Dewart Lake Engineering Feasibility Study

Kosciusko County, Indiana

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DEWART LAKE ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

EXECUTIVE SUMMARY

The Dewart Lake Protective Association (DLPA) received a Lake and River Enhancement (LARE) engineering feasibility study grant in 2010 to identify projects within the Dewart Lake watershed aimed at reducing the loading of sediment and nutrients to the lake. The engineering feasibility study focused on the Cable Run subwatershed with an additional site north of the County Road 1000 N in a ravine and another site located at the Quaker Haven Camp on an eroding hillside near the intersection of County Road 900 N and Ems D16. The goal of the feasibility study was to develop feasible solutions for the identified project sites. To be deemed feasible, a project needs to be acceptable to property owners, receive regulatory agency support, be physically constructible, and be environmentally and socially justifiable.

This study developed four feasible projects involving nine individual sites where streambank and stream bed erosion, or gully erosion were present. The feasible projects developed involve the use of grade controls, rock toe installation and limited grading of the stream banks on approximately 1600 feet of channels. When constructed the projects should save approximately 72 tons of eroded soil from entering Dewart Lake each year. Individual projects ranged from $3,000 to $52,000. The total estimated construction cost for the proposed projects is $85,000.

Landowner permission has been granted to proceed with final designs and permitting for the proposed work. Required permits for the work have been obtained and are included as an appendix with this report. Upon approval of construction grants applied for in January 2012, work is expected to proceed in late 2012 through 2013.

ACKNOWLEDGEMENTS

The Indiana Department of Natural Resources Division of Fish and Wildlife Lake and River Enhancement Program and the Dewart Lake Protective Association (DLPA) funded this feasibility and design study. Thanks to Kenneth Brehob from the DLPA for assisting Cardno JFNew during the study. Dr. Brehob coordinated meetings between the DLPA and Cardno JFNew and contacted affected landowners. Thanks to the many landowners that allowed Cardno JFNew personnel to survey drainages on their property for potential projects. Special thanks to Robert and June Spearman; Timothy and Robin Stiffler; Roy and Inez Caywood; Quaker Haven Camp; Larry and Susan Mock; Doug Mock and the Limberlost Girl Scout Council. Thanks to the Dewart Lake Protective Association members for their support. Cardno JFNew key contributors to this project include Tom Estrem, Mark Pranckus, John Richardson, Christine Dittmar, Brett Peters, and Betsy Ewoldt. Also a special thanks to Wayne Stanger, Technical Advisor for the Elkhart River Restoration Association Great Lakes Commission grant. Mr. Stanger assisted with soil loss equations, construction advice, landowner authorization, and cost estimates.

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DEWART LAKE ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

1.0 INTRODUCTION

1.1 Background

In 2007, the Dewart Lake Protective Association (DLPA) completed an Indiana Department of Natural Resources (IDNR) Lake and River Enhancement (LARE) program engineering feasibility study on seven highly eroding ravines on the northern portion of the watershed (Cardno JFNew, 2007). A 2005 lake diagnostic study identified the area on the northern portion of the watershed as a significant threat to Dewart Lake's regionally good water quality (Cardno JFNew, 2005). Treatments to address erosion were developed including wetland creation and slope and grade stabilization within the ravines. In 2007 and 2008, the DLPA received LARE program construction grants to implement the designs developed in the 2007 feasibility study. Projects were constructed by a local contractor with construction oversight from Cardno JFNew. The DLPA in association with the Camp Logan Girl Scout Camp and a service fraternity from Purdue University contributed to the construction through the donation of materials (field stone from the Camp property), the use of the Camp's skid steer, and volunteer labor. The treatments installed in 2007 and 2008 have reduced sediment input into Dewart Lake.

At the time, the eroding ravines along the northern portion of the watershed were the highest priority for protecting and improving water quality in Dewart Lake. In 2007, there was some minor discussion among the lake association leadership about including the Cable Run watershed in the study; however, the scope of the study was limited by the financial resources available through the grant. Applying resources to the highly eroding ravines took precedence over other portions of the watershed.

The DLPA received a second LARE feasibility grant in 2010 to investigate water quality improvement projects through the remaining portion of the watershed with an emphasis on the Cable Run subwatershed and a portion of the northern watershed were sedimentation was occurring.

1.2 Goals and Objectives

The geographic scope of the study includes Dewart Lake and its 5,466 acre (2,212 ha) watershed in Kosciusko County. The initial intent of the feasibility study was to address the Cable Run subwatershed (Figure 1). Prior to beginning the current study, several additional areas outside of the Cable Run subwatershed were identified for inclusion in the study including a site adjacent to the lake and several areas along the northern portion of the watershed.

The goal of the study was to assess areas within the project scope for the potential of water quality improvement projects, identify project locations, develop conceptual treatments, and determine if individual projects were feasible. A feasible project is defined as one that can physically be constructed, is acceptable to landowners, is economically and ecologically justifiable, and can receive regulatory approval.

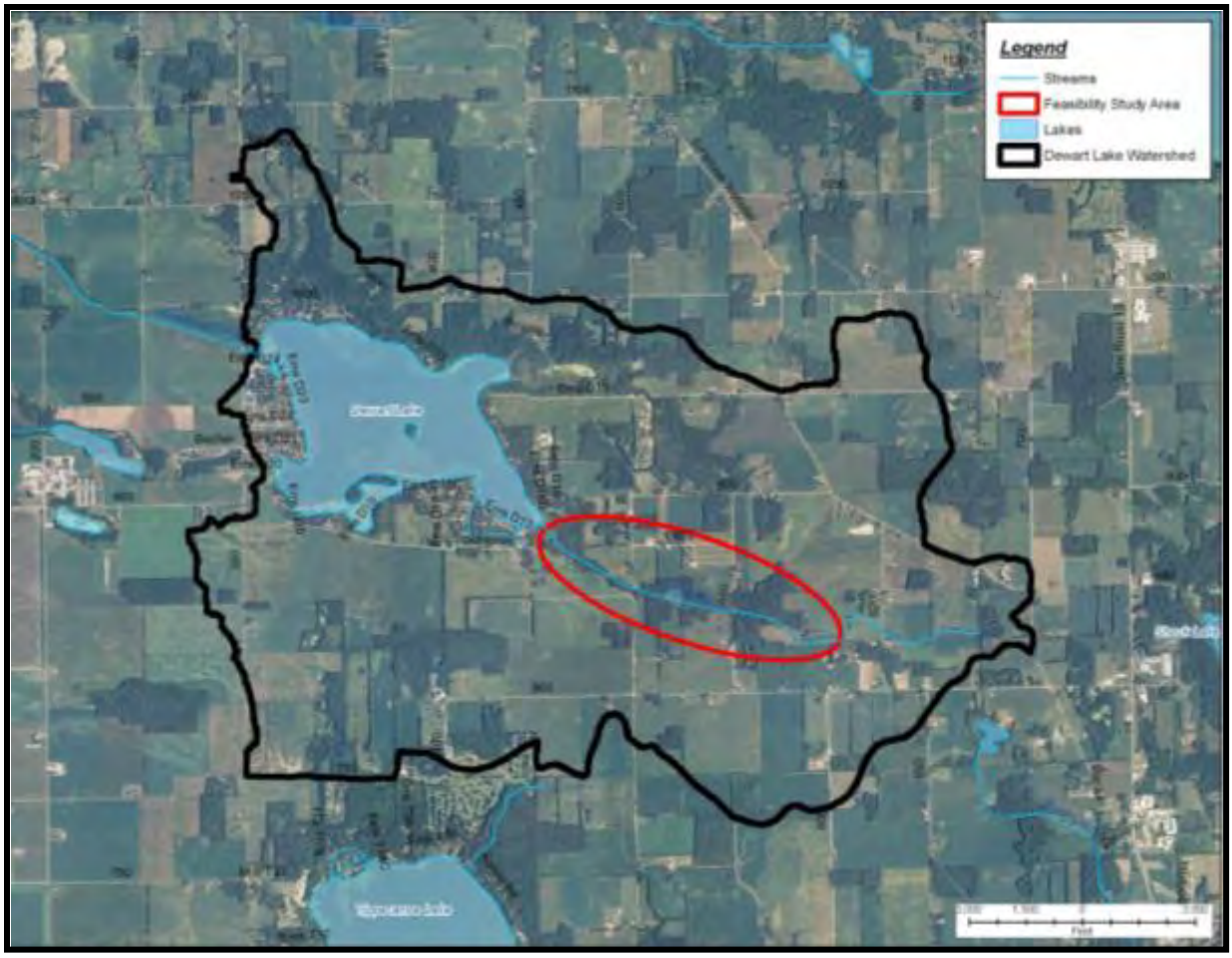

Figure 1. 2010 engineering feasibility study focus area, Cable Drain east of Dewart Lake, Kosciusko County, Indiana.

2.0 GENERAL OVERALL PROJECT DESCRIPTION

2.1 Location

The Dewart Lake watershed (14-digit hydrologic unit code 04050001200040) encompasses 5,466 acres (2,212 ha) in central Kosciusko County, Indiana (Figures 2 and 3), and lies immediately north of the north-south continental divide. Dewart Lake is a headwater lake in the Great Lakes Basin. Surface water drains to Dewart Lake via three primary routes. Direct drainage to the lake accounts for 48% of the watershed or 2,648 acres (1,072 ha) and includes the ravines along the lake's northern shoreline and the two subwatersheds in the northwest corner identified as 1000 N and Hasse watersheds (Figure 3). An unnamed intermittent stream/wetland system, identified as the 950 N subwatershed transports water from the eastern part of the watershed to Dewart Lake along the southern edge of the Limberlost Girl Scout Council property called Camp Ella J. Logan (Camp Logan). This system drains 727 acres (294 ha) and accounts for approximately 13% of the watershed (Figure 3). The remaining 2,091 acres (846 ha) or 38% of the watershed is drained by Cable Run which enters the lake at the southeast corner of the lake and is the main focus of this study (Figure 3). Water from Dewart Lake flows north through Waubee Lake into the Elkhart River. The Elkhart River flows into the St. Joseph River, which eventually discharges into Lake Michigan near St. Joseph, Michigan.

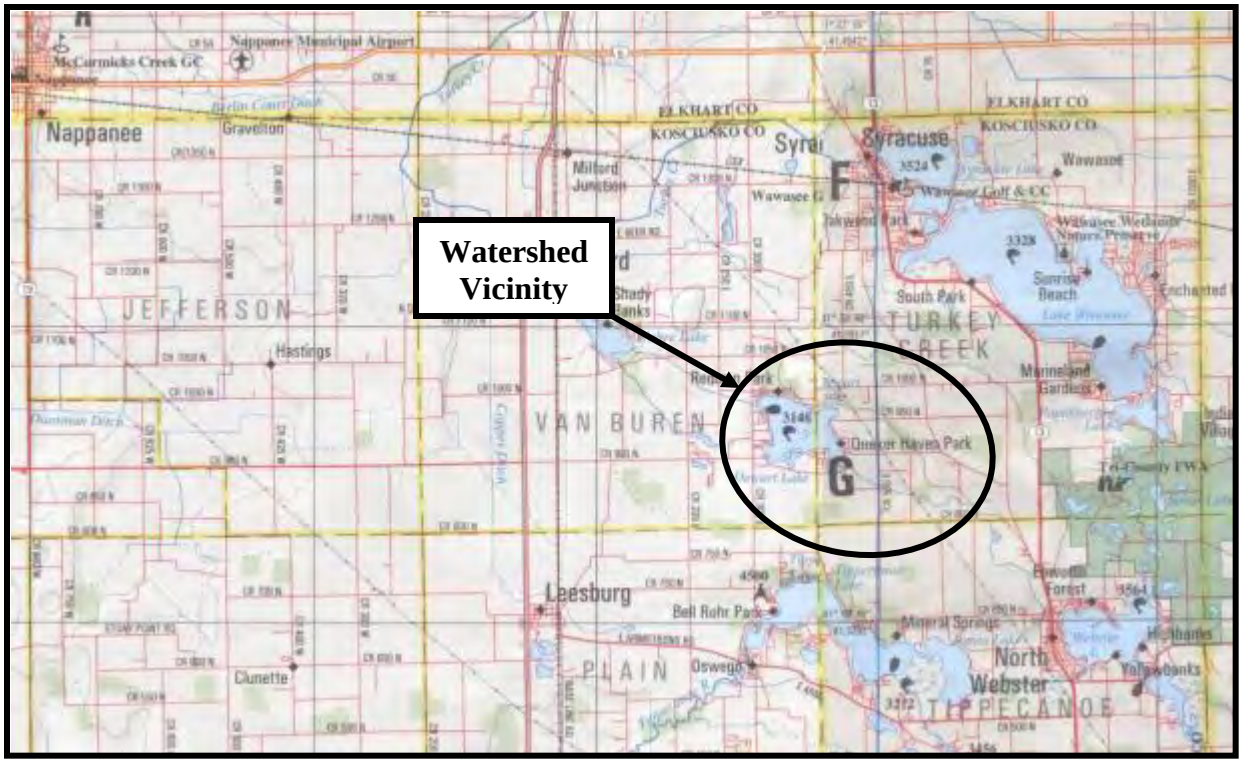

Figure 2. General project location, Dewart Lake, Kosciusko County, Indiana. Source: DeLorme, 1998.

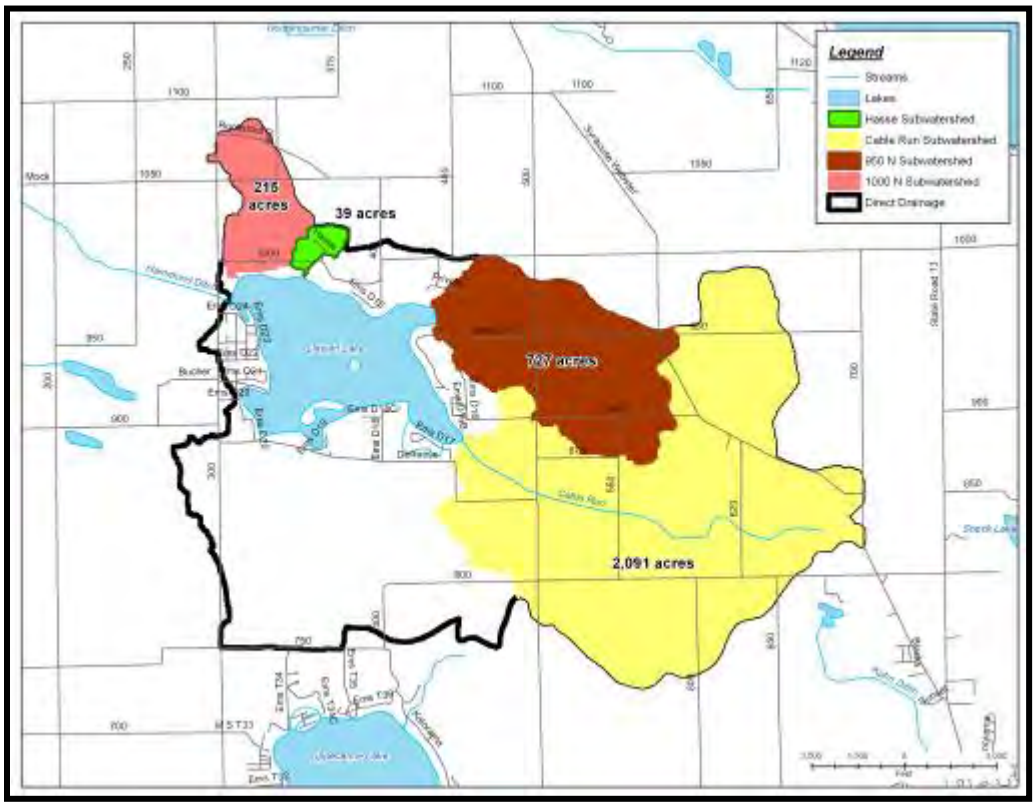

Figure 3. Dewart Lake subwatersheds. Note: the Hasse and 1000 N subwatersheds are also considered direct drainage.

2.2 Prior Studies

Table 1 lists prior studies conducted in the Dewart Lake watershed. Most studies conducted in the area have been focused on documenting existing fishery conditions within the lake. More recent work focused on the lake's plant community and on watershed and water quality improvement projects.

Table 1. Prior studies conducted in the Dewart Lake watershed.

Year	Entity	Topic	Study
1972	IDNR	Fisheries	Coldwater Fishery Potential
1976	IDNR	Fisheries	Dewart Lake, Kosciusko County, Fish Management Report
1982	IDNR	Fisheries	A Fishery Survey at Dewart Lake and First-Year Walleye Management
1984	IDNR	Fisheries	First-Year Survival of 3-4 Inch Walleyes in Dewart Lake
1985	IDNR	Fisheries	Survival of 3-4 Inch Walleye Fingerlings Versus Fry in Dewart Lake
1985	IDNR	Fisheries	Results of Walleye Stockings at Dewart Lake
1990	IDNR	Fisheries	Results of Walleye Stockings at Dewart Lake
		Water Quality	Indiana Clean Lakes Volunteer Monitoring Program
1994	CLP	Water Quality	Indiana Clean Lakes Assessment
1995	IDNR	Fisheries	Dewart Lake, Kosciusko County, Fish Management Report
1997-2001	KCHD	Water Quality	Stream Water Quality Monitoring Program
2000	CLP	Water Quality	Indiana Clean Lakes Assessment
2003	IDNR	Fisheries	Dewart Lake, Kosciusko County, Fish Management Report
2004	DU, EC	Wildlife	Changes in a Turtle Community for an Increasingly Human-impacted Lake: A Long-term Study
2005	Cardno JFNew	Watershed Management	Dewart Lake Diagnostic Study (including water quality assessments and aquatic vegetation surveys)
2007	Cardno JFNew	Feasibility Study	Dewart Lake Engineering Feasibility Study
2007-2010	Aquatic Weed Control	Aquatic Plant Management	Aquatic Vegetation Management Plan and Updates

DU, EC=Denison University and Earlham College
KCHD=Kosciusko County Health Department
IDNR=Indiana Department of Natural Resources

2.3 Public Meetings

A public meeting was held on September 29, 2010 at Camp Logan between lake residents and affected landowners. The meeting was sponsored by the Dewart Lake Protective Association and was aimed to be a project introduction meeting, providing attendees with an update on what previous water quality improvement projects have been conducted in the Dewart Lake watershed and what areas the current feasibility study will be investigating. A final public meeting and presentation of the study results was held April 9, 2012.

3.0 FEASIBILITY ANALYSIS TOOLS

Described below are several tools that were used in one or more of the proposed projects during the feasibility analysis. Several of the tools are environmental or ecological assessment procedures that allow for a site to be classified through quantifying a series of variables. A brief description of the regulatory process in Indiana is also included because the jurisdictional obligation of the regulatory agencies contributes significantly to the feasibility of a project.

3.1 Stream Assessments

Habitat

The Qualitative Habitat Evaluation Index (QHEI) was developed by the Ohio EPA for streams and rivers in Ohio (Rankin, 1989). While the Ohio EPA originally developed the QHEI to evaluate fish habitat in streams, IDEM and other agencies routinely utilize the QHEI as a measure of general "habitat" health. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrate; amount and quality of in-stream cover; channel morphology; extent and quality of riparian vegetation; pool, riffle, and run development and quality; and gradient are the metrics used to determine the QHEI score. Each metric is scored individually then summed to provide the total QHEI score. QHEI scores typically range from 20 to 100.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of the entire stream. As such, individual segments may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled in adjacent segments with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio indicate that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 are characteristic of stream conditions that are capable of supporting exceptional warmwater faunas (Ohio EPA, 1999). IDEM indicates that QHEI scores less than 51 indicate poor habitat and may not support the stream's aquatic life use designation (IDEM, 2006).

The Headwater Habitat Evaluation Index (HHEI) was developed by the Ohio Environmental Protection Agency (EPA) for Ohio streams with drainage areas measuring less than one square mile (259 ha) and a maximum pool depth measuring less than 16 inches (40 centimeters; OEPA, 2002). The Ohio EPA developed the HHEI to classify small streams and drainages into one of three groups. The groups are Class I (an ephemeral stream with a normally dry channel and little to no aquatic life); Class II (a stream with flowing water or isolated pools for an extended period of time and dominated by warm water-adapted aquatic biota); and Class III (a flowing stream comprised of cool and cold water-adapted aquatic biota). The HHEI is the first step of a three phase evaluation to accurately classify a stream. The second two phases involve biological assessments at different levels of taxonomic scale. The HHEI evaluates three habitat variables to assign an HHEI score. Substrate composition, including the dominant type of substrate, such as sand, silt, and gravel, and the total number of substrates, bankfull width, and maximum pool depth are evaluated to develop an HHEI score. This information can then be used to classify the stream into one of the three previously mentioned classes (Class I, Class II, or Class III). HHEI scores range from 9 to 100.

Biological Assessment

Macroinvertebrates are often used to classify the health of a stream because different species or families respond differently to environmental stress. Macroinvertebrate data gathered during the 2005 diagnostic study was used for the determination of biotic health in the Cable Run

drainage. Macroinvertebrates were sampled within Cable Run at the CR500 crossing. Macroinvertebrates were sampled using the multihabitat approach detailed in the U.S. Environmental Protection Agency Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd edition (Barbour et al., 1999). This method was supplemented by qualitative picks from substrate and by surface netting. Using data collected during this survey, Cardno JFNew calculated IDEM's macroinvertebrate Index of Biotic Integrity (mIBI) (IDEM, unpublished). IDEM's mIBI is a multi-metric index designed to provide a complete assessment of a stream's biological integrity. Karr and Dudley (1981) define biological integrity as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region."

