Rain Garden Maintenance

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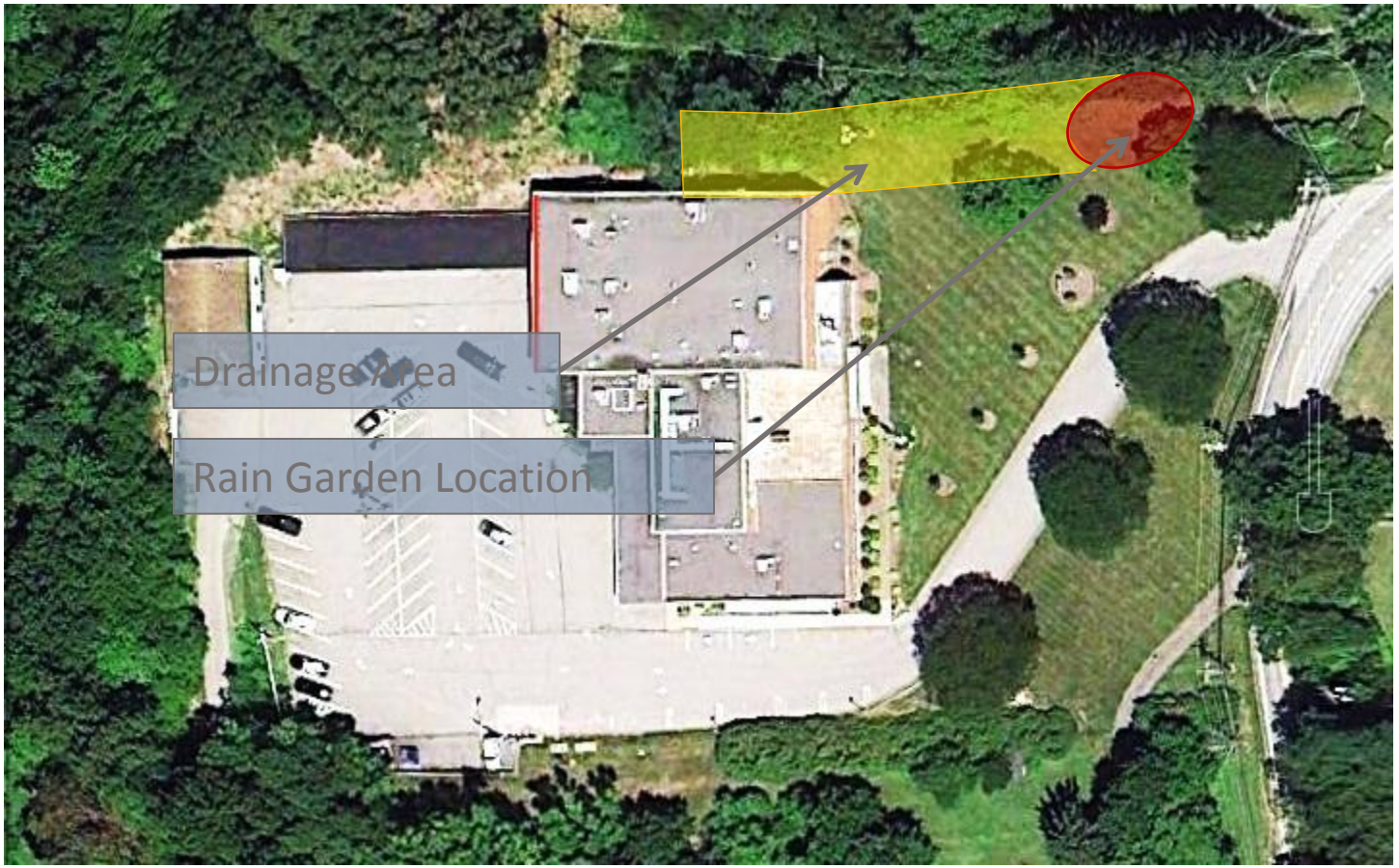
3 Rivers Wet Weather

All successful rain gardens are based on a defined drainage area



Run off is calculated using site specific Information

Site Information		
Type	**Area**	**Runoff coefficient**
Roof	3,000 s.f.	0.75
Lawn	7,168 s.f.	0.18

