rain garden design and installation

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SPRING LAKE Restoration Nurseries™

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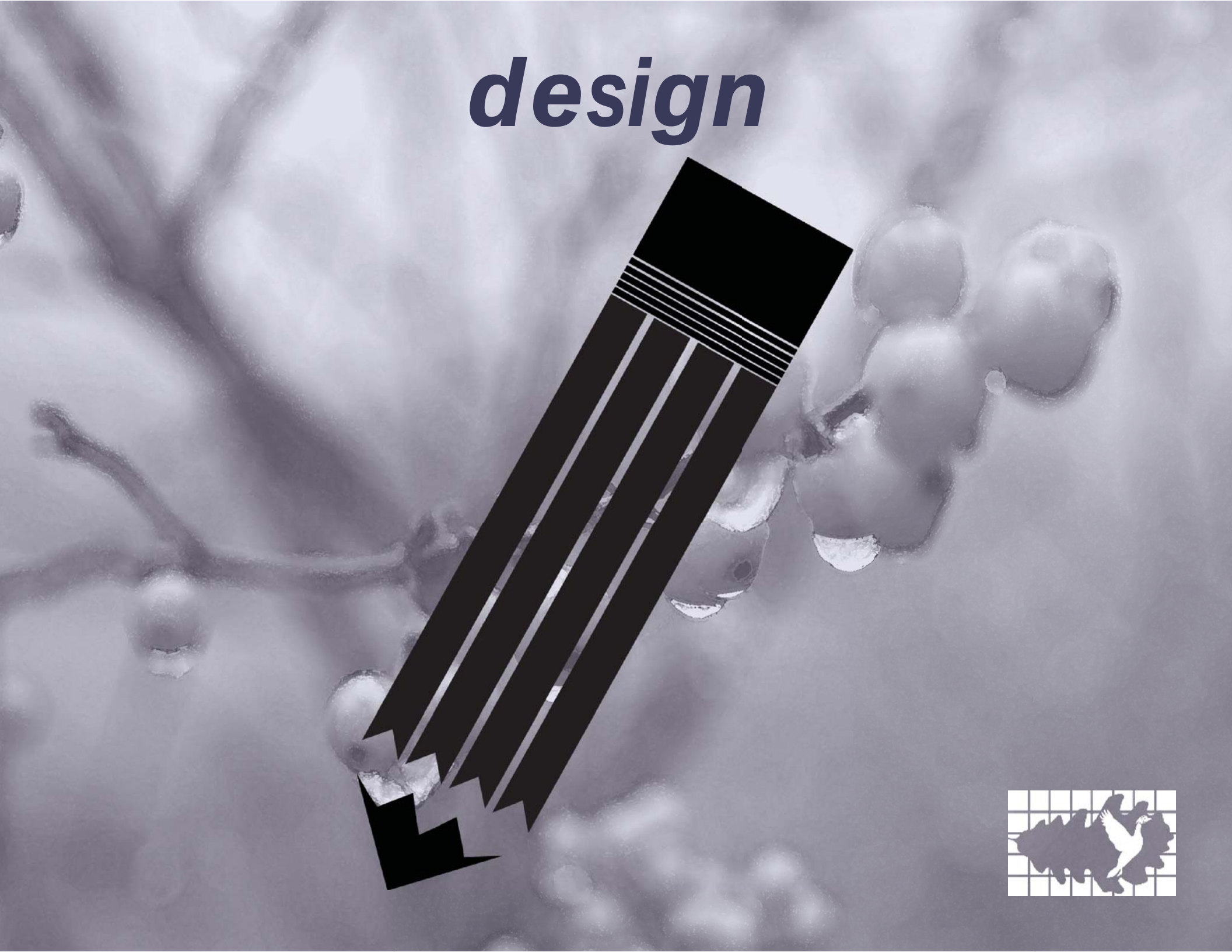
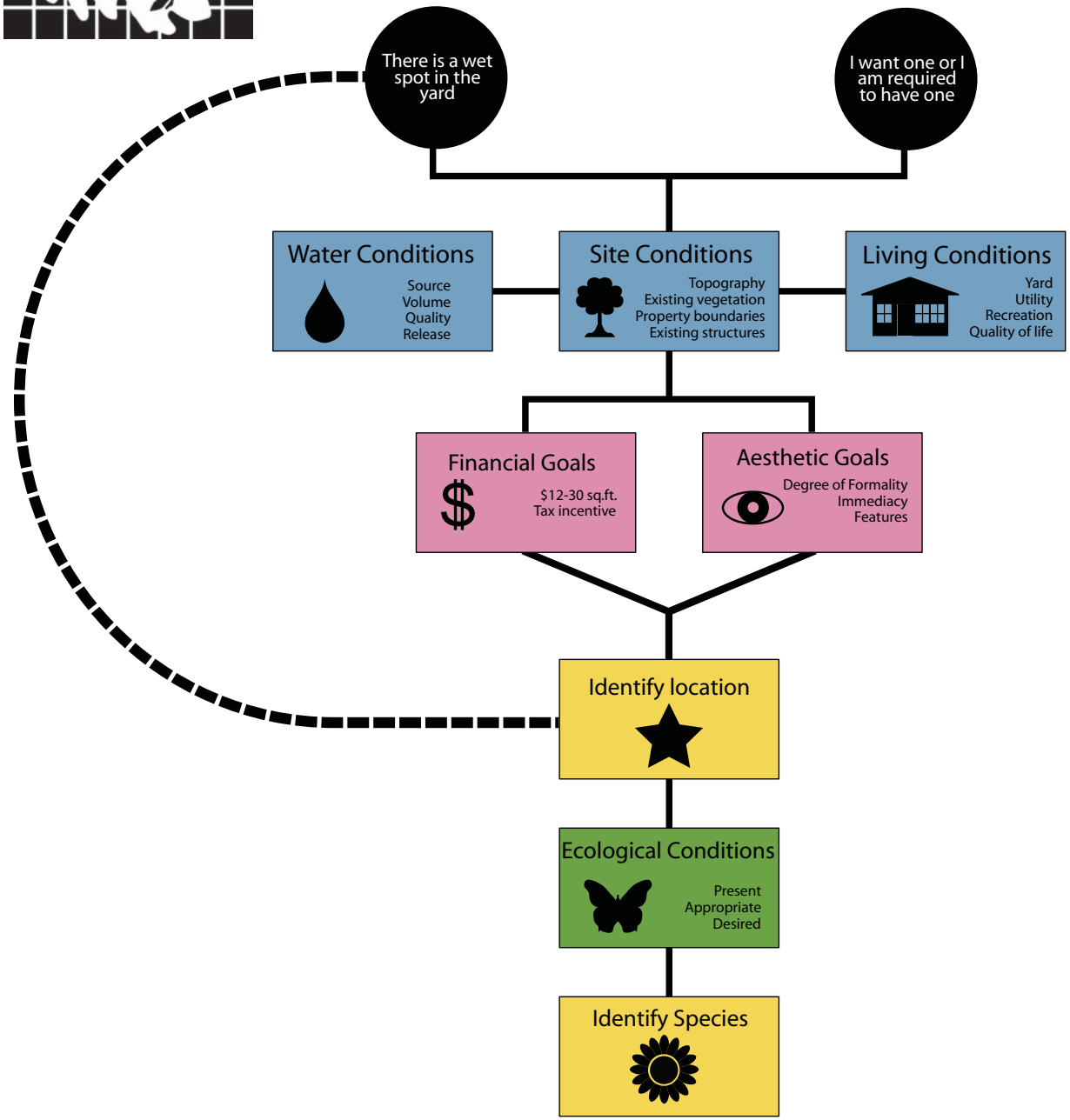
design



design considerations

why ?



reasons

opportunities and constraints

objectives

Example 1

- What is the source of water?

