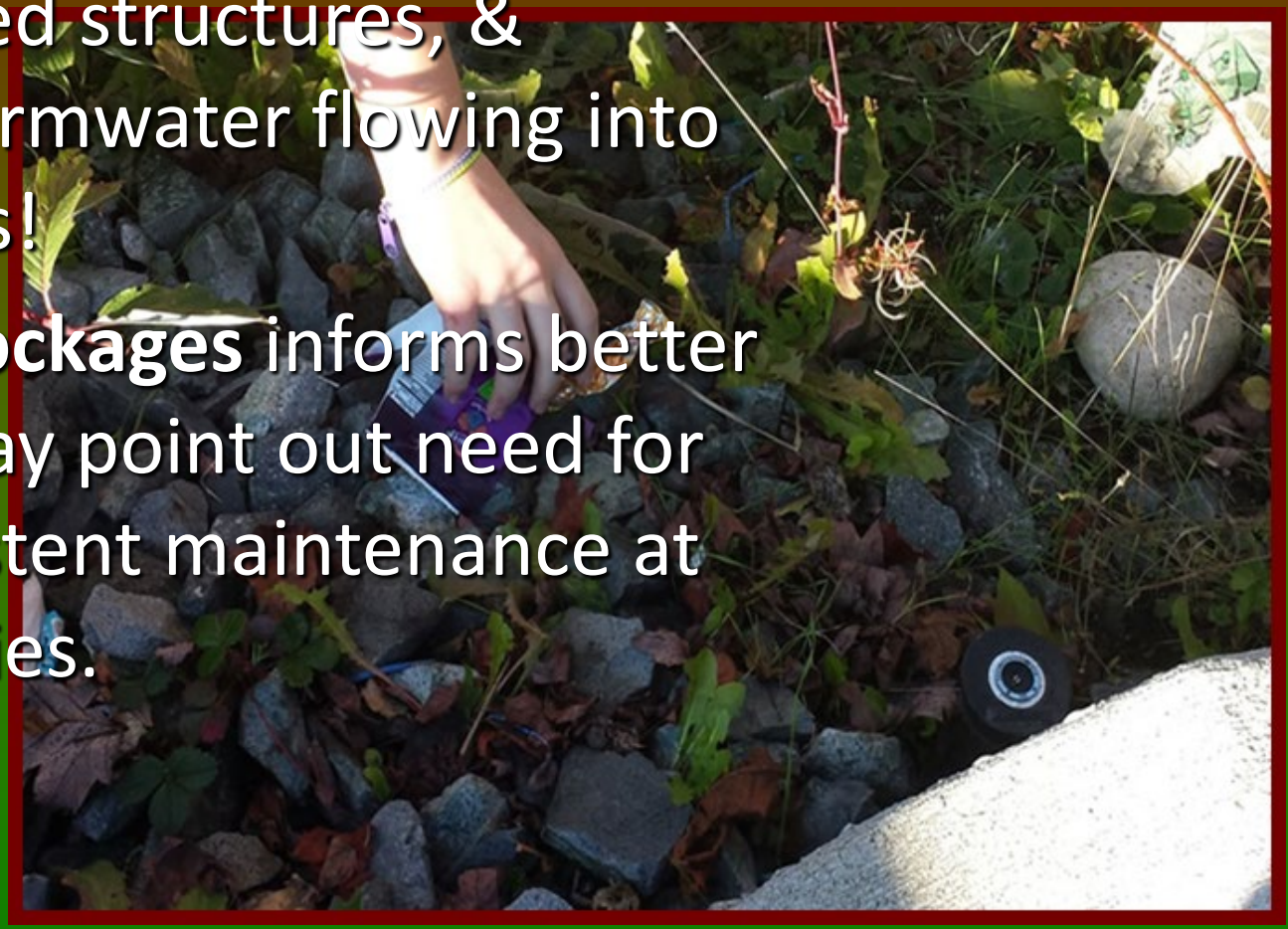
III-2. Does overflow direct water away from facility?

- Options are provided for ***up to 3*** *overflows*
- As each *could* be different, review question for all overflow mechanisms employed
- In our example facility (below), there are *two overflows* and both direct water away.

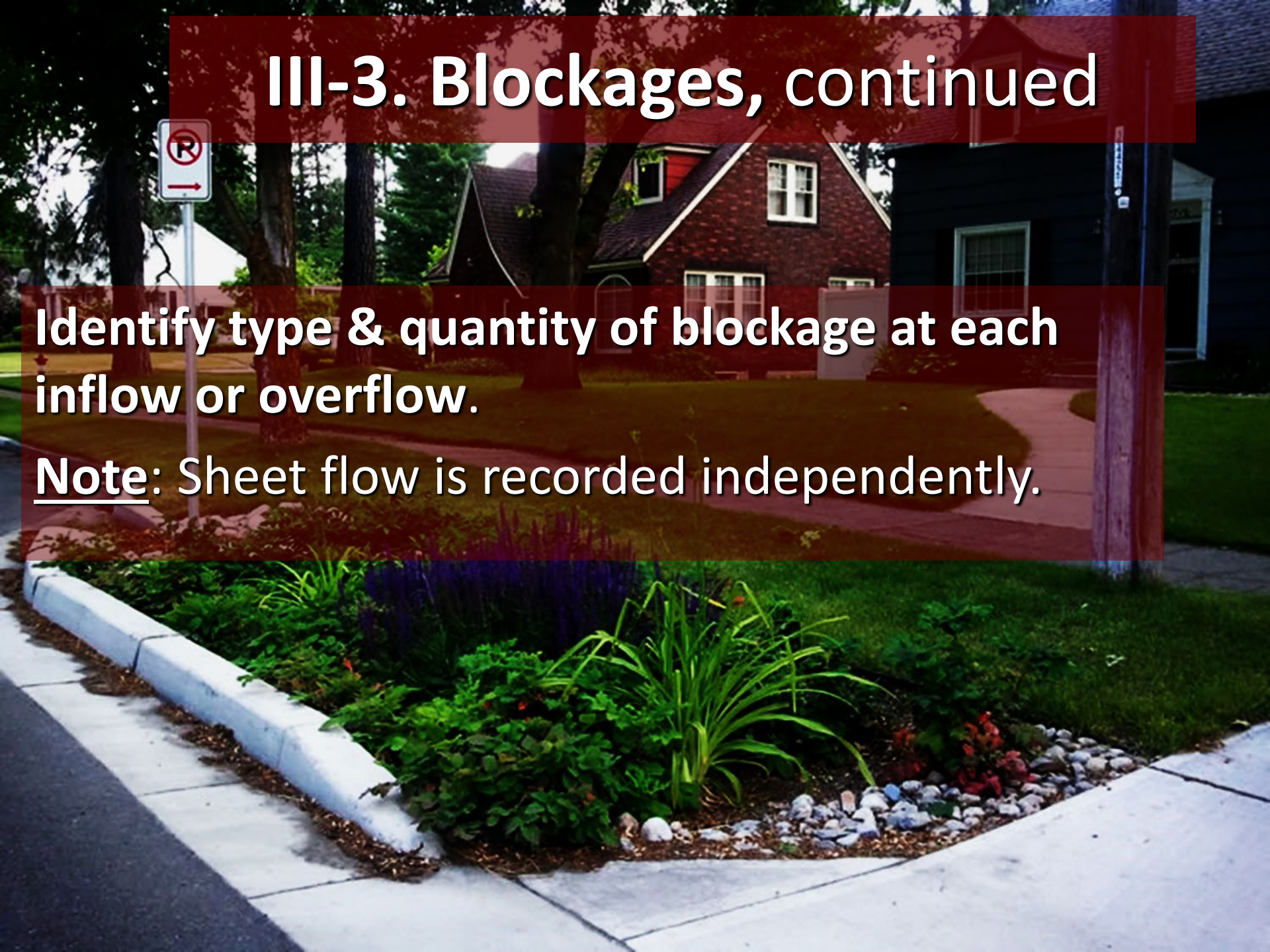
III-2. Does overflow direct water away from facility?								
Overflow 1			Overflow 2			Overflow 3		
Yes ✓	No	Unknown	Yes ✓	No	Unknown	Yes	No	Unknown

III-3. Blockages

- **Blocked inflows & overflows** can lead to water backups, flooding and damaged structures, & reduced stormwater flowing into rain gardens!
- **Tracking blockages** informs better design & may point out need for more consistent maintenance at some facilities.



III-3. **Blockages,** continued



Identify type & quantity of blockage at each inflow or overflow.

Note: Sheet flow is recorded independently.

III-3. Blockages, continued

Blockages: Some systems may require investigating pipes with flashlights or probes.

Others are above ground & easier to visually assess.

III-3. Blockages, continued

Determine percent blockage using cover-class codes described in instructions.

Record code, as shown in example below, e.g., "N" for "None." "T" for less than ½ % (i.e., trace).

Other cover-class codes use "A, B, C, D, E, or F" depending on amount of blockage present.

III-3. Blockages:	Inflow 1	Inflow 2	Inflow 3	Sheet Flow	Overflow 1	Overflow 2	Overflow 3
Percent Blockage	T			T	N		
Blockage type							

Blockage is determined by how clogged the structure or area is.

N = None T = <.5% A= .5-5% B = 6-25% C = 26-50% D = 51-75% E = 76-95% F >96%

Types are: N – None S – Siltation O – Organic (dead) R – Rock T – Trash V – Vegetation (living)

III-3. Blockages, continued

Determine type of blockage using the options under "type."

Record code, as shown in example below, e.g., "S" for "Siltation." "O" for dead organics (e.g., leaves."

III-3. Blockages:	Inflow 1	Inflow 2	Inflow 3	Sheet Flow	Overflow 1	Overflow 2	Overflow 3
Percent Blockage	T			T	N		
Blockage type	S			O	N		

Blockage is determined by how clogged the structure or area is.

N = None T = <.5% A= .5-5% B = 6-25% C = 26-50% D = 51-75% E = 76-95% F >96%

Types are: N – None S – Siltation O – Organic (dead) R – Rock T – Trash V – Vegetation (living)

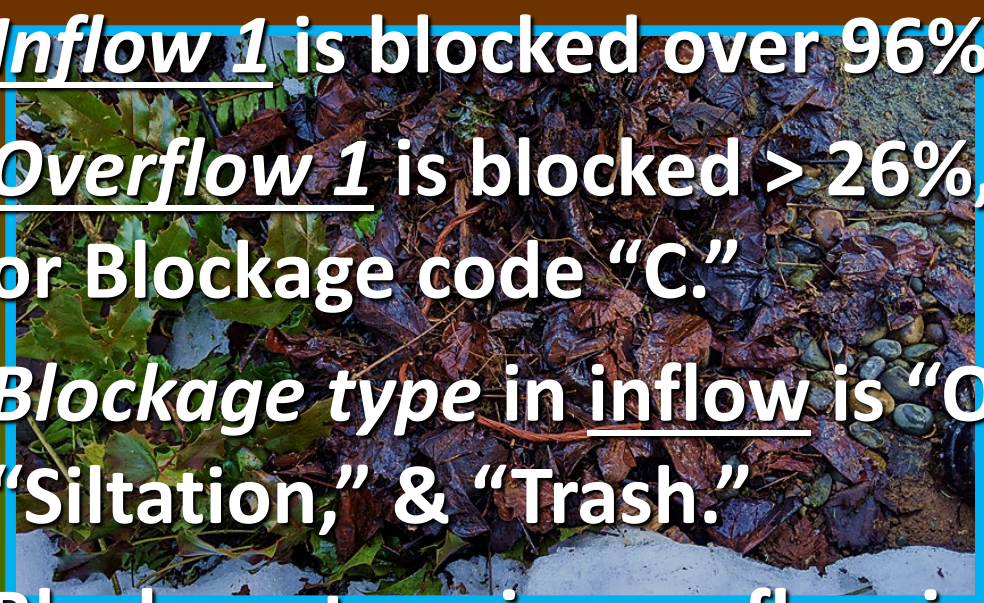
III-3. Blockages, continued

Examples:

III-3. Blockages, continued

As noted in examples:

- ***Inflow 1*** is blocked over 96% -Blockage code "F."
- ***Overflow 1*** is blocked > 26%, but less than 50%, or Blockage code "C."
- *Blockage type* in inflow is "Organic (dead)," "Siltation," & "Trash."
- Blockage type in overflow is "Organic (dead)."

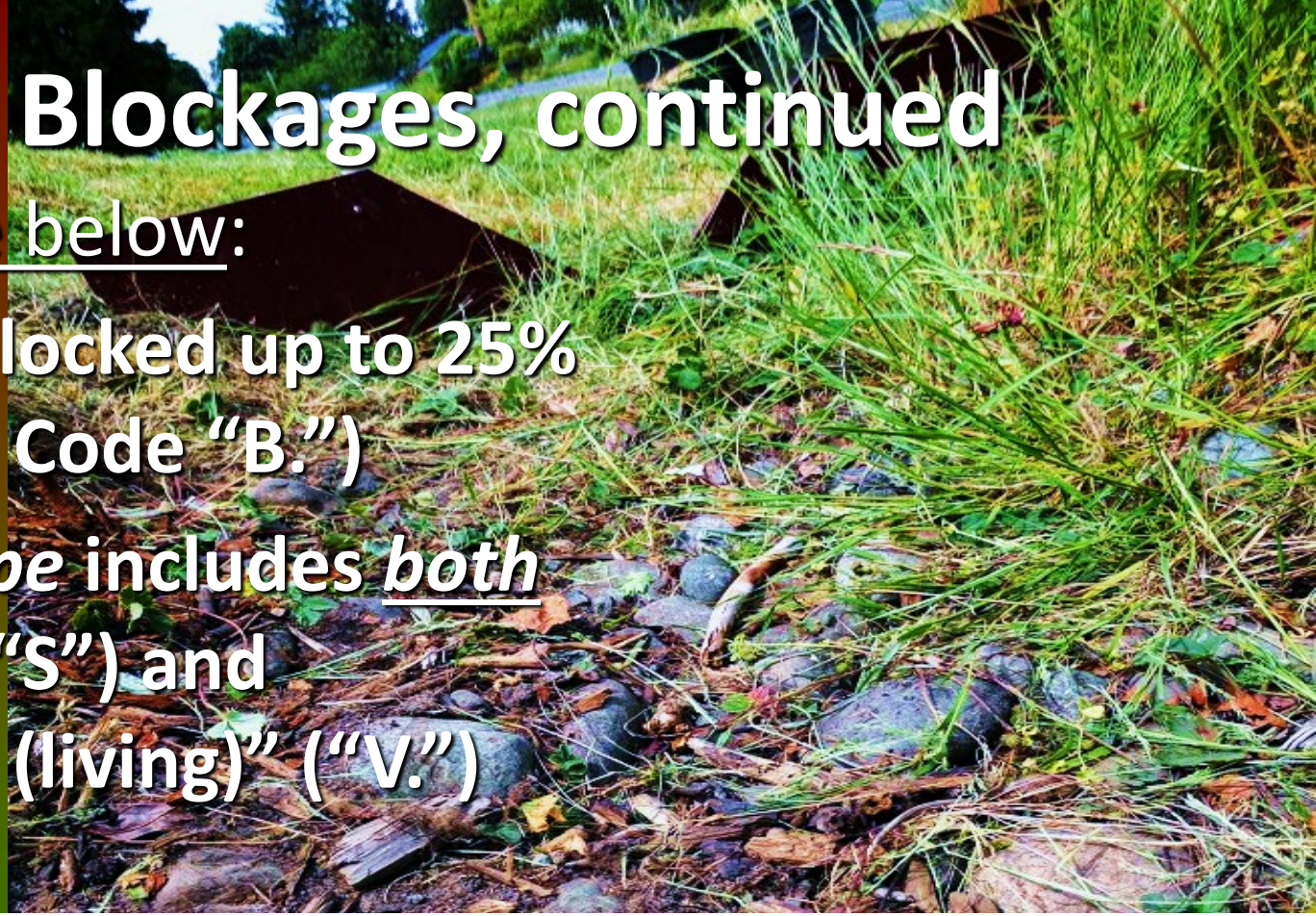


III-3. Blockages:	Inflow 1	Inflow 2	Inflow 3	Sheet Flow	Overflow 1	Overflow 2	Overflow 3
Percent Blockage	F				C		
Blockage type	O, S, T				O		

Blockage is determined by how clogged the structure or area is.
N = None T = <.5% A= .5-5% B = 6-25% C = 26-50% D = 51-75% E = 76-95% F >96%

Types are: N – None S – Siltation O – Organic (dead) R – Rock T – Trash V – Vegetation (living)

III-3. Blockages, continued



Using example below:

- ***Inflow 2*** **is blocked up to 25% (Cover-class Code "B.")**
- ***Blockage type*** **includes *both* "Siltation" ("S") and "Vegetation (living)" ("V.")**

III-3. Blockages:	Inflow 1	Inflow 2	Inflow 3	Sheet Flow	Overflow 1	Overflow 2	Overflow 3
Percent Blockage	F	B			C		
Blockage type	O, S, T	S, V			O		

Blockage is determined by how clogged the structure or area is.
N = None T = <.5% A= .5-5% B = 6-25% C = 26-50% D = 51-75% E = 76-95% F >96%

Types are: N – None S – Siltation O – Organic (dead) R – Rock T – Trash V – Vegetation (living)

III-4. Erosion

Simple visual assessment of *all* zones in the rain garden. Codes are provided on form.