Design Storm Information			
	Precip. Frequency		
Duration	**1 year**	**2 year**	**5 year**
5-min	0.315	0.376	0.455
10-min	0.489	0.587	0.707
15-min	0.600	0.717	0.868
30-min	0.794	0.96	1.19
60-min	0.969	1.18	1.49
2-hr	1.100	1.34	1.69
3-hr	1.170	1.41	1.78
6-hr	1.410	1.7	2.11
12-hr	1.660	1.98	2.45
24-hr	1.950	2.32	2.83

Data from NOAA Precipitation Frequency Data Server 8/10/11, Station Name: Emsworth L/D Ohio River, 36-2574; http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=pa

- Determine surface types and area,
- And runoff coefficients
- Chart selected design storms

Runoff Volumes are then calculated to size the RGA

Runoff Volumes						
	Precip. Frequency					
Duration	1 year		2 year		5 year	
5-min	1,115 c.f.	8,342 gal.	1,331 c.f.	9,958 gal.	1,611 c.f.	12,050 gal.
10-min	1,731 c.f.	12,950 gal.	2,078 c.f.	15,545 gal.	2,503 c.f.	18,723 gal.
15-min	2,124 c.f.	15,890 gal.	2,538 c.f.	18,988 gal.	3,073 c.f.	22,987 gal.
30-min	2,811 c.f.	21,027 gal.	3,399 c.f.	25,424 gal.	4,213 c.f.	31,515 gal.
60-min	3,430 c.f.	25,662 gal.	4,177 c.f.	31,250 gal.	5,275 c.f.	39,459 gal.
2-hr	3,894 c.f.	29,131 gal.	4,744 c.f.	35,487 gal.	5,983 c.f.	44,756 gal.
3-hr	4,142 c.f.	30,985 gal.	4,992 c.f.	37,341 gal.	6,302 c.f.	47,139 gal.
6-hr	4,992 c.f.	37,341 gal.	6,018 c.f.	45,021 gal.	7,470 c.f.	55,879 gal.
12-hr	5,877 c.f.	43,962 gal.	7,010 c.f.	52,436 gal.	8,674 c.f.	64,883 gal.
24-hr	6,903 c.f.	51,642 gal.	8,213 c.f.	61,440 gal.	10,019 c.f.	74,946 gal.

- Runoff Volume in Cubic Feet=

  A x C x P

  A= Area

  C= Runoff Coefficient

  P=Precipitation

- Runoff Volume in Gallons=

  c.f. x 7.48051948

Calculate Infiltration Rate

Native Soils Infilration Rate
$D=T_pK$
D=Depth
T_p=Permited ponding time, here 3 days or 72 hours
K=infilration rate in ft/day, here .54 x .5*
D=72 x .54 x .5
D= 19.44
* "Soil infiltration rate K depends on soil texture. During construction, compaction must be avoided in order to preserve infiltration capacity. Nevertheless, inadvertent compaction and sedimentation reduce infiltration rate, so in design a safety factor is applied to K, commonly equal to 0.5; in other words, the infiltration rate used in design is in effect half of the value indicated the soil texture." -Landscape Graphic Standards

- Generate custom report from USDA Web Soil Survey

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

- Look up infiltration rate in Landscape Graphic Standards
- Calculate infiltration rate