The mIBI is designed to assess biotic integrity directly through ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff's Family Biotic Index), number of taxa, number of individuals, percent dominant taxa, EPT (*Ephemeropteran*, *Plecopteran*, and *Trichopteran*) index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. After data from sampling sites have been collected, values for the ten metrics are compared with corresponding ranges and a rating of 0, 2, 4, 6, or 8 is assigned to each metric. The average of these ratings gives a total mIBI score, the best possible of which is 8. Macroinvertebrate communities in streams scoring less than 2 are considered severely impaired; these streams are rated by IDEM as non-supporting for their aquatic life use designation. Macroinvertebrate communities in streams scoring from 2 to 4 are considered moderately impaired and the associated streams are rated by IDEM as partially supporting their aquatic life use designation. Macroinvertebrate communities scoring from 4 to 6 and from 6 to 8 are rated as slightly impaired and non-impaired, respectively. These streams are designated as fully supporting of their aquatic life use designation as determined by IDEM.

3.2 Wetland Assessments

The National Wetland Inventory (NWI) is a database of wetlands maintained by the U.S. Fish and Wildlife Service to monitor the status and trends of wetlands within the U.S. Wetland data are collected using remote imagery data analysis. In other words, aerial and satellite photographs are interpreted for wetland signatures and characteristics. The wetlands are classified based on a modified Cowardin classification scheme (Dahl and Bergeson, 2009). The data represent a good starting point for a review of wetlands within a proposed project area.

3.3 Functionality and Impact Determination

To predict the erosion rates of the streambank, the Bank Assessment for Non-point source Consequences of Sediment (BANCS) model (Rosgen, 2006) was used. This model uses two bank erosion estimation tools: the Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS). The BANCS model evaluates the bank characteristics and flow distribution along river reaches and maps BEHI and NBS risk ratings commensurate with streambank and channel changes. Annual erosion rates are estimated and then multiplied by the bank height and by a corresponding bank length of a similar condition, providing an estimate of cubic yards and tons of sediment per year. This information can be compared to the annual sediment yield data to apportion the amount of sediment potentially contributed by streambanks.

3.4 Regulatory Agencies

In Indiana, two state agencies, one federal agency, and one or more branches of local government may be involved in reviewing and approving (permitting) proposed projects. Who reviews and approves of a project is dependent on the location, type, size, and impact of the project. Described below is a brief summary of each agency's jurisdiction and permitting process. More detailed information can be found the publication "Waterways Permitting Handbook" (IDEM, 2008).

Indiana Department of Natural Resources (IDNR)
The IDNR Division of Water regulates various construction activities within, over, and under the state's waterways through various state laws. Specific to most feasibility projects, the IDNR regulates the filling, excavating, and/or modification of lakes and streams through the Lakes Preservation Act and the Flood Control Act. The Lakes Preservation Act provides the IDNR the ability to regulate activities that impact the recreational, natural resource, and scenic beauty values of public freshwater lakes. The Flood Control Act provides the IDNR the ability to regulate activities within the floodway of any waterway to minimize flooding. Typically, these activities include bank protection and work that changes the cross section area of the channel.

Indiana Department of Environmental Management (IDEM)
IDEM regulates the placement of fill in "Waters of the State", which includes lakes, streams, and wetlands through the 401 Water Quality Certification program. Small projects that have minimal impacts such as 300 feet (91 m) or less of streambank or shoreline or 0.1 ac (0.04 ha) of wetland can be permitted under the Regional General Permit (RGP). A RGP requires a notification form and several additional pieces of information. A project is considered authorized (permitted) if the applicant is not contacted by IDEM within 30 days of the date of receipt. Larger impacts require Individual 401 Water Quality Certification, which is a more rigorous application and review process.

U.S. Army Corps of Engineers (USACE)
The USACE is a federal agency that regulates the placement of fill in "Waters of the U.S.", which includes lakes, streams, and wetlands through the Section 404 of the Clean Water Act. Within the 404 program, there are several different permit types that depend on the size and nature of the proposed activity. A Nationwide General Permit (NGP) is a permit that authorizes activities that have only minimal impact to the aquatic environment. The Regional General Permit (RGP) authorizes activities that impact 1 acre (0.4 ha) or less of "Waters of the U.S." Programmatic General Permits (PGP) authorizes specific activities such as shoreline protection on public freshwater lakes and allows for an IDNR permit to serve as the federal permit, as well.

County Soil and Water Conservation District (SWCD)
Projects that disturb one or more acres (0.4 ha) of ground require a Rule 5 permit from IDEM through an application to the local SWCD office that consists of an erosion control plan. The Rule 5 permit is meant to prevent and avoid impacts from construction on aquatic resources through the development and implementation of a site-specific erosion control plan.

County Drainage Boards
A stream or drainage within a watershed may be classified as a legal drain where the county drainage board maintains authority of certain activities that can impact conveyance and drainage from the surrounding landscape. Some activities authorized by the drainage board may still require other state and/or federal approval. Conversely, a project may be authorized by the other regulatory agencies; however, because of the nature of the project such as activities that increase detention time, the project may not receive drainage board approval.

4.0 IDENTIFIED WATER QUALITY IMPROVEMENT PROJECTS

In June 2010, Cardno JFNew and Ken Brehob from the DLPA toured the Cable Run watershed and the direct drainage area on northwest corner of the lake to identify potential projects. Access was limited to areas along Cable Run where landowner permission was obtained via mailings prior to the tour and areas observed from the roadways. The mid-June tour allowed watershed practices to be seen prior to agricultural crops growing to a height that would hinder observation. The other project areas, Quaker Haven Camp and the northwest portion of the watershed area, had previously known water quality issues that were brought to the attention of the lake association's leadership.

Seven potential projects were identified along Cable Run or drainages of Cable Run, one project was located at the Quaker Haven camp, and one project was located north of County Road 1000 N in the drainage just east of Hasse Court (Table 2; Figure 4). Water quality issues identified primarily involved eroding streambanks and slopes.

Table 2. Identified water quality improvement project locations within the Dewart Lake watershed.

Site #	Site name/Owner	Subwatershed/ Project Area	Water Quality Issue	Cause of Issue
QH1	Quaker Haven Camp	Direct drainage	Sedimentation	Eroding slope
CR1	Mock Property	Cable Run	Sedimentation and nutrient loading	Bank erosion
CR2	Mock Property	Cable Run	Sedimentation and nutrient loading	Bank erosion
CR3	Mock Property	Cable Run	Sedimentation and nutrient loading	Bank erosion
CR4	Mock Property	Cable Run	Sedimentation and nutrient loading	Bank erosion/land use
CR5	Caywood Property	Cable Run	Sedimentation and nutrient loading and aquatic organism passage	Bank erosion
CR6	Caywood property	Cable Run	Sedimentation and nutrient loading	Bank erosion
CR7	Caywood property	Cable Run	Sedimentation and nutrient loading	Bank erosion
NW1	Hasse Drain Spearman & Stiffler property	Minor tributary to lake	Sedimentation and nutrient loading	Bank erosion

Initially, two additional project areas on the Camp Ella J Logan Girl Scout Camp were investigated. One site involved a failing site identified in the first feasibility study and constructed in 2009. The second site was an eroding ravine two ravines to the west of the failed site. That ravine was inspected during the 2007 study and at the time, there were no

apparent water quality issues. The inspection in 2011 revealed a ravine with eroding banks that was contributing significant amounts of sediment to the base of the ravine near the shoreline of Dewart Lake. It is speculated that erosion likely became accelerated between 2007 and the present after several large storm events perturbed that banks causing them to begin eroding even during small storm events. During the course of the study, the DLPA and the LARE program worked to plan and implement projects directly to stabilize the two sites. For this reason, they were not included in the study because their feasibility required no further investigation. Two site were eliminated from consideration early in the Feasibility Study: one site located upstream from NW1 involving the construction of a wetland detention basin north of Hasse Road; and another site on Cable Run just downstream from CR 7 that had erosion and livestock access issues, were initially identified during the watershed tour but were determined not feasible due to access issues. Investigation of the potential projects on these two sites was suspended. Future studies could investigate these potential water quality improvement projects should site access be granted by the landowners.

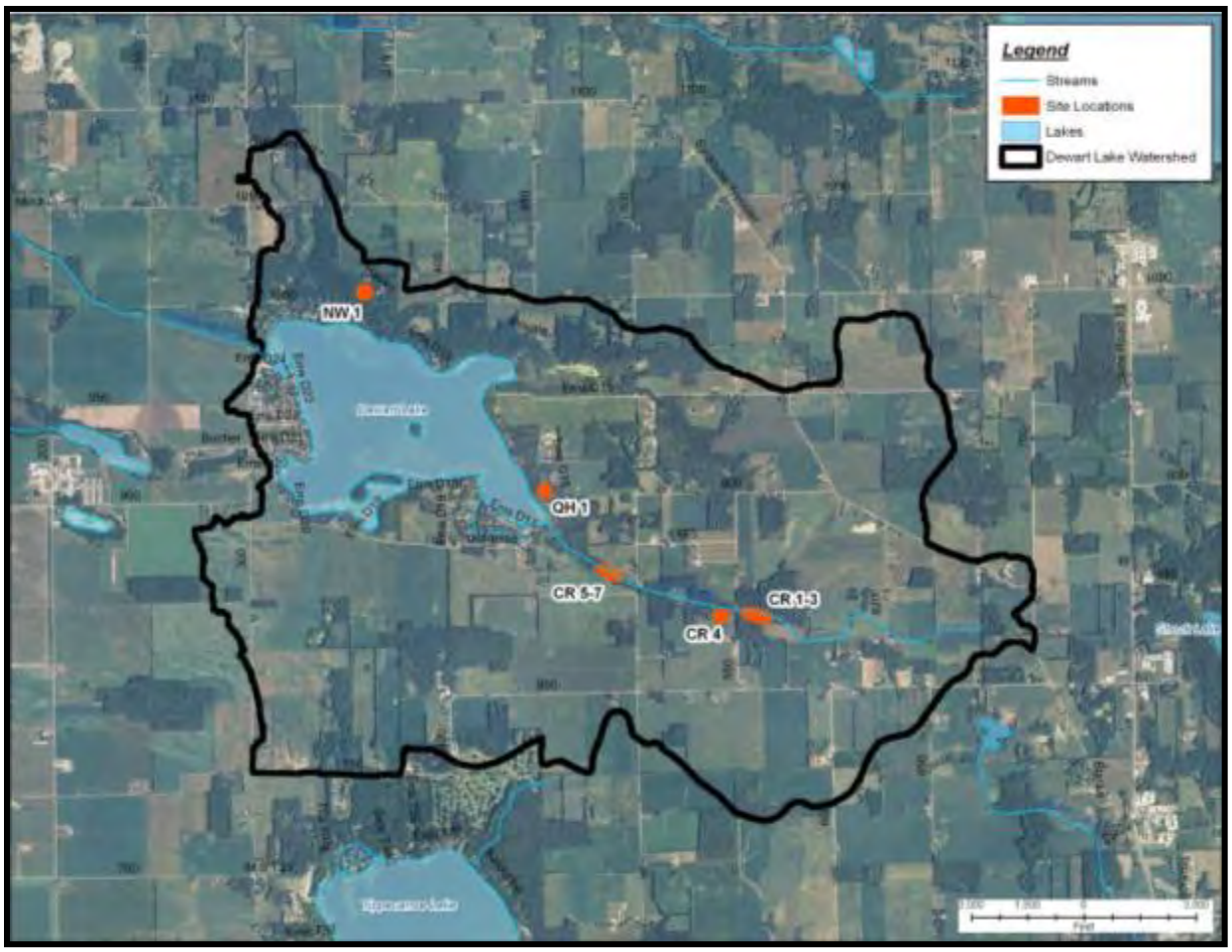

Figure 4. Locations of potential water quality improvement projects identified by Cardno JFNew and the DLPA in June 2010.

4.1 Project NW1: Hasse Drain – Spearman and Stiffler Properties

4.1.1 Site Description

The Hasse Drain project involves an unnamed ravine draining the Hasse subwatershed located on the north side of Dewart Lake, north of County Road 1000 N (Figure 4). The ravine drains approximately 39 acres (15.8 ha) or only about 1% of the Dewart Lake watershed; however, there is significant erosion occurring on the banks at three locations where wood debris or previous attempts to construct some type of rock grade control structure were failing. The previously installed rock controls were not keyed into the banks high enough and as a result the stream was cutting around the structures and eroding the banks (Figure 5).

Figure 5. Example of erosion occurring around previously installed structure in the Hasse Drain (NW1) on the Spearman and Stiffler properties.

4.1.2 Preliminary Design and Conceptual Drawings

The conceptual design is to construct three grade control structures within the ravine at locations where significant erosion is occurring around the old grade control structures (Figure 6). These structures will be built with sand bags and are designed to effectively raise the bed elevation of the stream channel. By controlling or reducing the grade of the stream, the reduction in velocity will reduce the erosive potential of the water against the banks, thereby decreasing bank undercutting and removing the sources of in-stream derived sediment.

The grade control structures will be constructed of sandbags on average 1-2 feet (0.3-0.6 m) above the existing bed grade (Figures 7 and 8). Rock would have been used to construct the structures; however, due to wooded and steep terrain within the ravine equipment access is limited. Sandbags will extend up the banks approximately 3 feet (0.9 m) to prohibit water from flowing around the structure. Once the sandbags have been installed, permanent turf reinforcement mat will be installed over the sandbags to both improve aesthetic appeal and strengthen the grade control structure. Erosion occurring on the ravine banks at each grade

control location (a combined area of approximately 60 feet long by 8 feet high) will be re-graded by hand to remove any overhanging soil areas, seeded with a slope stabilization seed mix and covered with coir yarn matting (Dekowe 700 or Rolanka Bio D 70). All areas disturbed during construction within the wooded area of the project site will be seeded with a native slope stabilization seed mix and covered with standard straw erosion control blanket. All other areas disturbed during construction activities including access points will be returned to preconstruction conditions. Copies of all ravine survey forms can be found in Appendix B.

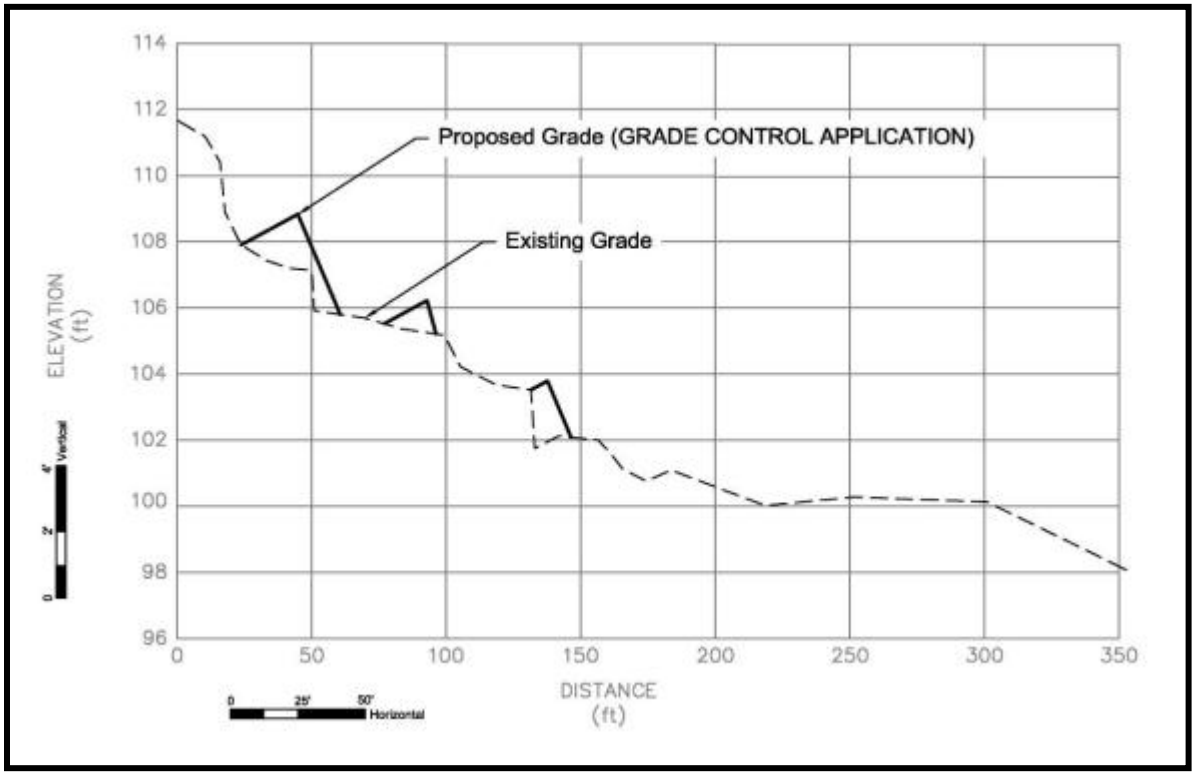

Figure 6. Profile of existing Hasse Drainage project reach (NW1) with proposed locations of grade control structures shown at the proposed height above grade.

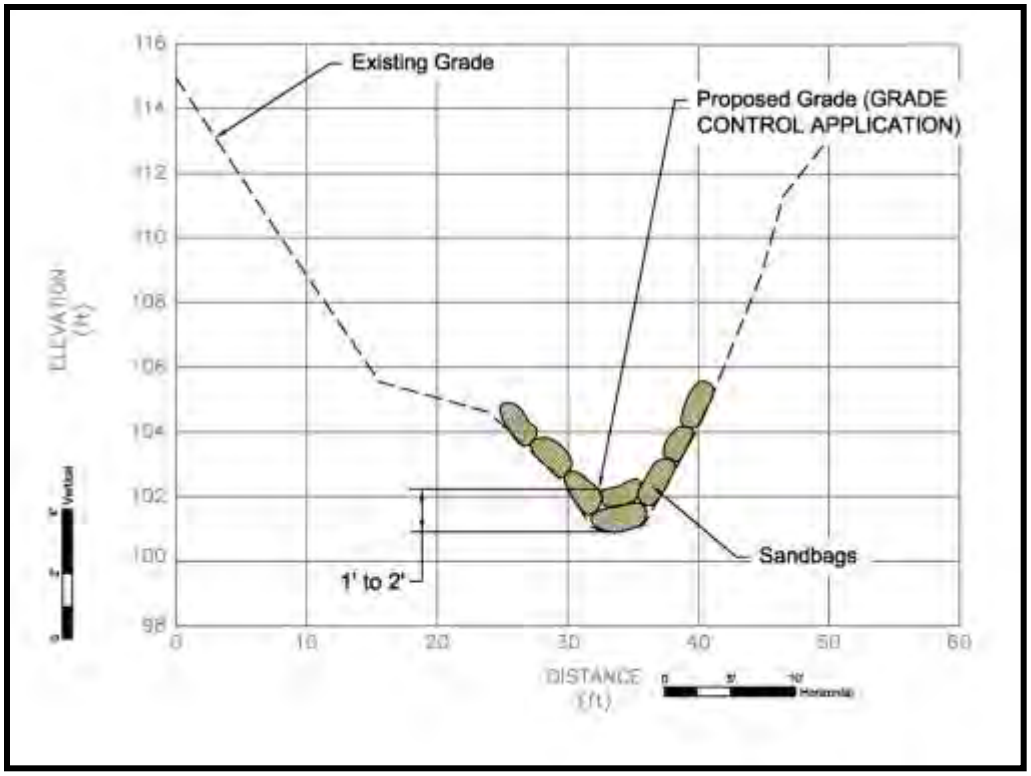

Figure 7. Typical cross section of grade control to be constructed in the Hasse Drainage (NW1) at three locations.