Our example bioretention facility showed no erosion, as recorded here:

III-4. Erosion: Rank the severity of erosion and/or channelization observed in each zone of the rain garden.

	Zone 1	Zone 2	Zone 3
Erosion / Channelization	N	N	N

Erosion Severity Codes N – None MI – Minor MO – Moderate E – Extensive

Next slide shows examples of rain gardens with different levels of erosion in different zones.

III-4. Erosion, continued

Practice Examples

What level of erosion would you record for these two rain garden? **Consider, then advance to next slides for discussion** ***(refer to instructions for definitions).***

III-4. Erosion: Rank the severity of erosion and/or channelization observed in each zone of the rain garden.

	Zone 1	Zone 2	Zone 3
Erosion / Channelization			

Erosion Severity Codes N – None MI – Minor MO – Moderate E – Extensive

III-4. Erosion, continued

Practice Examples

From the ***snapshot view*** here, **"Moderate" to "Extensive" would be appropriate choices due to: side-slope erosion and >20% erosion.** If view of whole site showed >90% for side slopes throughout, **"Extensive"** would be correct to flag this for urgent remedy.

III-4. Erosion: Rank the severity of erosion and/or channelization observed in each zone of the rain garden.

	Zone 1	Zone 2	Zone 3
Erosion / Channelization	MO	E	N

Erosion Severity Codes N – None MI – Minor MO – Moderate E – Extensive

III-4. Erosion, continued
Practice Examples

This is **well under 90%, but over 20%**. It shows a mix of high levels of erosion and none at all. "Moderate" would be a good choice here to flag this site for remedies to erosion soon.

III-4. Erosion: Rank the severity of erosion and/or channelization observed in each zone of the rain garden.

	Zone 1	Zone 2	Zone 3
Erosion / Channelization	MO	E	N

Erosion Severity Codes N – None MI – Minor MO – Moderate E – Extensive

III-5. Other Hydrology Concerns

Narrative option useful for recording:

- Any relevant info not captured in previous sections
- Clarifications of data recorded in previous sections
- Unusual or non-typical hydrology

III-5. Other Hydrology Concerns:

Please describe any situations that may affect hydrology that is not accounted for in the information collected.

There are two cells in the ROW to infiltrate the stormwater. The 2nd cell is intended to receive the overflow from the 1st. It does not appear it receives much, if any, flow from the 1st; just a minor amount of sheetflow. There is a tiny amount of leaflitter accumulating near the top of the 1st cell's overflow, but it does not rise high enough to flow into cell #2. Cell #2 has only light armor and is developing some weeds in its overflow.

IV. Zone 1 Conditions

Step 1: Record overall *length* of Zone 1 – flat bottom of rain garden/bioretention facility

Step 2: Divide length into 3 equal parts & record as below.

Starting from the left, these will be noted as:

1A (left third); 1B (center); 1C (right third)

IV. ZONE 1 CONDITIONS

IV-1. Zone 1 Length:

	Measurement
Length of Zone 1	42 feet
Length of Sections 1A, 1B and 1C (length / 3)	14 feet

IV. Zone 1 Conditions

Denote the Three Zone-1 Sections with:

- **Outstretched measuring tape running length of Zone 1; or**
- **Pin flags**

NOTE: Keep markers in place for continued data gathering!

IV-2. Standing Water, Siltation, Liners

For this section, record each feature of the 3 Zone 1 sections, using the pin flags and/or outstretched measuring tape to guide you in knowing which section you're working in.

IV-2. Standing Water, Siltation, and Liners:			
	Sect. 1A (Left Third)	Sect. 1B (Midpoint)	Sect. 1C (Right Third)
Standing Water Depth	None or ___ inches	None or ___ inches	None or ___ inches
Siltation Depth	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"
Is Liner Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth	N/A ____ inches	N/A ____ inches	N/A ____ inches
Is Filter Fabric Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth?	N/A ____ inches	N/A ____ inches	N/A ____ inches

IV-2. Standing Water, Siltation, Liners continued

1. **Standing water: Use ruler or measuring tape provided & record in inches (if present).**
2. **Siltation: This is very fine sediment. Use ruler & record in inches.**

IV-2. Standing Water, Siltation, and Liners:

	Sect. 1A (Left Third)	Sect. 1B (Midpoint)	Sect. 1C (Right Third)
Standing Water Depth	None or ___ inches	None or ___ inches	None or ___ inches
Siltation Depth	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"
Is Liner Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth	N/A ____ inches	N/A ____ inches	N/A ____ inches
Is Filter Fabric Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth?	N/A ____ inches	N/A ____ inches	N/A ____ inches

IV-2. Standing Water, Siltation, Liners

3. **Liner: Typically only used in bioretention, & then only rarely.** If present, will be noted on plan. Any liner should be ***below*** easy probing depth.

IV-2. Standing Water, Siltation, and Liners:

	Sect. 1A (Left Third)	Sect. 1B (Midpoint)	Sect. 1C (Right Third)
Standing Water Depth	None or ___ inches	None or ___ inches	None or ___ inches
Siltation Depth	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"	N= None T= Trace M= <.25" E= >.25"
Is Liner Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth	N/A ____ inches	N/A ____ inches	N/A ____ inches
Is Filter Fabric Present?	Yes No Unknown	Yes No Unknown	Yes No Unknown
At what depth?	N/A ____ inches	N/A ____ inches	N/A ____ inches

IV-2. Standing Water, Siltation, Liners

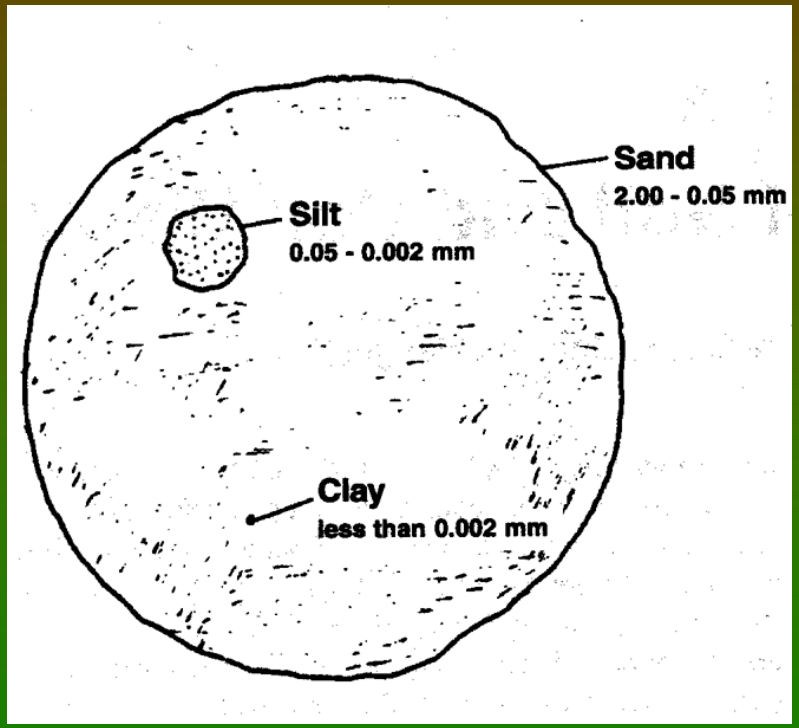
3. **Filter Fabric:** Presence of filter fabric must be flagged, as fabric may ultimately lead to problems. Used to prevent weed colonization and/or or rock armoring from migrating to soils below, but over time fabric captures sediment, potentially leading to drainage blockages and/or increased weed colonization.

If you encounter fabric while prepping area for soil assessment **(Section IV-3)**, mark as "present," record depth placement in garden, & try to probe in a different area. Try a few spots in each section. **Where it's present, do not puncture it to take soil cores**.

IV-3. Soil Texture

"Soil texture" refers to the relative size of particles that make up a particular area's soil.

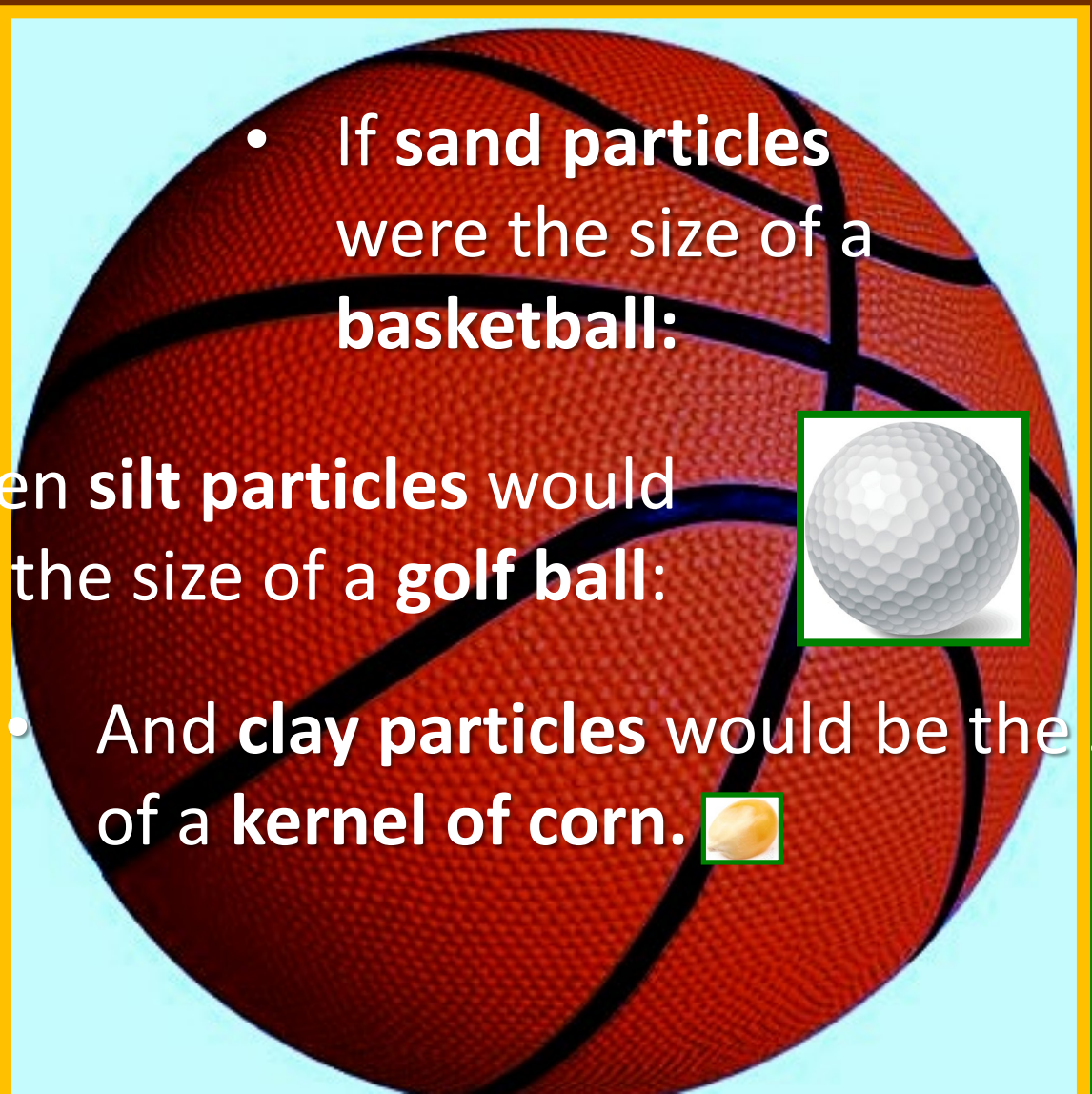
- **Clay =** finest texture/smallest particles.
  Clay feels smooth/slippery.
- **Sand =** coarsest texture/larger particles.
  Sand feels very gritty.
- Silt particles are in between those two extremes.
  Silt can feel equally gritty & smooth.



IV-3. Soil Texture, continued

Looked at another way:

- If **sand particles** were the size of a **basketball:**



- Then **silt particles** would be the size of a **golf ball**:

- And **clay particles** would be the size of a **kernel of corn.**

IV-3. Soil Texture, continued

Knowing soil texture can give clues about how well a particular soil might perform.

In a rain garden, we are most concerned with soil's capacity to support plant growth and allow stormwater to infiltrate and drain quickly enough.

Adapted illustration: Doug Adamson, RDG Planning & Design, courtesy USDA-NRCS, Des Moines, IA

IV-3. Soil Texture, continued

Complete TOP of form for section IV-3, following the guidelines in your instructions & illustrated on the following slides.

IV-3. Soil Texture	1A	1B	1C
Depth to Native Soils	Didn't reach or 16 in.	Didn't reach or 20 in.	Didn't reach or 15 in.
Compacted surface soils Y= Yes N=No	Yes (No)	Yes (No)	Yes (No)
Rain Garden Mix Soil Texture			
Native Soil Texture			

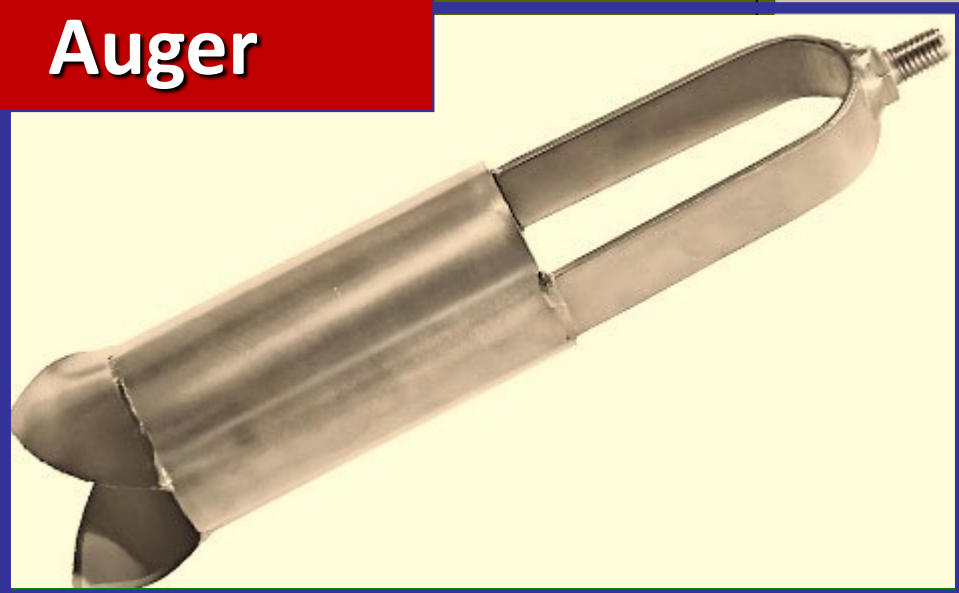
Soil Texture: SELECT ONE OF THESE OPTIONS: SANDY, SILTY, CLAYEY

Native Soils: Those soils which the facility was built in; not soil added to make the rain garden

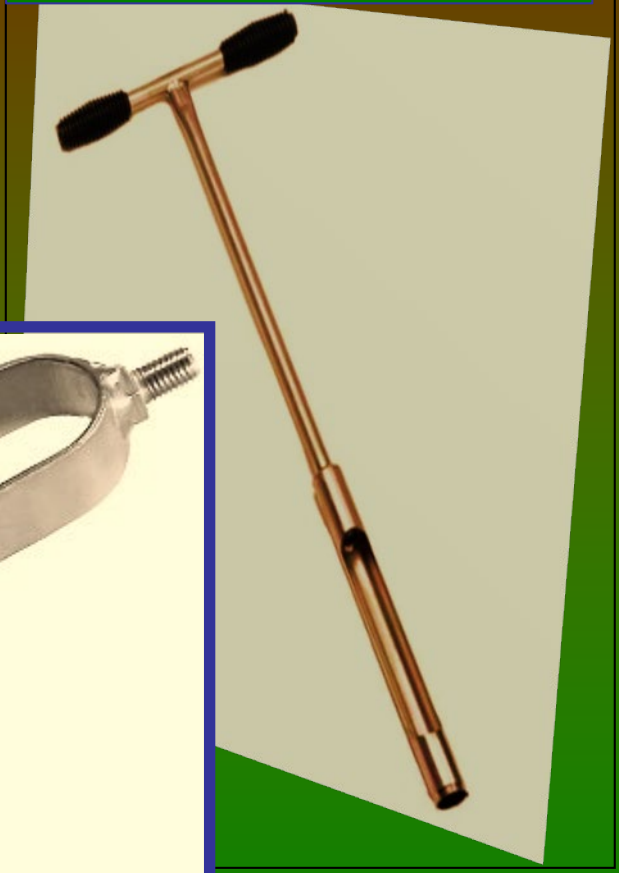
IV-3. Soil Texture, continued

Tools for assessing texture:

Hand Bucket Auger



Soil-Core Probe



IV-3. Soil Texture, continued

- Tools will also allow you to know depth of special rain garden or bioretention soils.
- Color of soil sample will change when original native soil is reached, below rain garden soils.