  Rooftop/Downspout

- What is the size of the watershed?

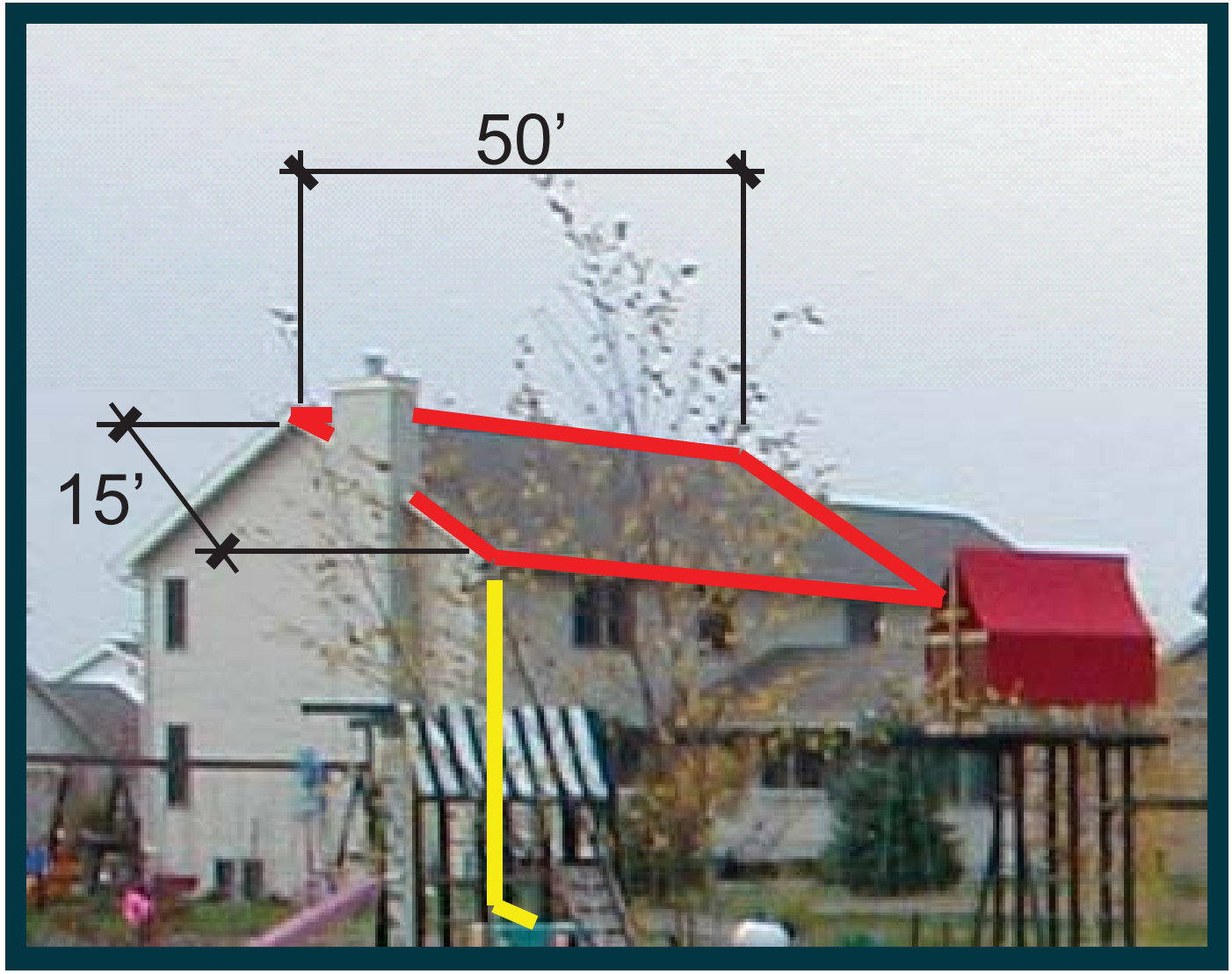
  50’x15’=750 sqft

- What is the quality of water?

  Some sediment, low pollution

- Where can the rain garden release?

  In the yard but, not under the deck, or in the swing set, or in planting areas



design considerations

water constraints

Example 2

- What is the source of water?

  overland/parking lot cross drainage

- What is the size of the watershed?

  265’x80’=21,200 sqft

- What is the quality of water?

  sediment, oil, free carbons, debris, sand, salt

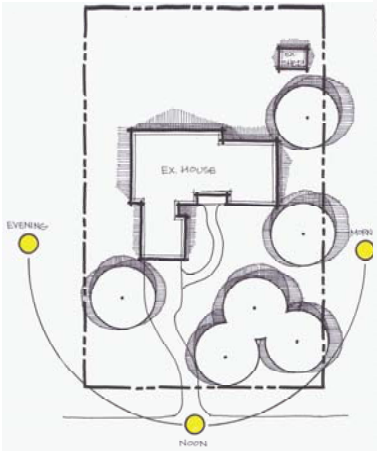
- Where can the rain garden release?

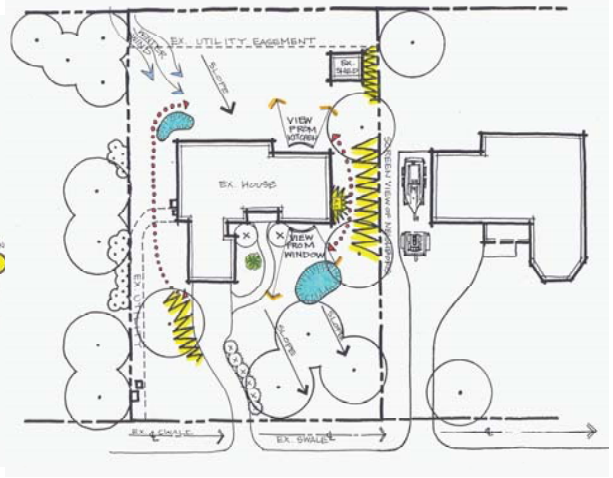
  municipal system

design considerations

site constraints

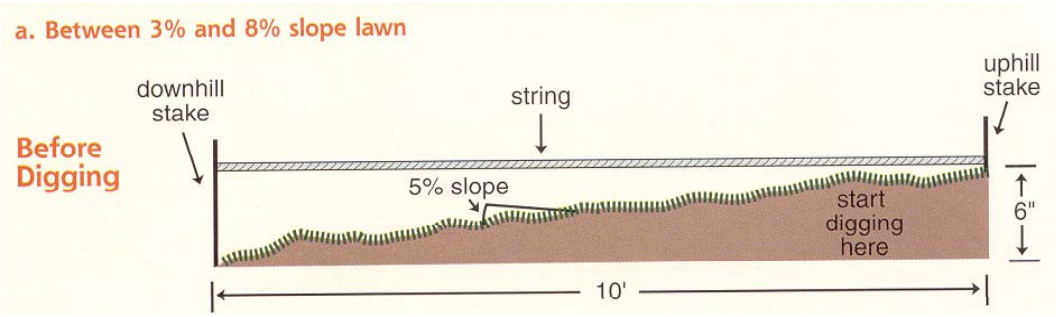
- Identify all existing vegetation
- Determine the location of all utilities
- Locate all structures to remain and to be removed
- Determine property lines and legal easements
- Identify any local ordinance that may govern