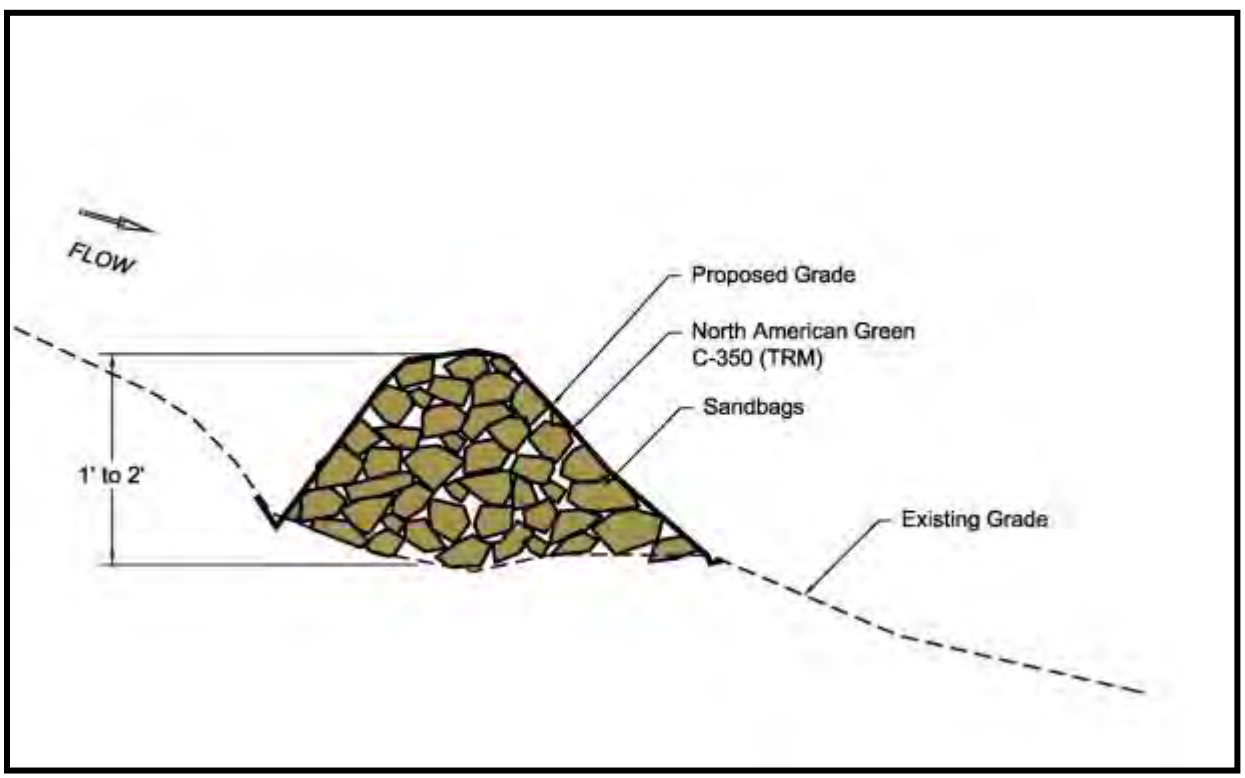

Figure 8. Typical profile of structure to be installed at three locations in the Hasse Drain (NW1).

4.1.3 Probable Costs and Proposed Timelines

The following probable cost for the proposed project at Site NW1 is $11,880.00. Table 3 details the estimated cost for project administration, materials, and construction. Administrative services include bid development, subcontractor identification, communication, construction oversight, report preparation, and project management.

Table 3. Opinion of probable costs for the construction of the grade control structure and bank stabilization for the Hasse Drain (Site NW1).

Item	Quantity	Unit	Unit Cost	Total
Administrative	1	Each	$1,200.00	$1,200.00
Mob/demob	1	Each	$1,000.00	$1,000.00
Labor	120	Hours	$45.00	$5,400.00
Bags	11	Per 100	$50.00	$550.00
Seed	1	Acre	$160.00	$160.00
Sand	20	Cu Yd	$12.00	$240.00
Coir Yarn Matting	50	Sq Yd	$3.00	$150.00
Turf Reinforcement Mat	420	Sq Yd	$5.00	$2,100.00
Subtotal				$10,800.00
Contingency (10% of overall project)				$1,080.00
Total				***$11,880.00***

The recommended project timeline is based on LARE grant funding cycles. It is recommended that the DLPA apply for construction funding in January of 2012, contract construction services, and construct the projects starting in the fall. This project should be combined with the Quaker Haven project for efficiency of construction administration and mobilization.

4.1.4 Easement and Land Availability Determination

The project site is located on two different landowner properties, Robert and June Spearman who own the southern portion of the site and Timothy and Robin Stiffler who own the north portion. The two upstream grade control structures will be on the Stiffler property while the downstream grade control structure will be on the Spearman property. After providing the owners with a description of the purpose of the feasibility study and the benefits to the lake, landowner permission was obtained for accessing the site for field work during the conceptual design phase. Following completion of a conceptual design, meetings were conducted onsite with landowners describing the design and were asked for their written permission to proceed with the final design and construction, if funds became available. Copies of the signed landowner agreements can be found in Appendix C.

4.1.5 Unusual Physical and Social Costs

The identified unusual physical and social costs associated with design and construction of the proposed projects will be minimal. Since heavy equipment will not be used to construct the grade control structures there will be minimal disturbance to the surrounding wooded upland environment. Access to the site will be gained through the southern portion of the Stiffler property and will result in only minor disturbance to the existing yard. Areas impacted during construction will be seeded with grass seed and stabilized with straw or erosion control fabric. Grade control structures will not cause flooding to any of the surrounding environment and will

only affect the immediate areas within the ravine. The soil loss was calculated using the following: Grade Controls - 3' bottom width, 0.5' depth of erosion (annually), 175' length = 8.7 tons annually. Bank Stabilization - 8' depth, 1.0' recession, 60 length = 24 tons annually.

4.1.6 Functionality and Impact Determination

Using a soil loss calculator provided by the Great Lakes Commission the annual soil loss for the Hasse Drain (NW1) is 32.7 tons per year (personal communication, Wayne Stanger and Appendix B). However, this estimate may be exaggerated by the fact that it accounts for stabilizing the entire gully if left untreated. The current delivery of sediment to Dewart Lake is likely less than 5 tons a year, but could easily increase over the years without treatment as there is no indication that the erosion will decrease in the future. Left untreated the standpipe, which was installed just upstream of CR 1000 N to reduce road flooding at the bottom of this steep ravine, will continue to be buried in sediment, from these upstream sources.

4.1.7 Wetland Functional Assessment

According to a review of the United States Fish and Wildlife Service's National Wetlands Inventory (NWI) map, there are no wetlands located within the project area. The side slopes of the ephemeral waterway approach a 1:1 (nearly vertical) condition with no floodway and no potential for wetlands to occur. There are floodplain wetlands that have been created on this waterway adjacent to 1000 N when a riser was installed on the culvert under the road to increase detention of water during storms. The subsequent velocity reduction caused by this standpipe allowed sediment to settle upstream of the road and create a floodplain wetland. However, this wetland is 200 feet or more downstream of the project site and will not be affected by the proposed work.

4.1.8 Biological and Habitat Integrity Survey

The existing Hasse Drain channel does not maintain a consistent flow throughout the year and is only periodically carries water after storm events. As such, the drainage channels support minimal if any aquatic biota; therefore, aquatic macroinvertebrate and instream habitat assessments of the ravine were not completed. The surrounding area is a mature upland forested environment composed most commonly of shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), bush honeysuckle (*Lonicera maackii*), black cherry (*Prunus serotina*) and multiflora rose (*Rosa multiflora*).

4.1.9 Environmental Impact Assessment

There will be limited environmental impact associated with this project. The existing conditions of the periodically inundated Hasse Drain channel support limited or no aquatic biota. Stabilizing the grade of the existing channel will help to reduce erosion of the existing banks thereby reducing the amount of sediment deposited in Dewart Lake. Additionally, reducing bank erosion will limit the number of trees lost to bank erosion benefitting the surrounding forested environment. As no equipment will be used during construction, the surrounding forested environment will not be impacted. No habitat, wetland or upland, will be lost or gained by the proposed project.

4.1.10 Justification of Site Selection

The general site location was selected based on recommendations from DLPA members. Evidence of erosion within the drainage is evident at the bottom of the drainage just off County Road 1000 N where a standpipe is located that has a large accumulation of sediment. The construction of the grade controls will be beneficial to the lake as it will reduce the amount of sediment entering Dewart Lake. Construction activities will not disturb the surrounding forested environment of the ravine.

4.1.11 Permit Requirements

The proposed project site is technically within the jurisdiction of the USACE through Section 404 of the Clean Water Act and IDEM under Section 401 of the Clean Water Act. However, the proposed activity qualifies under existing Regional General Permits for minor impacts to waters of the United States. The project administrator should send the one page Notification form to IDEM (Appendix E) at least 30 days prior to construction, with a copy sent to the USACE Detroit District office. Approval is automatic after 30 days as long as the submittal requirements have been met, regardless of whether the agency responds.

4.2 <u>Project QH1: Quaker Haven Foundation and Dewitt Properties</u>

4.2.1 Site Description

The Quaker Haven Camp project is located at Quaker Haven Camp near the intersection of County Road 900 N and EMS D16B (Figure 9). A sink hole has developed at the top of a bank adjacent to Dewart Lake which is believed to have been created by a combination of roof runoff from the Camp office building and overland flow. The sink hole is approximately 10 feet x 13 feet x 4 feet deep (3 m x 4 m x 1.2 m) and approximately 20 feet (6.1 m) from a nearby Quaker Haven Foundation building (Figures 10 and 11). Sediment eroded from the bank is transported to and forms a large delta encroaching into the wetland that is part of Dewart Lake. Recent grading of the land below this gully has blended the sediment delta into the adjacent grades; however, the erosion will continue until the gully is stabilized.

Figure 9. Project QH1, Quaker Haven Camp project site location map, Kosciusko County, Indiana.

Figure 10. Photo of sink hole that has developed at the top of the bank at the Quaker Haven Camp Project (Site QH1).

Figure 11. Photo looking up from base of slope at developed sink hole at the Quaker Haven Camp Project (Site QH1).

4.2.2 Preliminary Design and Conceptual Drawings

The construction of a vegetated swale from the top of the bank where the sink hole has developed to the base of the slope is recommended to address the erosion problem at the Quaker Haven Foundation building (Figure 12). The existing sink hole that has been created would first need to be cleaned out and the profile of the vegetated swale created. The initial profile used to shape the vegetated swale would be on average 15 feet (4.6 m) wide by 4 feet (1.2 m) deep and extend from the top of the bank to the toe of the slope for approximately 45 feet (13.7 m). Once the swale profile and dimensions have been created, existing concrete at the site can be placed on the bottom of the swale to partially backfill the swale. Utilizing the existing concrete pieces will allow the swale bed elevation to be built up without having to bring in new fill material. Once the concrete has been placed, the swale should be backfilled using excess spoils on site so that the average depth of the swale becomes 2 feet (0.6 m). Once the final grade of the swale is constructed the swale bottom as proposed should be seeded with a native slope stabilization seed mix and lined with North American Green SC250 turf reinforcement mat. The side slope of the swale should be seeded and covered with a North American Green SC150BN erosion control blanket (Figure 13). All access areas will be returned to preconstruction conditions.

Figure 12. Plan view of proposed vegetated swale location at Quaker Haven Camp (Site QH1), adjacent to Dewart Lake, Kosciusko County, Indiana.

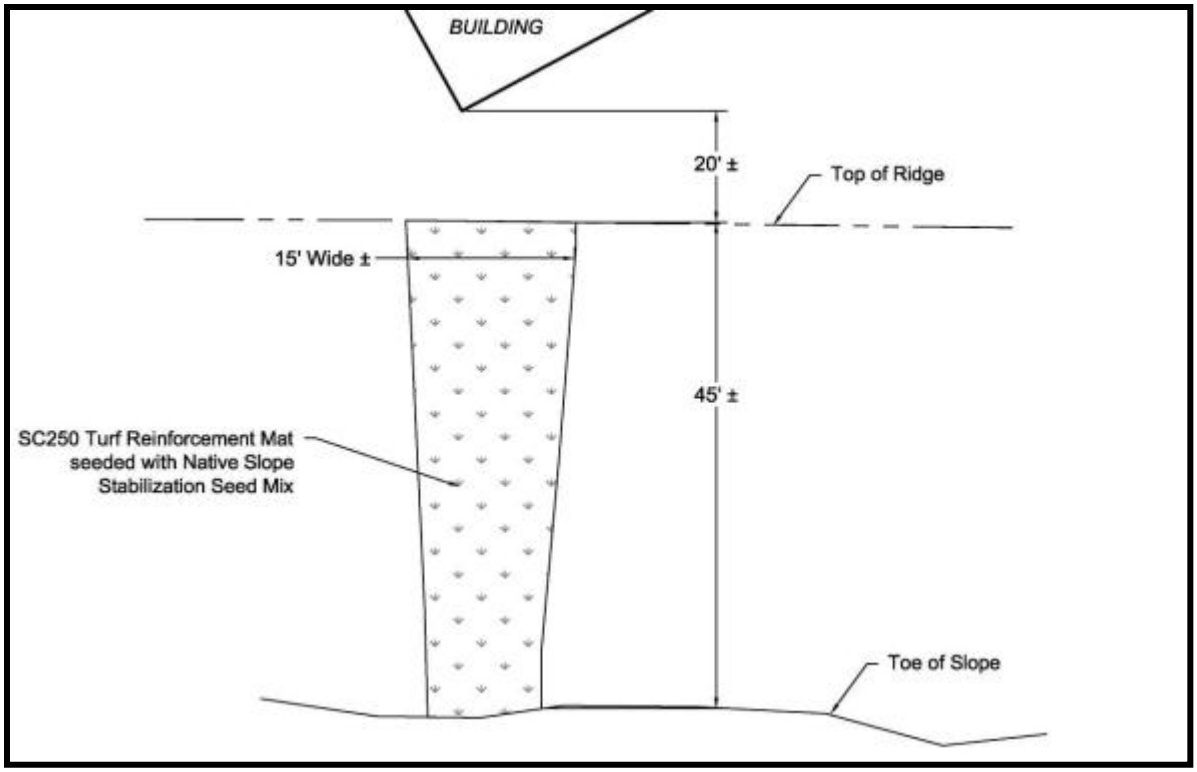

Figure 13. Conceptual drawing of proposed vegetated swale to repair an existing eroded gully at Quaker Haven Camp (Site QH1), Dewart Lake, Kosciusko County, Indiana.

4.2.3 Probable Costs and Proposed Timelines

The following probable cost for the proposed project at the Quaker Haven Camp is $3,245.00 Table 4 details the estimated cost for project administration, materials, and construction. Administrative services include bid development, subcontractor identification, communication, construction oversight, report preparation, and project management

Table 4. Opinion of probable costs for the construction of a vegetated swale at the Quaker Haven Camp (Site QH1). Item cost includes delivery and installation.

Item	Quantity	Unit	Unit Cost	Total
Administrative	1	Each	$300.00	$300.00
Mob/demob	1	Each	$300.00	$300.00
Labor	8	Hour	$45.00	$360.00
Excavator + operator	8	Hour	$125.00	$1,000.00
Seed	1/4	Acre	$160.00	$40.00
Erosion control blanket	50	Sq Yd	$3.00	$150.00
Turf Reinforcement Mat	200	Sq Yd	$4.00	$800.00
Subtotal				$2,950.00
Contingency (10% of overall project)				$295.00
Total				***$3,245.00***

4.2.4 Easement and Land Availability Determination

The project involves two landowners, the Quaker Haven Foundation who owns the property where the sink hole is located down to the base of the eroding slope and Michael Dewitt who owns the property from the base of the slope to Dewart Lake. After providing the owners with a description of the purpose of the feasibility study and the benefits to the lake, landowner permission was obtained for accessing the site for field work during the conceptual design phase. Following completion of a conceptual design, landowners were sent letters describing the conceptual designs and were asked for their written permission to proceed with the final design and construction, if funds became available. Copies of the signed landowner agreements are in Appendix C.

4.2.5 Unusual Physical and Social Costs

No physical or social costs are anticipated as a result of this project. The construction of a vegetated swale will be beneficial to the Quaker Haven Foundation as the existing sink hole is a hazard to camp guests. The timing of construction can be organized so that it occurs during the off season of the camp which would limit guest interaction with equipment and temporary loss of use of the building adjacent to the sink hole. The stabilization of the sink hole will also be beneficial to the Dewitt property as the deposition of sediment on the property will be stopped.

4.2.6 Functionality and Impact Determination

The gully was estimated to contribute 20.6 tons of soil to the lake each year based on the 7' top width, 4' bottom width, 5' depth and 30' length = 20.6 Tons annual soil loss savings (Wayne Stanger, personal communication and Appendix B). This estimate seems relatively high because the gully does not seem to be eroding as fast as it once was due to the source of the erosion (water from the building downspouts) being routed away from this gully. The gully is probably contributing 1-2 tons per year in its current state.

4.2.7 Wetland Functional Assessment

According to a review of the United States Fish and Wildlife Service's National Wetlands Inventory (NWI) map, there are no wetlands located within the proposed construction area; however, approximately 70 feet (21.3 m) below the proposed rock chute there is a semi-permanently flooded palustrine, emergent/scrub-shrub wetland composed primarily of cattails (*Typha sp.*) and button bush (*Cephalanthus occidentalis*) (Figure 14). Construction activities will not occur in or impact the existing wetland.

4.2.8 Biological and Habitat Integrity Survey

The surrounding area at the top of the bank and adjacent to the sinkhole is maintained residential lawn while the area at the base of the bank transitions into an emergent scrub/shrub wetland 70 feet from the base of the slope. There is very little plant diversity adjacent to the gully. It is composed mainly of hackberry (*Celtis occidentalis*), white oak (*Quercus alba*), bush honeysuckle (*Lonicera maackii*), blackberry (*Rubus sp.*) and wild grape (*Vitis sp.*).

4.2.9 Environmental Impact Assessment

There will be limited environmental impact associated with this project. Stabilizing the existing bank will reduce the amount of sediment deposited in the wetland located just below the project site and ultimately Dewart Lake. The loss of a 10-12 inch (25.4-30.5 cm) diameter hackberry (*Celtis occidentalis*) and 8 inch (20.3 cm) white oak (*Quercus alba*) will need to occur to construct the vegetated swale, otherwise the surrounding habitat will not be impacted.

Figure 14. Semi-permanently flooded, palustrine, emergent/scrub-shrub, wetland identified on National Wetland Inventory map near Quaker Haven Camp (Site QH1). Source: U.S. Fish and Wildlife Service. http://www.fws.gov/wetlands/

4.2.10 Justification of Site Selection

The developed sink hole at the Quaker Haven Camp was brought to attention by camp employees and DLPA members. Upon a visit to the site the deposition of significant amounts of soil into the wetland at the edge of the lake was evident by the large amount of accumulated sediment which extended from the bottom of the slope to the lake edge as a delta.

4.2.11 Permit Requirements

No permits will be required for the construction of the proposed project. This is not a jurisdictional Waters of the United States.

4.3 <u>Project CR5, CR6 and CR7: Caywood Property</u>

4.3.1 Site Description

The Caywood project is located to the west of County Road 500 within the Cable Run drainage and includes Cable Run sites CR5, CR6 and CR7 (Figure 15). Cable Run is a legal county drain and is maintained by the Kosciusko County Drainage Board. At CR5 the 8.5 feet (2.6 m) culvert crossing under County Road 500 is elevated above the base flow water level on the downstream side which is preventing aquatic organism passage upstream (Figure 16). Approximately 200 feet (61.0 m) of the left downstream bank directly downstream from the

culvert is severely eroding and is very steep with little to no vegetation established (Figure 17). Downstream at site CR6 minor bank erosion is occurring for approximately 80 feet (24.4 m) on the right downstream bank (Figure 18). For both of these reaches a rock toe is proposed to stabilize the eroding slope. The rock toe work is also proposed along a 60 foot (18.3 m) reach associated with the label CR7 downstream. Much of the stream reach downstream of site CR7 is actually acting as a sediment depositional area. This reach is developing a new bankfull bench as sediment deposits on the bench formed within the over widened channel during higher flows. This development of a bankfull bench has already occurred at a couple locations immediately upstream and downstream from CR7.

Figure 15. Site location map for the Caywood Project on Cable Run, including Sites CR5, CR6, and CR7, Kosciusko County, Indiana

Figure 16. Caywood property project site CR5, perched culvert in Cable Run at downstream end (west side) of County Road 500 East crossing.

Figure 17. Bank erosion occurring on the left downstream bank, just west of CR 500 East (Caywood property Site CR5).

Figure 18. Bank erosion occurring on Cable Run west of CR 500 East (Caywood property Site CR6).

4.3.2 Preliminary Design and Conceptual Drawings

The Caywood project is divided into three zones, CR5, CR6 and CR7 (Figure 19). The conceptual design at CR5 is to construct a rock ramp to the bottom elevation of the existing culvert to allow for fish passage. The rock ramp would be constructed of revetment rip rap with a median diameter of 10-12 inches (25.4-30.5 cm) and extend downstream approximately 15 feet (4.6 m) to the existing downstream riffle (Figure 20). To address the erosion issues on the left downstream bank a rock toe constructed of 10-12 inch (25.4-30.5 cm) diameter stone will be constructed to a height of 3 feet (0.9 m) from the culvert downstream for the first 100 feet (9.1 m) while the remaining 100 feet (51.8 m) will have a rock toe constructed to a height of 1.5 feet (0.5 m). The rock toe would be keyed into the existing bed a minimum of 12 inches (30.5 cm) and placed along the toe of the existing bank (Figure 21). Bank re-grading will also occur for the first 30 feet (9.1 m) where bank erosion is the most severe and reduced number of trees allows for the re-grading without significant loss of existing trees. This area will be seeded with a native slope stabilization seed mix and covered with an erosion control blanket. The remaining portions of the bank downstream will not be re-graded due to the abundance of trees on the banks. In these sections it is anticipated the bank will naturally stabilize due to the installation of the rock toe, which will reduce the amount of toe scour. At CR6 and CR7 the installation of rock toe to a height of 1.5 feet (0.5 m) is also suggested to reduce minor bank erosion occurring for a total of approximately 140 feet (24.4 m). Bank grading is not suggested at CR6 and CR7 due to a reduced bank angle.