IV-3. Soil Texture, continued

Method: Either Bucket Auger or Soil-core Probe

Step 1: Select sites in 1A, 1B, 1C at least 2' away from inflow ***origin***(s) or overflow point(s). Move aside rocks, mulch or overhanging vegetation from areas to be sampled.

IV-3. Soil Texture, continued

Method: Either Bucket Auger or Soil-core Probe

Step 2: Place small tarp on adjacent landscape to prepare to receive soil samples.

Tarp will prevent soil from falling onto rain garden rocks & mulch, which could trigger weeds.

IV-3. Soil Texture

Method: Either Hand Bucket Auger or Soil-core Probe

***Step 3*: Determine if soil is too compacted to probe.**

Signs of compaction:

- ❑ Soil shows crust or clods on surface
- ❑ Soil too hard to push shovel or trowel in
- ❑ Soil too hard to push soil probe in

IV-3. Soil Texture, continued

Method: Either Bucket Auger or Soil-core Probe

Step 2: Is soil compacted?

YES

Record “Didn’t reach” & note as “Compacted”

NO

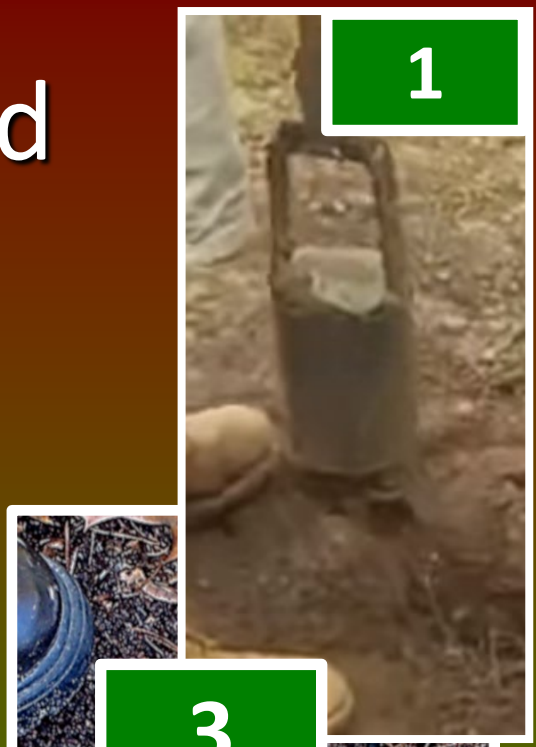
Follow instructions for tool provided: Auger or Corer

Remember to collect data from each section: 1A, 1B, 1C

IV-3. Soil Texture, continued

Method: Hand Bucket Auger

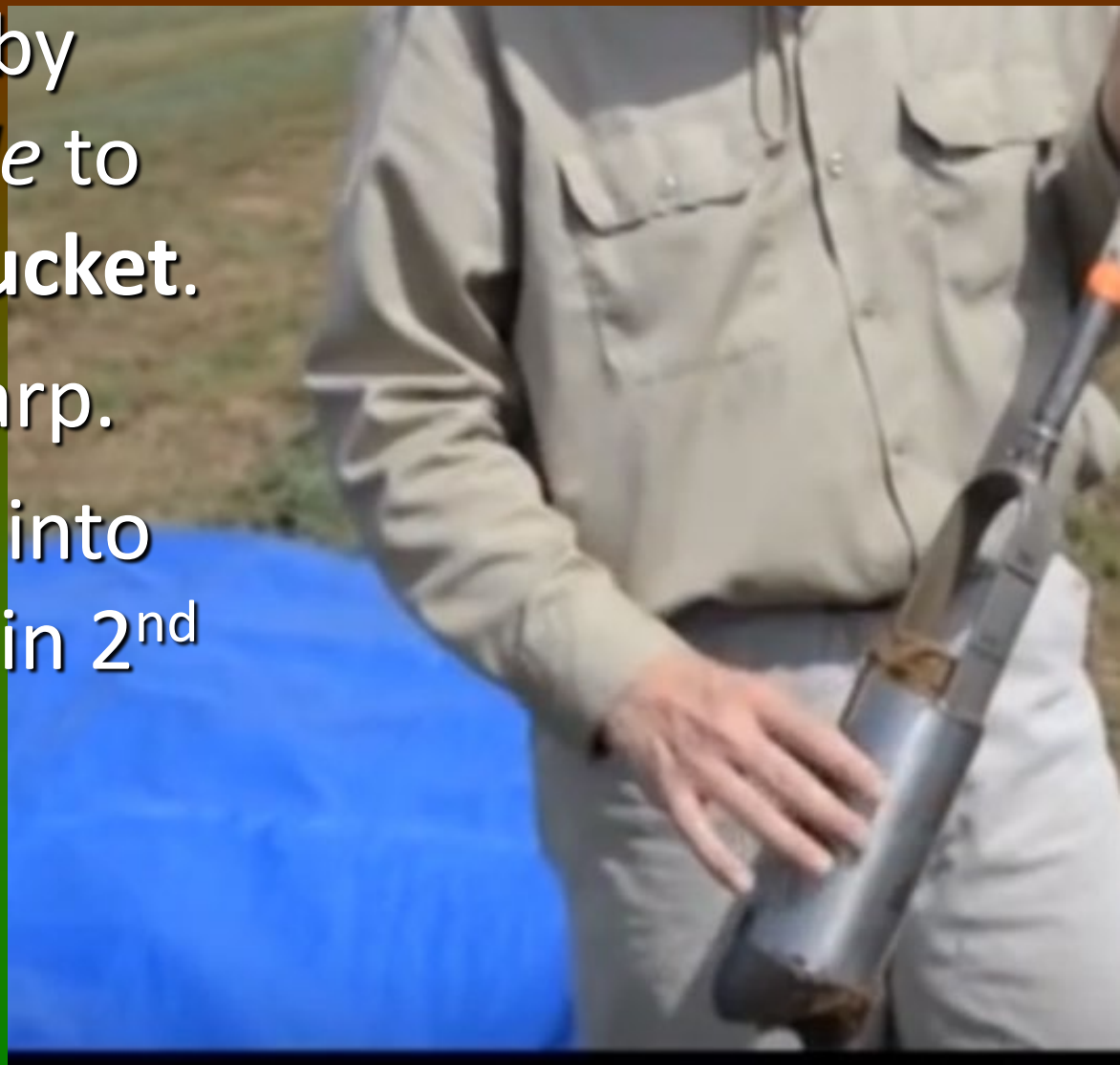
1. **Place tool** into cleared spot.
2. **Screw tool** into ground until …
3. Soil level is even with top of "bucket."



IV-3. Soil Texture, continued

Method: Hand Bucket Auger

4. Remove auger, by *tilting it to one side* to **keep the soil in bucket**.
5. Empty soil on tarp.
6. Re-insert auger into same hole to obtain 2nd sample.



IV-3. **Soil Texture**, continued

Method: Hand Bucket Auger

7. Continue taking samples until you can go no further or you *reach native soils.* **Native soils will be a different color, usually lighter.**

You'll likely dig at least 12", often 18", but as much as 24" before reaching native soils.

8. **Important:** Don't empty your final sample that includes the native soils in the auger bucket until you have measured the ***exact*** *number of inches of native soils in the soil plug*.

IV-3. Soil Texture, continued

Method: Hand Bucket Auger

9. Measure the *depth of the hole* to determine "depth to native soils."

For deep holes, insert auger back in the hole and **note ground-level location** on the tool. Measure tool to that mark.

10. **Deduct** the number of inches of ***native soils*** you recorded in your **final soil sample** from total hole depth.

11. In shallow holes, you can see the line where native soils begin and *insert measuring tape directly into hole*, possibly using flashlight if necessary to ensure correct location.

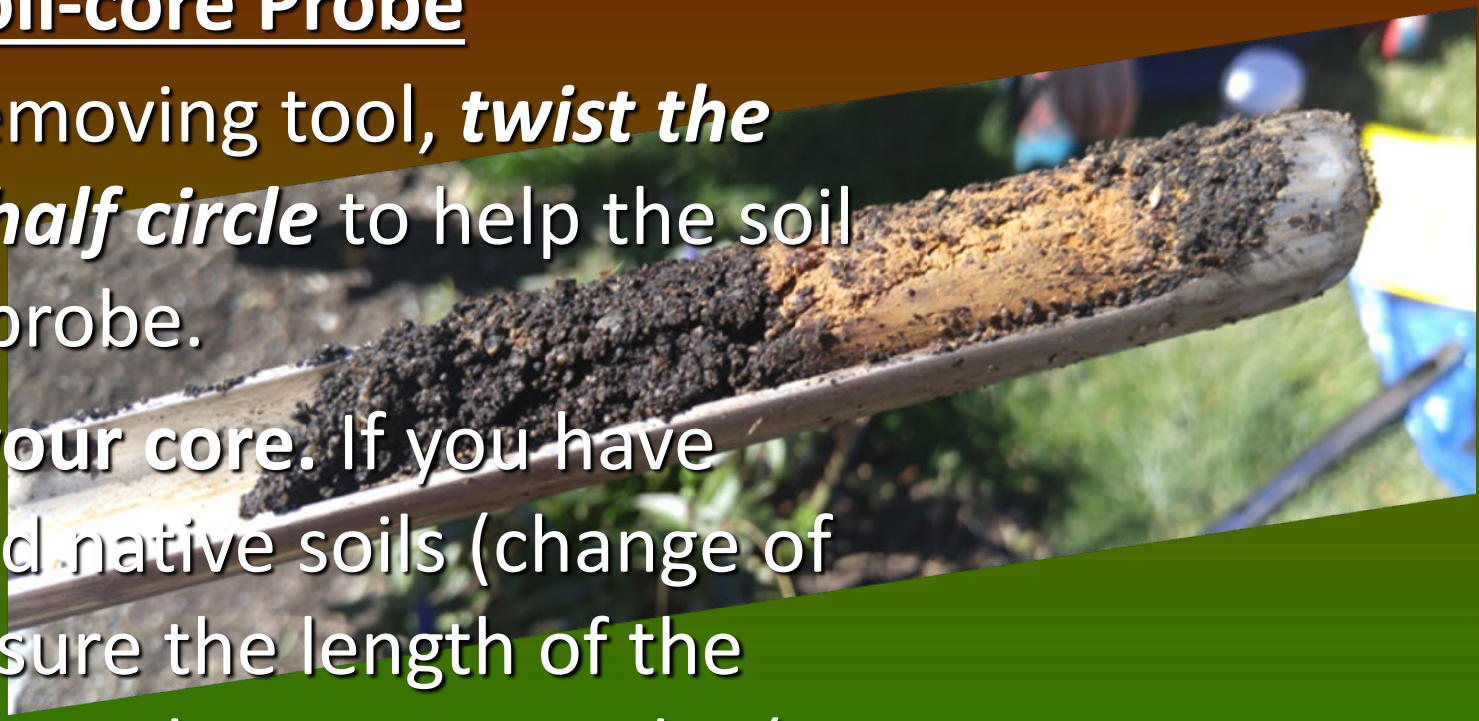
IV-3. Soil Texture, continued

Method: Soil-core Probe

1. **Place tool** into cleared spot.
2. With effort, **press soil probe** into the ground as far as you can go. If you find an impediment, such as a stone, remove the probe and move it to a new spot (remember to stay at least 2 feet from inflow ***origin***/overflow ***points***).

IV-3. Soil Texture, continued

Method: Soil-core Probe



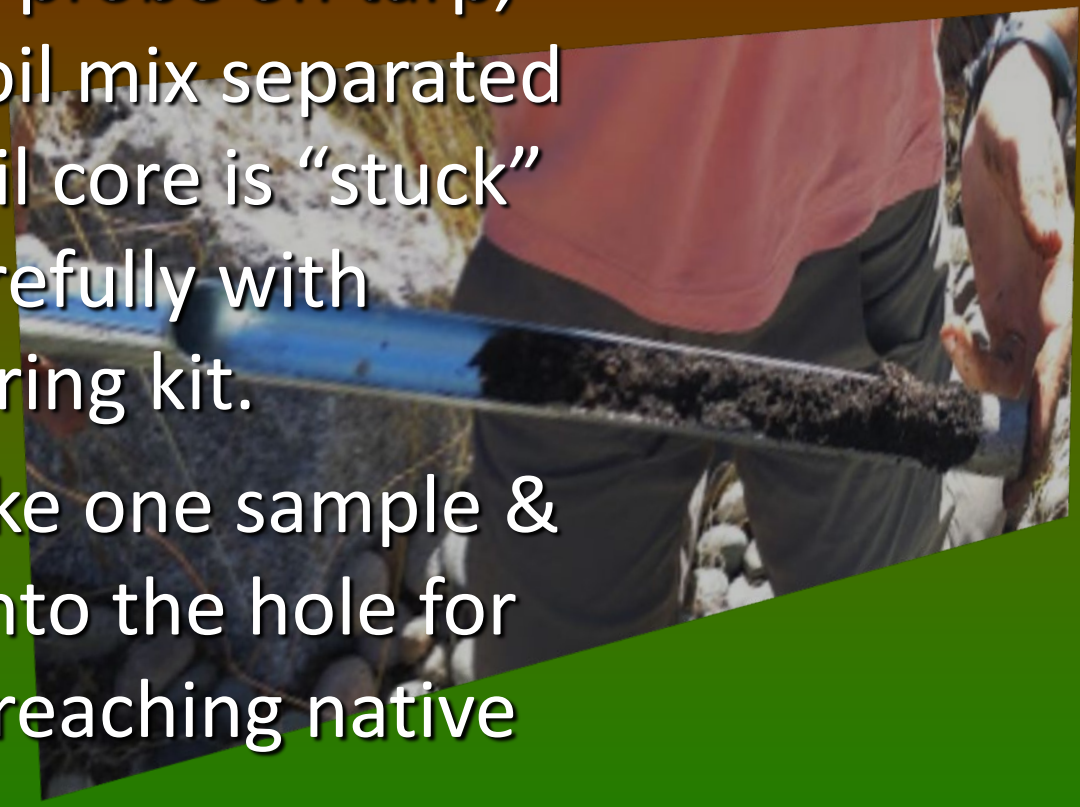
3. Before removing tool, ***twist the probe in a half circle*** to help the soil stay in the probe.

4. **Inspect your core.** If you have encountered native soils (change of color), measure the length of the **native** soil sample on your probe (to deduct later from final depth of hole).

IV-3. Soil Texture, continued

Method: Soil-core Probe

5. Empty sample from probe on tarp, keeping rain garden soil mix separated from native soils. If soil core is "stuck" in probe, release it carefully with screwdriver in monitoring kit.



6. You may need to take one sample & then re-insert probe into the hole for more samples before reaching native soils.

IV-3. Soil Texture, continued

Method: Soil-core Probe

7. If taking multiple samples, record ***exact number of inches of native soils*** on final soil core.

8. To record **"depth to native soils"** from multiple samples, insert tool into hole, marking ground-level location on tool. Then measure length of tool to that location, and ***deduct number of inches of native soils*** recorded from final soil core.

IV-3. Soil Texture, continued

Complete TOP of form for section IV-3.

