Protecting Your Infrastructure from Stream Erosion

Ohio Storm Water Management and Drainage Conference

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COLDWATER CONSULTING, LLC

SUSTAINABLE SOLUTIONS FOR YOUR WATER RESOURCES

Presentation Outline

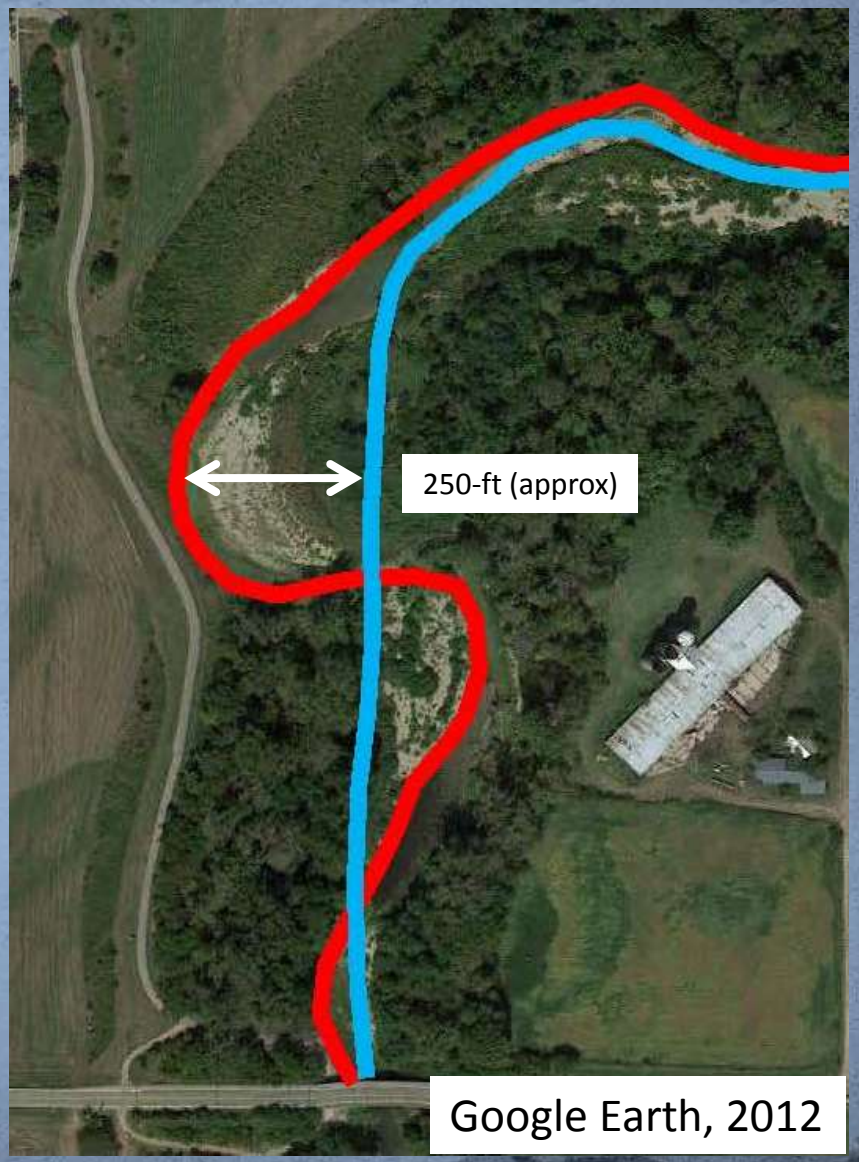
- Infrastructure / stream conflicts
- Application of natural channel design techniques
- Case studies
  - Dry Fork Creek - Hamilton County, Ohio
  - Glady Run - Greene County, Ohio
  - Little Miami River – Xenia, Ohio
  - Little Twin Creek - Montgomery County, Ohio
- Project success factors
- Closing thoughts

Infrastructure / Stream Conflicts

- Streams are dynamic systems that are subject to horizontal and vertical adjustments
- The rate of adjustment may be accelerated in disturbed streams (floodplain filling, hydrologic changes, channel straightening, etc.)
- At-risk infrastructure includes utility lines, transportation assets, and recreational assets (bike paths, shelters, etc.)

Streams Are Dynamic!!!