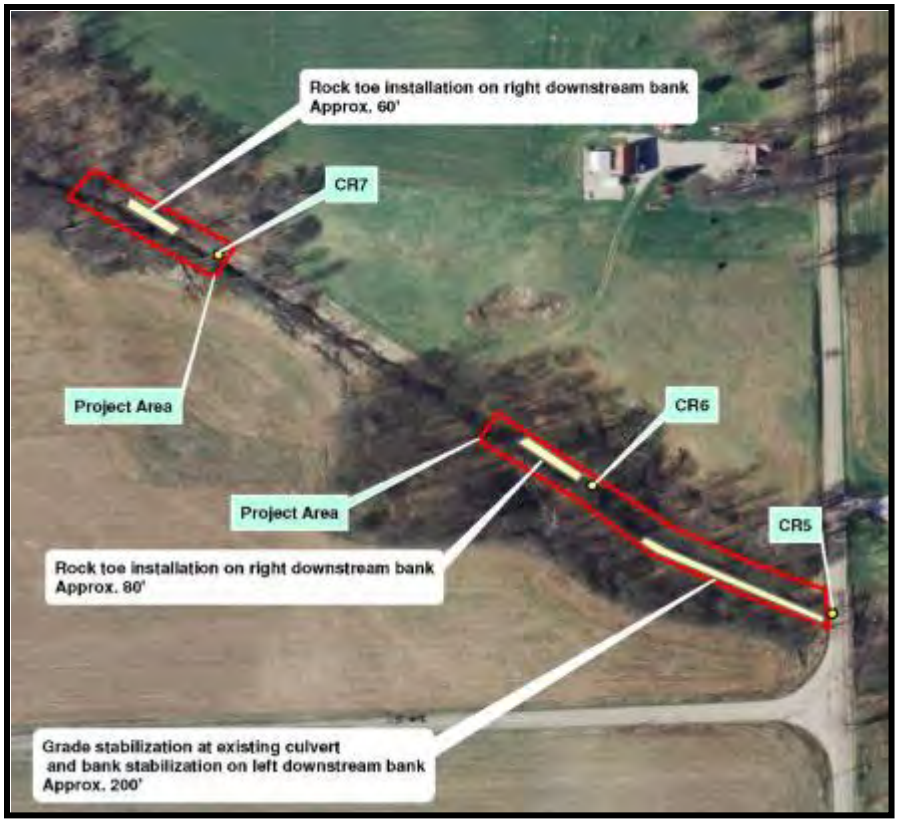

Figure 19. Proposed work on the Caywood property (Sites CR5, CR6, and CR7), along Cable Run, Kosciusko County, Indiana. The north south road is County Road 500 East and the east west road is County Road 950 North.

4.3.3 Probable Costs and Proposed Timelines

The following probable cost for the proposed project 3 on Cable Run is $19,260.00. Table 5 details the estimated cost for project administration, materials, and construction. Administrative services include bid development, subcontractor identification, communication, construction oversight, report preparation, and project management.

Table 5. Opinion of probable cost to construct rock ramp and install 340 feet (103.6 m) of rock toe treatment the Caywood property Sites CR5, CR6, and CR7, Cable Run, Kosciusko County, Indiana.

Item	Quantity	Unit	Unit Cost	Total
Administrative	1	Each	$1,700.00	$1,700.00
Mob/demob	1	Each	$1,000.00	$1,000.00
Labor	56	Each	$45.00	$2,520.00
Excavator + operator	56	Hour	$125.00	$7,000.00
Seed	1	Acre	$160.00	$160.00
Erosion control blanket	100	Sq Yd	$3.00	$300.00
Riprap (INDOT Class 1)	138	Tons	$35.00	$4,830.00
Subtotal				$17,510.00
Contingency (10% of overall project)				$1,750.00
Total				***$19,260.00***

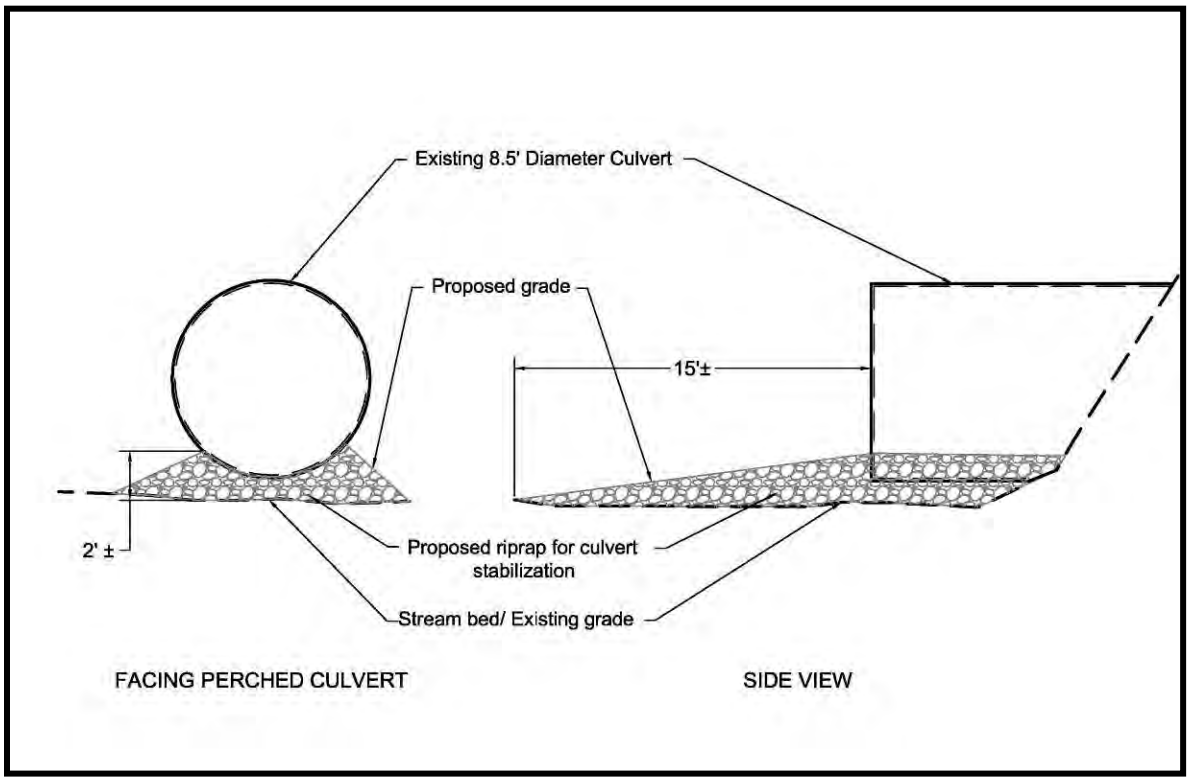

Figure 20. Conceptual drawing of proposed rock ramp to be installed at Site CR5 on the Caywood property, Kosciusko County, Indiana.

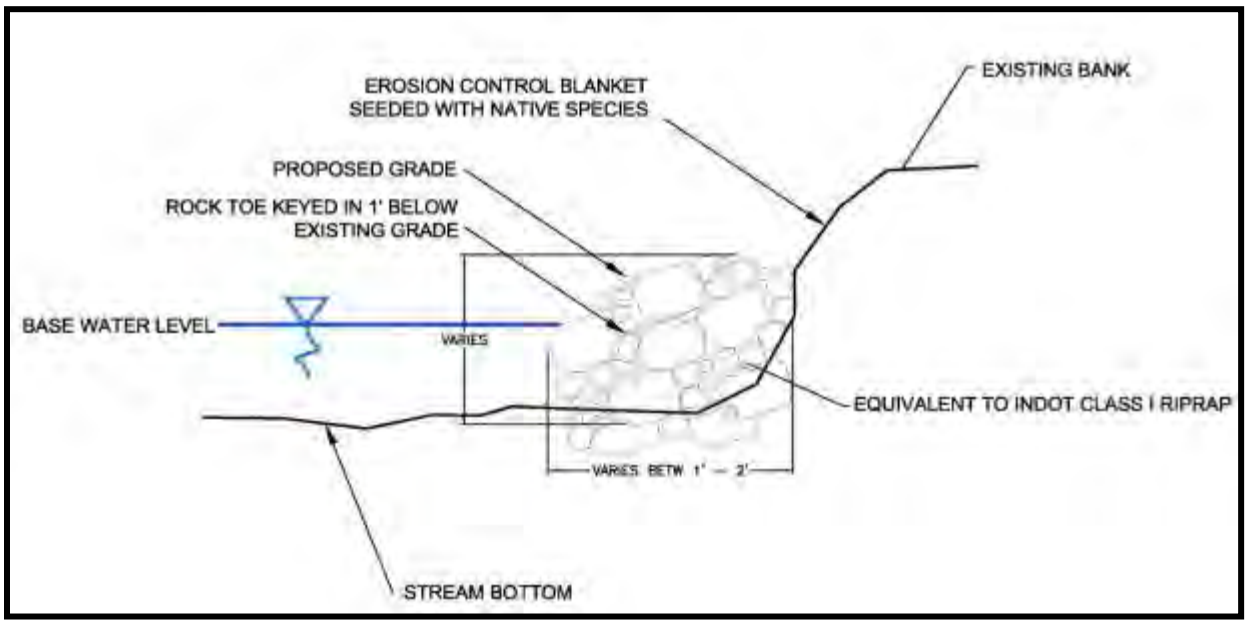

Figure 21. Conceptual drawing of rock toe and bank regarding treatment to be installed at Sites CR5, CR6 and CR7 on the Caywood property, Kosciusko County, Indiana.

4.3.4 Easement and Land Availability Determination

The property is owned by Roy and Inez Caywood. After providing the owners with a description of the purpose of the feasibility study and the benefits to the lake, landowner permission was obtained for accessing the site for field work during the conceptual design phase. Following completion of a conceptual design, a meeting was conducted onsite with the landowner to describe the proposed design plans. At that time the landowner was asked to provide comments on the conceptual design and asked for their written permission to proceed with the final design and construction, if funds became available. Copies of the signed landowner agreement can be found in Appendix C.

4.3.5 Unusual Physical and Social Costs

No significant physical and social costs are anticipated as a result of the proposed projects within the Cable Run drainage on the Caywood property. Total water conveyance capacity of the drainage will not be impacted by the proposed projects. Access along the length of the site will be through the stream as the surrounding banks are too steep for equipment access. Additional access may occur at County Road 500, which could interfere with traffic; however, only a portion of the road would be impacted during construction so that traffic could still pass. Some backfill material may be required for bank re-grading at CR5 which could be taken from the nearby farm field. As the fields are planted with row crops all construction activities will be conducted after the fall harvest. All areas disturbed during construction will be returned to pre-construction conditions.

4.3.6 Functionality and Impact Determination

To estimate the amount of sediment that would be deposited into the drain if no action were taken, the BANCS model was used (see section 3.3). This model estimates the annual erosion rates based on the near bank stress and the bank erosion hazard index in cubic yards and tons of sediment lost per year. Table 6 is a summary of the annual streambank erosion estimate for the proposed project site. Data sheets for this model can be found in Appendix D.

Table 6. Total annual streambank erosion estimate for Sites CR5, CR6 and CR7 on Cable Run, Caywood property, Kosciusko County, Indiana.

CuFt/Yr	CuYds/Yr	Tons/Yr	Tons/Yr/Ft
300.0	11.11	14.44	0.05

4.3.7 Wetland Functional Assessment

According to a review of the United States Fish and Wildlife National Wetland Inventory (NWI), the Project 3 site area is located in a seasonally flooded forested/scrub/shrub palustrine wetland (Figure 22). Common species include reed canary grass (*Phalaris arundinacea*), silver maple (*Acer saccharinum*), sedges (*Carex sp.*), hackberry (*Celtis occidentalis*), garlic mustard (*Alliaria petiolata*), American, elm (*Ulmus americana*), jewelweed (*Impatiens sp.*), bush honeysuckle (*Lonicera maackii*), and riverbank wild rye (*Elymus riparius*).

The majority of the riparian wetland has been drained by the existing Cable Run, which was entrenched into the floodplain when it was reconstructed in the 1940's. The stream is now 2 to 12 feet below its original floodplain riparian wetland elevation. The riparian area still serves the function of floodwater storage, overland flow filtration, and wildlife habitat because it remains forested in the project reach.

The proposed project will not impact the adjacent wetlands or forested riparian areas as all work will be conducted within the limits of the existing stream channel.

Figure 22. Seasonally flooded forested/scrub/shrub palustrine wetland identified on National Wetland Inventory map for the Caywood property. Source: U.S. Fish and Wildlife Service. http://www.fws.gov/wetlands/

4.3.8 Biological and Habitat Integrity Survey

In 2004 biological and habitat surveys were completed within the proposed project location as part of the 2004 Dewart Lake Diagnostic study. Macroinvertebrate data was not collected during this study so the 2004 data will be used to assess the Cable Run drainage biotic health. A Qualitative Habitat Evaluation Index (QHEI) was completed during the current study and was used to evaluate the habitat. In 2004, the calculated mIBI was 5.3 which suggest the streams biotic community is only slightly impaired (Cardno JFNew, 2005). Cable Run on the Caywood property had a QHEI score of 35.5 which suggests the stream has impaired habitat and may not be supportive of its aquatic use designation. The diversity of aquatic biota is likely limited by habitat availability. While suitable substrate exists (i.e. gravel, cobble) most of the channel is over widened and the water depth is only inches deep at base flow, with little instream cover.

4.3.9 Environmental Impact Assessment

No negative environmental impacts are likely to result from the construction of the proposed water quality improvements on Cable Run within the Caywood property. Stabilizing the existing banks will reduce the amount of instream derived sediment and ultimately the amount of sediment that reaches Dewart Lake. Currently, the perched culvert under County Road 500 East is not allowing fish passage during base flow conditions. The construction of a rock ramp

to the culvert invert will allow fish to migrate upstream from County Road 500 East. This increased degree of migration potential within the Cable Run drainage is beneficial to the fish community in a number of ways as it could allow for potential increased fish diversity in other sections of Cable Run drainage and allow for movement to more suitable habitat throughout the drainage, especially during the winter season when deeper habitats are required for overwintering. The use of a small excavator within the existing channel to construct the proposed rock toe will not severely impact the existing instream habitat. Currently there is only minimal large woody debris and the substrate is composed of gravel and cobble so the movement through the channel will not disturb those habitats.

4.3.10 Justification of Site Selection

During the June 2010 watershed tour, severe bank erosion was noted at the County Road 500 East crossing on the left downstream bank immediately downstream from the culvert. Active erosion was evident by the presence of bare soil and sections of the stream bank collapsing and undercutting. Landowner permission from Mr. Caywood was granted to Cardno JFNew allowing a considerable length of the Cable Run drainage to be investigated. With the identification of numerous streambank erosion sites and the cooperation of the landowner, over 340 feet of eroding banks can be stabilized on Cable Run.

4.3.11 Permit Requirements

A Clean Water Act Section 401 Water Quality Certification from IDEM and a Section 404 Permit from the USACE will be required because Cable Run is considered “Waters of the United States” and the rock ramp and rock toe would be considered fill that is regulated by these agencies. An IDNR floodway permit will be required as is all work within the floodway that is not part of regular drainage maintenance. Copies of the permits for project construction can be found in Appendix E.

4.4 Project CR1, CR2, CR3, and CR4: Mock Property

4.4.1 Site Description

The Mock property project sites are located on both the west and east sides of County Road 550 East on the Cable Run drainage including a small tributary to Cable Run that enters the drainage from the south on the east side on County Road 550 East (Figure 23). The four treatment areas (CR1, CR2, CR3, and CR4) each address a separate water quality issue (Figure 24). CR1 includes the tributary stream where a headcut is occurring, CR2 is at the confluence of the tributary and Cable Run where bank erosion is occurring on the right downstream bank for approximately 75 feet (22.9 m), CR3 is located on the east side of County Road 550 East culvert where the bank is eroding due to steep banks for approximately 100 feet (30.5 m) and CR4 is on the west side of County Road 550 East where directly downstream from the culvert on the left downstream bank erosion is occurring for approximately 150 feet (45.7 m).

Figure 23. Mock property project sites CR1, CR2, CR3, and CR4 location map, Kosciusko County, Indiana.

Figure 24. Location of individual projects (CR1, CR2, CR3, and CR4) on Cable Run within the Mock property, Kosciusko County, Indiana. The north south road is County Road 550 East.

Figure 25-28. Example of erosion issues on Cable Run within the Mock property. Clockwise from top left: headcut on tributary east of County Road 550 East (CR1); erosion on right downstream bank at junction of tributary with Cable Run (CR2); erosion on left downstream bank just east of County Road 550 East (CR3); erosion on left downstream bank just west of County Road 550 East (CR4), Kosciusko County, Indiana.

4.4.2 Preliminary Design and Conceptual Drawings

Four projects were conceptually designed along Cable Run within the Mock property. The proposed work at CR1 is to install a grade control structure downstream of the identified headcut approximately 30 to 60 feet (9.1 to 18.2 m) upstream from the confluence with Cable Run in the tributary. The grade control structure will be constructed of revetment rip rap approximately 1-2 feet (0.3-0.6 m) above the existing grade (Figure 29). Stone will extend up the banks approximately 3 feet (0.9 m) to prohibit water from flowing around the structure. The grade control incorporates a 3 foot (0.9 m) wide key trench that is excavated and filled with rock a minimum of 12 inches (30.5 cm) below the existing grade and into the embankments to the top of each bank. The downstream portion of the grade control structure will have a slope of 10:1. The installation of a grade control in this area will prevent the movement of the headcut upstream. Also, there is some bank erosion occurring on the left downstream bank immediately downstream from the headcut. In this location the bank would be re-graded and seeded with native slope stabilization seed mix and covered with erosion control blanket.

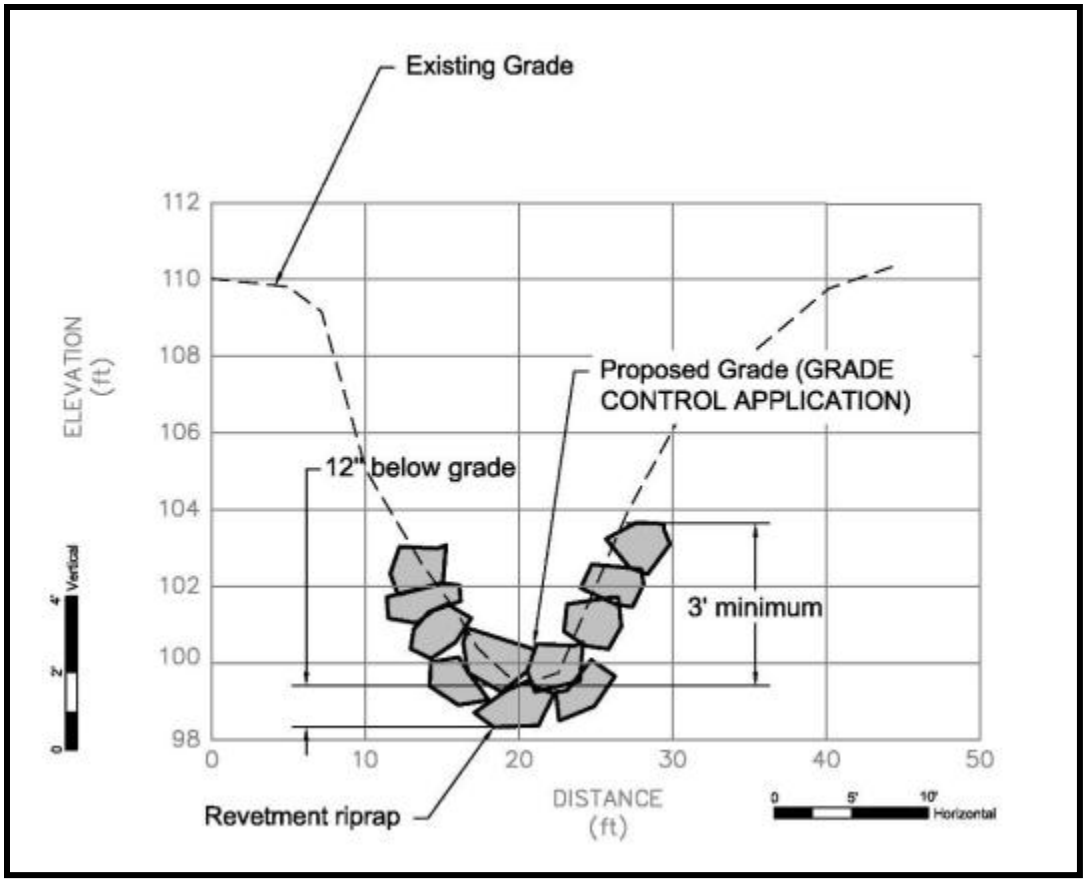

Figure 29. Typical cross-section of grade control proposed for downstream of existing headcut within the unnamed tributary on the Mock property East of County Road 550 East (Site CR1).

The proposed erosion control work for Site CR2 and CR3 on Cable Run east of County Road 550 East is to install a rock toe to a height of 1.5 feet (0.5 m) along approximately 700 feet (213.4 m) of the right and left downstream banks where erosion is occurring (Figure 30). This area extends upstream to the eastern property boundary of Larry Mock, which is located just downstream of the confluence of Cable Run and a second tributary that enters the Cable Run from the north. Additionally, at site CR3 the existing bank is proposed to be re-graded, seeded with a native slope stabilization seed mix and covered with erosion control fabric.