Record depth to native soils for 1A, 1B, 1C.

IV-3. Soil Texture	1A	1B	1C
Depth to Native Soils	Didn't reach or 16 in.	Didn't reach or 20 in.	Didn't reach or 15 in.
Compacted surface soils Y= Yes N=No	Yes (No)	Yes (No)	Yes (No)
Rain Garden Mix Soil Texture			
Native Soil Texture			

Soil Texture: SELECT ONE OF THESE OPTIONS: SANDY, SILTY, CLAYEY

Native Soils: Those soils which the facility was built in; not soil added to make the rain garden

Return to soil samples on tarp & prepare to complete BOTTOM of section IV-3.

IV-3. Soil Texture, continued

<u>Determine Texture</u> of Rain Garden / Bioretention Soil Mix with "texture by feel" method.

- Keep the rain garden soils & native soils separated on your tarp.
- Damp soils OK, but don't use saturated soils for the texture test.

IV-3. Soil Texture, continued

Determine Texture of Rain Garden / Bioretention Soil Mix.

Using a simplified version of "texture by feel" method (described in instructions), determine if soils are:

- **Primarily Sandy; or**
- **Primarily Silty; or**
- **Primarily Clayey**

IV-3. Soil Texture

"Texture by feel" method.

Follow instructions & steps on the flow chart.

Start with a peach-pit size of soil, removing larger pieces of grit.

Watch online video:

https://youtu.be/0tRQUPDRiDU

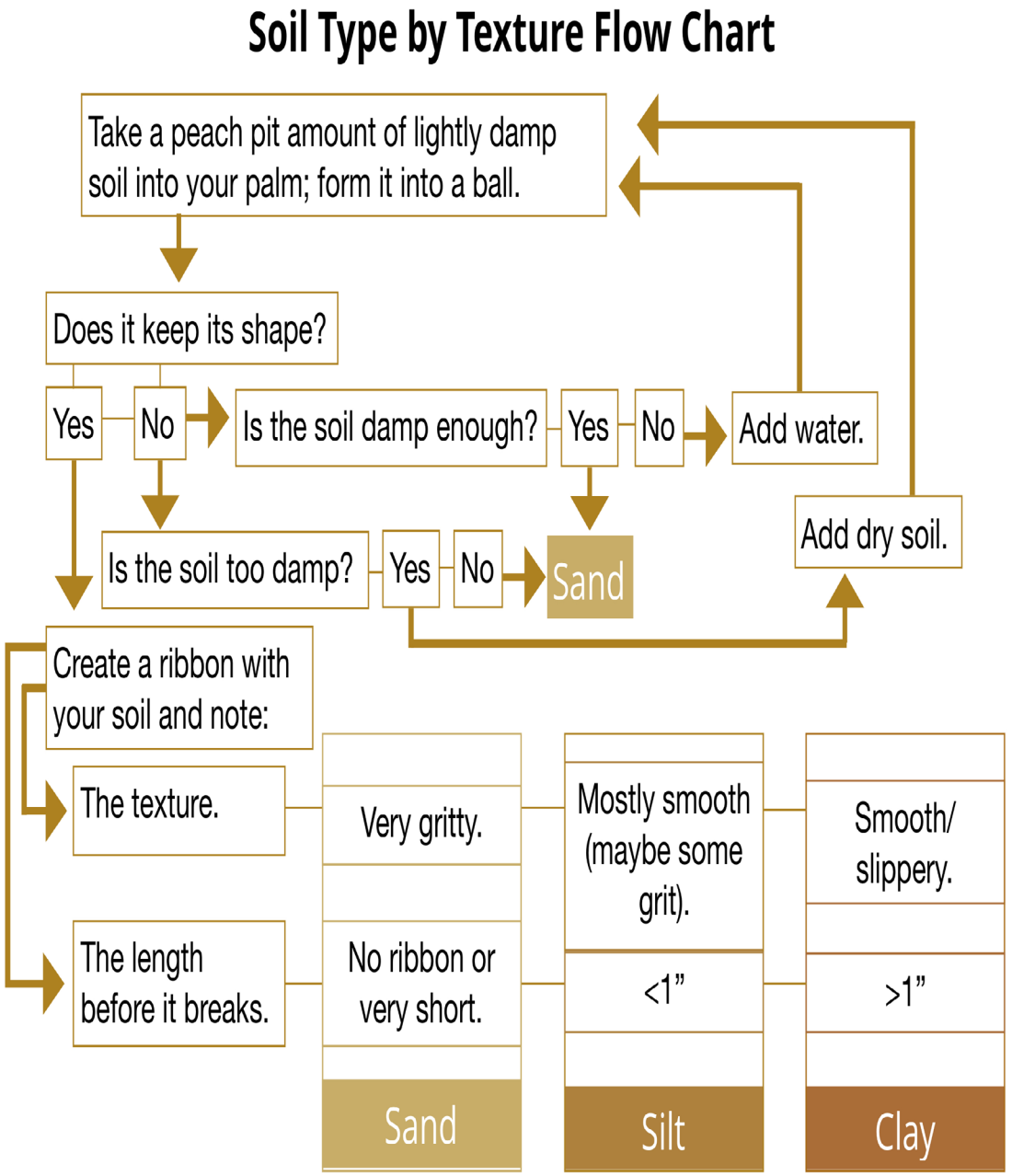
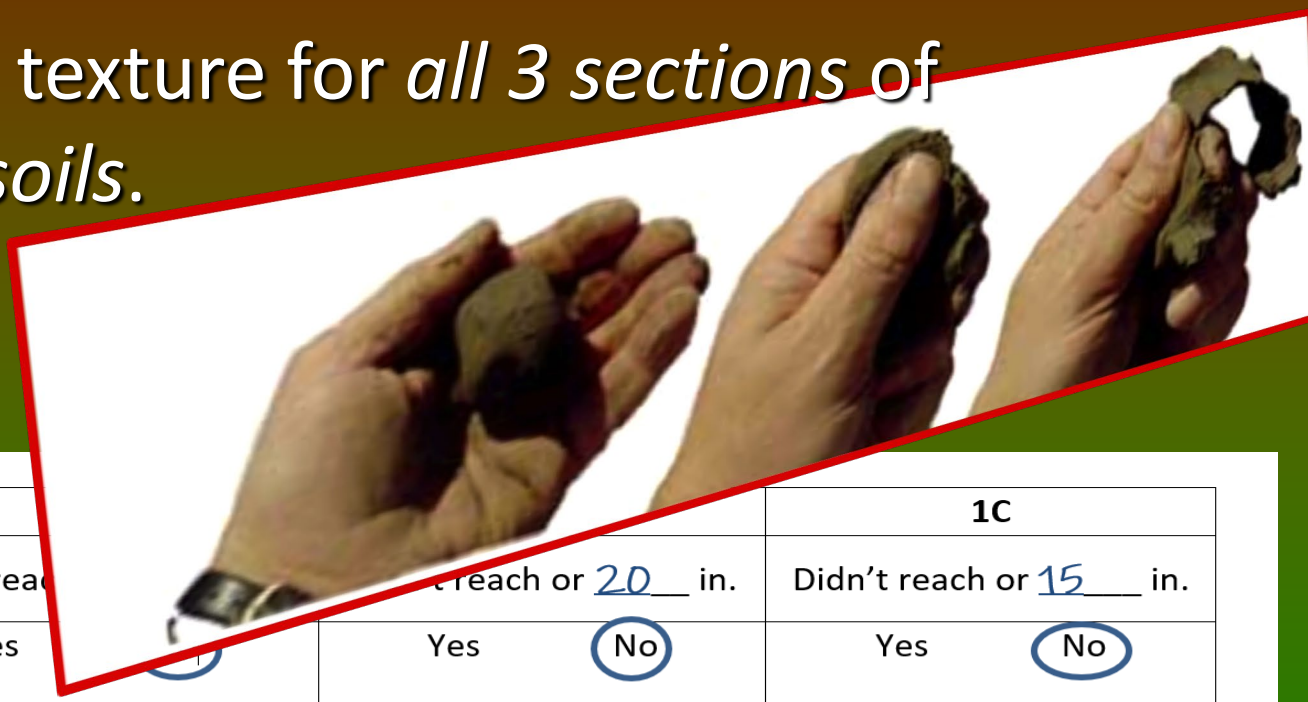


Chart designed by Samantha Elie, Native Plant Salvage Foundation

IV-3. Soil Texture, continued

1. Perform **texture analysis** for *all 3 sections* of Zone 1: 1A, 1B, 1C on the *rain garden soils*.
2. Then, analyze texture for *all 3 sections* of Zone 1's *native soils*.
3. Record data.



IV-3. Soil Texture			1C
Depth to Native Soils	Didn't rea	t reach or 20 in.	Didn't reach or 15 in.
Compacted surface soils Y= Yes N=No	Yes	Yes (No)	Yes (No)
Rain Garden Mix Soil Texture	Sandy	Sandy	Sandy
Native Soil Texture	Silty	Silty	Silty

Soil Texture: SELECT ONE OF THESE OPTIONS: SANDY, SILTY, CLAYEY

Native Soils: Those soils which the facility was built in; not soil added to make the rain garden

IV-3. Soil Texture, continued

Other observations:

In the final box, record any other observations that seem anomalous or that will further explain your findings to the data reviewers.

Example based on our findings above might be:

IV-4. Other Substrate Observations:

Please describe any observations about soils that are not accounted for in the information collected.

The bioretention soil mix has either been modified since construction or was not evenly applied originally, as it is deeper in the middle than at either end.

IV-3. Soil Texture, continued

- When finished, carefully replace soil.
- Be mindful not to allow soils to contaminate mulch and inflow/overflow rock armoring.
- After soil is returned, carefully replace any mulch, rock armoring, and any other materials moved in order to conduct assessments.


Section V:
Substrates, Vegetation, Conditions
Linda Andrews Landscape & Design

Section V-1: Substrate

V. OVERALL SUBSTRATES, VEGETATION, CONDITIONS

V-1. Substrate: Use key below and guide to assess characteristics in each zone of the rain garden.

	1A	1B	1C	2	3
Type of Mulch					
Depth of Mulch					

Mulch Types

N – None

S – Shredded Mulch (stringy / fibrous with long, coarse particles of varying lengths)

F – Fine Mulch (ground wood chips or barks with particles 1" or less, leaf litter and dead vegetation.

C – Coarse Mulch (arborist chips, nuggets, play chips with particles typically 1 – 3")

Mulch Depth N - None T - Trace - <1" A - 1 – 3" B - >3"

	Zone 1	Zone 2	Zone 3
Mulch Coverage			
Bare Ground Coverage			
Pea Gravel Coverage			
Drain Rock Coverage			
2 – 12" Rock Coverage			
>12" Rock/Log Coverage			

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

Section V-1: Substrate

Why assess mulch type & depth?

- Mulch is correlated to better plant growth.
- Used correctly, mulch can minimize weeds.
- Mulch slows stormwater as it flows across landscapes.
- Mulch retains moisture in the soil.
- Mulch supports healthy soil biota and fungi.

Assess Type of Mulch – By Zones

Record data for each Zone-1 Section & also Zones 2 & 3

- Use laminated visual guides to categorize
- *Shredded*
- *Fine*
- *Coarse*

Shredded Mulch

Shredded Mulch

Fine Mulch = 1” or less

Fine Mulch

Coarse Mulch

- 1- to 3-inch typical size
- “play chips”

Coarse Mulch

- 1- to 3-inch typical size
- Arborists’ chips

Coarse Mulch

- 1- to 3-inch typical size
- “nuggets”

Practice!

Type of mulch, by zone in photo:

- **Zone 1? Fine**
- **Zone 2? Fine**
- **Zone 3? Coarse**

V. OVERALL SUBSTRATES, VEGETATION, CONDITIONS

V-1. Substrate: Use key below and guide to assess characteristics in each zone of the rain garden.

	1A	1B	1C	2	3
Type of Mulch	F	F	F	F	C
Depth of Mulch	A	A	A	T	B

Mulch Types

N – None
S – Shredded Mulch (stringy / fibrous with long, coarse particles of varying lengths)
F – Fine Mulch (ground wood chips or barks with particles 1" or less, leaf litter and dead vegetation.
C – Coarse Mulch (arborist chips, nuggets, play chips with particles typically 1 – 3")

Mulch Depth N - None T - Trace - <1" A - 1 – 3" B - >3"

Depth of Mulch

Gently move mulch away from a small area, allowing ruler to be inserted directly on bare ground.

Measure adjacent mulch depth **(not** where mulch has been relocated).

Replace disturbed mulch.

V-1. Substrates

Use the **codes provided** to note type of mulch in each section.

Round depth findings to **nearest category** & average if it varies across section.

Example below: Mulch was 1-3” in all of Zone 1, thus Category “A” is recorded.

V. OVERALL SUBSTRATES, VEGETATION, CONDITIONS

V-1. Substrate: Use key below and guide to assess characteristics in each zone of the rain garden.

	1A	1B	1C	2	3
Type of Mulch	C	C	C	C	C
Depth of Mulch	A	A	A	T	B

Mulch Types

N – None
S – Shredded Mulch (stringy / fibrous with long, coarse particles of varying lengths)
F – Fine Mulch (ground wood chips or barks with particles 1” or less, leaf litter and dead vegetation.
C – Coarse Mulch (arborist chips, nuggets, play chips with particles typically 1 – 3”)

Mulch Depth N - None T - Trace - <1” A - 1 – 3” B - >3”

V-1. Substrates

Next Step: Percent-cover assessments

V. OVERALL SUBSTRATES, VEGETATION, CONDITIONS

V-1. Substrate: Use key below and guide to assess characteristics in each zone of the rain garden.

	1A	1B	1C	2	3
Type of Mulch					
Depth of Mulch					

Mulch Types

N – None
S – Shredded Mulch (stringy / fibrous with long, coarse particles of varying lengths)
F – Fine Mulch (ground wood chips or barks with particles 1" or less, leaf litter and dead vegetation.
C – Coarse Mulch (arborist chips, nuggets, play chips with particles typically 1 – 3")

Mulch Depth N - None T - Trace - <1" A - 1 – 3" B - >3"

	Zone 1	Zone 2	Zone 3
Mulch Coverage			
Bare Ground Coverage			
Pea Gravel Coverage			
Drain Rock Coverage			
2 – 12" Rock Coverage			
>12" Rock/Log Coverage			

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >95%

Cover Classes

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

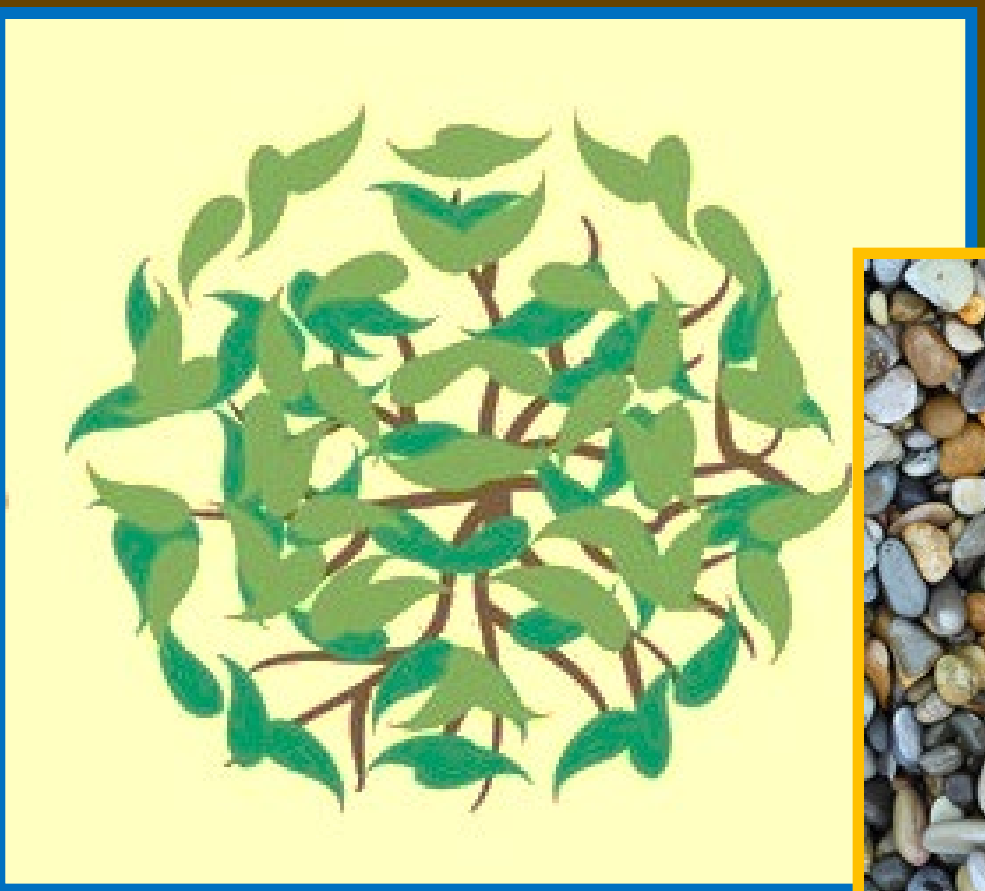
Percent Cover – Determining Cover Classes