Google Earth, 1994

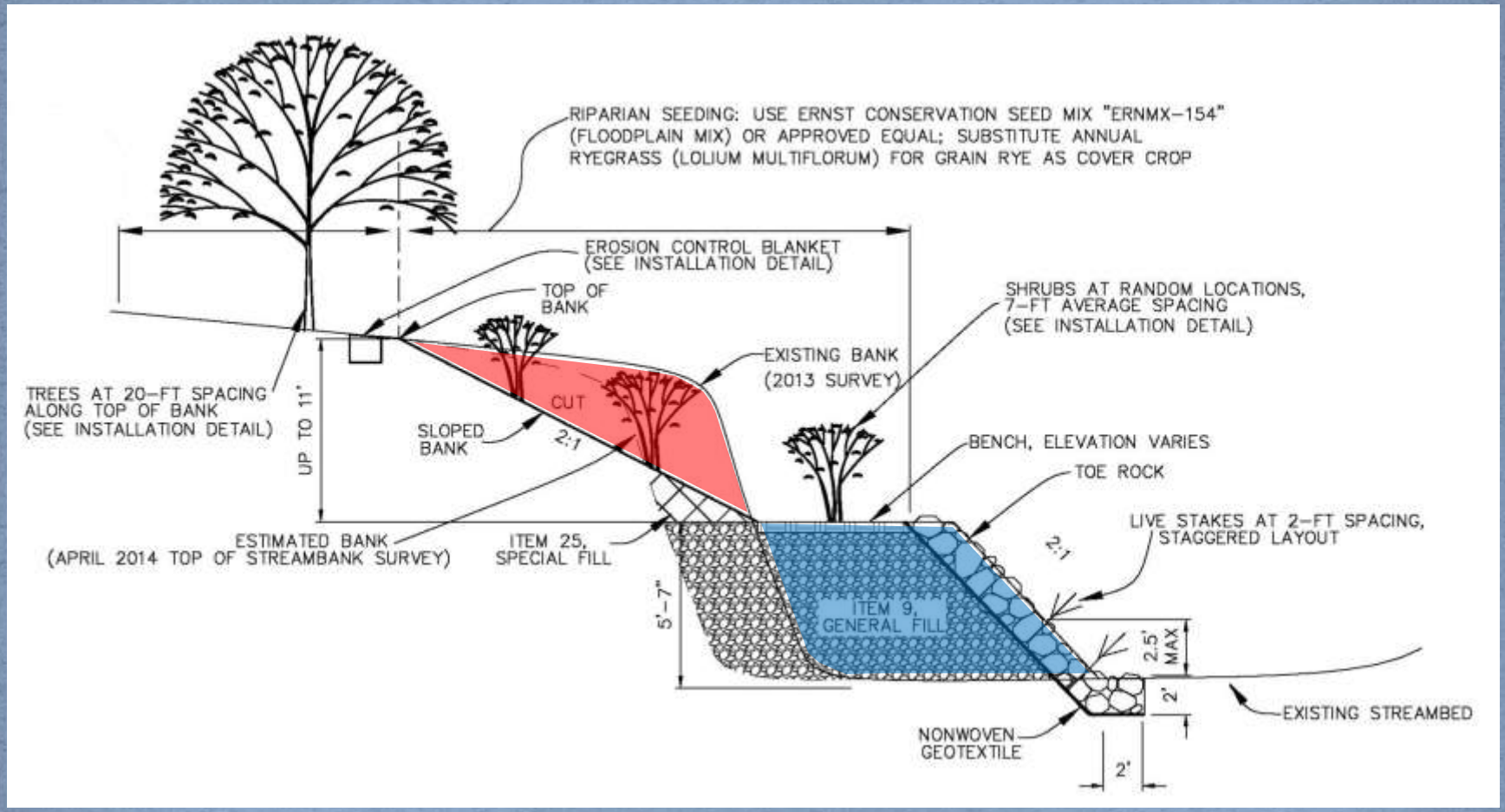


Google Earth, 2012

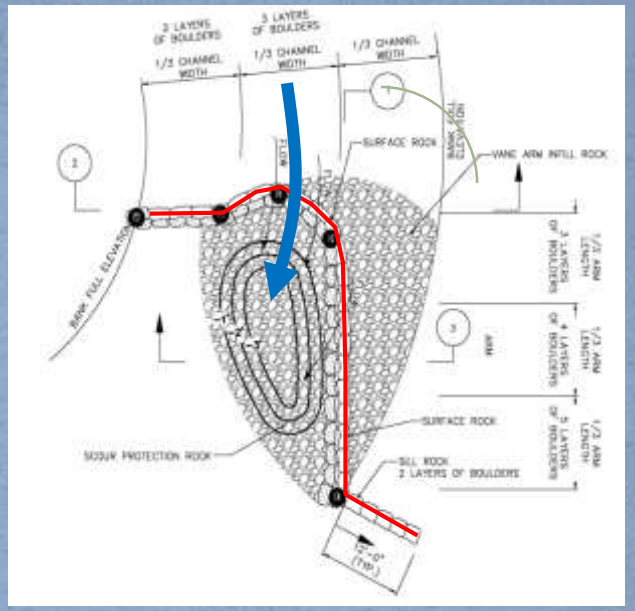
Natural Channel Design Techniques

- Reconfigured channel cross-sections (reduced bank slopes, bankfull benches)
- Grade control structures (boulders or logs)