At CR4 a rock toe is proposed to be installed, but since it is directly downstream from a culvert the rock toe will be installed to a height of 3 feet (0.9 m). Bank re-grading is also recommended along the first 50 feet (15.2 m) of the left downstream bank at CR4 as the bank has overhanging sections of soil and is very steep. Areas re-graded would be seeded with a native slope stabilization seed mix and covered with erosion control material. A large cottonwood approximately 30 feet (9.1 m) downstream from the County Road 550 East culvert is being severely undercut and will need to be removed to allow re-grading of the bank in that area as well. Removal of the tree was acceptable to the landowner as currently it interferes with farming activities. The tree would eventually fall due to the amount it is currently undercut. A debris pile composed of old concrete and woody debris is also present within the channel below the bankfull elevation at CR4 and would be removed as part of this project.

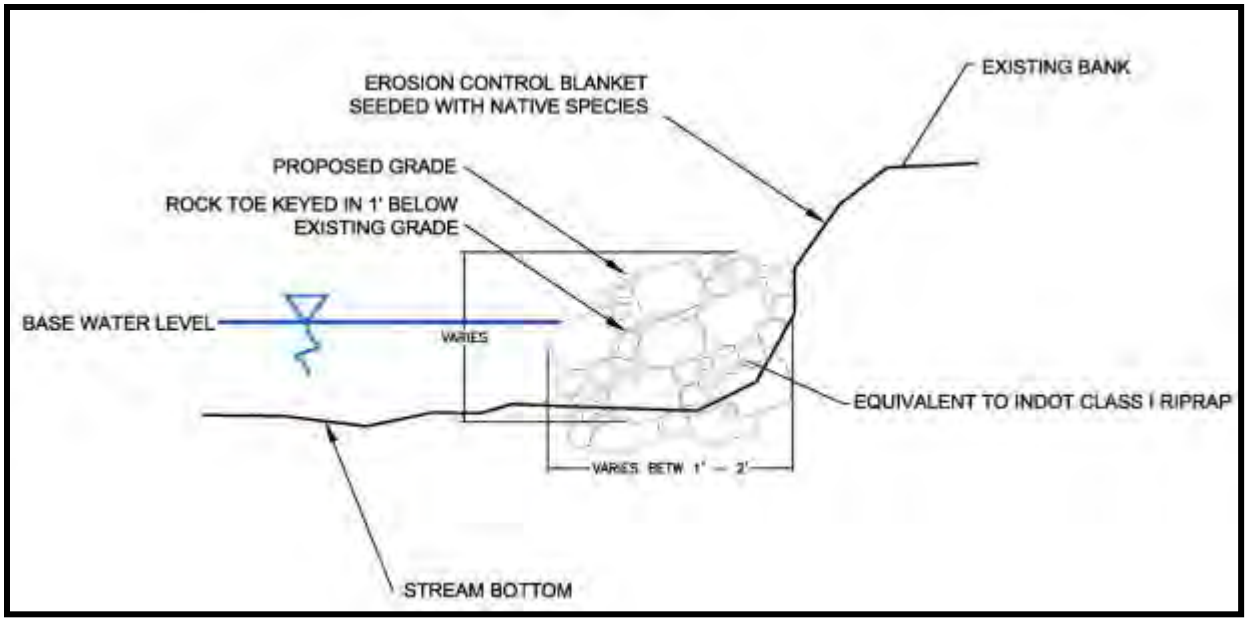

Figure 30. Typical cross section of rock toe and bank re-grading application proposed for the eroding reaches of Cable Run upstream of County Road 550 East on the Mock property (Sites CR2 and CR3).

4.4.3 Probable Costs and Proposed Timelines

The following probable cost for the proposed Mock property projects on Cable Run is $52,570.00. Table 7 details the estimated cost for project administration, materials, and construction. Administrative services include bid development, subcontractor identification, communication, construction oversight, report preparation, and project management.

Table 7. Opinion of probable cost for the construction of two grade controls and installation of 1,550 feet (472.4 m) rock toe treatment at Project Site 4 on Cable Run, Kosciusko County, Indiana.

Item	Quantity	Unit	Unit Cost	Total
Administrative	1	Each	$4,400.00	$4,400.00
Mob/demob	1	Each	$2,000.00	$2,000.00
Labor	120	Each	$45.00	$5,400.00
Excavator + operator	120	Hour	$125.00	$15,000.00
Seed	2	Acre	$160.00	$320.00
Erosion control blanket	100	Sq Yd	$3.00	$300.00
Riprap (INDOT Class1)	582	Tons	$35.00	$20,370.00
Subtotal				$47,790.00
Contingency (10% of overall project)				$4,780.00
Total				***$52,570.00***

4.4.4 Easement and Land Availability Determination

Two landowners are involved with this proposed series of projects. Doug Mock owns the property containing Site CR1 and Larry and Susan Mock own the property containing Sites CR 2, CR3 and CR4. After providing each landowner with a description of the purpose of the feasibility study and the benefits to the lake, landowner permission was obtained for accessing

the site for field work during the conceptual design phase. Following completion of a conceptual design, a meeting was conducted onsite with Larry Mock and a letter mailed to Doug Mock to describe the proposed design plans. At that time the landowners were asked to provide comments on the conceptual design and asked for their written permission to proceed with the final design and construction, if funds became available. Copies of the signed landowner agreements are in Appendix C.

4.4.5 Unusual Physical and Social Costs

No unusual physical or social costs are anticipated from the construction of the proposed water quality improvement projects on Cable Run within the Mock properties. The installation of a rock toe and re-grading of the stream banks will not increase the flood potential of Cable Run drainage in the vicinity of the work or upstream of the proposed projects. Flooding will not be increased from the proposed grade control at CR1, as the constructed grade control will be set at the existing grade of the channel. Access to project sites CR1, CR2, and CR3 will be gained at County Road 550. On both the right and left side of Cable Run there is an existing farm lane which allows access along the stream. Some minor removal of trees and shrubs will occur for equipment access to CR1, but overall the surrounding area should not be impacted. Construction access to Site CR4 on the west side of County Road 550 East will occur after the fall harvest to avoid any issues with site access at those times. All areas disturbed during construction activities will be returned to preconstruction conditions.

4.4.6 Functionality and Impact Determination

To estimate the amount of sediment that would be deposited into the drain if no action were taken, the BANCS model was used (see section 3.3). This model estimates the annual erosion rates based on the near bank stress and the bank erosion hazard index in cubic yards and tons of sediment lost per year. Table 8 is a summary of the annual streambank erosion estimate for the proposed project sites. Data sheets for this model can be found in Appendix D.

Table 8. Total annual streambank erosion estimate for Project 4.

CuFt/Yr	CuYds/Yr	Tons/Yr	Tons/Yr/Ft
218	8.07	10.49	0.05

4.4.7 Wetland Functional Assessment

A review of the National Wetlands Inventory (NWI) map indicates there are three different wetland types located within the vicinity of the proposed work. A seasonally flooded forested/scrub/shrub palustrine wetland located around on the west side of County Road 550 and a seasonally flooded forest palustrine wetland and seasonally flooded scrub/shrub palustrine wetland located on the east side of County Road 550. Common species found within the project site include wood-nettle (*Laportea canadensis*), reed canary grass (*Phalaris arundinacea*), scouring rush (*Equisetum sp.*), jewelweed (*Impatiens sp.*), silver maple (*Acer saccharinum*), sedges (*Carex sp.*), hackberry (*Celtis occidentalis*), american elm (*Ulmus americana*) bush honeysuckle (*Lonicera maackii)* and sycamore (*Platanus occidentalis*).

No work is proposed in or adjacent to these wetland areas. All work will be within the existing limits of the Cable Run drain where there are no wetlands, just open water. The access to the work areas is on the high banks of the ditch as well. No wetlands will impacted by the access. The structures themselves will have no effects on the wetlands in the vicinity except potentially to keep them from draining in the future.

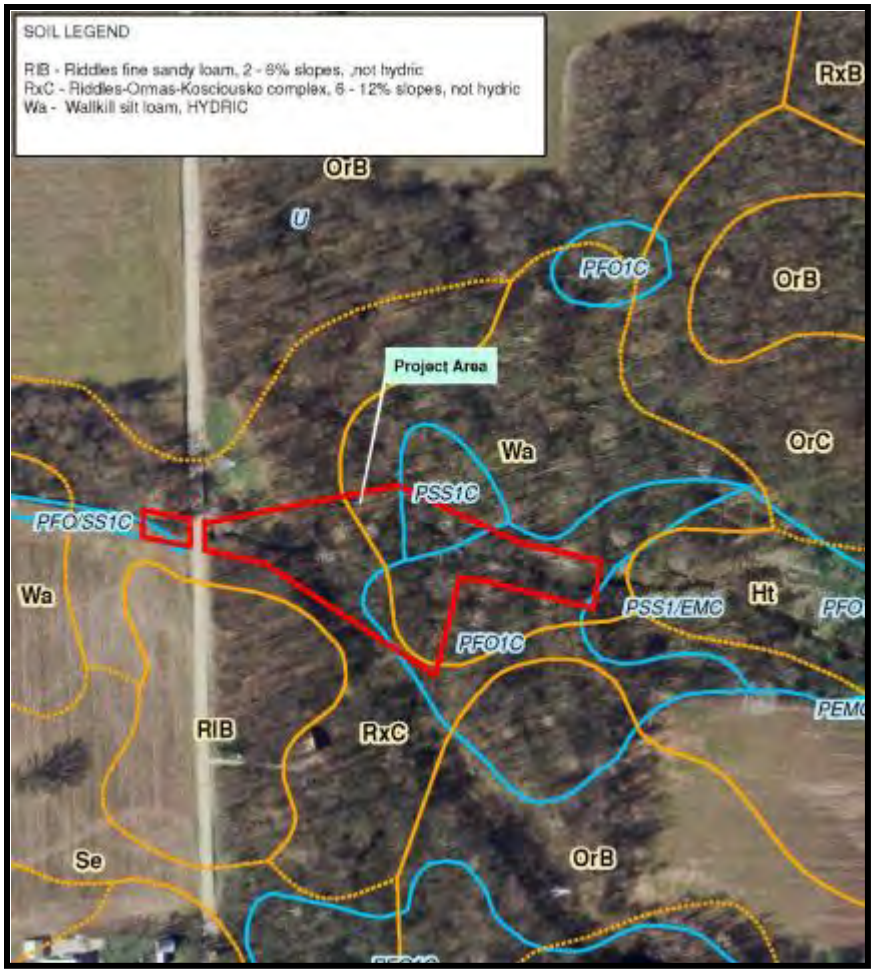

Figure 31. Wetlands and soil types within the vicinity of the proposed prosed projects on the Mock properties (Sites CR1, CR2, CR3, and CR4), Kosciusko County, Indiana. The wetland labels include seasonally flooded forested/scrub/shrub palustrine wetland (PFO/SS1C) located around CR4; seasonally flooded forest palustrine wetland (PFO1C) located around CR1; and seasonally flooded scrub/shrub palustrine wetland (PSS1C) located around CR2. Taken from National Wetland Inventory map. Source: U.S. Fish and Wildlife Service. http://www.fws.gov/wetlands.

4.4.8 Biological and Habitat Integrity Survey

In 2004, biological and habitat surveys were completed within the proposed project location as part of the 2005 Dewart Lake diagnostic study. Macroinvertebrate data was not collected during this current study, so the 2004 data will be used to assess Cable Run drainage biotic health. A Qualitative Habitat Evaluation Index (QHEI) was completed both downstream and upstream from County Road 550 East during the current study and will be used to evaluate the habitat. The small tributary stream to Cable Run at Site CR1 has a drainage area of less than 1 mi^2 therefore a Primary Headwater Habitat Evaluation Form (HHEI) was used to assess habitat quality. In 2004, the calculated mIBI was 5.3 which suggest the streams biotic community is only slightly impaired (Cardno JFNew, 2005). At both the downstream and upstream locations the calculated QHEI score was 43, which suggest the stream has impaired water quality habitat and may not be supportive of its aquatic use designation. Diversity of aquatic biota is likely limited by habitat availability. The tributary stream had a HHEI score of 70 which indicates the stream is a Class II headwater stream and could potentially support a fair-good biotic diversity. The tributary is a warm-water stream and has permanent to intermittent flow.

4.4.9 Environmental Impact Assessment

The proposed construction projects at Project 4 will not negatively impact the instream aquatic biotic or the surrounding forested wetland and upland areas within the immediate site area and up or downstream of the site. The proposed projects will benefit the Cable Run drainage by reducing the amount of sediment erosion and thereby reducing the amount of sediment entering Dewart Lake. Access to area CR 1-CR 3 is gained through an existing maintained path therefore; few trees if any will need to be removed to gain access to some bank locations at CR 1 and CR 3. As proposed, efforts will be made to remove only those trees necessary for access and bank adjustments and keep all the high quality trees species. Common and/or exotic/invasive species will be targeted for removal to gain access to the work areas. Access to CR 1 may need to be gained through the stream; however, limited large woody debris habitat is present which will need to be at least temporarily removed for access. The substrate in this reach is composed of gravel, cobble and sand which should allow the small equipment to move through the stream with limited disturbance to the bed.

4.4.10 Justification of Site Selection

The four projects proposed within the Mock properties provide an opportunity to stabilize a sizable length of the Cable Run where historical straightening and deepening of the channel created highly erosive banks. Active erosion is evident throughout the identified reach both upstream and downstream from County Road 550 East.

4.4.11 Permit Requirements

A Clean Water Act Section 401 Water Quality Certification from Indiana Department of Environmental Management (IDEM) and a Section 404 Permit from United States Army Corp of Engineers (USACE) will be required because the project areas are “Waters of the United States” and the stone toe and grade control structure would be considered fill. An IDNR floodway permit will be required as is all work within the floodway that is not part of regular drainage maintenance. Copies of the permits to construct the proposed projects are found in Appendix E.

5.0 PROJECT SUMMARY

In June 2010 a tour of the Dewart Lake watershed with a focus on the Cable Run drainage was conducted to identify locations of erosion and sedimentation problems and determine if any feasible solutions were available. Seven sites were identified along Cable Run or drainages of Cable Run, one project was located at the Quaker Haven camp, and one project was located north of County Road 1000 N in the Hasse Drain watershed. Water quality issues identified primarily involved eroding streambanks and slopes. The seven sites within the Cable Run drainage were organized into two separate project areas based on land ownership. Controlling and reducing erosion within these areas will be beneficial to maintaining good water quality in Dewart Lake. The proposed projects combined are expected to save 72 tons of soil from entering Dewart Lake each year after installation.

The conceptual designs developed at the numerous project sites include the installation of grade controls, the conversion of an eroding ravine to a grassed swale and the utilization of a rock toe application and some bank re-grading. Project costs ranged from $3,000.00 to $52,000.00 and were reflected in the amount of work and materials needed at a site. The overall cost for all of the projects was estimated at $85,000.00, which includes acquiring the necessary permits for all the proposed projects, contractor mobilization fees, and administrative services.

The DLPA submitted for two separate construction LARE grants for the 2012 year. One included the proposed projects within the Cable Run and the other included the eroding ravine north of CR 1000 N (Hasse Drain) and the ravine at the Quaker Haven Camp. Both of the proposed projects are intended to be matched by federal grant money through the Great Lakes Commission that was obtained in 2011 by the Elkhart River Restoration Association.

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APPENDIX A

WATERSHED TOUR SUMMARY

DEWART LAKE PROTECTIVE ASSOCIATION
ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

Cardno JFNew

Dewart Lake Engineering Feasibility Study
Watershed Tour 6/18/2010 Summary

Introduction

JFNew identified landowners along Cable Run and in the northwest portion of the Dewart Lake watershed to ask permission for access to complete a watershed tour. The objective of the tour was to identify potential feasibility project locations. An initial mailing was sent out in March 2010 with second mailings in May 2010 for select landowners where no response to the original mailing was obtained.

The watershed tour occurred on June 18, 2010 and was performed by primarily by Mark Pranckus from JFNew and Ken Brehob from the DLPA. The tour was limited to areas where access was granted. A complete tour of Cable Run and the northwest watershed was not possible. The tour also included two sites on the Camp Logan Girl Scout camp.

As part of the preparation for the tour, Kosciusko County Surveyor Dick Kemper was contacted about the study. He was invited on the tour, but was unable to make it due to scheduling conflicts. Mr. Kemper will be included in all project correspondence involving Cable Run.

Watershed Tour Findings Summary

Described below are the preliminary projects identified during the watershed tour.

Project 1 – Quaker Haven Bank Erosion

<table>
<tr><td>Field ID: QH1</td><td rowspan="3">Project Description:
A sink hole at the top of a bank adjacent to the Dewart Lake has been created by bank re-grading done on the hillside below the sink hole and overland flow. Sink hole is approximately 10 ft x 13 ft and is 6 ft deep. A cabin is approximately 20 ft from hole.</td></tr>
<tr><td>Project Partners:
• Land owner</td></tr>
<tr><td>Potential Project(s):
• Rebuild bank
• Install catch basin to route water down the bank.
• Rock chute down the bank</td></tr>
<tr><td colspan="2">Water Quality Problem: Direct sediment deposition to the lake</td></tr>
</table>

Examples of erosion at Quaker Haven Camp.

Project 2 – County Road 500 Fish Passage and Bank Erosion

Field ID: CR1	**Project Description**: The downstream 8.5' diameter culvert crossing CR 500 is perched preventing low flow passage for aquatic organisms. Thirty feet of the left downstream bank directly downstream from culvert is severely eroding. 180 ft of the left downstream bank is on a severe bank angle with little to no vegetation.
Project Partners: • Land owner • Kosciusko Co. Surveyor • Kosciusko Co. Highway Department	
Potential Project(s): • Install a fish ramp • 30 ft of direct bank stabilization • 180 ft of bank re-grading	
Water Quality Problem: Aquatic organism passage through culvert and bank erosion	

Examples of the perched culvert and bank erosion downstream of CR 500.

Project 3 – Cable Run Bank Erosion – Downstream Reach

Field ID: CR2	**Project Description**: 30 ft of minor bank erosion on the right downstream bank.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Stabilize bank through re-grading	
Water Quality Problem: Sediment and nutrient loading	

Example of bank erosion downstream of CR 500.

Project 4 – Cable Run Bank Erosion – Downstream Reach

Field ID: CR4	**Project Description**: Minor bank erosion for approximately 300 ft where bank has a steep angle. Use direct bank stabilization techniques to address erosion. Install wing deflectors and cross vanes to narrow low flow channel and provide interberm development within channel.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Stabilize bank through re-grading • Low flow channel narrowing and interberm establishment	
Water Quality Problem: Sediment and nutrient loading	

Example of bank erosion downstream of CR 500.

Project 5 – Cable Run Bank Erosion – Downstream Reach

Field ID: CR6 and CR7	**Project Description**: Minor bank erosion for approximately 150 ft and 50 ft, respectively where livestock (buffalo) had close access to stream bank.
Project Partners: • Land owner • Kosciusko Co. Surveyor • Kosciusko Co. SWCD • NRCS	
Potential Project(s): • Stabilize bank through re-grading • Move electric fence • Create a buffer between grazing area and stream	
Water Quality Problem: Sediment and nutrient loading	

Example of bank erosion downstream of CR 500.

Project 6 – Cable Run Channel Crossing – Downstream Reach

Field ID: CR9	**Project Description**: Approximately 830 ft upstream of where Cable Run enters Dewart Lake there is a stream crossing with two 48" HDPE culverts. Both culverts are set at the same elevation with the right downstream culvert being blocked and the majority of the flow is going through the left downstream one. The area on top of and around the culverts is eroding on the upstream side.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Re-set culverts with one being higher in elevation that the other. • Stabilize channel crossing	
Water Quality Problem: Sediment and nutrient loading	

Example of channel crossing and associated erosion.

Project 7 – Cable Run Bank Erosion – Upstream Reach

Field ID: CR10	**Project Description**: A debris dam just downstream of the CR 550 culvert is deflecting flows into the left downstream bank causing significant bank erosion. Further downstream, the left downstream bank is bare and scoured. Row crops are planted relatively close to the top of the bank.
Project Partners: • Land owner • Kosciusko Co. Surveyor • Kosciusko Co. SWCD • NRCS	
Potential Project(s): • Remove debris dam at downstream culvert crossing • Stabilize highly eroding bank • Re-grade bank • Create stream buffer	
Water Quality Problem: Sediment and nutrient loading	

Example of the significant erosion downstream of the CR 550 culvert and the bank scour on the left downstream bank further downstream.

Project 8 – Cable Run Bank Erosion – Upstream Reach

Field ID: CR11	**Project Description**: The left downstream bank is steep and eroding for approximately 100 feet where a powerline crosses above the stream.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Stabilize eroding bank using a bioengineered approach.	
Water Quality Problem: Sediment and nutrient loading	

Example of the bank erosion on the left downstream bank where a power line crosses over the stream.

Project 9 – Cable Run Bank Erosion – Upstream Reach

Field ID: CR12	**Project Description**: Approximately 75 feet of the right downstream bank is eroding on an outside bend. The bank is only approximately 3 feet high; however, there appears to be very little protection and nothing to prevent the erosion from continuing.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Stabilize eroding bank using a bioengineered approach.	
Water Quality Problem: Sediment and nutrient loading	

Example of the bank erosion on the right downstream bank on an outside bank.