Picture "Birds'-eye View

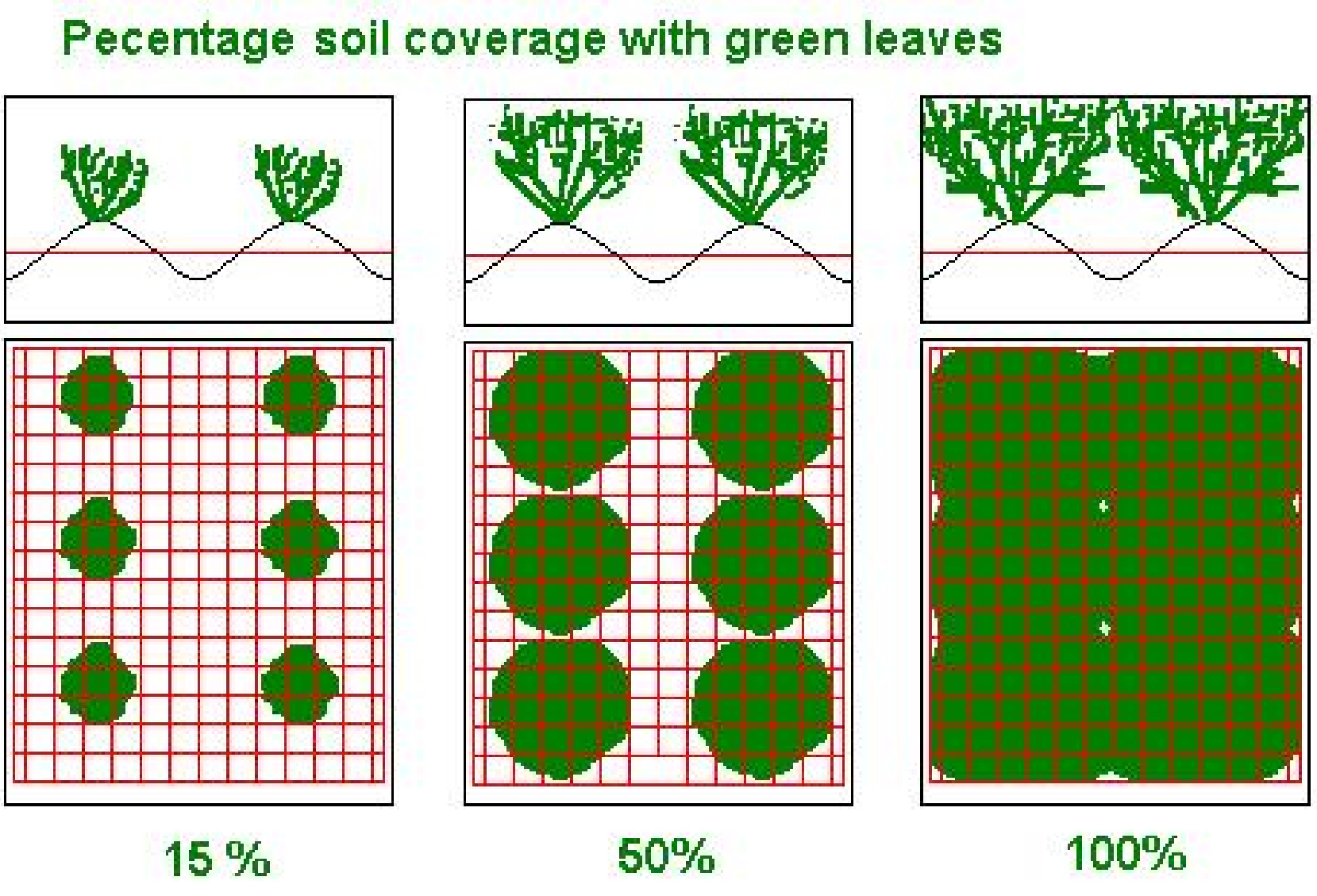
In assessing percent cover, imagine your view is ***looking down*** at the whole picture.

Percent Cover –
Determining Cover Classes

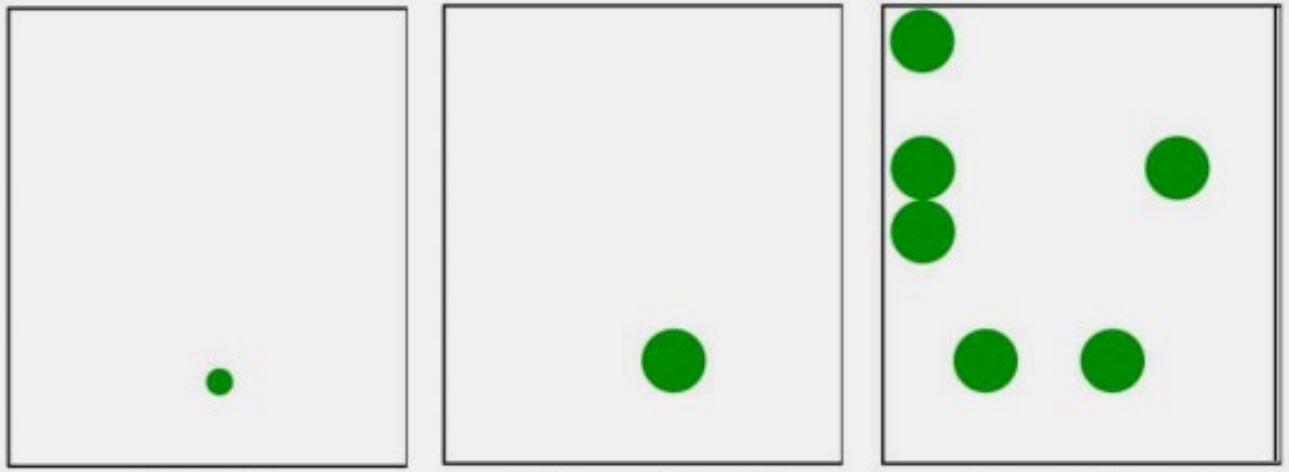
Picture “Birds’-eye View



A few visuals …



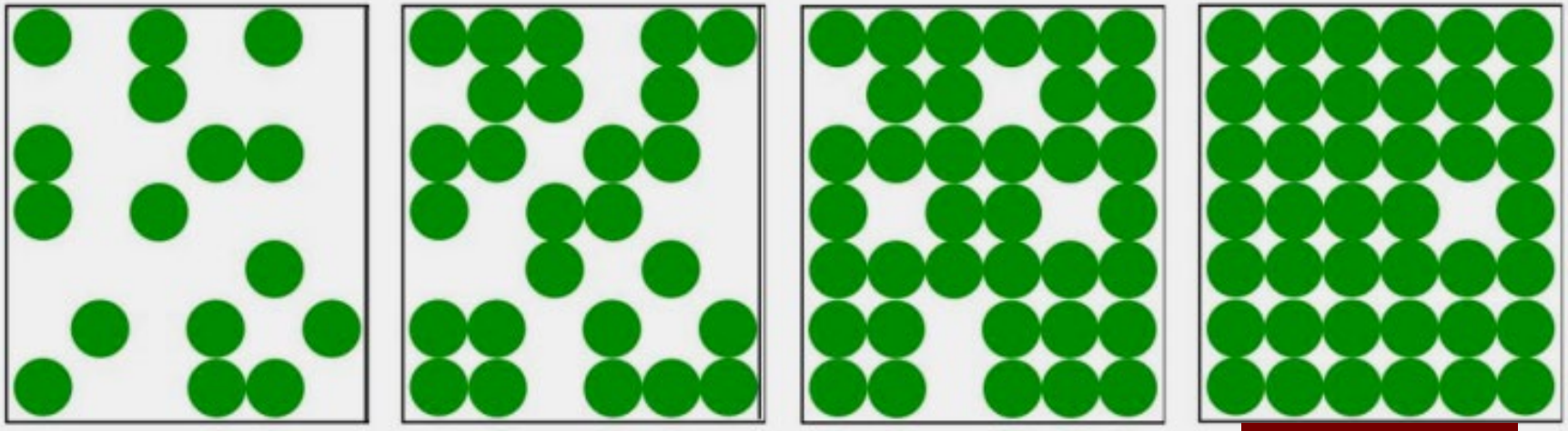
N = None T = <.5% A= .5-5% B = 6-25% C = 26-50% D = 51-75% E = 76-95% F >96%



Trace ("T") = <0.5%

A = 0.5% to 5%

B = 6% to 25%



C = 26% to 50%

D = 51% to 75%

E = 76% to 95%

F = > 96%

Modified from: Daubenmire, R. 1959. A canopy-cover method of vegetation analysis. *Northwest Sci.* 33:43-65.

Coverage – By Zones
Mulch, Bare Ground, & Rock Type

V-1. Substrates

Next Step: Percent-cover assessments

V. OVERALL SUBSTRATES, VEGETATION, CONDITIONS

V-1. Substrate: Use key below and guide to assess characteristics in each zone of the rain garden.

	1A	1B	1C	2	3
Type of Mulch					
Depth of Mulch					

Mulch Types

N – None
S – Shredded Mulch (stringy / fibrous with long, coarse particles of varying lengths)
F – Fine Mulch (ground wood chips or barks with particles 1" or less, leaf litter and dead vegetation.
C – Coarse Mulch (arborist chips, nuggets, play chips with particles typically 1 – 3")

Mulch Depth N - None T - Trace - <1" A - 1 – 3" B - >3"

	Zone 1	Zone 2	Zone 3
Mulch Coverage			
Bare Ground Coverage			
Pea Gravel Coverage			
Drain Rock Coverage			
2 – 12" Rock Coverage			
>12" Rock/Log Coverage			

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >95%

Mulch Coverage – By Zone

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

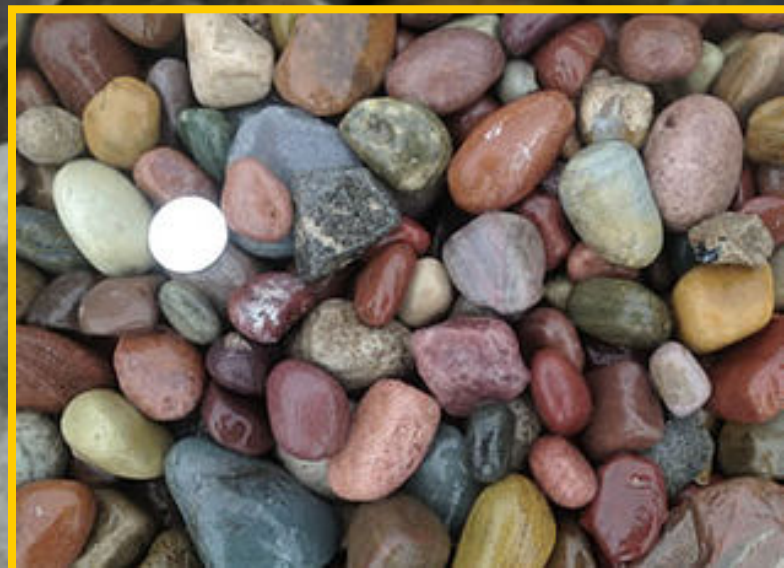
Bare Ground Coverage – By Zone

Type of Rock: Pea Gravel

- Small by definition – under 3/8-inch
- Angular or round

* Note quarter coin used for scale in photo.

Type of Rock: Drain Rock



Type of Rock: 2-12”


2-12”

Rocks or Logs >12”

This category includes:

- Large landscape rocks
- Stepping stones
- Log bridges & natural wood features

Remember to account for <u>percent cover</u>, not actual number of rocks/logs!

Practice!


Type of Mulch? Size of Rock?

% Coverage: Mulch & Rock

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

Section V-1: Substrate

Complete form for all 3 zones.

Be sure to record category code, not number.

	Zone 1	Zone 2	Zone 3
Mulch Coverage	D	C	D
Bare Ground Coverage	N	A	N
Type of Rock: Pea Gravel	N	N	N
Type of Rock: Drain Rock	N	N	N
Type of Rock: 2 – 12”	B	T	A
Type of Rock/Log: >12"	A	N	A

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

V-2. Vegetation

- Coverage by zones
- Vigor
- Definitions in instructions
- Handouts define target invasives

Vegetation Assessment: Why?

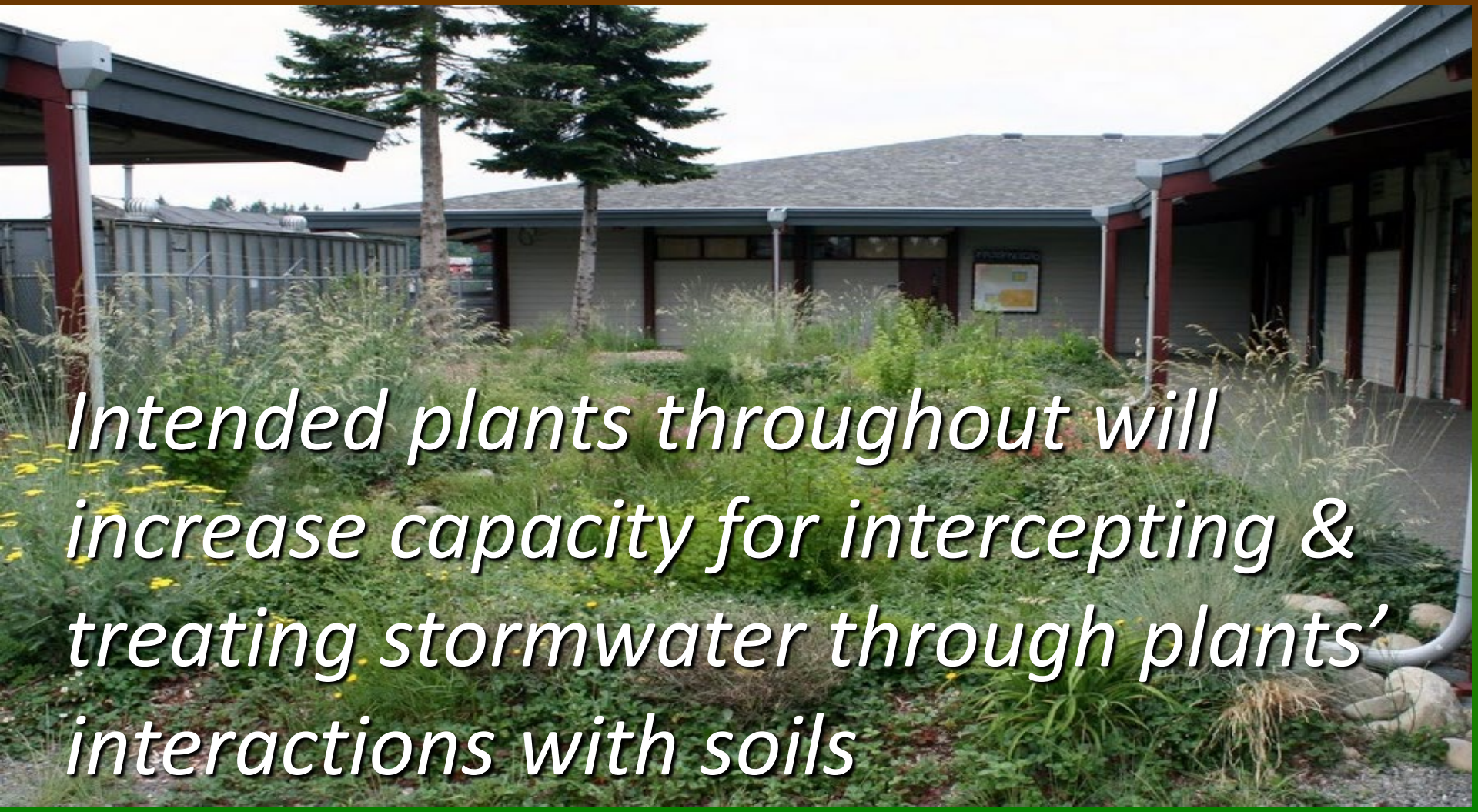
- Feedback on plants' performance = better future plant choices
- Public perception is factor of success: Healthy plants = more attractive / more public acceptance

Feedback Makes a Difference!