- Permanent and temporary stabilization (toe rock, vegetation, erosion control blanket)

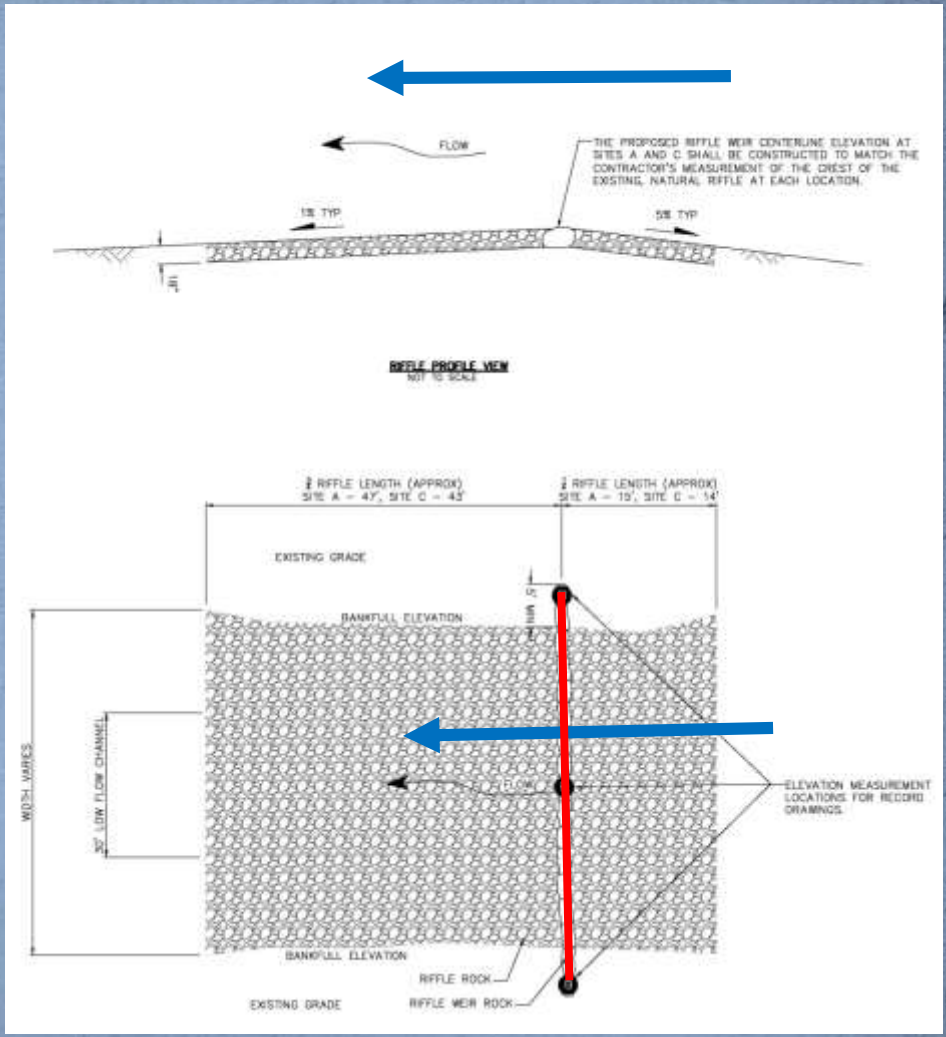
Reconfigured Cross-Section



Grade Control Structure, J-Hook



Grade Control Structure, Constructed Riffle



Permanent and Temporary Stabilization

Toe rock and erosion control blanket (straw / coconut mix)

Live stakes (willow)

