Stormwater Management Design at Pickett Park

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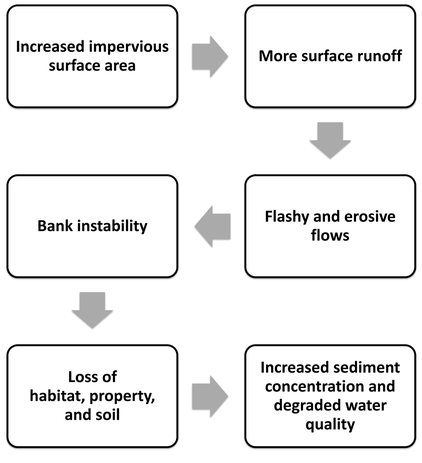
Agricultural & Biological Engineering

1. Problem Definition & Background:

Site Information:
- Purdue recreational asset
- Drainage area = 0.57 mi^2
- Stream Length = 1,200 ft

Channel Design Impact:
- Controls storm water runoff
- Reconnects floodplain
- Improves pedestrian access and vehicle safety
- Creates donation opportunity for bridge

Rain Garden Design Impact:
- Promotes infiltration
- Creates educational asset
- Provides pollinator habitat



Aerial View of Pickett Park

Actively Eroding Bank

Current Site Conditions

Local Restored Site Downstream

2. Important Factors:

Cultural:
- Educational tool for students and community

Economic:
- Potential reduction in park's maintenance cost

Environmental:
- Habitat enhancement and property protection

Social:
- Stabilizes a university asset for event hosting

3. Constraints:

- Spatially confined within Purdue property and by existing structures (fences, trees, culverts)
- Available data and access to existing designs
- Designed within the course of spring semester

4. Criteria:

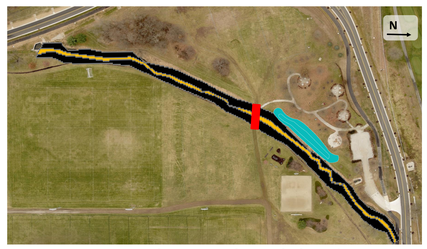
- Reconnects Todd Creek to its floodplain
- Second stage/floodplain contains 100-year flood event
- Disturbs least amount of land/trees
- Establishes a functional, environmental learning space
- Cost is contingent upon available university funding
- Must be realistic to obtain needed permits
- Plants must be:
  - A native species
  - Able to take direct sunlight
  - Inundated for at least 24 hours

5. Channel Design:

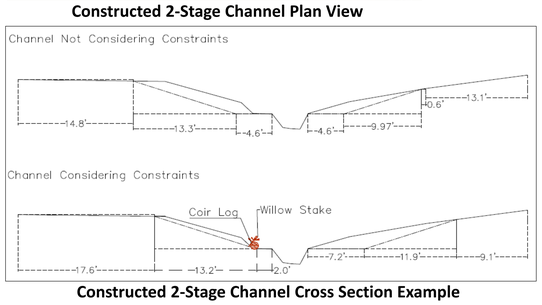
Methods:
- Hydrological Modeling (HEC-HMS)
- Hydraulic Modeling (HEC-RAS)
- Design (AutoCAD Civil 3D)

Two-Stage Channel Design Details:
- Culvert removed and replaced by bridge
- First Stage
  - Assessed formation of natural floodplain bench
- Second Stage
  - Conveys 100 year flow (246.3 cfs)
  - 3:1 bench width ratio
  - 3:1 side slope
  - Long native grasses
  - Toe Protection
    - Coir log
    - Willow stakes

Results:
- Average floodplain bench velocity (4.2 ft/s)
  - < Permissible velocity (5 ft/s)
- Average floodplain shear stress (0.62 lb/ft^2)
  - < Permissible shear stress (1.45 lb/ft^2)
- 100% natural existing trees/tree line saved
- 72% of ornamental trees saved, 28% relocated
- Proposed culvert removal & bridge replacement



Constructed 2-Stage Channel Plan View



Constructed 2-Stage Channel Cross Section Example

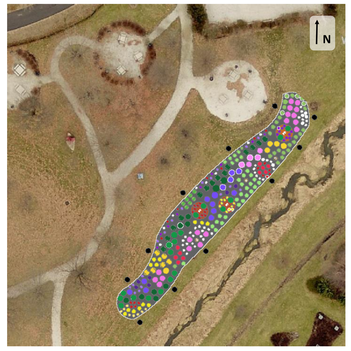
Economic Analysis:

Channel Design Cost Estimate			
Product:	**Cost Per Unit(USD):**	**Number Of Units:**	**Total Cost(USD):**
Medium Excavator	$710.00	9.00	$6,390.00
Excavator Operator	$66.00	52.00	$3,432.00
Dump Tuck Rental per hour for 3 trucks:	$360.00	52.00	$18,720.00
Dumping Fee:	$12.00	142.00	$1,704.00
2 ft- Willow Stakes:	$1.60	130.00	$208.00
Vegetated Coir Logs 10'	$40.00	400.00	$16,000.00
Instillation Cost For Coir Logs:	$80.00	400.00	$32,000.00
Anchors with Rope:	$20.00	67.00	$1,340.00
Midwestern Riparian Mix:	$1,200.00	0.83	$996.00
		TOTAL COST:	$80,790.00

6. Rain Garden Design:

Design Details:
- Strategically positioned to catch most runoff
- 5,016 ft^2, 193 ft long, 32 ft wide
- 1 ft berm on stream side
- 148.86 yd^3 in spoils
- Main soil type: silt loam

Rock Lay Design:
- Dorado Beach River Rock: 6.5 yd^3
- Black Beach Pebbles: 3.1 yd^3
- Mulch, shown in gray

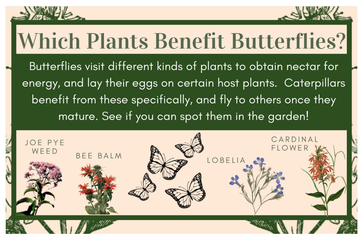


Full Bloom Rain Garden Planting Model

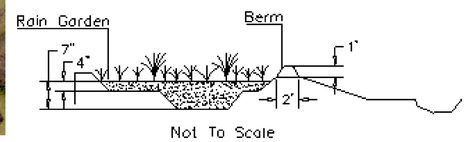
Economic Analysis:

Rain Garden Cost Estimate:			
Product	**Cost Per Unit(USD):**	**Number Of Units:**	**Total Cost(USD):**
Rain Garden Plants:	$2.50	312.00	$780.00
Biodegradeable Weed Control Blanket:	$66.00	6.00	$396.00
Black River Rock:	$10.00	165.00	$1,650.00
Golden River Rock:	$10.00	352.00	$3,520.00
3" Rip Rap Rock:	$18.65	0.96	$17.90
Mulch:	$25.00	6.00	$150.00
Signage:	$20.00	11.00	$220.00
Mini Excavator:	$475.00	1.00	$475.00
Excavator Operator:	$85.00	5.50	$467.50
Dump Tuck Rental per hour for 3 trucks:	$360.00	5.50	$1,980.00
Dumping Fee:	$12.00	15.00	$180.00
		TOTAL COST:	$9,836.40

Signage:
- Showcases benefits brought to the area
- 11 total signs
  - 1 for each plant species
  - 1 for each ecosystem service



Planting Design:
- Populated with hydrophilic, native plants
- 20 different species, 312 plants in total
- Biodegradable erosion control blanket
- Plug planting method



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Standards:
USDA NRCS NEH Part 654
Purdue Rain Garden Manual

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