Tracking details can lead to improved functioning of rain gardens, informing:

- Better plant selection based on conditions for future rain gardens or improving monitored sites
- Temporary protections if necessary from wildlife

Maintaining healthy plant cover = more effective stormwater treatment



V-2. Rain Garden Vegetation

- **Using cover classes described, assess % cover (1) for *all* vegetation & (2) for 6 separate categories** (as described in instructions & illustrated below).

V-2. Rain Garden Vegetation: Please use cover classes and vigor codes (below) to indicate coverage and plant vigor ranking for each vegetation type. This is a visual observation in which you are only looking at the surface of the rain garden. Please use field guides provided to identify target problem plants.

Vegetation Type		Zone 1	Zone 2	Zone 3
All Vegetation:	Coverage			
Target Problem Plants:	Coverage			
	Vigor			
Non-Target Weeds:	Coverage			
	Vigor			
Deciduous Shrubs / Trees:	Coverage			
	Vigor			
Evergreen Shrubs / Trees:	Coverage			
	Vigor			
Herbaceous:	Coverage			
	Vigor			
Ground Cover:	Coverage			
	Vigor			

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%
Vigor Ranking:	**P** – Poor	**M** – Moderate	**R** – Robust		

V-2. Assess "vigor" *only* for 6 categories

("vigor" discussed in following slides)

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%
Vigor Ranking:		**P** – Poor		**M** – Moderate		**R** – Robust	

V-2. Rain Garden Vegetation: Please use cover classes and vigor codes (below) to indicate coverage and plant vigor ranking for each vegetation type. This is a visual observation in which you are only looking at the surface of the rain garden. Please use field guides provided to identify target problem plants.

Vegetation Type		Zone 1	Zone 2	Zone 3
All Vegetation:	Coverage	E	E	E
Target Problem Plants:	Coverage	A	T	T
	Vigor	R	M	M
Non-Target Weeds:	Coverage	T	T	T
	Vigor	M	M	M
Deciduous Shrubs / Trees:	Coverage	B	C	C
	Vigor	R	R	R
Evergreen Shrubs / Trees:	Coverage	N	B	B
	Vigor	R	R	R
Herbaceous:	Coverage	E	D	D
	Vigor	R	M	R
Ground Cover:	Coverage	A	C	C
	Vigor	R	R	R

Plant Vigor: What defines it?

- "Vigor" is ultimately the capacity for natural survival and growth.
- Evaluate overall signs of *health & strength*.
- Somewhat qualitative assessment, but use obvious cues.
- Only 3 categories: "poor," "moderate," & "robust."
- Assess for each category & in each zone of garden.

Plant Vigor: Clues

Signs of "Poor" vigor include:

- Plant appears stressed
- Dead/dying branches
- Deformed
- Browsed
- Trampled

Plant Vigor: Clues

Signs of “Poor” vigor include:

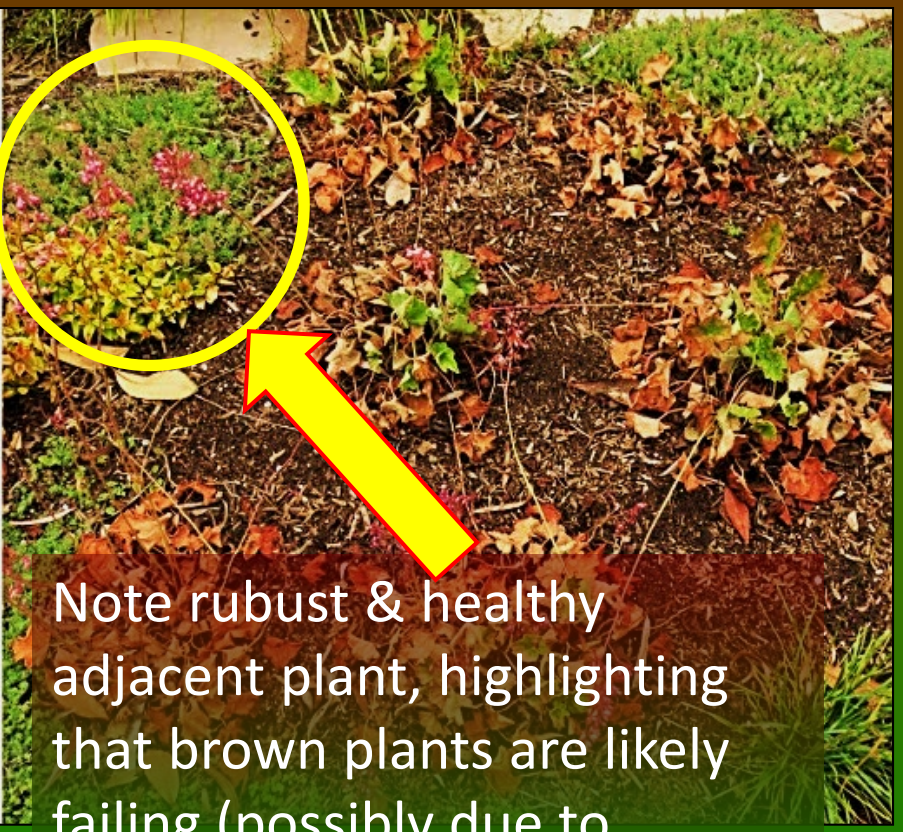
Plants brown from sun damage due to improper placement.

Plant Vigor: Clues

Signs of "Poor" vigor include:

Plants brown from sun damage due to improper placement.

Plant Vigor: How to distinguish poor health from normal life cycle? Questions to consider:



Note rubust & healthy adjacent plant, highlighting that brown plants are likely failing (possibly due to improper siting).

- Are plants turning brown due to poor health or moving to dormancy for autumn?
- Do other plants (different species) nearby also appear dead or dying?
- Is plant evergreen? (e.g., sword fern shouldn't be all brown.)

Plant Vigor?!

The absence of almost all green plant life clearly indicates high plant mortality in the open areas and a few barely-living plants elsewhere. This would need to be flagged as “poor,” and possibly also discussed in more detail in the “other observations” section.

V-2: #1 – <u>All</u> Veg Cover By Zone

Cover Classes:

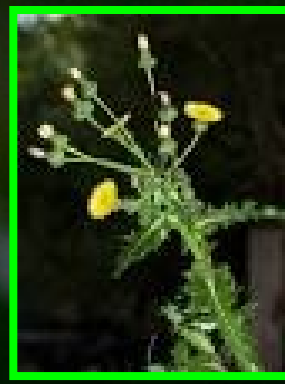
N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%
***Vigor Ranking*:**		**P** – Poor		**M** – Moderate		**R** – Robust	

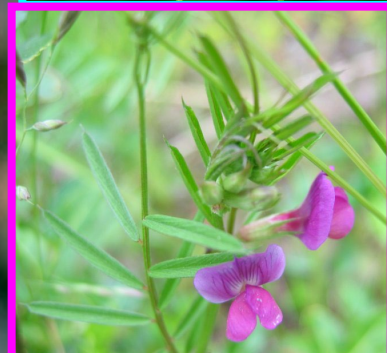
Overhanging Plants *Outside* Rain Garden?

- The assessment is concerned with the **function of the rain garden as it was designed**, by evaluating vigor/coverage of both *chosen plants* and any volunteer species that have colonized it.
- Trees or large shrubs whose trunk is beyond Zone 3 with branches overhanging the garden are **not part of the garden**.
- If overhanging vegetation has *influence* on the garden, **record any relevant impact** of nearby vegetation in section V-3, "Other observations."

Target Invasive Weeds

- Described in resource guides
- Invasive species that can colonize quickly
- Their presence may also indicate hydrological issues





Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

Reed Canary Grass

Invasive Grasses

- Velvet Grass
- Fine Fescue
- Perennial Rye

Willow Herb – “Weedy Fireweed”

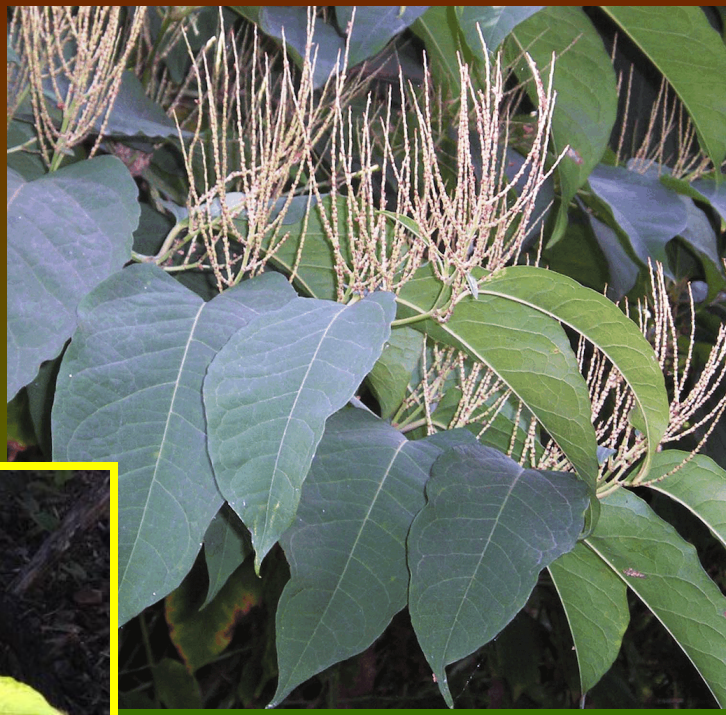
- **Epilobium ciliatum**

Non-native Blackberries

- Himalayan
- Evergreen/Cutleaf

Hedge Bindweed

Invasive Knotweeds



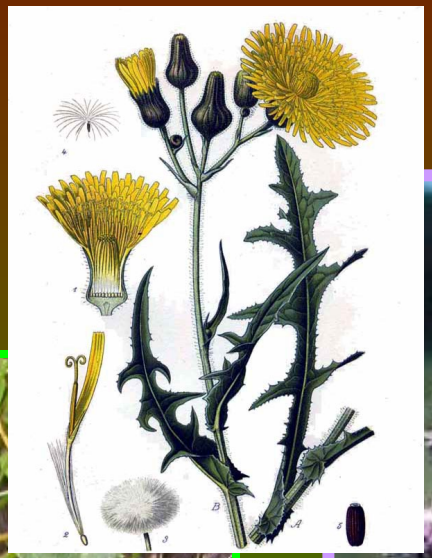
Herb Robert – “Stinky Bob”

Geranium robertianum

Birds-foot Trefoil

Lotus corniculatus

All Thistles/Sow-thistles



“Dandelion Hawkweeds”

Vetches, Sweet Peas, Clovers

Docks – Rumex spp.

More Targets: Presence might indicate drainage issues. Thus these wet-soil colonizers includes *both* invasive & native plants.

- Creeping buttercup
- Purple-loosestrife
- Skunk Cabbage (native)
- Cattails (native)
- Algaes
- Horsetails (might be native)

Non-target Weeds

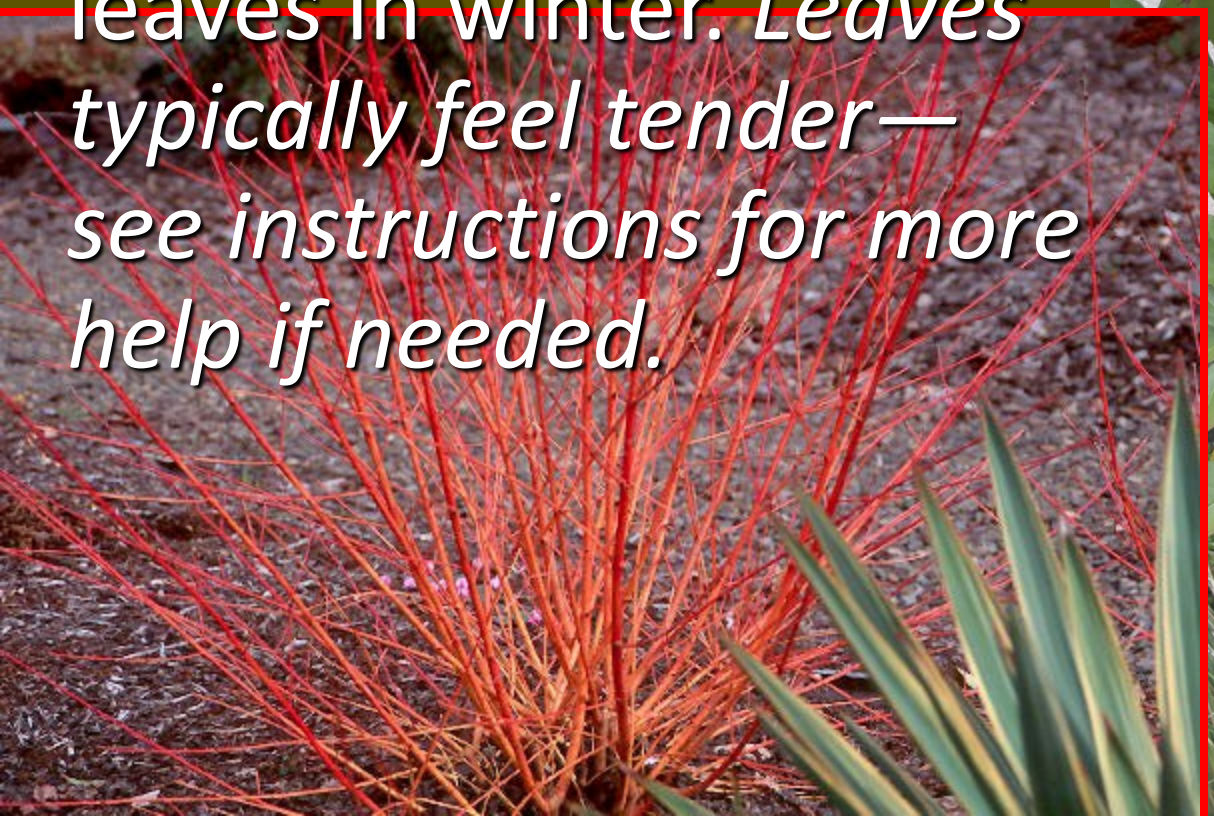
Includes **all** weeds that are **not** specifically called out in the "TPP" list.