Native shrubs

Case Study – Dry Fork Creek

- Project Owner: Great Parks of Hamilton County
- Project Goal: Restore and stabilize rapidly eroding streambanks causing property loss and risk to adjacent park infrastructure
- Alluvial soils, watershed area of 77 mi^2
- Principal Design Elements:
  - 3,300 cys of excavation
  - 1,600 cubic yards of toe rock
  - J-Hook structures (5 total)
  - Constructed Riffles
  - Native plantings (seeding, shrubs, trees, live stakes)
- Total restoration length: approximately 1,400-ft
- Construction Cost: $597,800
- Construction Schedule: July to December, 2014
- Funded through Clean Ohio Conservation Program

Site A - Pre-Construction, 8/16/2014

Site A - Construction, 10/5/2014

Site A - Restoration, 10/27/2014

Site A - Post-Construction, 9/23/2015

Site A - Post-Construction, 8/20/2016

Site A – low flow, 12/22/2014

Site A – moderate flows, 12/7/2014

Site C, Bridge - Pre-Construction, 9/1/2014

Site C, Bridge - Construction, 9/5/2014

Site C, Bridge - Restoration, 9/28/2014

Site C, Bridge – Post-Construction, 9/23/2015

Site C, Bridge – Post-Construction, 6/12/2016

Site C, Bend – Pre-Construction, 8/16/2014

Site C, Bend – Construction, 11/2/2014

Site C, Bend – Restoration, 11/30/2014

Site C, Bend – Post-Construction, 9/23/2015

Site C, Bend – Post-Construction, 6/12/2016

Case Study – Glady Run

- Project Owner: Greene County Parks and Trails
- Project Goal: Stabilize and restore rapidly eroding stream banks and protect a heavily used bike path
- Cohesive soils, historically straightened channel, watershed area of 3.5 mi^2
- Principal Design Elements:
  - 600 cubic yards of toe rock
  - Native plantings (seed, shrubs, trees, live stakes)
  - Protection of adjacent bike path and timber fence
- Total Project Length: Approximately 2,900-ft
- Construction Cost: $139,933
- Construction Schedule: February to June, 2015
- Funded through Ohio EPA's 319 Program