Project 10 – Cable Run Bank Erosion – Upstream Reach

Field ID: CR14	**Project Description**: A head cut has stopped moving upstream where the roots of two trees have grown in the channel. There is also a severely eroding bank on the left downstream bank downstream of the head cut. If the roots were comprised, the head cut would continue upstream.
Project Partners: • Land owner • Kosciusko Co. Surveyor	
Potential Project(s): • Stabilize eroding bank • Install permanent grade control	
Water Quality Problem: Sediment and nutrient loading	

Example of the bank erosion on the left downstream bank downstream of the rootwad grade control and the head cut that is moving upstream.

Project 11 – Camp Logan Sediment Trap

Field ID: CL 1	**Project Description**: The existing sediment trap at the base of a ravine where previous work has occurred needs to be cleaned out. Part of the sediment is due to a failing project upstream; however, maintenance of the existing trap should be expected as part of the regular O and M after the project is repaired.
Project Partners: • Camp Logan	
Potential Project(s): • Develop a maintenance plan for existing sediment trap including looking into retrofitting it so that it can cleaned using existing camp resources and providing a plan to deal with removed material.	
Water Quality Problem: Sediment and nutrient loading	

Project 12 – Camp Logan Eroding Ravine

Field ID: CL 2	**Project Description**: A ravine to the west of the ravines where previous projects have occurred shows signs of having an eroding bed. A preliminary study will be conducted to determine how much sediment is resulting from the ravine and develop a plan to stabilize the area.
Project Partners: • Camp Logan	
Potential Project(s): • Stabilize ravine grade	
Water Quality Problem: Sediment and nutrient loading	

Project 13 – Bank erosion on the Haas Court Ravine

Field ID: NB1 and NB2	**Project Description**: Two areas of erosion were observed on the ravine west of Haas Court. Both areas are the result of flow being directed on the high bank from either channel obstructions or a head cut passing through the section of channel.
Project Partners: • Landowners	
Potential Project(s): • Bank stabilization	
Water Quality Problem: Sediment and nutrient loading	

Example of the two eroding banks on the ravine west of Haas Court.

Project 14 – Wetland near Haas Court Ravine

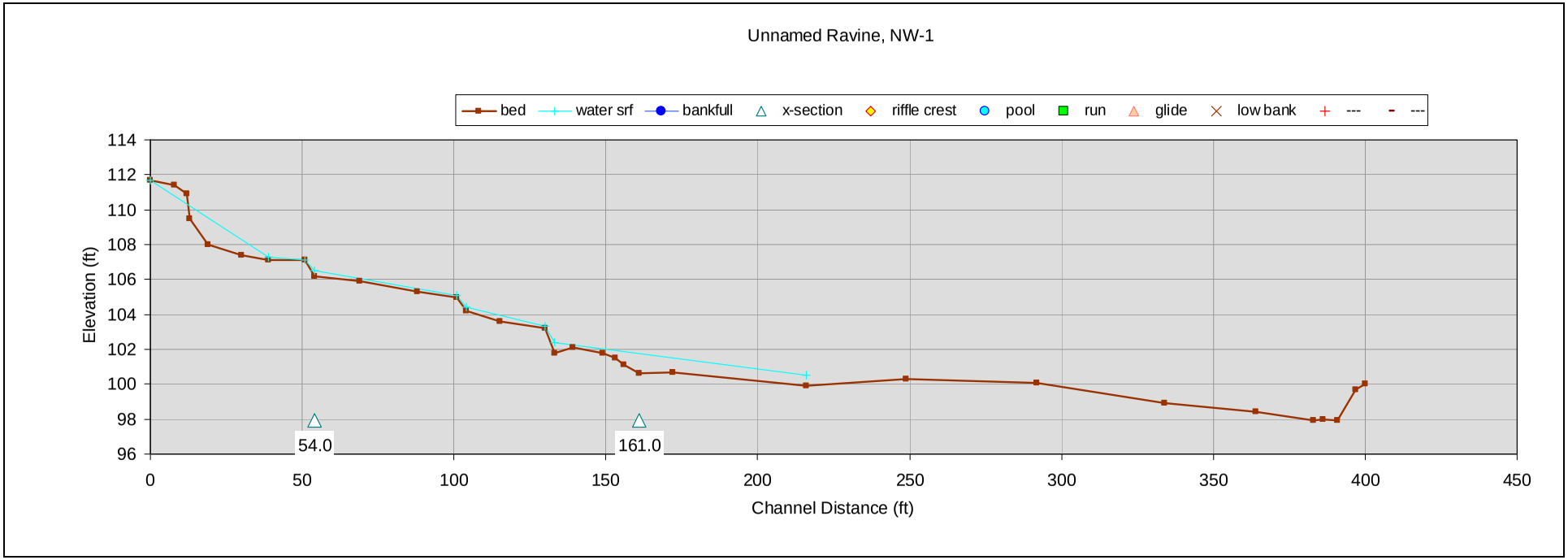
Field ID: N/A	**Project Description**:
Project Partners: • Landowners • NRCS	
Potential Project(s): • Create a wetland to store stormwater	
Water Quality Problem: Sediment and nutrient loading, stormwater management	

APPENDIX B

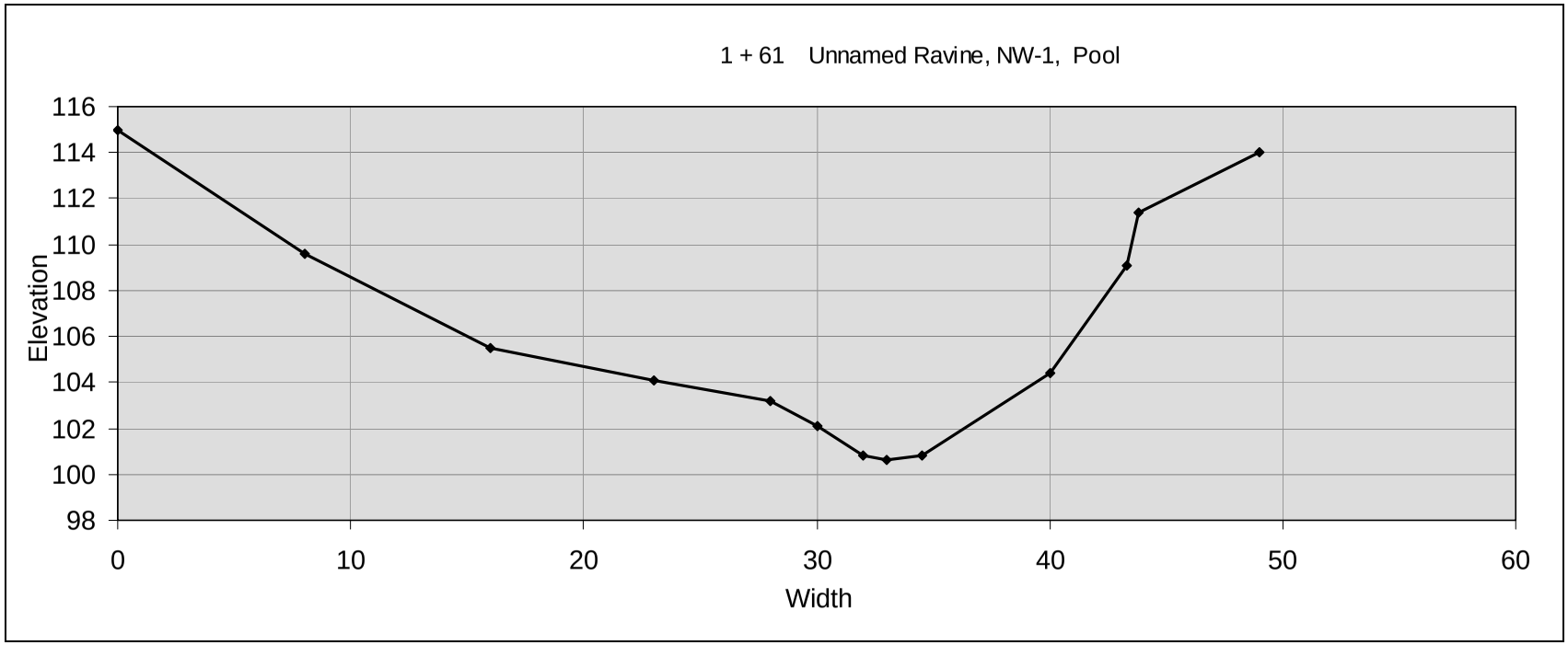
CROSS-SECTION AND LONGITUDINAL SURVEY FORMS

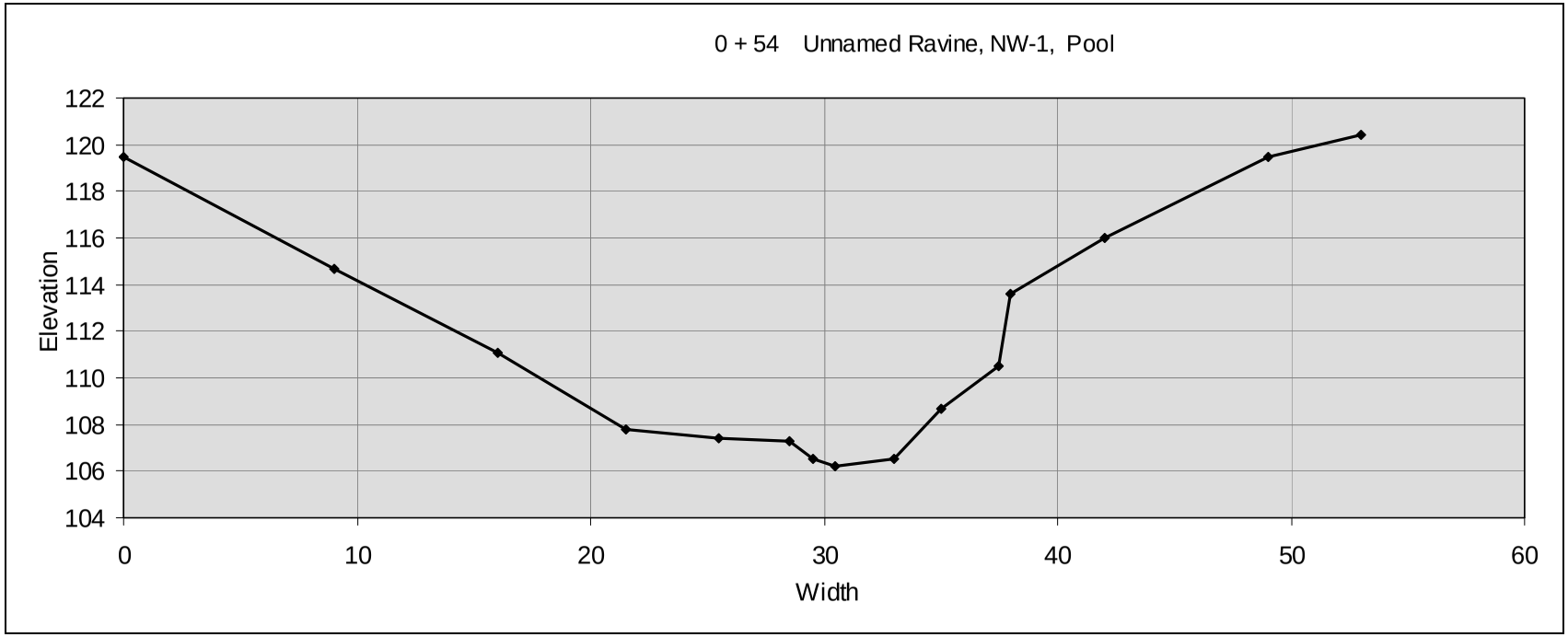
DEWART LAKE PROTECTIVE ASSOCIATION
ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

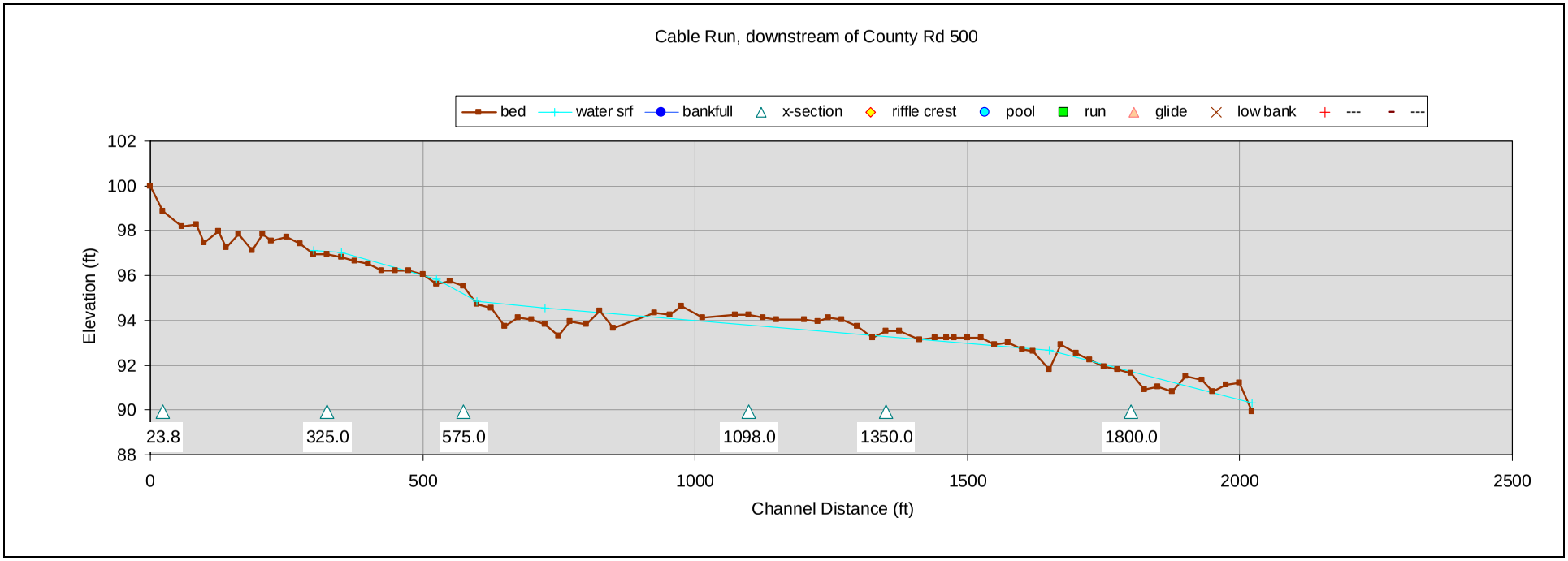
Cardno JFNew


Unnamed Ravine, NW-1
bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
low bank

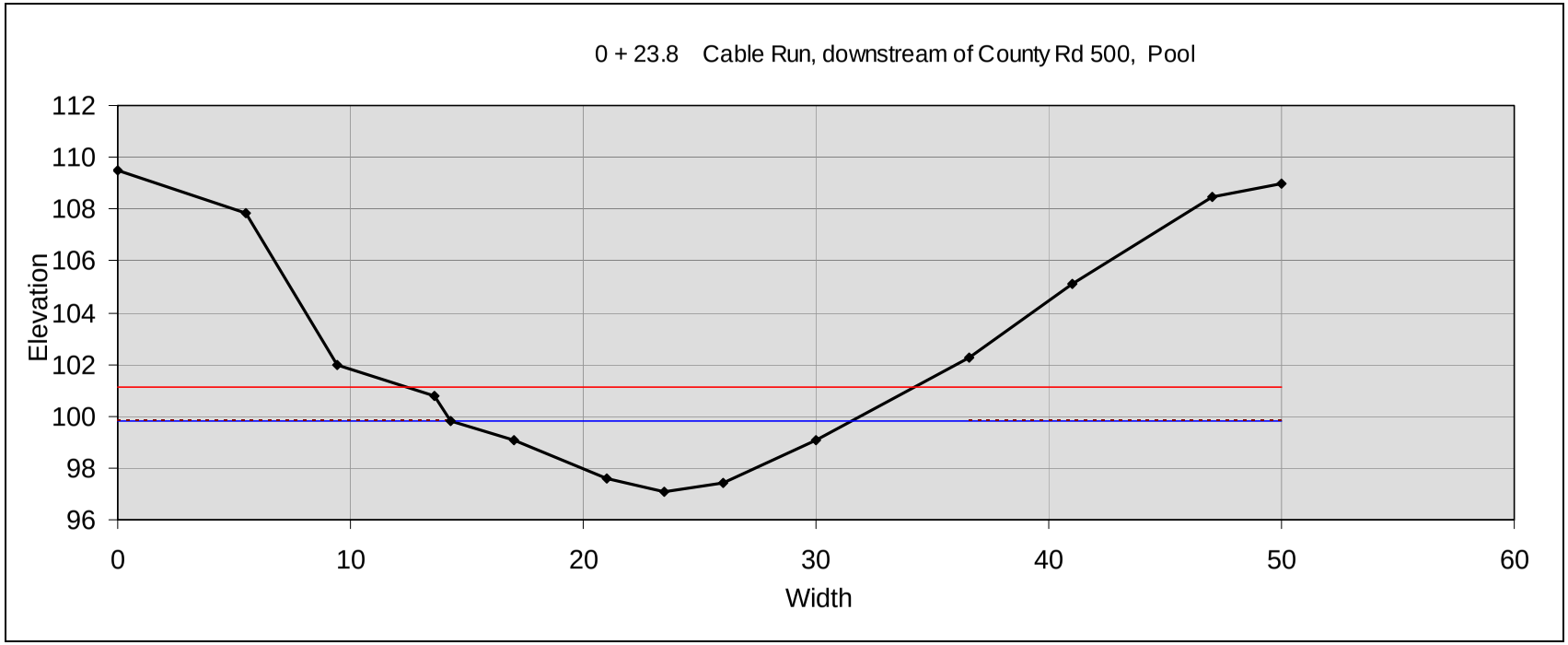
Elevation (ft)
114
112
110
108
106
104
102
100
98
96
54.0
161.0
0
50
100
150
200
250
300
350
400
450
Channel Distance (ft)

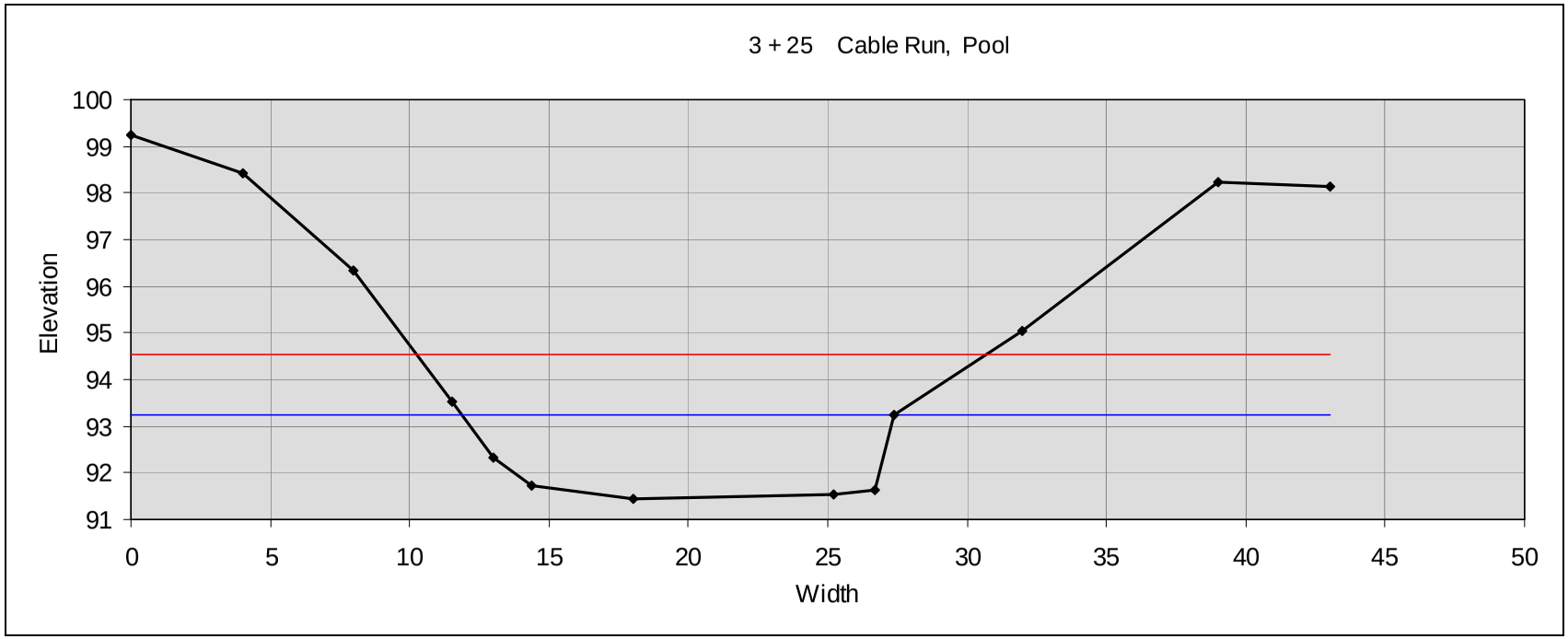

1 + 61 Unnamed Ravine, NW-1, Pool
Elevation
116
114
112
110
108
106
104
102
100
98
0
10
20
30
40
50
60
Width