Calculate storage capacity per S.F. of Rain Garden

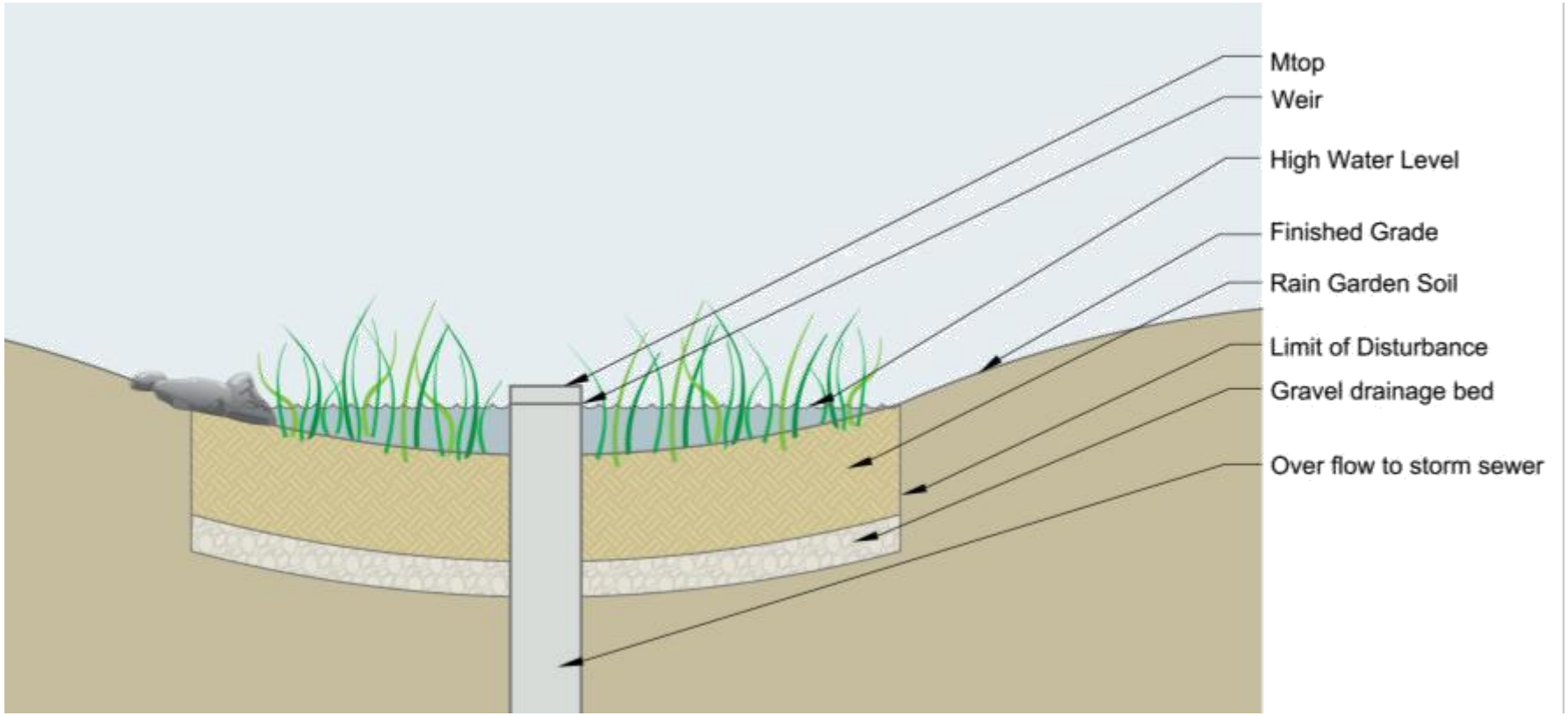
Storage Capacity per s.f. of rain garden				
S=RP+D				
S=Soil Water Storage				
R=Rooting Depth				
P=Porosity of material Gravel= 0.4 Soil= 0.6				
D=Depth of ponding				
	Depth of Soil (gravel bed 1/2 of soil depth)			
Height of Weir	**1**	**2**	**3**	**4**
12 in.	13.5 gal./s.f.	19.4 gal./s.f.	25.4 gal./s.f.	31.4 gal./s.f.
18 in.	17.2 gal./s.f.	23.2 gal./s.f.	29.2 gal./s.f.	35.2 gal./s.f.
24 in.	20.9 gal./s.f.	26.9 gal./s.f.	32.9 gal./s.f.	38.9 gal./s.f.

- Look up porosity rates of material based on soil report
- Calculate Storage Capacity per Square Foot of Rain Garden

*Note: does not include absorption rates of plant materials

Rain Garden Plan

Typical Rain Garden Section



*Note: Rain Garden does not have an under drain.

Plant Selection Criteria

- Can tolerate standing water
- Can tolerate dry conditions
- Native plants (or cultivars) are best. Plant communities :
  - Moist Prairie
  - Bottom Lands
  - Seasonal Wetlands
- Seasonal color and foliage
- Wildlife value


HomeGoods
I'm a Rain Garden!
I filter and clean rain water before it enters the sewer, reducing burden on waste water treatment facilities.