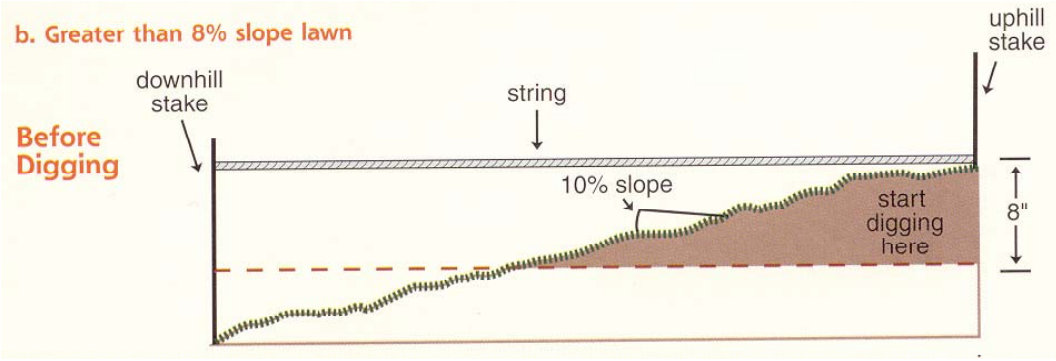




Example 1&2

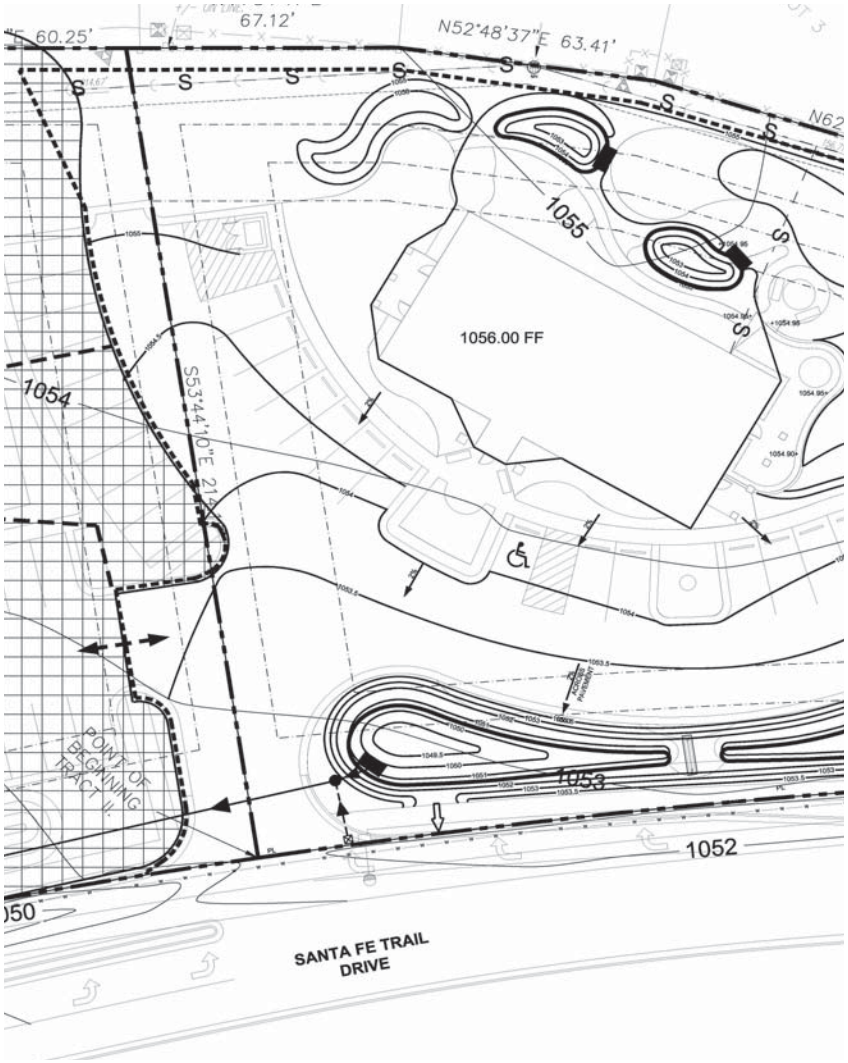
- Determine slope





images courtesy WI DNR

Slope = Rise/Run
0.05 = .5'/10'
multiply 0.05 by 100 to make a percent
and 0.05(100) = 5%



design considerations

site constraints

Example 1&2

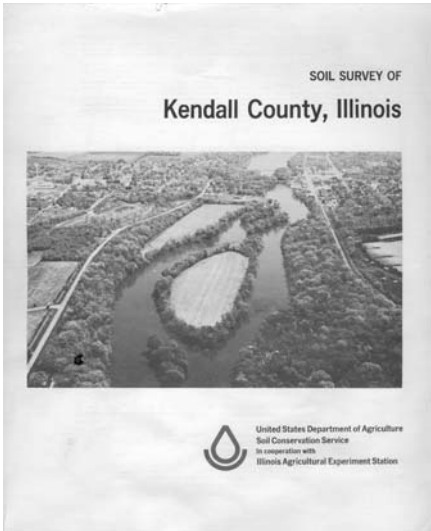
- Determine soil type

Experiment:
Dig one or more holes 1'x1' wide and 1' deep. Fill with water and monitor for one hour. Deterine how much water has soaked into the ground.

Well drained soils = .20" - 2"/hr
Clay soils = .05"- .19"/hr

Experiment:
Conduct a ribbon test to determine soil texture

Well drained soils = 1/2" or less
Clay soils = 1/2" or more



design considerations

site constraints

Example 1&2

- Determine garden size

Example 1

Recall watershed area was
50’ x 15’ = 750 sq ft.

750 sq ft * 0.25 (6-7 in deep well drained soils) = 187.5 sq ft rain garden required
Round up! We need a 200 sq ft rain garden.
(A garden about the size of a parking space)

Example 2

Recall watershed area was
265’ x 80’ = 21,200 sq ft.