Cover Classes:

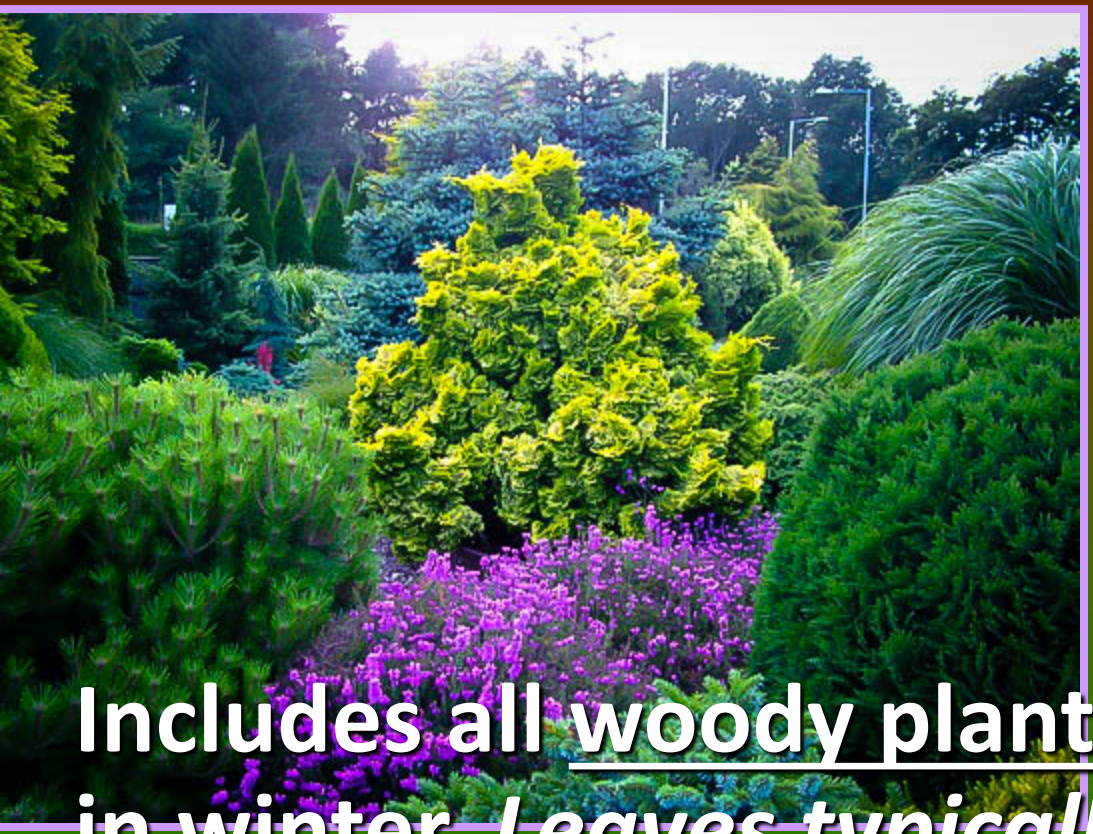
N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

Deciduous Shrubs & Trees

Includes all **woody plants** that lose their leaves in winter. *Leaves typically feel tender—see instructions for more help if needed.*



Evergreen Shrubs/Trees



Includes all <u>woody plants</u> that <u>retain</u> leaves in winter. ***Leaves typically feel leathery or are needle-like. Can include sub-shrubs—see instructions for more help if needed.***

“Herbaceous” = Perennials, Grasses, Emergents, Ferns

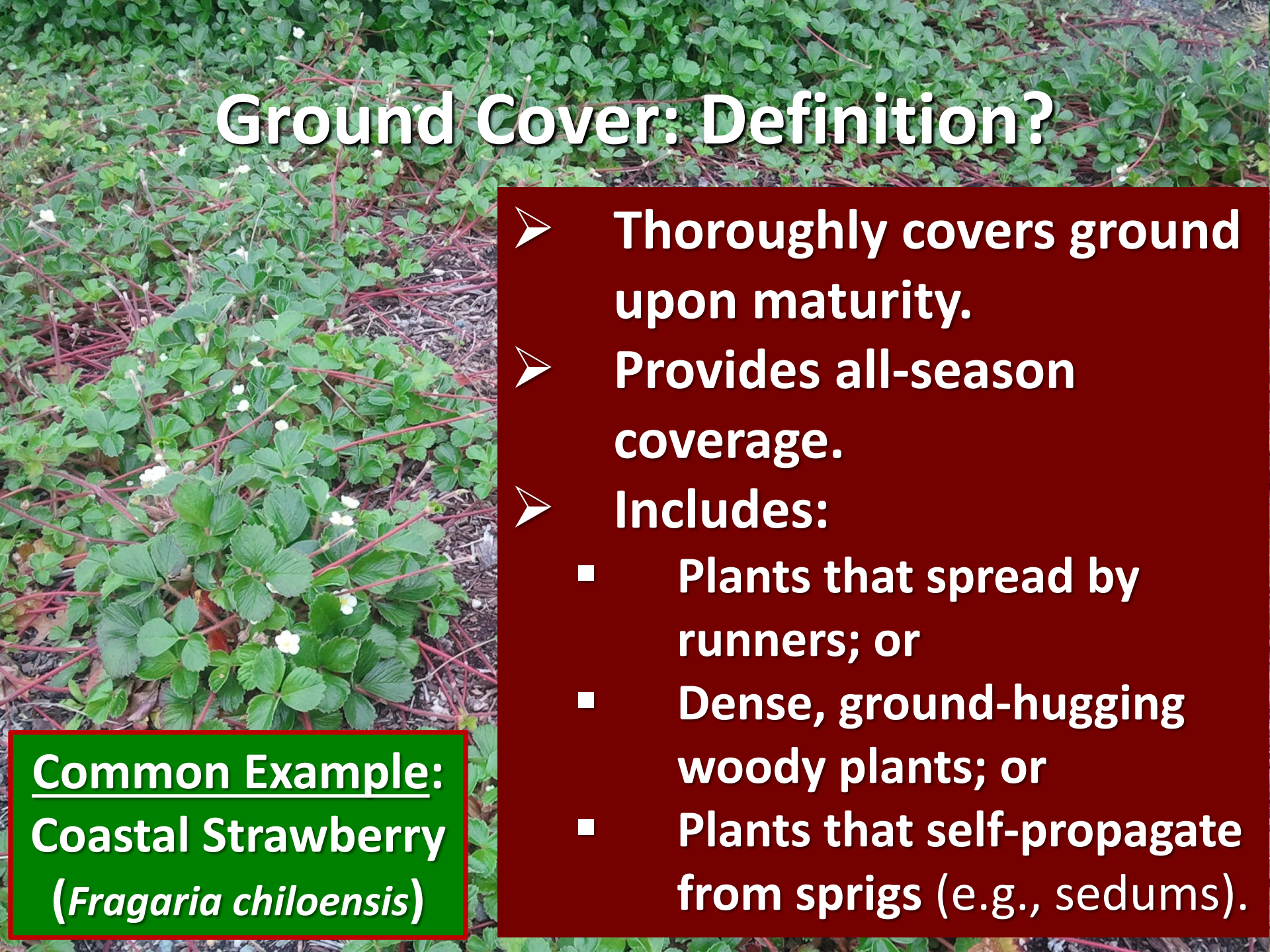
Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%

Vigor Ranking:	P – Poor	M – Moderate	R – Robust

Ground Cover: Definition?

- Thoroughly covers ground upon maturity.
- Provides all-season coverage.
- Includes:
  - Plants that spread by runners; or
  - Dense, ground-hugging woody plants; or
  - Plants that self-propagate from sprigs (e.g., sedums).



Common Example:
Coastal Strawberry
(*Fragaria chiloensis*)

Ground Cover

Cover Classes:

N = None	T = Trace <.5%	A= .5-5%	B = 6-25%	C = 26-50%	D = 51-75%	E = 76-95%	F = >96%
***Vigor Ranking*:**		**P** – Poor		**M** – Moderate		**R** – Robust	

Coastal Strawberry
(*Fragaria chiloensis*)

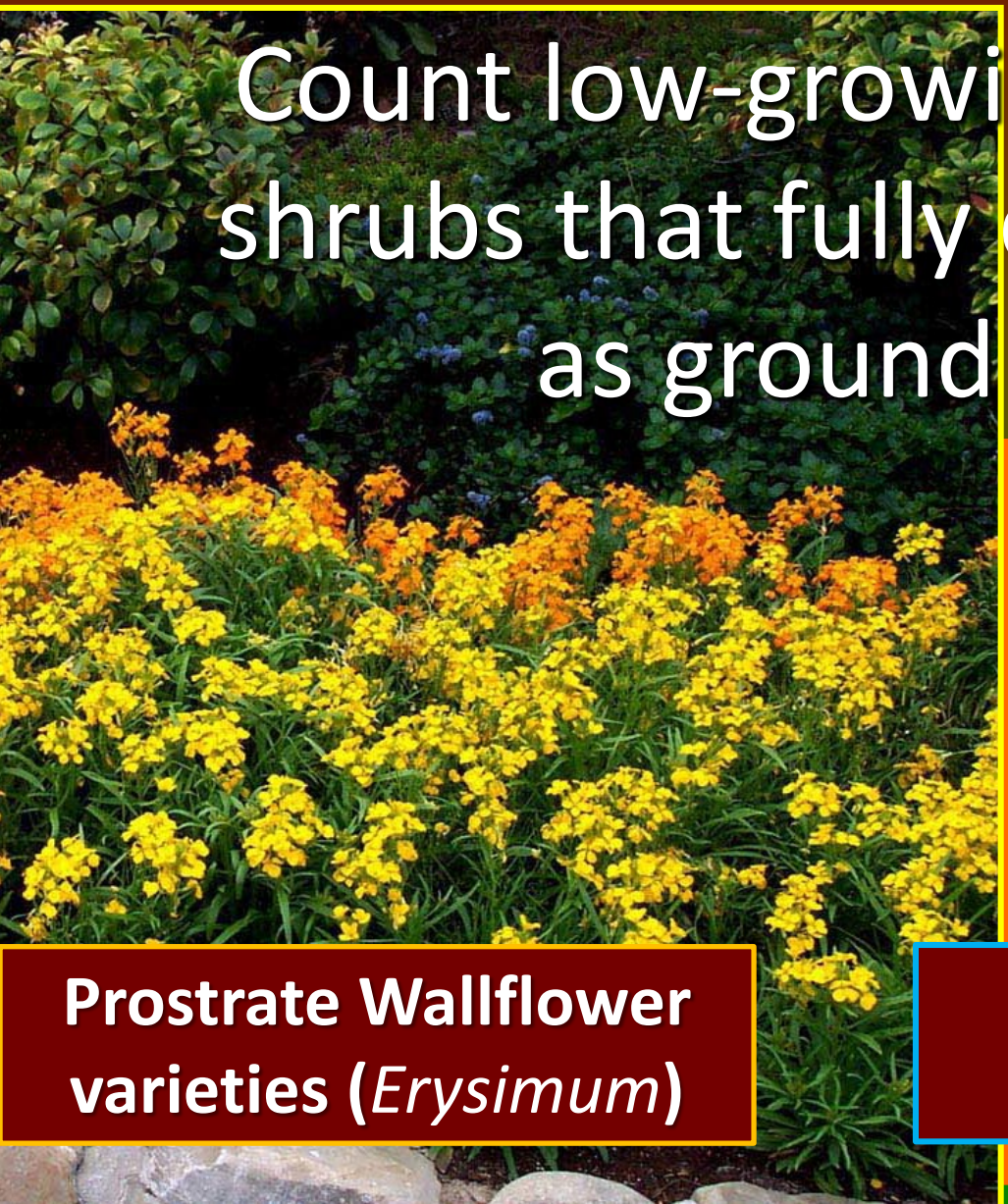
Ground Cover Examples

Creeping Raspberry
(*Rubus calycinoides*)

Creeping Thymes

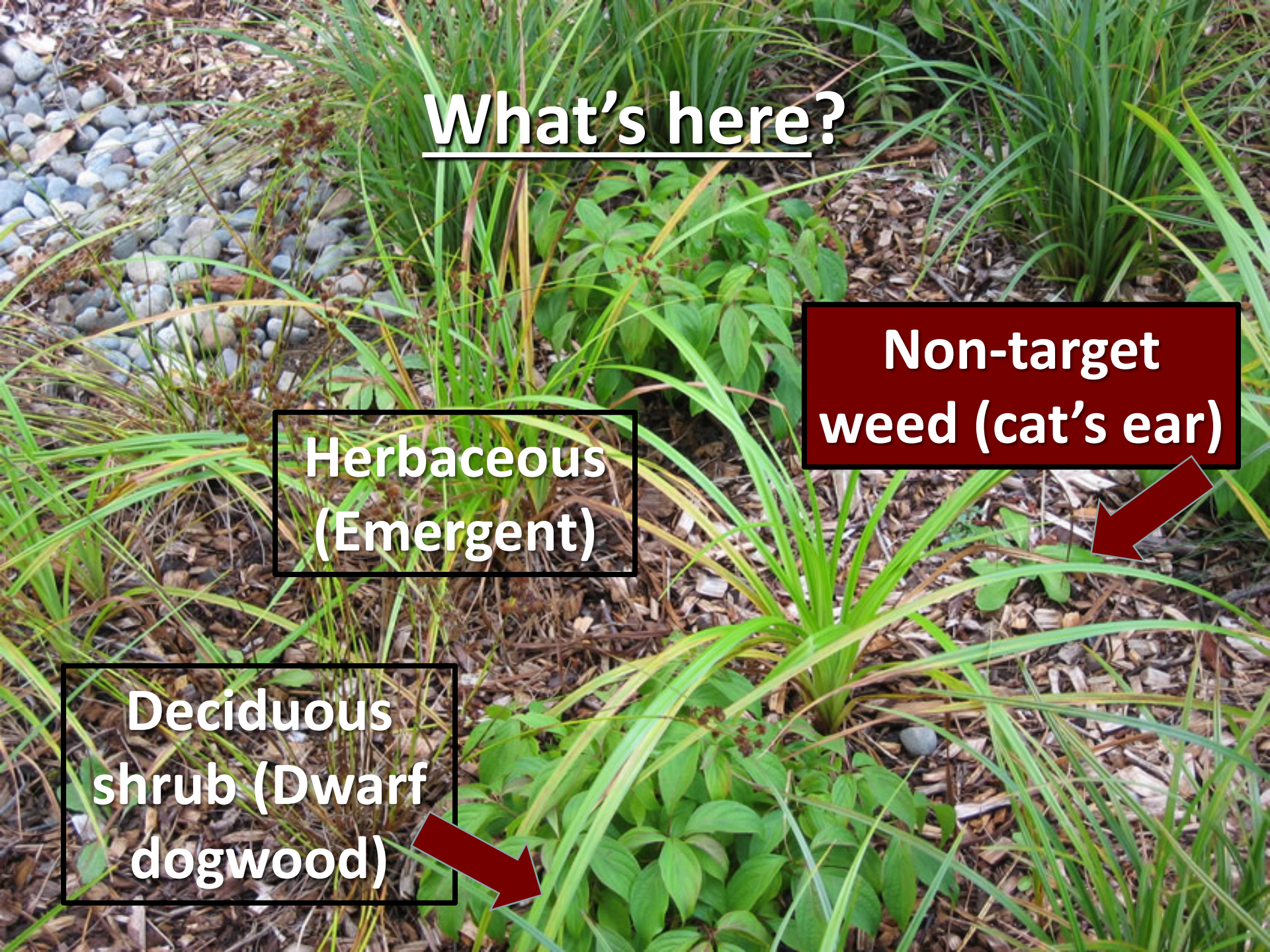
Sub-shrubs – *Shrubs or Ground Cover?*

Count low-growing/prostrate shrubs that fully cover ground as ground cover.



Prostrate Wallflower varieties (*Erysimum*)

Sun Rose (*Helianthemum*)


What's here?
Herbaceous (Emergent)
Non-target weed (cat's ear)
Deciduous shrub (Dwarf dogwood)

V-3. Other Vegetation Observations

This section enables more explanation of site conditions, including relevant influence from nearby plants *not in the garden*, but either adjacent or hanging overhead.

V-3. Other Vegetation Observations:

Please describe any vegetation observations that are not accounted for in the information collected.

Vegetation is overall thriving and very healthy. Regular maintenance schedule has minimized number of invasive plants, allowing intended plants to flourish. At date of this monitoring, early spring maintenance not yet performed to address new annual weeds and to cut back ornamental grasses, but we were informed that will occur soon.

There is a Deodar Cedar overhanging the garden that contributes substantial needle deposits throughout the year. If regular maintenance schedule is not maintained, these deposits can smother small rain garden plants. Also, large street trees nearby (also not in the rain garden) are a species that is prone to branches breaking/dropping during wind or ice storms. Garden must be checked after storms.

There is a bank of nearby invasive blackberries, but the regular maintenance in this facility has so far prevented them from spreading.

V-4: Public Amenities

V-4. Public Amenities: Select a rank to answer each of the following questions.

How visible is the site to the public?	**Low**	**Moderate**	**High**
How aesthetically pleasing is this site?	**Low**	**Moderate**	**High**
How well maintained is this site?	**Low**	**Moderate**	**High**
Is there any educational signage affiliated with the rain garden?	**Yes**	**No**	

V-5. Other Observations:

Please describe any other observations that are not accounted for in the information collected.