Excavation

Building the Weir

Adding Gravel drainage layer

Making Rain Garden Soil

Finished Grading

Planting

Completed Garden
Picture taken after 4 days of steady rain

2 years latter

Common maintenance problems

Poor / No Drainage

Dead and Dying plants

Weeds

Little or no water entering rain garden

Litter

Blow outs

Drainage problems start with poorly draining soils. Notice the under drain to help get excess water out of the rain garden.

Ground water in the bottom of the excavation is a bad sign.

Poor site management causes big problems. This rain garden on a construction site being used as a lay down area during the winter.

Plugged geotextiles are a very common problem. The only good solution is to remove or slice open the geotextile.

Extreme example of no drainage. Water can stand no longer than 72 hours before mosquitos start breeding.

Some soils will just not drain

Auguring can solve some drainage problems in the right type of soils. If you can enter a rock or shale layer the water will start percolating.

Additional underdrainage can be added to alleviate ponding.

This one is holding water!

It is supposed to! It has a liner. Know the design professional's intent before you start maintenance.

Early spring can be deceiving with rain gardens and standing water. This rain garden is fine, the underlying soils are still frozen.

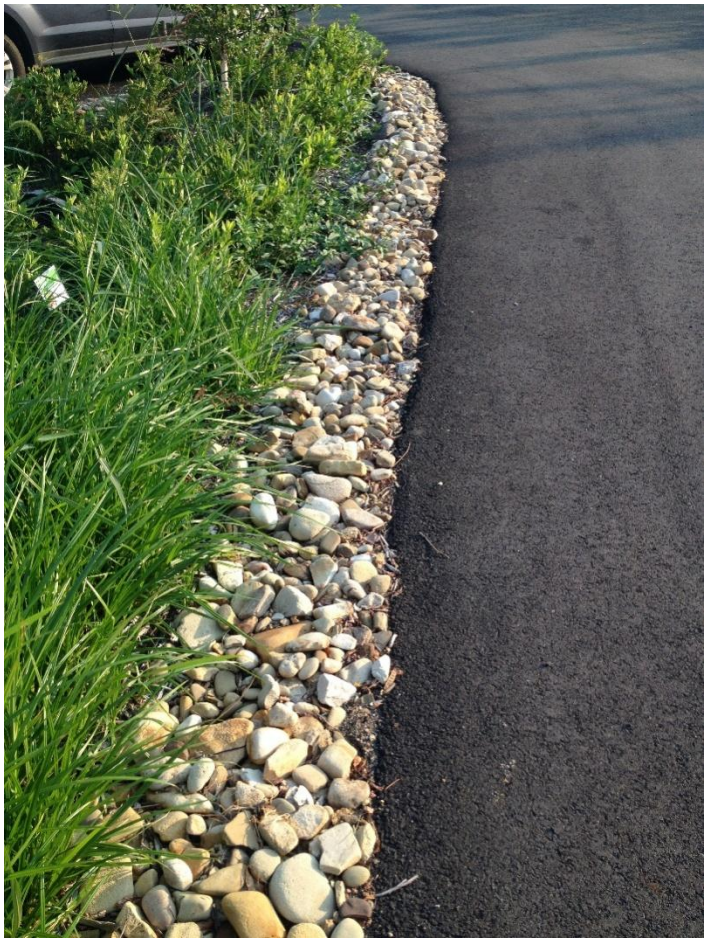
Weeds and tree seedlings are a common problem just as they are in regular landscapes.

Nutsedge is a huge problem. Moist organic soils are a perfect habitat for Nutsedge.

Rain garden short circuit and excessive siltation from parking lot run off. Not enough water is going to get into this rain garden to do any good.

Another engineer who had no confidence in the dark science of Green Infrastructure

Armoring the edge prevents erosion be careful not to dam out the sheet flow



Salt runoff from parking lots is also a huge problem. Most plants can not stand high salt concentrations in the soil.

Erosion is a common problem, these curb cuts are too small. Solution make them larger and farther away from the inlet.

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