21,200 sq ft * 0.25 (6-7 in deep well drained soils) = 5,300 sq ft rain garden required
We need a 5,300 sq ft rain garden.
(A garden about the size of 27 parking spaces)

Type of Soil	3-5 in. deep	6-7 in. deep	8 in. deep
Sandy	0.19	0.15	0.08
Silt Loam	0.34	0.25	0.16
Clayey	0.43	0.32	0.20

Application: Rain Gardens within 30’ of the home or structure

Type of Soil	Size of Rain Garden as % of Roof Area	Infiltration Rate, in/hr
Sandy	20% (5:1)	0.4
Silt Loam	30% (3:1)	0.20
Clayey	60% (2:1)	0.05

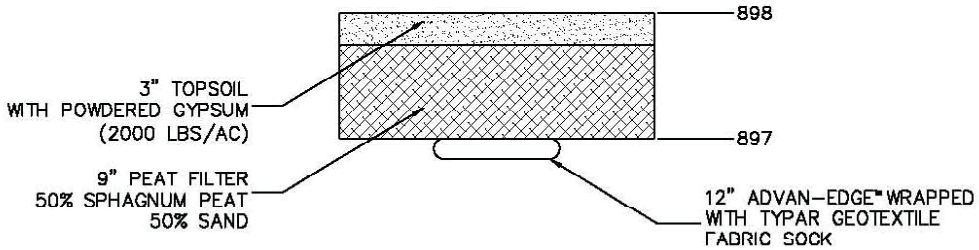
Application: Rule of thumb for controlling 90% of runoff
The infiltration rate (in/hr) = Size multiplier regardless of depth

Using Peat & Sand to Ammend Soil

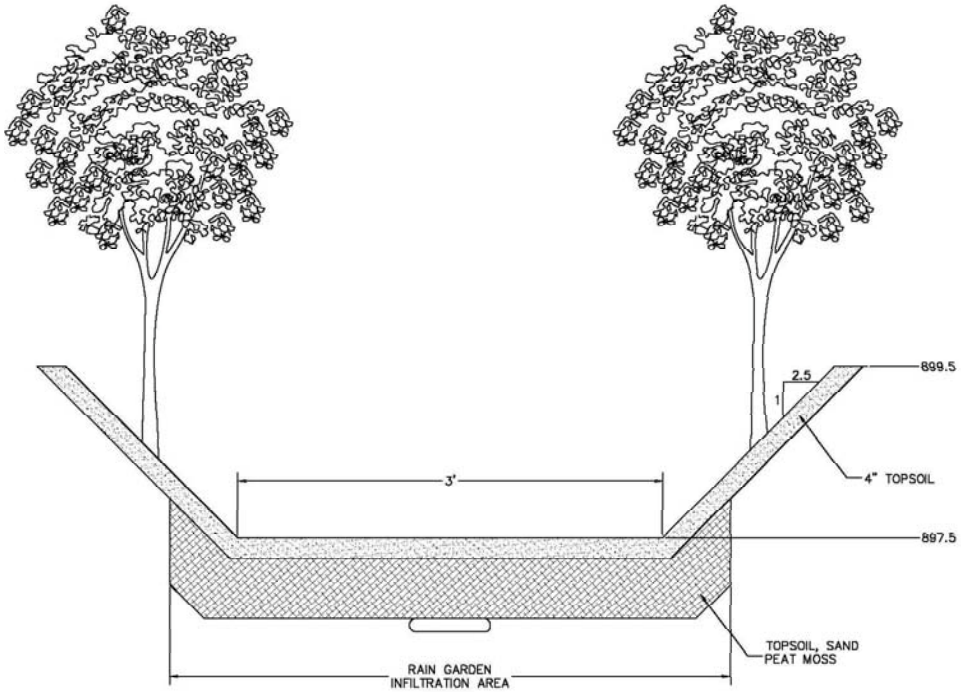
- Increase infiltration rate (1.3 in/hr permeability for a sand peat mixture)
- Provide additional phosphorous capture extend design life of system (30-year design life for phosphorous retention)

Type of peat is critical
Fibric sphagnum moss peat is preferred due to:

- Higher hydraulic conductivity (as high as 142 in/hr vs. as low as 0.0001 in/hr in sapric reed-sedge peat)
- Fibric sphagnum moss peat is about one order of magnitude higher in the quantity of Fe and Al sorption sites available compared with reed-sedge peat. The Fe and Al sites are use to sorb the ortho-phosphate in stormwater runoff.
- Decomposition of peat (fibric>hemic>sapric) results in less and less adsorptive capacity for the orthophosphates



CROSS SECTION DETAIL VIEW



CROSS SECTION A-A

design considerations

living constraints

- Develop a program

  What are the site needs?

  1. Recreation
  Areas for games, gathering spaces, viewing wildlife, sunbathing, walking

  2. Utility
  Compost pile, trash area, place to pot plants, a "holding" nursery, parking

  3. Quality of life
  What is needed to make you feel better?

design considerations

financial goals

- Identify your budget for:
  - design
  - material
  - construction

- How much can/will you do yourself?

A designed, and installed rain garden costs between $12-$25 sqft.

Cost is driven by aesthetic goals, who will prepare the work, the severity of the site.

Turf Grass Lawn with an Irrigation System vs. Native Prairie; from Seed

Estimated Annual Cost Per Acre; for a Five-Acre Planting Project

Turf Grass Lawn

	Year One	Year Two	Year Three	Year Four	Year Five	Annual Thereafter
Installing Seed, Mulch and Fertilizer	$ 2,770.00					
Mowing	$ 2,400.00	$ 2,500.00	$ 2,600.00	$ 2,750.00	$ 2,900.00	$ 3,000.00
Fertilizer Application		$ 750.00	$ 765.00	$ 770.00	$ 780.00	$ 790.00
Irrigation System	$ 4,000.00	$ 400.00	$ 500.00	$ 500.00	$ 600.00	$ 750.00
Municipal Water	$ 1,500.00	$ 800.00	$ 800.00	$ 800.00	$ 800.00	$ 800.00
Aerating/De-thatching		$ 850.00		$ 875.00		$ 1,115.00
Annual Expense	$ 10,670.00	$ 5,300.00	$ 4,665.00	$ 5,695.00	$ 5,080.00	$ 6,455.00
Total Cost After Five Years	***$ 31,410.00***					

Native Prairie

	Year One	Year Two	Year Three	Year Four	Year Five	Annual Thereafter
Installing Seed and 2-1/2" Plugs	$ 4,300.00					
Mulching	$ 675.00					
Mowing	$ 800.00	$ 400.00				
Spot Herbicide Treatment	$ 200.00	$ 500.00	$ 500.00	$ 330.00	$ 200.00	$ 150.00
Prescribed Burn		$ 2,125.00	$ 2,150.00		$ 2,200.00	$ 550.00
Annual Expense	$ 5,975.00	$ 3,025.00	$ 2,650.00	$ 330.00	$ 2,400.00	$ 700.00
Total Cost After Five Years	***$ 14,380.00***					

Notes:

1 Project size is 5 acres, continguous; costs are per acre for a project of this size
2 Prairie installation includes seeding 20 species and planting 500 2-1/2" plugs
3 Prairie burn cost is based on one prescribed burn every four years
4 Figures are not adjusted for inflation
5 To compare turf grass lawn without irrigation, simply subtract irrigation system from turfgrass cost
6. Prairie seed and plug installation can be made less expensive by including fewer species and fewer or no plugs

