

Risk Factors for Stream Restoration

1. High Flows
2. Low Flows
3. Lateral Constraints
4. Road Crossings
5. Stormwater Outfalls
6. Invasive Plants
7. Beavers & Other Critters
8. Expect the Unexpected



Challenge 1. High Flows

- Floodplain is critical for stress relief
- Design/construct for maximum flood



High Flows: Solutions

- Reconnect floodplain to carry "bankfull" flows
- Resist bed shear stress with grade controls & riffles
- Protect soil on banks & floodplain (temporary & permanent)



$$\text{Entrenchment Ratio} = W_{fpa} / W_{bkf} = 75/15 = 5$$



Resist Bed Stress



- Log & rock weirs
- Reinforced riffles
- Vanes

Protect Soil: Temporary



- Biodegradable matting
- Straw & annual grasses
- Rushes & sedges


Protect Soil: Permanent




- Native grasses
- Rushes & sedges
- Shrubs & trees



Challenge 2. Low Flows

- Maintain pools for habitat
- Connection to ground water (hyporheic zone)



Low Flows: Solutions

- Narrow low-flow channel with benches
- Bed-form diversity
- Natural substrate for hyporheic connection


Challenge 3. Lateral Constraints

- Protect infrastructure
- Optimize ecosystem services



Lateral Constraints: Solutions

- Structures to direct flow
- Vegetated benches
- Consider flood flows




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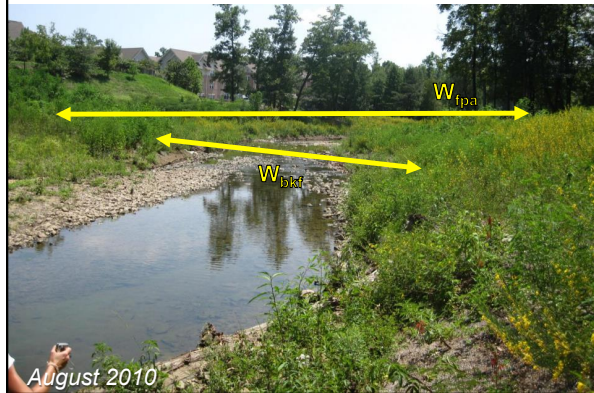
Little Shades Creek

- Houses
- Sewer lines
- Roads & bridges




February 2010

Entrenchment Ratio = $W_{fpa} / W_{bkf} = 60/38 = 1.6$



Challenge 4. Road Crossings

- Aquatic organism passage
- Minimize geomorphic impacts
- Pass flood flows



Road Crossings: Solutions

- Hydraulic opening to pass flows & sediment
- Vanes to direct flow & control grade



Hydraulic Opening

- Bridge
- Arch culvert
- Bottomless or buried bottom
- Floodplain openings



Flow Direction & Grade Control

- Vanes
- Cross vanes
- W-vanes



Challenge 5. Stormwater Outfalls

- Minimize erosion & scour in channel
- Improve water quality



Stormwater Outfalls: Solutions

- Energy dissipation basins
- Floodplain wetlands
- Watershed stormwater retention & infiltration



Floodplain stormwater retention and treatment



Challenge 6. Invasive Plants

1. Diverse native riparian plant communities
2. Self-sustaining streamside forest



Invasive Plants: Solutions

- Long-term maintenance
- Education
- Commitment



Challenge 7. Beavers & Other Critters

- Healthy streamside forest
- Free-flowing stream





Critters: Solutions

- Tree guards
- Eradication: beaver, deer, geese



Challenge 8. Expect the Unexpected

- Mowers



Challenge 8. Expect the Unexpected

- Moo'ers



Challenge 8. Expect the Unexpected

- Bad weather



Challenge 8. Expect the Unexpected

- Fire



Summary: Plan for Success

1. Plan for floods -- immediately & often
2. Plan for dry weather
3. Plan for vegetation maintenance
4. Understand constraints
5. Expect the Unexpected