V-4. Public Amenities

Select the quality of amenities using "low, medium, high"

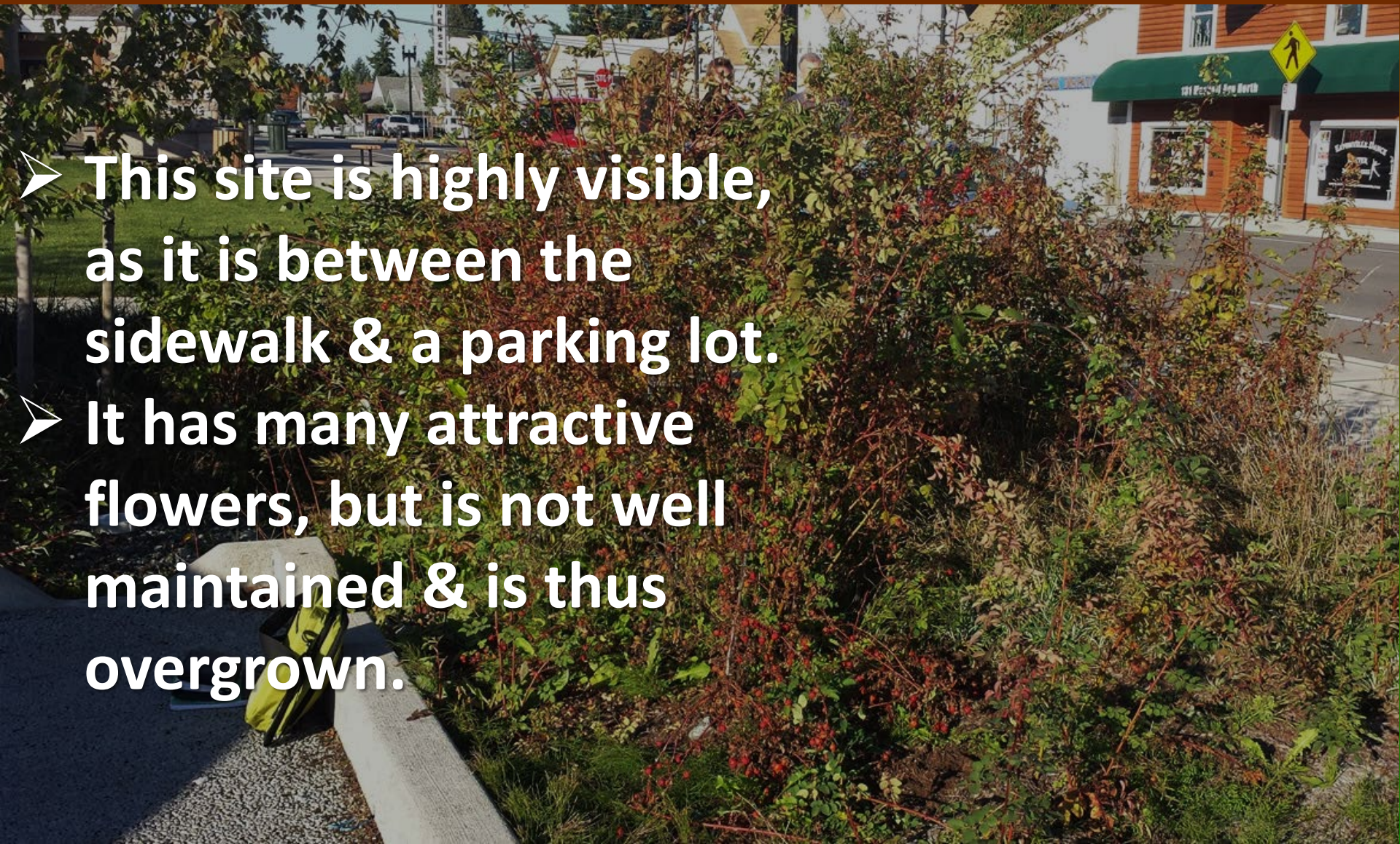
- **"Visibility"** is determined based on ease of view from from passers-by. Examples: Rights-of-way, front yards, courtyards of commercial locations, parking lots.
- **"Maintenance"** can be judged based on amount of weeds, need for pruning & mulching, health of plants.
- **"Aesthetics"** is largely subjective question. Recognize that goal is general acceptance, thus basic attractiveness & sense of order are valuable features.

V-4. Public Amenities

- Make judgments in your monitoring team to rank visibility, aesthetics, & quality of maintenance.
- Team-based judgments help average out personal biases.

V-4. Public Amenities: Select a rank to answer each of the following questions.			
How visible is the site to the public?	Low	Moderate	(High)
How aesthetically pleasing is this site?	Low	Moderate	(High)
How well maintained is this site?	Low	Moderate	(High)
Is there any educational signage affiliated with the rain garden?	(Yes)	No	

How Visible to the Public? How Aesthetically Pleasing?



- This site is highly visible, as it is between the sidewalk & a parking lot.
- It has many attractive flowers, but is not well maintained & is thus overgrown.

Visible? Aesthetically pleasing? Low – Moderate – High

- This site is highly visible, between the sidewalk & street.
- It has many attractive flowers, is kept well trimmed & mulched.

Visibility?
Aesthetics?
Maintenance?

- This site is **highly visible** in a park.
- **Inappropriate plants** were chosen in the original plan, & most have died, creating bare spots & allowing weeds to colonize.
- **Poor maintenance** further diminishes the aesthetics of this site.

Visibility? Aesthetics? Maintenance?

- This site is **highly visible in a front yard.**
- It's **well maintained.**
- Close plant spacing is used to minimize weeds; some find the "wild" look unattractive, which could lead to different views as you come to consensus in your group re: aesthetics.
- Consistent maintenance lends overall **tidy effect,** which is typically deemed **"attractive."**

Visibility? Aesthetics? Maintenance?

- This site highly visible to passers-by, beautiful, and well maintained.

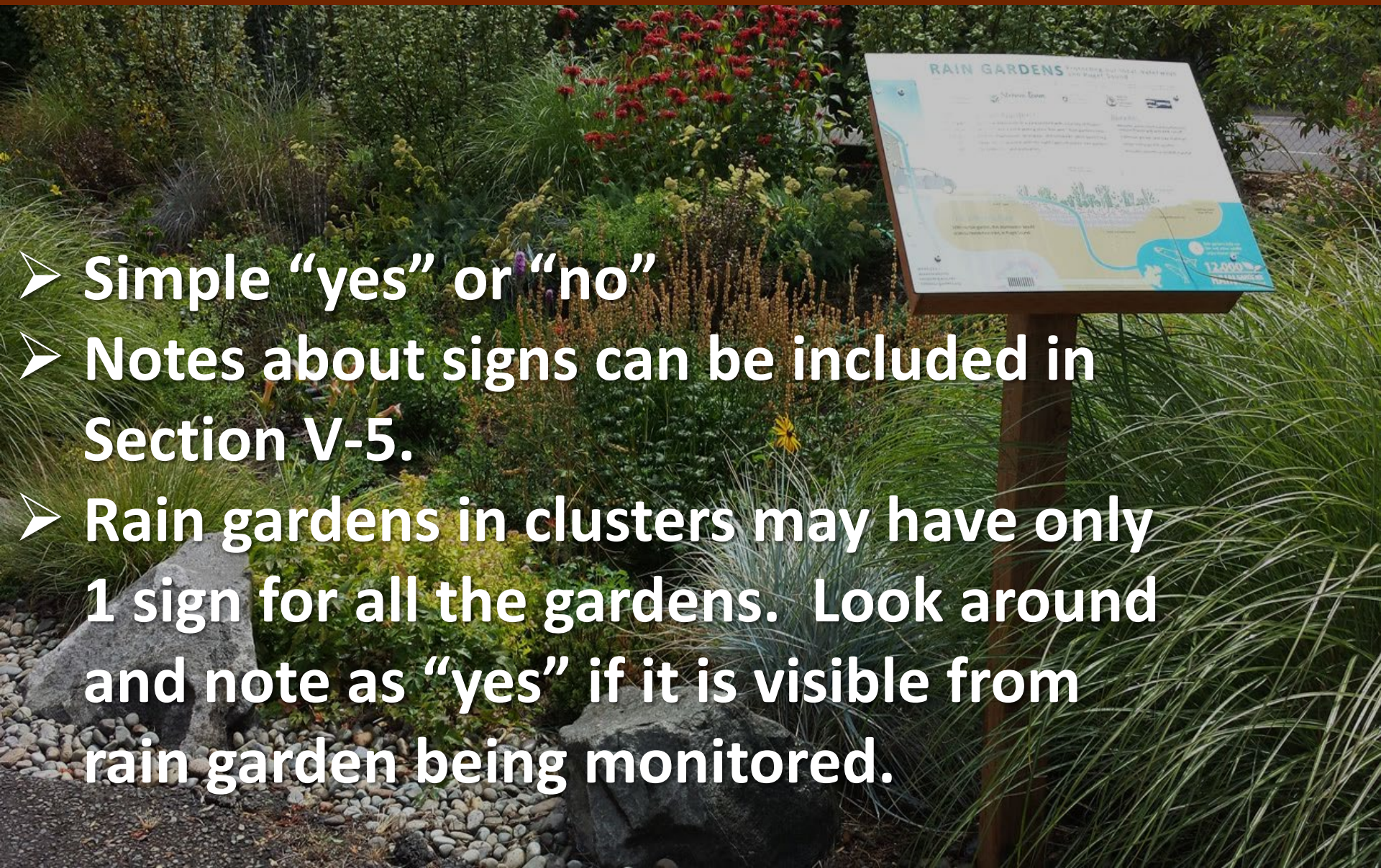
Linda Andrews Landscape & Design


Well maintained & attractive.

Well maintained & attractive.

Highly visible. Easy to maintain by design. Simple design, but attractive due to tidiness/order.

Educational Signage?



- Simple “yes” or “no”
- Notes about signs can be included in Section V-5.
- Rain gardens in clusters may have only 1 sign for all the gardens. Look around and note as “yes” if it is visible from rain garden being monitored.

V-5. Other Observations

- Use this section to record additional information about any of the monitoring results that were not captured in the form's allotted categories.
- Notes about areas of concern or unique attributes will help the data readers better understand the function of the rain garden.

V-5. Other Observations:

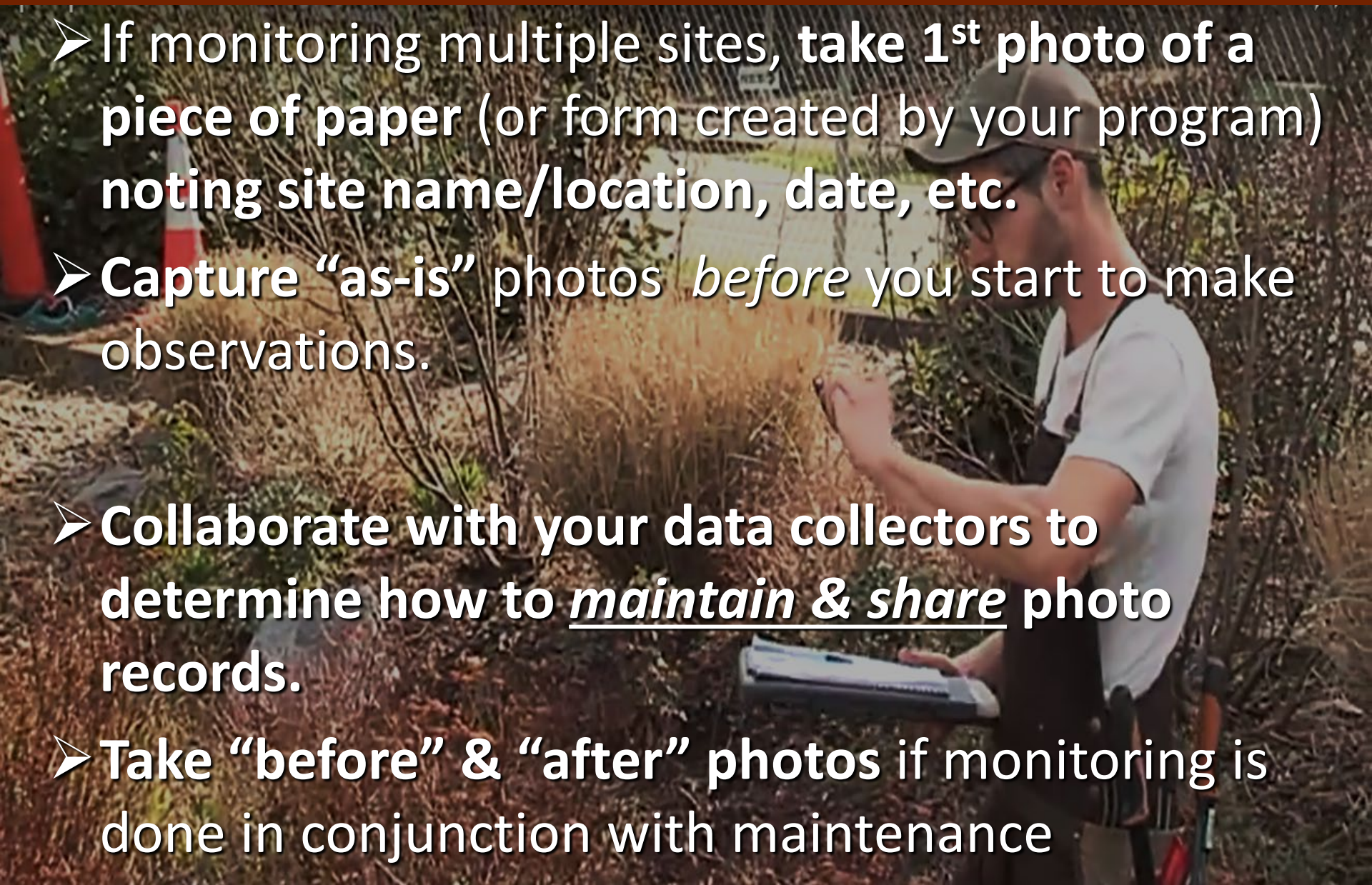
Please describe any other observations that are not accounted for in the information collected.

This bioretention facility appears to be performing well. In fact, it may be oversized as noted above. The consistent maintenance schedule should continue, as it is making a difference in attractiveness & community acceptance. The educational sign has recently been re-attached to new post, but it looks like it needs a more permanent repair. Also, vandals may strike again, so sign should be fixed as soon as possible to avoid it being taken from the site.

Optional: Photo Points & Records

- **Maintaining regular photo points** adds to the database for any given rain garden.
- **Identify and record *consistent locations*** to be photographed at each monitoring visit. Ideas:
  - ✓ **Opposite sides of the rain garden, looking inward**
  - ✓ **Inflow & overflow structures/systems**
  - ✓ **Mulch & rock types and coverage**
  - ✓ **Public viewpoints**
- **Also photograph problems, innovative solutions employed, or anything noteworthy.**

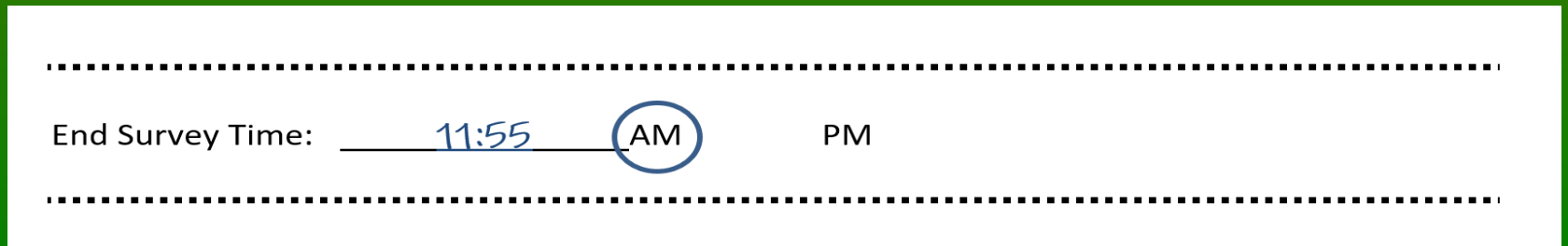
Optional: Photo Points & Records



- If monitoring multiple sites, **take 1st photo of a piece of paper** (or form created by your program) **noting site name/location, date, etc.**
- **Capture "as-is"** photos *before* you start to make observations.
- **Collaborate with your data collectors to determine how to *maintain & share* photo records.**
- **Take "before" & "after" photos** if monitoring is done in conjunction with maintenance

Record Ending Time & Finish Up!

- **Record** the team's **ending time** to assist in planning future monitoring at this site.
- **Ensure all** pages / sections of form are **completed.**
- **Clean & dry** tools, tarps, laminated sheets, etc.
- **Follow instructions for returning your monitoring kit & providing your forms.**
- **Follow through on sending or uploading any photos** taken from photo points.
- **Thanks to you & your team** for attention to detail!



Credits

Presentation developed by E. Guttman, Washington State University Extension. Edited by R. Simmons, & C. Bertolotto, WSU; & A. Clark, Stewardship Partners.

Adapted from classroom & field presentations of C. Bertolotto, E. Guttman, P. Kedziorski, & R. Simmons, WSU Extension.

Almost all **photos were taken** *by those named above*. **Additional photos & illustrations** provided by L. Andrews/ Patterns In Nature Landscaping, D. Adamson, S. Elie, D. Hymel/Rain Dog Designs, Tierra Inc., open-source stock images, & *Rain Garden Handbook for Western Washington*.