Total Annual Cost		
	Turf	**Prairie**
Year One	$10,670	$5,975
Year Two	5,300	3,025
Year Three	4,665	2,650
Year Four	5,695	330
Year Five	5,080	2,400
Five Year Total	**31,410**	**14,380**

design considerations

aesthetic goals

- Determine the immediacy of the planting
- Identify any features desired for the site
- Determine the appropriate level of design (formal to informal)
- Identify the ‘look’ you want o achieve

design considerations

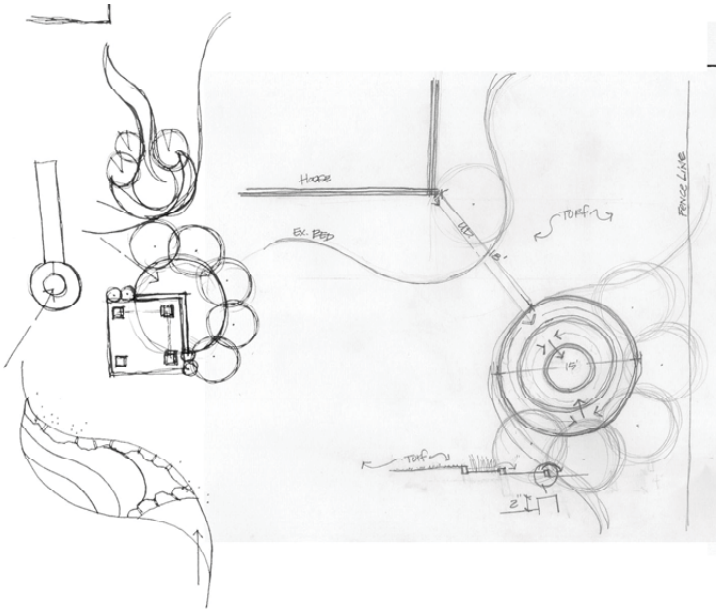
aesthetic goals

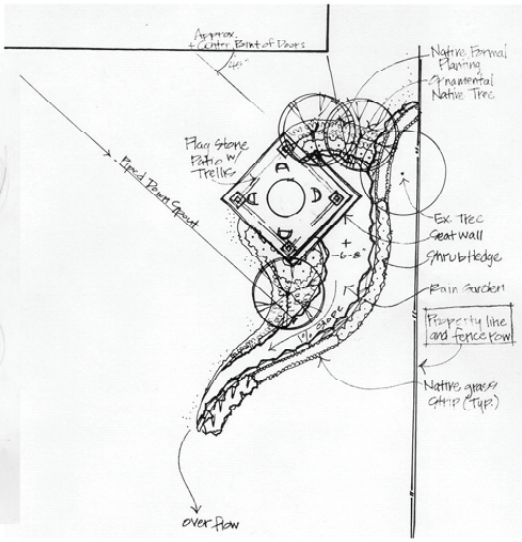
- Design to integrate with existing or future vegetation and landscaping

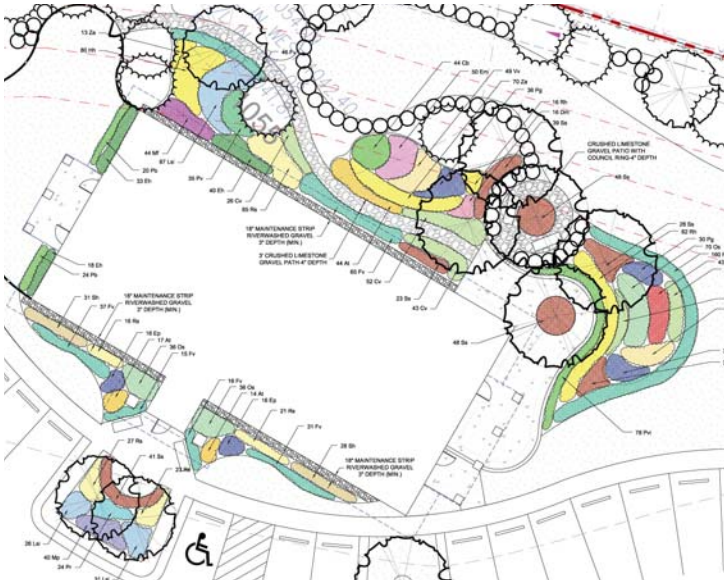
- Enhance with local stone, fences, trails, other plantings, and benches to give the garden an “intentional look”

- Rain Gardens can have ANY form, shape or concept! They can be curvilinear or rectilinear – use your imagination

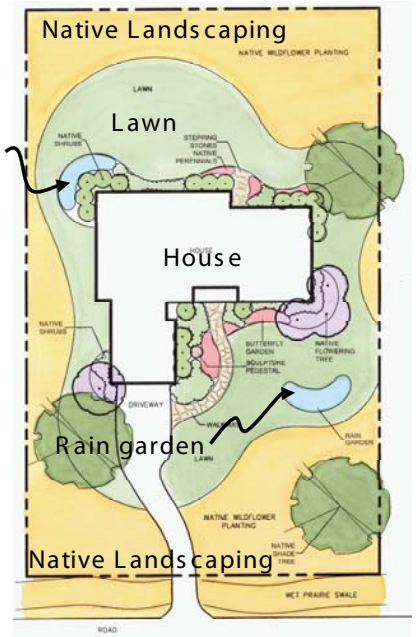
– respond to your site
– respond to your goals







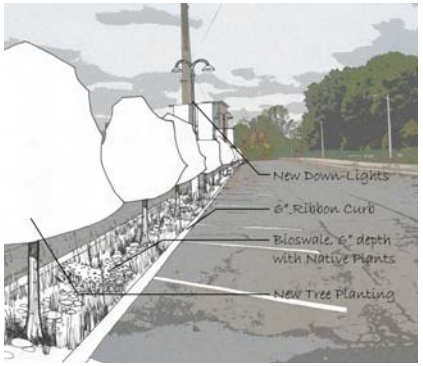
Rain garden

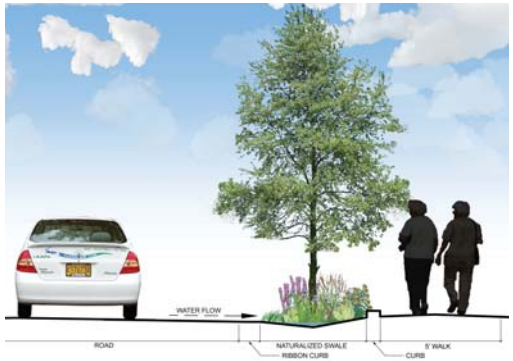


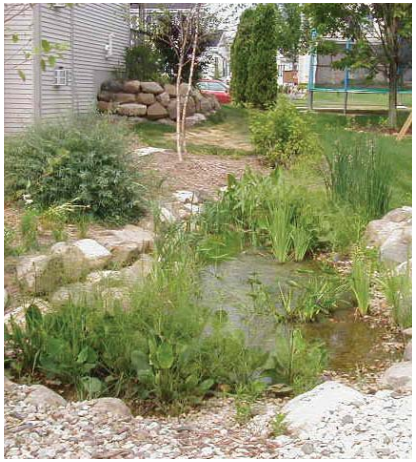
design considerations

aesthetic goals

- Do not sacrafice aesthetics for functionality; a rain garden is ***both***
- Rain gardens can be accomodated almost anywhere; often leading to the most interesting gardens
- These are ***gardens;*** think outside the 'kidney'



