PURDUE UNIVERSITY

CAPSTONE/DESIGN EXPERIENCE 2016

Resident Erosion Control

Agricultural & Biological ENGINEERING

Daniel Madson, ASM

Objective/Background:

The objective of this project was to evaluate an erosion concern at a residential property. The property is located at1820 Arrowhead Drive, West Lafayette. Homeowner Lynn Hiser approached the capstone personnel looking for assistance with gully erosion on the property. Over the course of the last two years, the above-average precipitation has destabilized the gully, causing large sections to slide down the slope. The increased erosion and destabilization has caused the residents to become concerned about loss of property and damage to homes. The gully itself merges with Goose Creek and is a waterway to the Indian Creek system. The project final design approach is to break up the multiple aspects causing the erosion into two or three heritage capstone projects.

Methodology

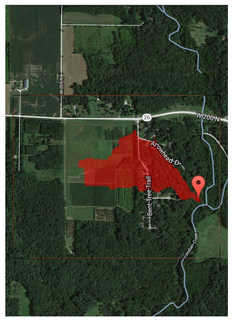


Figure 1: Overall Watershed 29 Acres

Figure 2: Watershed on Bent Tree Trail 14 Acres

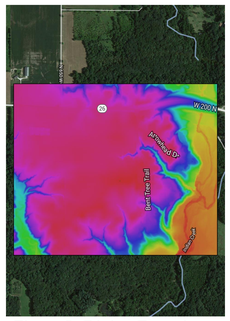


Figure 3: Digital Elevation Model of Bent Tree Trail

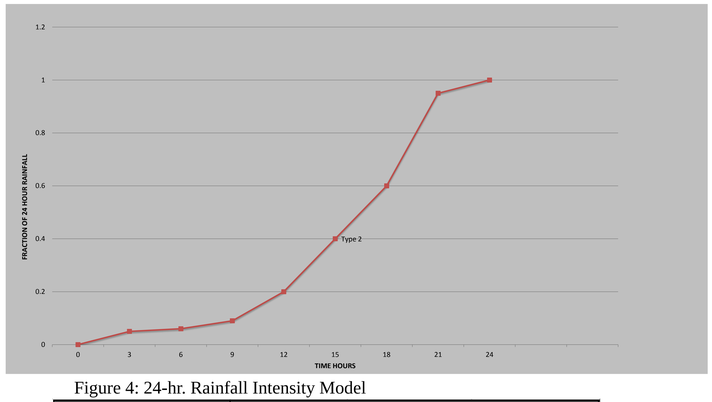
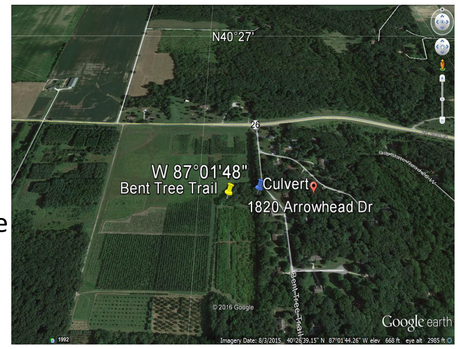


Figure 4: 24-hr. Rainfall Intensity Model

	24 hour Rainfall Calculations CFS		
Locations	2 year	5 year	10 year
Bent Tree Trail	32	37	43
Total Watershed	67	77	89

Figure 5: Peak Precipitation CFS

Design Concept



Bent Tree Trail

- Installation of check dam at base of slope (Figure 6)
- Use V-shaped Riprap Channel to control future erosion (Figure 7)
- Revegetation of banks (Figure 8)

Culvert

- Suggest installing a 24” culvert instead of 12”
- Place Riprap baskets at the entrance and exit (Figure 7)
- Line the channel of the grass waterway with Riprap (Figure 7)
- Place a check dam (Figure 6) at the base of the waterway to reduce water flow rate

Residential

- The channel will need to be lined first with a series of check dams (Figure 6)
- Remove invasive species
- Reduce canopy cover to allow 15% sun light infiltration
- Contour the ridges (Figures 8 & 9)
- Backfill and profile steep areas
- Riprap existing water channels (Figure 7)
- Revegetation of ridge and slopes (Figure 8)

Design Components :

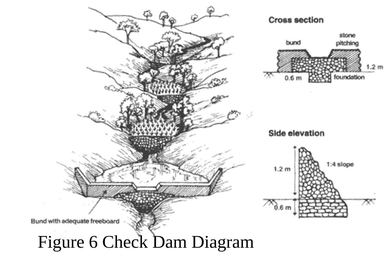


Figure 6 Check Dam Diagram

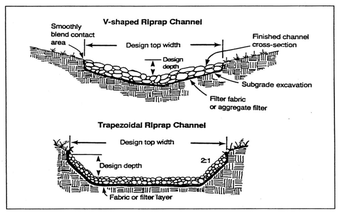


Figure 7:Riprap Diagram

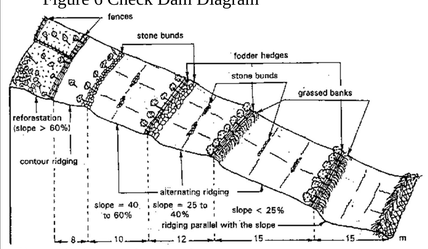


Figure 8. Slope Design Diagram

Figure 9: Contour Waddling

Budget	Riprap	Check Dams	Revegetation
Arrow head Sub. Division	75,000	3,000	1,000
Culvert	15,000	1,500	500
Bent Tree Trail	20,000	1,500	500

Figure 10: Budget based on NRCS service data

Time Line	Nov.	Dec.	Jan.	Feb.	Mar.	April
Surveying of Water Shed						
Consulting Forester						
Erosion Technique Selection						
Vegetation Selection						
Rain Fall Calculations						

Design Assumptions

Design Storm

- 2-year, 24-hour event 3 in
- 5-year, 24-hour event 3.5 in
- 10-year, 24-hour event 4 in

Watershed Areas

- Bent Tree to culvert -14 Acres
- Total area to Goose Creek - 29 Acres

Constraints

Residential

- Budget
- Access/ seasons
- Waterway restrictions

Culvert

- Co-op project with county Bent Tree Trail
- Seasonal availability of staff

Impact/ Sustainability

- Improved water quality
- Habitat creation
- Buffer zones for toxins before entering water ways
- Stabilization of property along the gully
- Improved aesthetics
- Low maintains

Alternative Solutions

- *Bioengineering/ Bio tech.:* The use of plants and inert plant objects to stabilize banks.
- Polypropylene or polyethylene geo-grid fabric to stabilize slopes
- Brush Mattress
  Use vegetation to “armor” slope

Sponsor:
Lynn Hiser

Technical Advisor:
Roberts Stwalley Ph.D., PE
Sam Noel

Instructors:
Bernard Engel, Ph.D,PE
Robert Stwalley, PH.D,PE

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