Area Alt-3 – Pre-Construction, 2/4/2015

Area Alt-3 – Construction, 3/19/2015

Area Alt-3 – post-construction, 8/14/2015

Area F – pre-construction, 2/4/2015

Area F – construction, 4/6/2015

Area F – restoration, 4/28/2015

Area F – post-construction, 8/14/2015

Case Study – Little Miami River

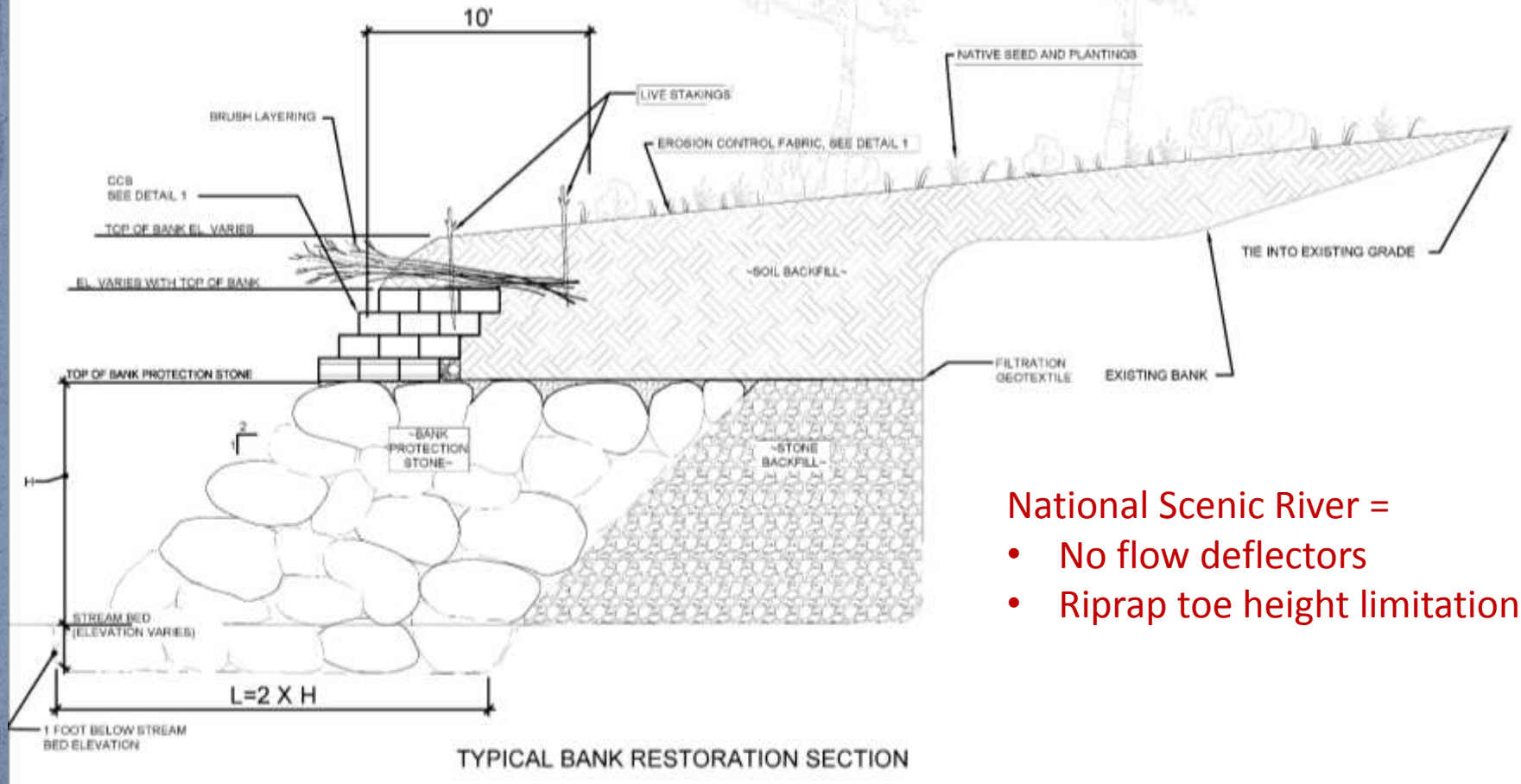
- Project Owner: City of Xenia, Ohio
- Project Goal: Stabilize and restore severely eroding stream banks at the headwall of the outfall for the Ford Road Wastewater Treatment Plant
- Watershed area of 217 mi^2
- Principal Design Elements:
  - Regrading and vegetating vertical stream banks
  - Stream bank stabilization (rock, tree revetments, CCS, live stakes, branch layers, riparian tree plantings)
  - Invasive species control (honeysuckle, reed canary grass)
- Total Project Length: Approximately 1,560-ft
- Construction Cost: $778,500
- Construction Schedule: December 2010 to June 2012
- Funded through Ohio EPA's 319 Program and ARRA

Little Miami River
National Scenic River

Two years of excessive streambank erosion (35 feet) put Xenia's Ford Road WWTP outfall in jeopardy