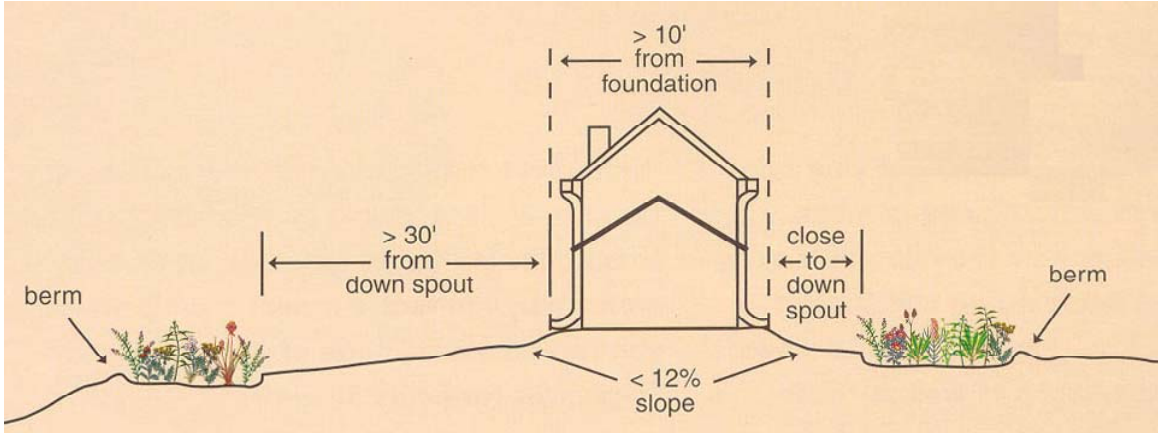




design considerations

identify location

- Identify a site that's at least 10 feet away from your building - a sunny location is best!
- Align it with your lot's basic drainage pattern so overflow will drain away from house
- Locate as close to the source as possible



design considerations

determine ecology

- What would have been here? Identify historical native conditions)
- What will survive here now? Determine the appropriate native species for the existing and proposed site conditions
- What systems do you desire? There may be times when you can adjust site parameters to influence in order to achieve the conditions desired

Wetland

Open or shaded landscape, low spots and saturated soils
Various moisture levels
Various plant heights
Various plant types: woody, herbaceous
Colorful in late spring and early fall

Typical Species Include:
Asclepias incarnata
Panicum virgatum
Phlox glaberina
Carex vulpinoidea
Iris virginica shrevei
Juncus torreyi
Lobelia cardinalis
Physostegia virginiana
Sagittaria latifolia
Scirpus atrovirens

Prairie

Open Landscape Full Sun, no shade
Dominated by grass, but high forb diversity
50% of blooms from June to August, 25% in spring, 25% in fall
Historically burned every year

Typical Species Include:
Andropogon gerardii
Monarda fistulosa
Sorghastrum nutans
Rudbeckia hirta
Echinacea pallida
Liatris pychnostachya
Asclepias tuberosa

Woodland

Shaded landscape
Various moisture levels
Blooms primarily in spring
Layered vegetation
Canopy closure 80% +

Typical Species Include:
Podophyllum peltatum
Dentaria lacianata
Polygnatum biflorum
Asarum canadense
Trillium grandifolium
Arisaema triflorum
Asclepias tuberosa

design considerations

determine species

- Select species based on appropriate ecosystem
- Plant in drifts; mass and accent plantings of single species provide immediate bold color
- Pattern drifts to emulate undulations or irregular edges in your landscape, or from the hardscape and architectural lines of the site
- Grasses or groundcovers give a continuous, refined look
- Planting with quarts or gallons give a more immediate mature look
- Plant fine textured plants in the foreground & coarse textured species in the background to create a sense of depth

design considerations

determine species

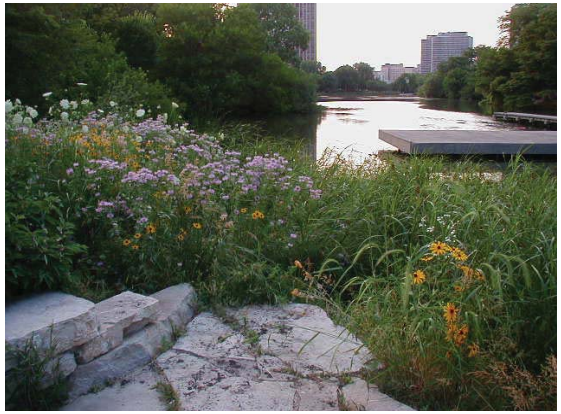
- Defined edges give a naturalized planting a deliberate look and provide evidence of habitation

- Plant groups of differently colored and textured species adjacent to each other

- Use formal plantings in the foreground and restoration as the backdrop

- Formalized planting areas are not restorations. Too much diversity can lead to a messy or arboretum aesthetic.

- The smaller the size of the planting area the more specific the placement and understanding of species arrangement required.



installation

& running the numbers for example 1

installation considerations

selecting plants

- Grasses or groundcovers give a continuous, refined look
- Plant fine textured plants in the foreground & coarse textured species in the background to create a sense of depth
- Label plants (one per group) for quick ID during weeding
- Plant groups of differently colored and textured species adjacent to each other
- Formalized plantings areas are not restorations, too much diversity can lead to a messy or arboretum aesthetic
- The smaller the size of the planting are the more specific the placement and understanding of species arrangement required
- Incorporate diverse mixture of sedges, rushes, & grasses with your flowering species
- Mix heights, shapes, & textures

Why Use Native Plants?

a. Hardy native wet prairie (well-drained soils) and emergent (clay soils) plant species will tolerate spring floods and summer droughts

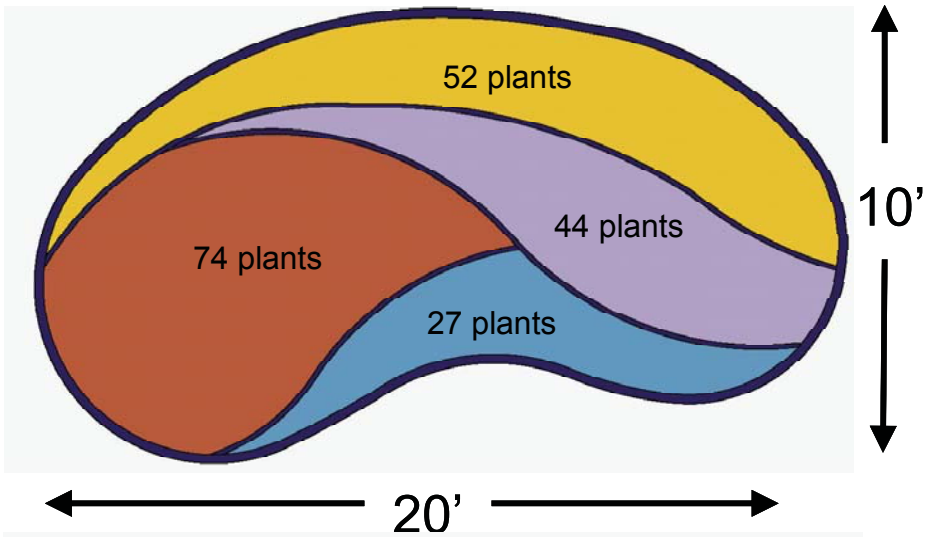
b. They perform better in our local soil, moisture, and light conditions