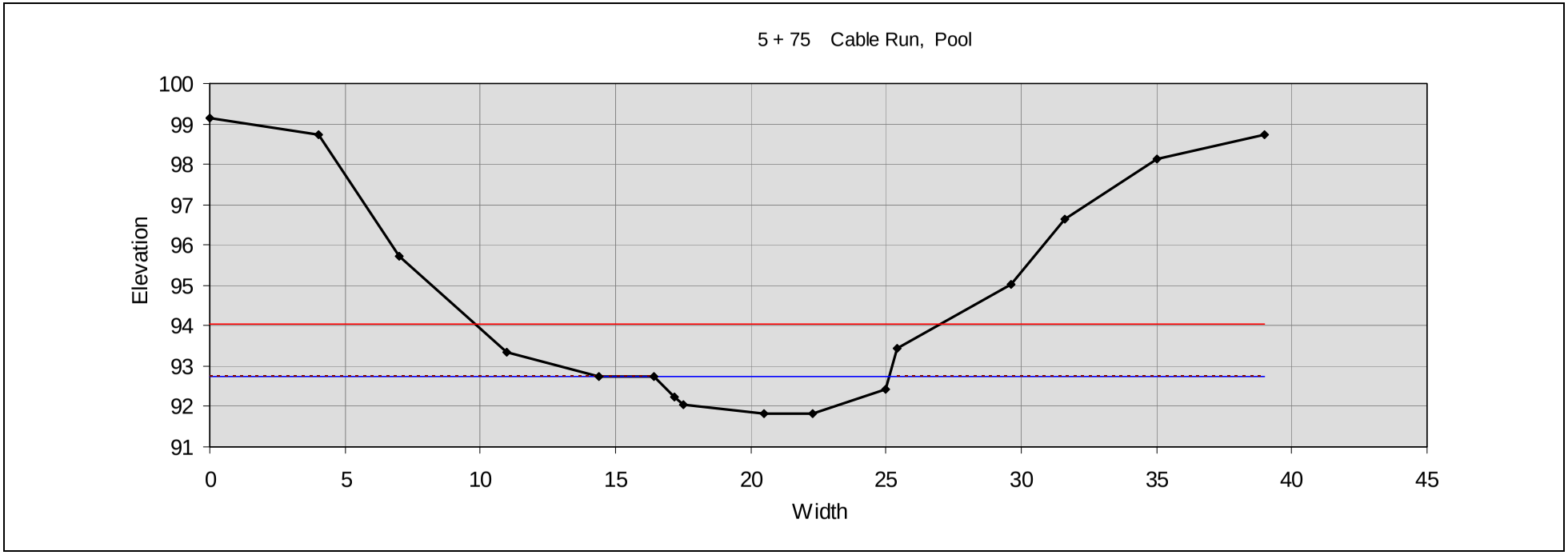

0 + 54 Unnamed Ravine, NW-1, Pool
Elevation
122
120
118
116
114
112
110
108
106
104
0
10
20
30
40
50
60
Width

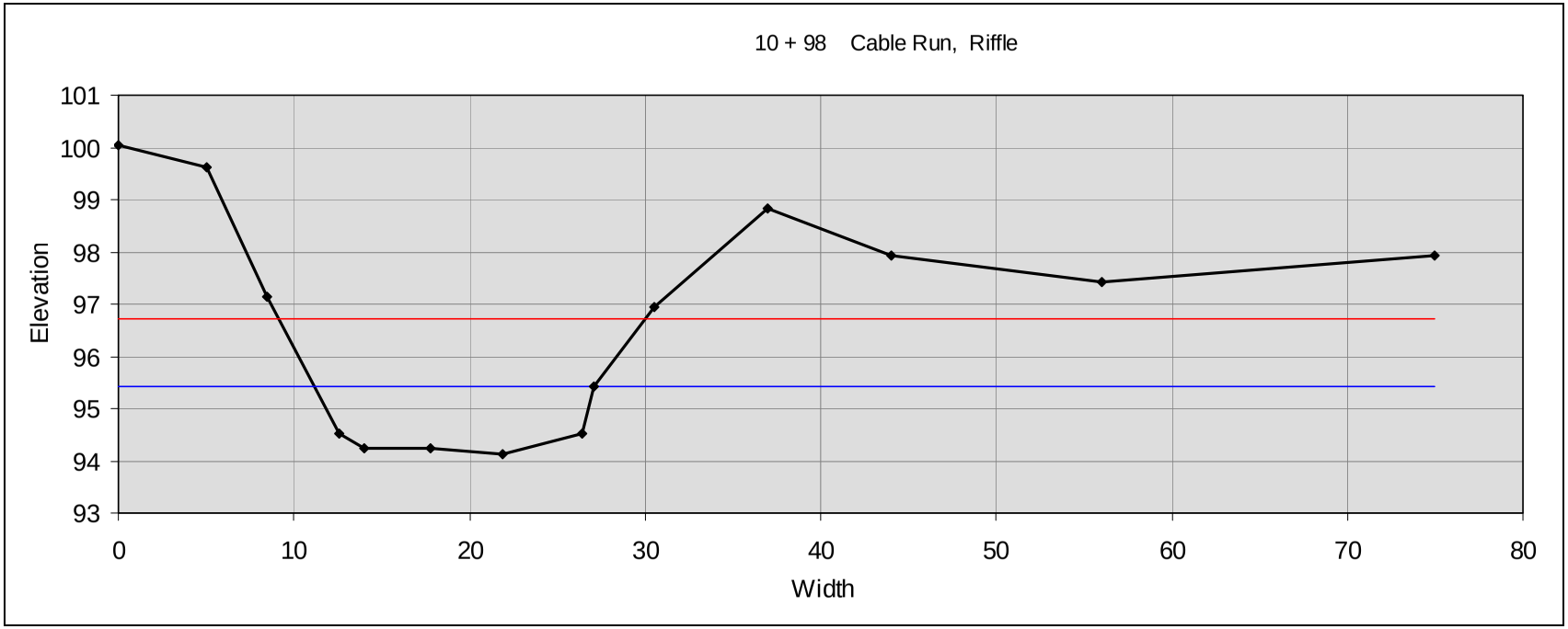

Cable Run, downstream of County Rd 500
bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
low bank

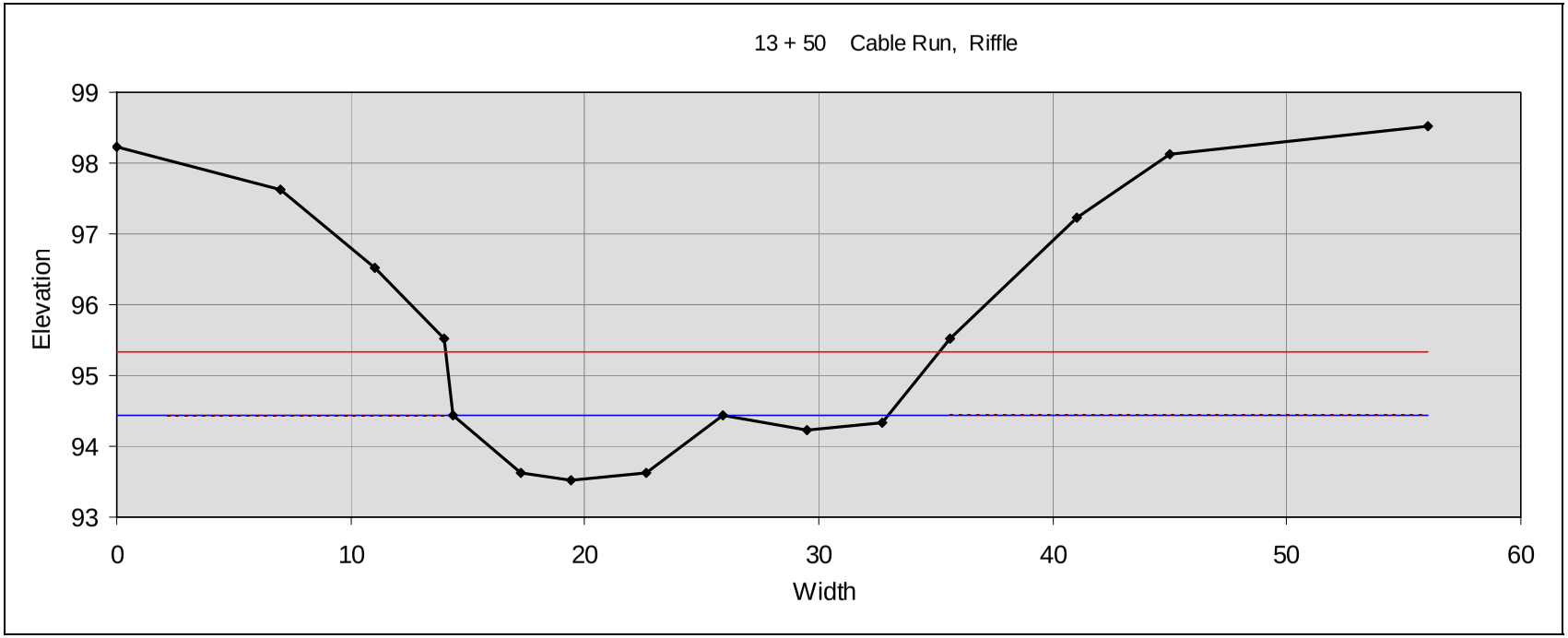
Elevation (ft)
102
100
98
96
94
92
90
88
23.8
325.0
575.0
1098.0
1350.0
1800.0
0
500
1000
1500
2000
2500
Channel Distance (ft)

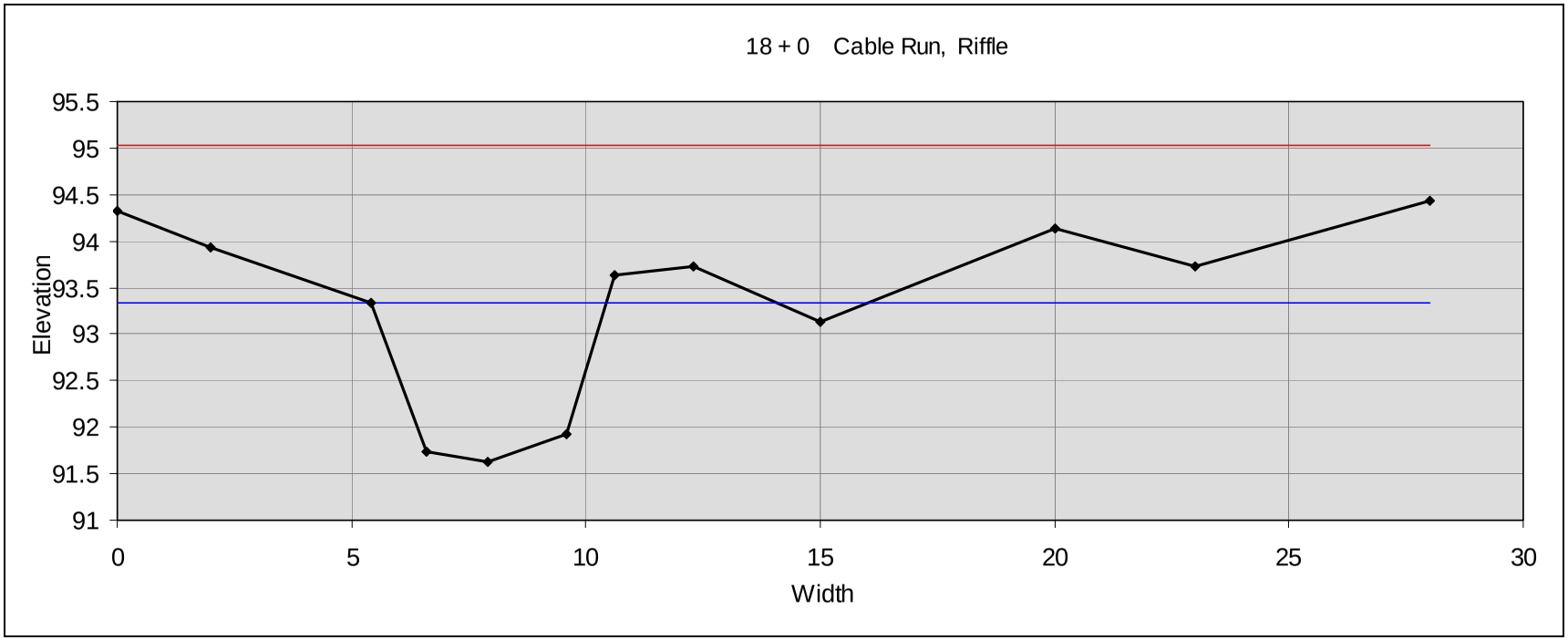

0 + 23.8 Cable Run, downstream of County Rd 500, Pool
Elevation
112
110
108
106
104
102
100
98
96
0
10
20
30
40
50
60
Width

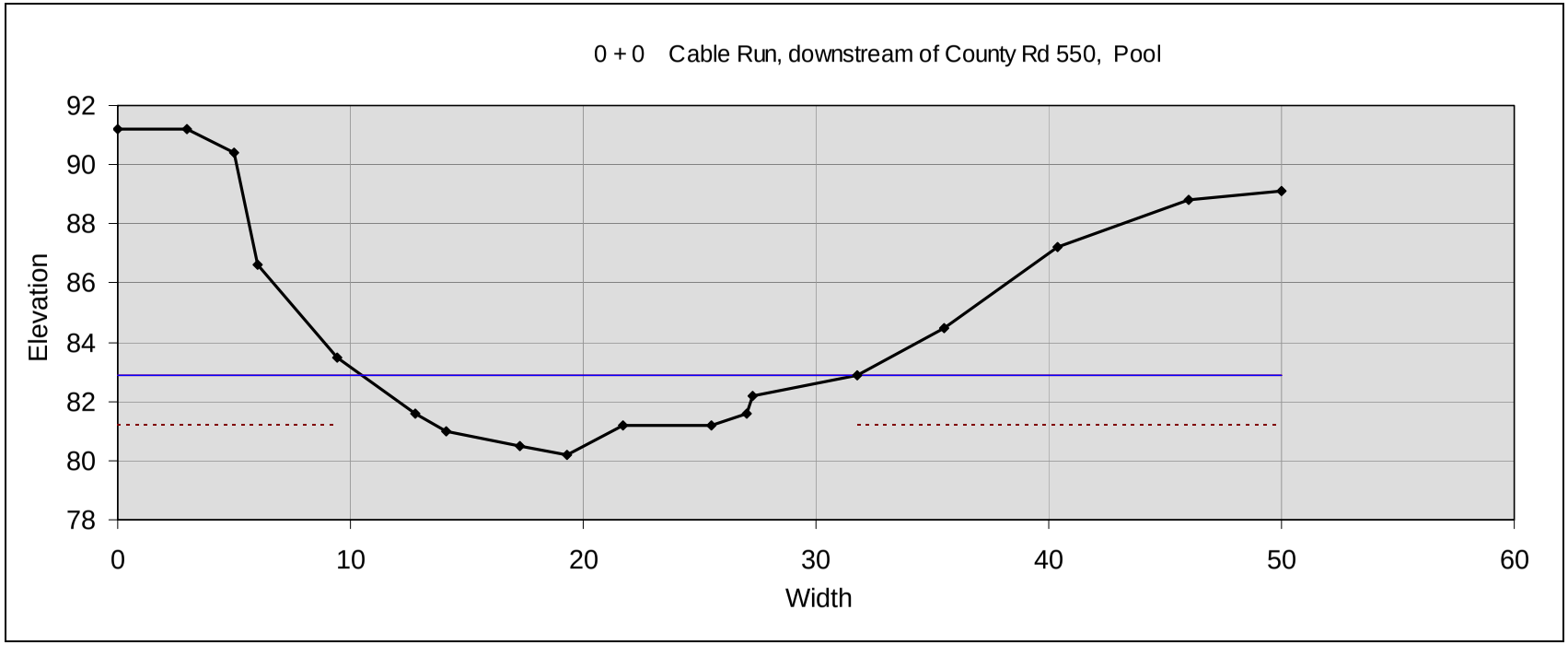

3 + 25 Cable Run, Pool
Elevation
100
99
98
97
96
95
94
93
92
91
0
5
10
15
20
25
30
35
40
45
50
Width

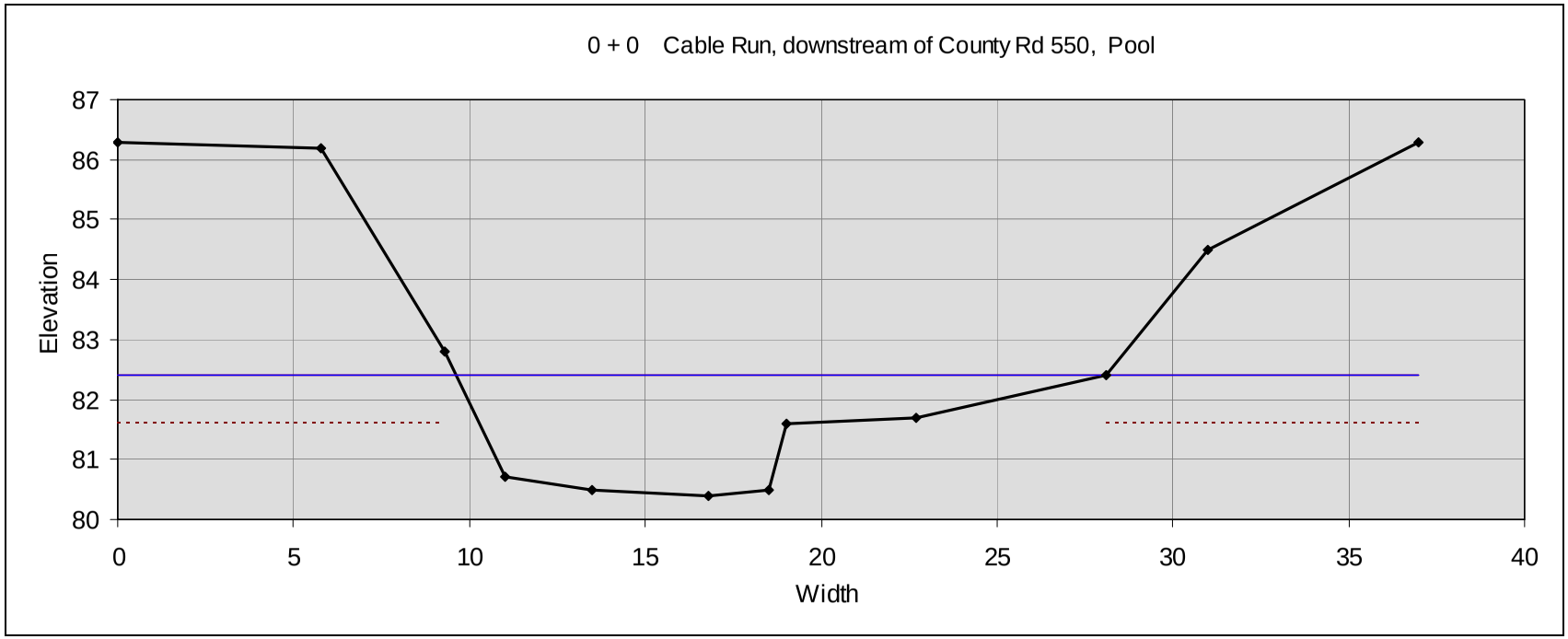

5 + 75 Cable Run, Pool
Elevation
100
99
98
97
96
95
94
93
92
91
0
5
10
15
20
25
30
35
40
45
Width

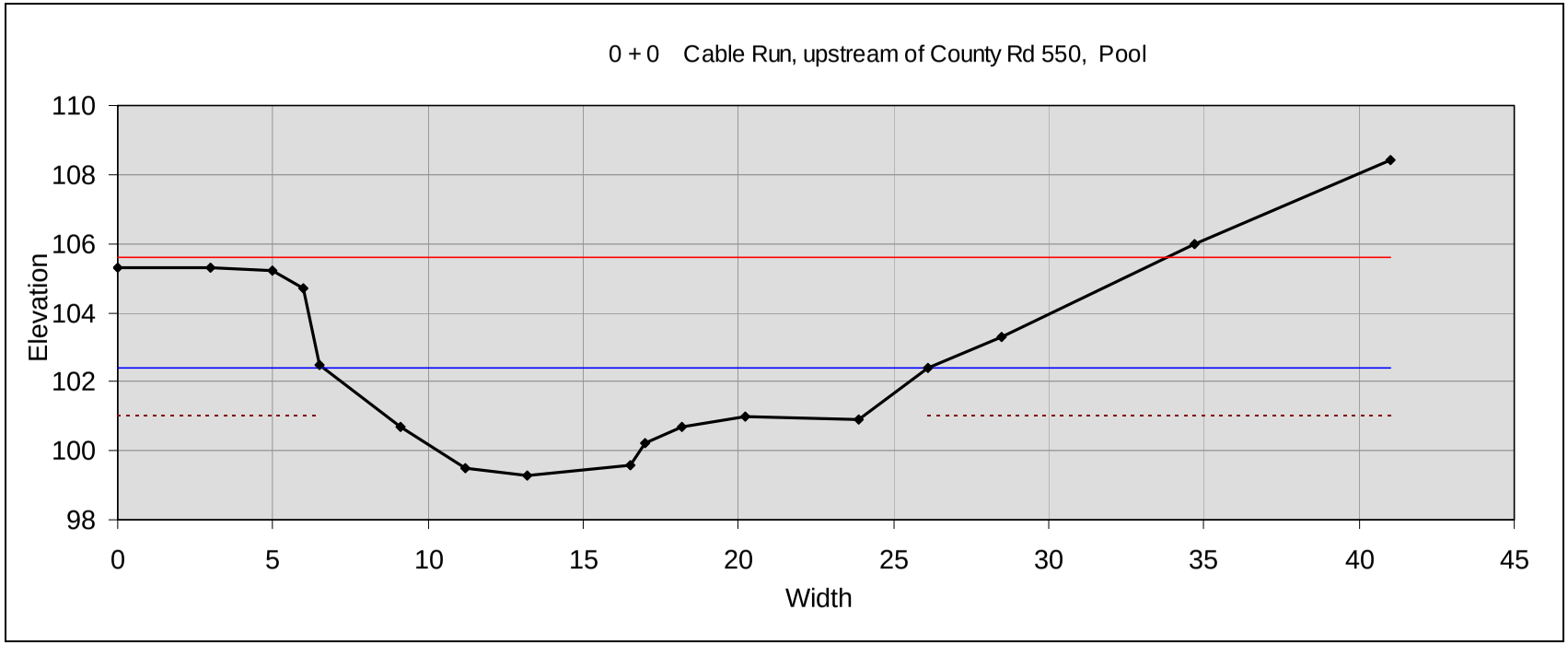

10 + 98 Cable Run, Riffle
Elevation
101
100
99
98
97
96
95
94
93
0
10
20
30
40
50
60
70
80
Width