Pre-construction, 2/07/2002

Bank Build-Out with Confined Cellular System



TYPICAL BANK RESTORATION SECTION

National Scenic River =

- No flow deflectors
- Riprap toe height limitation


Post-construction, March 2011


Post-construction June 2011


Post-construction, July 2011


Post-construction, 2012
After flood event

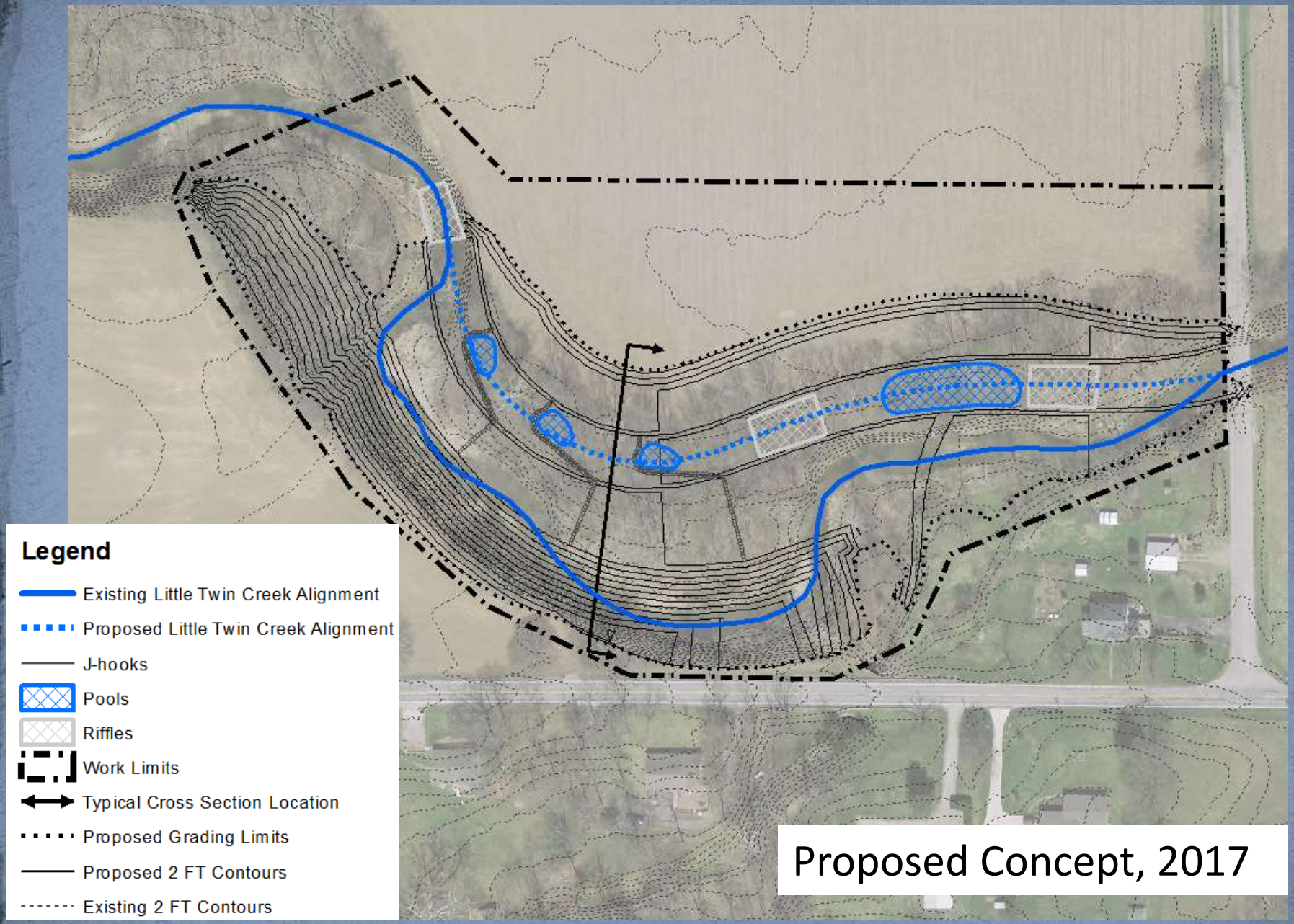
Case Study – Montgomery County Engineer's Office

- Project Owner: Montgomery County, Ohio
- Project Goal: Protection for nearby infrastructure and roadways along a series of high-priority sites experiencing severe stream bank erosion
- Sites
  - Little Twin Creek – Manning Road*
  - Spring Run – Mile Road
  - Tributary of Twin Creek – Oxford Road
  - Great Miami River – Upper River Road

Little Twin Creek
Manning Road

- Project Goal: Relocate the stream meander to protect the adjacent roadway from the severely eroding streambank
- Watershed area of 16.2 mi^2
- Principal Design Elements:
  - Stream relocation
  - J-hooks
  - Constructed pools and riffles
  - Slope re-grading
- Total Project Length: Approximately 1,000-ft
- Estimated Cost: $1.6M
- Proposed application to Clean Ohio for funding

Existing Conditions, 2016


Legend
Existing Little Twin Creek Alignment
Proposed Little Twin Creek Alignment
J-hooks
Pools
Riffles
Work Limits
Typical Cross Section Location
Proposed Grading Limits
Proposed 2 FT Contours
Existing 2 FT Contours
Proposed Concept, 2017

Project Success Factors

- Conservative designs (rock / boulder sizing, J-hook geometry, etc.)
- Clearly defined quantities for contractors (J-hook structure rock, toe rock, etc.)
- Construction scheduling to account for optimal streamflow conditions
- Contract provisions that addressed the protection and repair of adjacent infrastructure
- Qualified contractor and experienced construction oversight team

Dry Fork Creek, Site A - 1/3/2015 Flood

Glady Run, bike path overlay

Closing Thoughts

- Natural channel design-based stream restoration can be an effective means of infrastructure protection
- Natural channel design approaches are encouraged by permitting agencies (Corps, Ohio EPA, etc.)
- Natural channel design projects can be attractive candidates for grant funding

Questions?

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