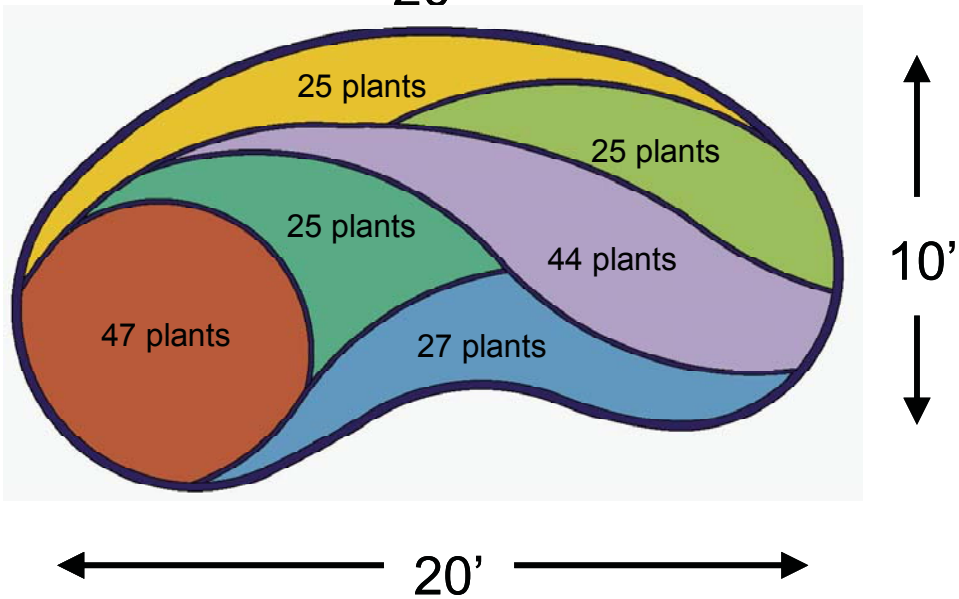
c. They do not require supplemental water, fertilizers, pesticides, or excessive labor

d. They have deep root systems (8’-15’) that help soils infiltrate better.

installation considerations

selecting plants





Different size plants give different levels of immediate refinement:

quart and plug

quart and gallon

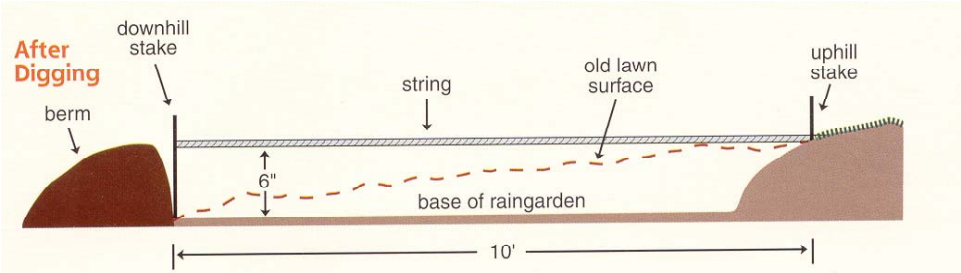
200 sq.ft. will require 200 plants minimum.

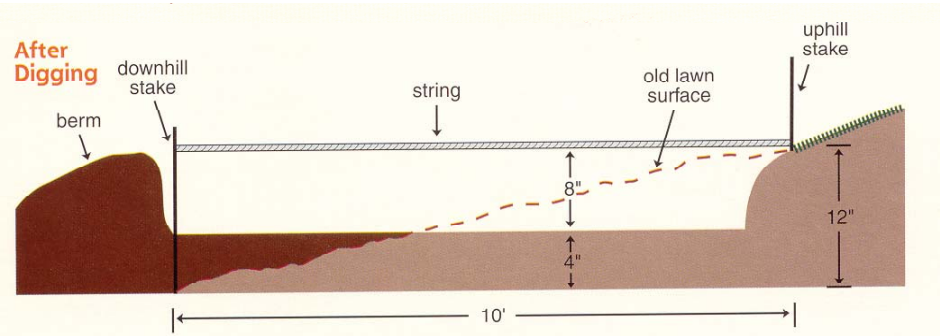
	Plug	Quart	Gallon
DIY’ers	$ 3/ea	$ 5/ea	$ 7.50/ea
Installed	$ 5/ea	$ 9/ea	$ 15/ea

Plant Cost: $800 (100 plugs, 100 quarts) ***DIY***

installation considerations

excavation





images courtesy WI DNR

- Determine shape by laying out a garden hose on the ground to define the perimeter
- Always, always call Diggers Hotline (1-800-242-8511) before you start excavating.
- Start by digging a shallow, flat, depression with gradually sloping sides.
- The bottom of the raingarden should have an average depth of 6” 12” (unless you want standing water).

5% Slope requires about 10’ width to get a 1% or less slope across the bottom of the rain garden.

This requires excavation of about 3.5 cubic yards of soil.

DIYer’s – Time + Energy
Installed - $17-20/ cy

Excavation Cost: $70 (3.5 cy @ $20/cy) *I*
Project Subtotal: $870

installation considerations

excavation

- Have a spot located in your landscape for excavated materials (Build a berm around your raingarden)

- Add soil amendments, if desired/needed

This requires extra excavation of about 7.5 cubic yards of soil (1').

The soil amendment is mixed and then laid in the rain garden with 3-6" of topsoil on top of the soil amendment.

Extra Excavation
DIYer's – Time + Energy
Installed - $17-20/ cy

Extra Excavation Cost: $150
(7.5 cy @ $20/cy)

Material
DIYer's – $15-25/cy
Installed - $30-38/cy

Material Cost: $150.00 (7.5 cy @ $20/cy) *I*
$262.50 (7.5 cy @ $35/cy) *I*
Project Subtotal: $1,282.50

installation considerations

excavation

- Channel water using a natural drainage way, constructed swale, or dig a trench & install a 4” PVC drain pipe, then connect to down spouts. *(make sure to have ¼” slope every 12”)*
  Trim pipe ends after they are in place

Material
DIYer’s – $5-8/lf
Installed - $9-15/lf
Material Cost: $480.00 (32 lf @ $15/lf) *I*

Project Subtotal: $1,762.50

installation considerations

planting rules

- Plant in drifts; mass and accent plantings of single species provide immediate bold color
- Pattern drifts to emulate undulations or irregular edges in your landscape, or from the hardscape and architectural lines of the site
- Use plants native to the region in which you live.
- Determine plants based on soil type.
- Layout or set-out plants prior to planting; arrange plants while they are still in their pots and prior to planting.
- Rototill planting beds to a depth of 6” prior to planting; be sure to remove all weed material prior to tilling to prevent weed spread.
- Be sure materials are planted in at least 3” of topsoil.
- Split the root systems of all potted plants at the root base with 1” cuts in a crisscross pattern using a sharp blade.

installation considerations

planting rules

- Use quart to gallon size plant material to give a more mature look more immediately.
- Perennials and grasses should be planted 1’ apart.
- Groundcovers should be planted 8” apart.
- Lightly compact soil around the plant to prevent air pockets and desiccation.
- Thoroughly water plants within 12 hours after planting.
- In areas treated with herbicide, plant materials within 14 days after herbicide treatment.

installation considerations

planting rules

- Full sun plants planted in the shade can result in reduced flower production and increased legginess as plants reach for the sun

Plants prone to legginess:
Goldenglow (Coreopsis) *Coreopsis tripteris*
This species has an upright structure with little leaf structure; it makes a nice background planting.

Blazing Star (Gayfeather) *Liatris pycnostachya*
This species averages about 4' ht. it should be planted with other species and as a background planting.

Purple Coneflower *Echinacea purpurea*
This species has a tight basal rosette but the blossom can cast as high as 3'; use behind other species that will block the stem.

Coreopsis tripteris
3-7' ht.
Blooms: Jul-Aug
Praire/Savana

Liatris pycnostachya
2-4' ht.
Blooms: Jul-Sep
Praire

Echinacea purpurea
2-3' ht.
Blooms: Jun-Oct
Prairie

- Tall grass species will become floppy without adequate competition and structural support

Plants prone to flop:
Yellow Coneflower *Ratibida pinnata*
This species has a tight basal rosette but the blossom can average about 4' tall; use behind other species and with competitive species to encourage upright growth.

Big Bluestem *Andropogon gerardii*
This species averages about 5-6' ht.; it requires other material or fencing for structural support.

Compass Plant *Silphium laciniatum*

The floret is often heavier than the stem can sustain.

Ratibida pinnata
1-4' ht.
Blooms: Jun-Aug
Praire

Andropogon gerardii
4-7' ht.
Blooms: Aug-Nov
Praire

Silphium laciniatum
3-7' ht.
Blooms: Jun-Sep
Prairie

installation considerations

planting rules

- Some native plants can become aggressive when placed inappropriately (without adequate containment or competition); often these species thrive in areas of impact, such as along mown edges

Plants prone to aggression:

Monarda (Bergamot) *Monarda fistulosa*
In rich garden soil this species can become larger than intended and will spread easily in disturbed or open soil.

Red-twig Dogwood *Cornus stolonifera*
This species is a wetland species but does well in drier conditions as well; it is also a large shrub (10-12' ht). It is excellent for screening.

Wild Strawberry *Fragaria virginiana*
This species makes an excellent groundcover, but in good garden soil, regular moisture, and full sun it can become a nuisance.

New England Aster *Aster novae-angliea*
This species is a wetland species but does well in drier soils it is easily wind spread.

False Aster *Boltonia asteroides*
This species does well in dry years and will spread aggressively by seed in open or disturbed soils.

Black-eyed Susan *Rudbecki hirta*
This species is biannual but will seed in disturbed and open soil easily; it can dominate a first year or second year planting.

Monarda fistulosa
2-4' ht.
Blooms: Jul-Aug
Praire

Cornus stolonifera
7-12' ht.
Blooms: May-Aug
Wetlands

Fragaria virginiana
6-8" ht.
Blooms: May-Jul
Prairie

Aster novae-angliea
1-4' ht.
Blooms: Aug-Oct
Praire

Boltonia asteroides
3-5' ht.
Blooms: Aug-Oct
Savanna/Woodlands

Rudbeckia hirta
1-3' ht.
Blooms: Jun-Aug
Prairie

installation considerations

planting rules

- Install straw or bark mulch to:
    1. Keep the weeds down,
    2. Protect and stabilize soil,
    3. Retain moisture,
    4. Give your rain garden that finished look

- Water 2 times a week for the two months until plants are established

- First year requires vigilant weeding

- Annual hand clipping and removal of dead stems in the spring; if you can - burn it off, but check with local authorities first

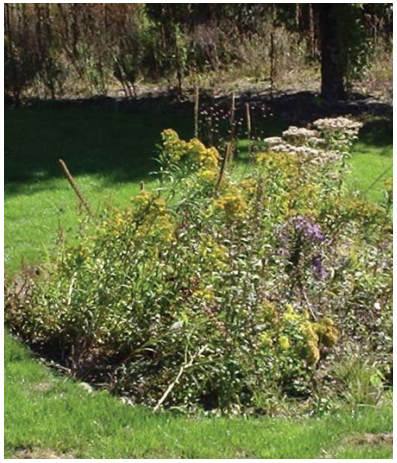
Mulch at a depth of 3-4”.
Calculate the required cubic yards of mulch by multiplying the area of the rain garden by depth of mulch in feet (ex. 4” is .25 ft), and divide by 27.

DIYer’s – Time + Energy+ $17-55/cy
Installed - $50-80/ cy

Material Cost: $100 (2.5 cy@ $40/cy) ***DIY***
Project Subtotal: $1,862.50

installation considerations

summary



Example 1 Numbers Review

- Size

Watershed size

15'x50' = 750' sq.ft.

Soil type

loamy sand @ 6" depth
(.25 sizing multiplier)

Garden Size needed to contain 2 yr storm

750 (.25) = 187.5 (Round up to 200)

- Plants

Material Cost

$800 (100 plugs, 100 quarts) ***DIY***

- Excavation

Install Cost

$70 (3.5 cy @ $20/cy) ***I***

Extra Excavation Cost: $150 (7.5 cy @ $20/cy) ***I***

- Soil Amendment

Install Cost

$262.50 (7.5 cy @ $35/cy) ***I***

- Trenching and Piping

Install Cost

$480 (32 lf@ $15/lf) ***I***

- Mulch

Material Cost

$100 (2.5 cy@ $40/cy) ***DIY***

Project Cost: $1,862.5 ($9.3/sq ft)

Our example did not include:
Stone, or wall construction $20-60 ff
Sculptural ammenities $Varies (bridges, sculpture)
Woody vegetation $60-400 ea
Subsurface drain or municipal connection $Varies
Curbing $Varies

To review this presentation in greater detail, download a copy of the AES Rain Garden Installation Manual, or for more information about rain gardens, native plants, or our nurserie services please visit

www.appliedeco.com

or call

(608) 897-8641

To order a copy of the DNR Rain Garden Manual

visit:

clean-water.uwex.edu/pubs/raingarden

or to purchase a hardcopy call:

UW-Extension offices, Cooperative Extension Publications

(877) 947-7827

thank you