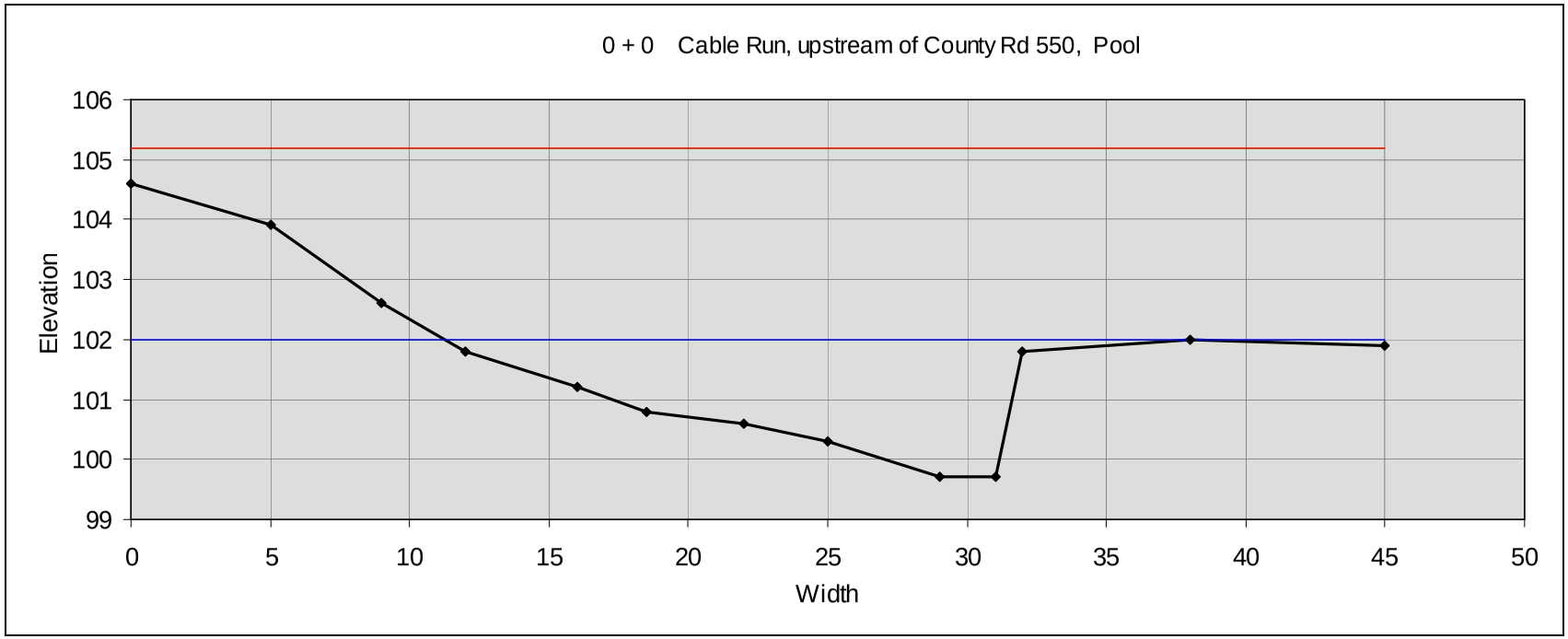

13 + 50 Cable Run, Riffle
Elevation
99
98
97
96
95
94
93
0
10
20
30
40
50
60
Width

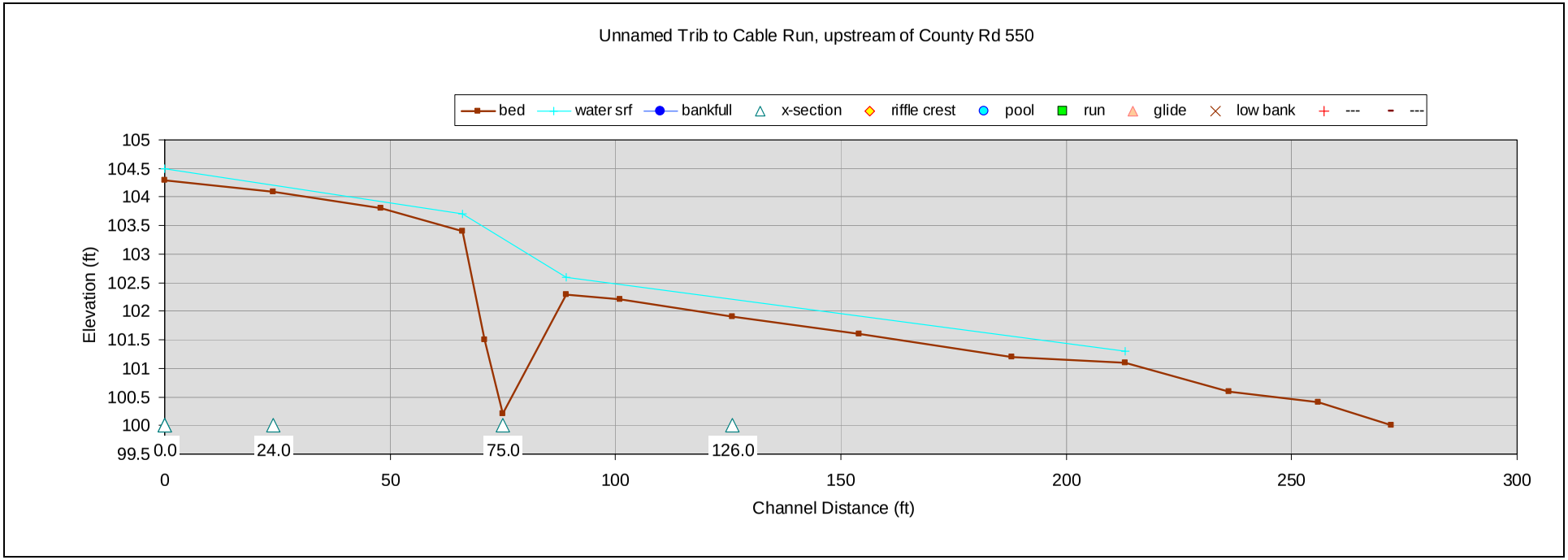

18 + 0 Cable Run, Riffle
Elevation
95.5
95
94.5
94
93.5
93
92.5
92
91.5
91
0
5
10
15
20
25
30
Width


0 + 0 Cable Run, downstream of County Rd 550, Pool
Elevation
92
90
88
86
84
82
80
78
0
10
20
30
40
50
60
Width

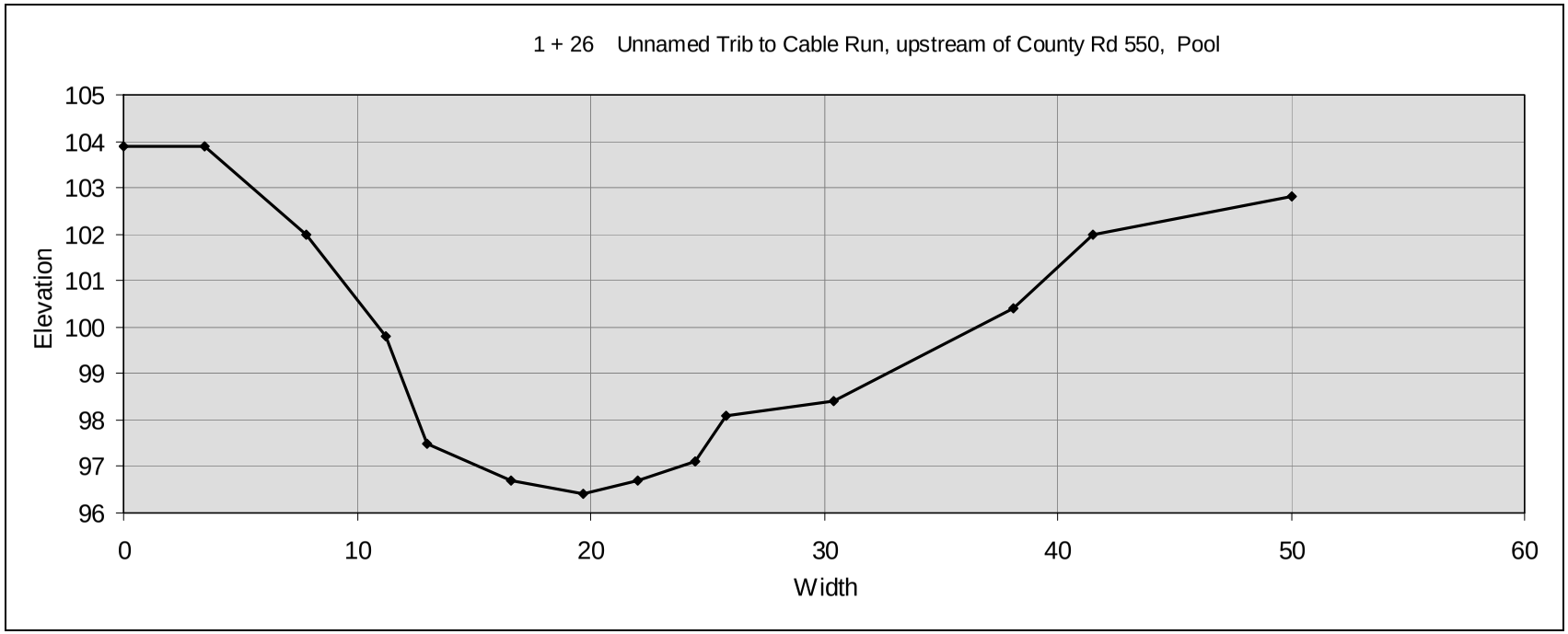

0 + 0 Cable Run, downstream of County Rd 550, Pool
Elevation
87
86
85
84
83
82
81
80
0
5
10
15
20
25
30
35
40
Width

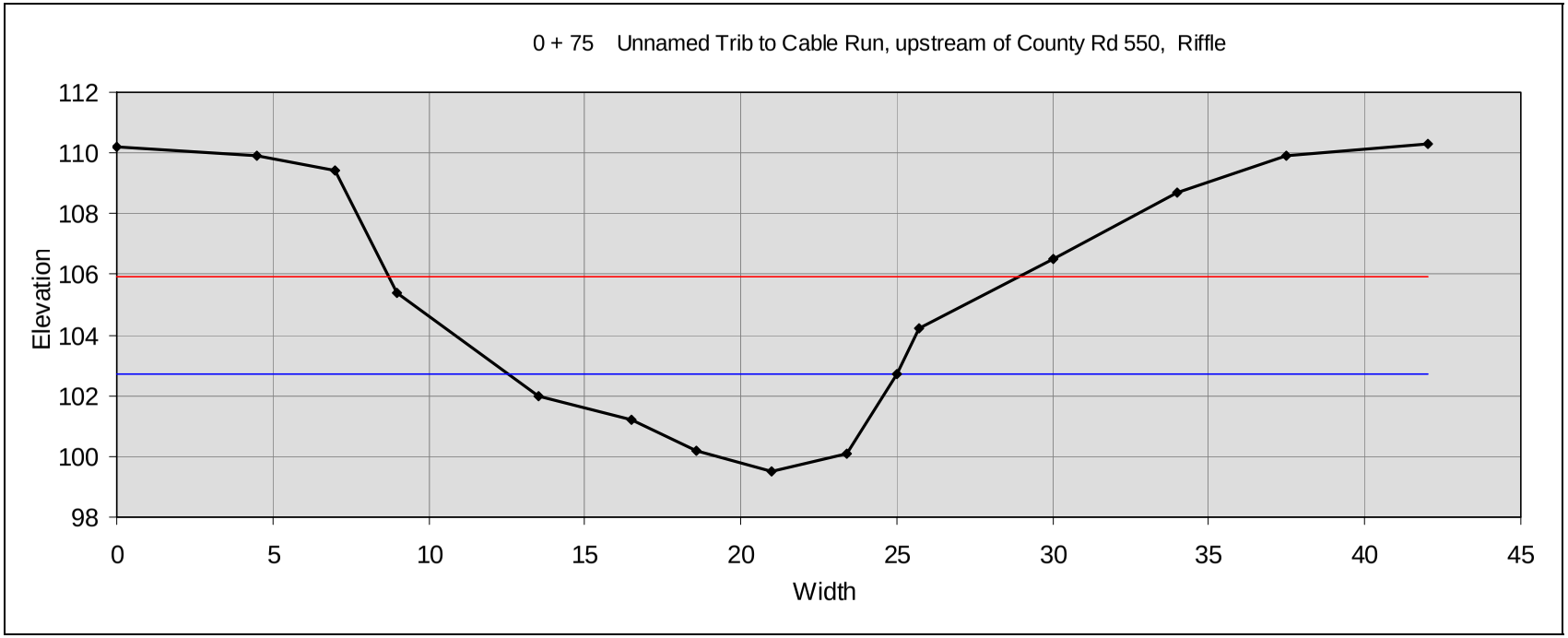

0 + 0 Cable Run, upstream of County Rd 550, Pool
Elevation
110
108
106
104
102
100
98
0
5
10
15
20
25
30
35
40
45
Width

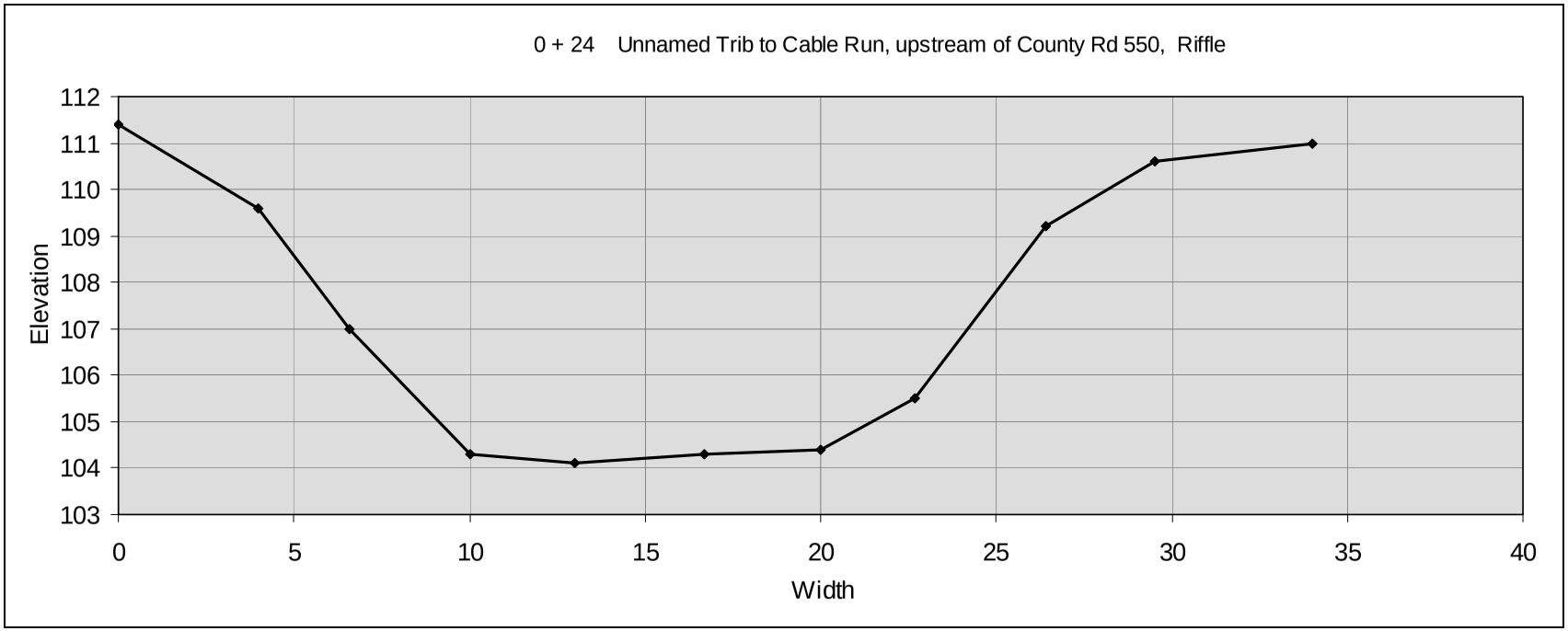

0 + 0 Cable Run, upstream of County Rd 550, Pool
Elevation
106
105
104
103
102
101
100
99
0
5
10
15
20
25
30
35
40
45
50
Width


Unnamed Trib to Cable Run, upstream of County Rd 550
bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
low bank

Elevation (ft)
105
104.5
104
103.5
103
102.5
102
101.5
101
100.5
100
99.5
0.0
24.0
75.0
126.0
0
50
100
150
200
250
300
Channel Distance (ft)


1 + 26 Unnamed Trib to Cable Run, upstream of County Rd 550, Pool
Elevation
105
104
103
102
101
100
99
98
97
96
0
10
20
30
40
50
60
Width


0 + 75 Unnamed Trib to Cable Run, upstream of County Rd 550, Riffle
Elevation
112
110
108
106
104
102
100
98
0
5
10
15
20
25
30
35
40
45
Width


0 + 24 Unnamed Trib to Cable Run, upstream of County Rd 550, Riffle
Elevation
112
111
110
109
108
107
106
105
104
103
0
5
10
15
20
25
30
35
40
Width

APPENDIX C

LANDOWNER AGREEMENT LETTERS

DEWART LAKE PROTECTIVE ASSOCIATION
ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

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Cardno JFNew

708 Roosevelt Road
Walkerton, Indiana 46574
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Phone 574 586 3400
Fax 574 586 3446
www.cardno.com

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December 14, 2011

Subject: Conceptual Design Plans, preliminary landowner agreement

Dear Timothy and Robin Stiffler:

Provided with this letter are the conceptual design plans proposed for water quality improvement projects within the drainage located north of County Road 1000 N that is located on your property. These are not final design plans, but will serve as the template to complete final design upon the receipt of funding for the project. Please sign this form at the bottom and return to me in the provided postage paid envelope if you agree with the proposed conceptual plans. By signing this letter you are granting permission to proceed with final design of the proposed projects when funding becomes available. As a reminder, your participation with the proposed project is voluntary and there will be no monetary commitment required on your part.

Cardno JFNew and the Dewart Lake Protective Association thank you for your consideration of the proposed water quality improvement projects. Please feel free to comment on the proposed water quality improvement projects and contact me at 574-586-3400 with any questions you may have.

Sincerely,

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

_✓_ Yes, I agree with the proposed conceptual design
____ No, I do not agree with the proposed conceptual design

Timothy Stiffler (Printed Name)

X (Signed)

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December 28, 2011

Robert and June Spearman
10013 N Hasse Ct.
Syracuse, IN 46567

Subject: Ravine Erosion Control

Dear Mr. and Mrs. Spearman:

Thank you for meeting with Wayne Stanger and me regarding stabilizing the areas of erosion in the ravine behind your residence on Hasse Court. We appreciate your willingness to continue discussing a potential project. As you are aware, we are currently working on behalf of the Dewart Lake Protective Association trying to find ways to reduce the amount of sediment and nutrients that flow to Dewart Lake. Your property is one of several we have identified for potential construction projects that would help the lake with this goal.

We have identified grant funding that will pay 100 percent of the cost of the project as proposed on the attached sketches. In brief, the proposed erosion area on your property would be stabilized by hand placing rock or sand bags covered by turf reinforcement mat to form grade controls in the bottom of the stream and to replace the 60 foot x 10 foot eroded area of soil from the embankment. Two similar structures are being proposed on your neighbors' property immediately upstream. Access to the site would be gained from your neighbors' property. No machinery would be used to construct these structures as proposed and the only trees cut would be the downed trees that lying across the drainage.

In order to proceed with a request for construction funding, which would include money for producing final design documents for your review and approval, we would appreciate your signature below. Your signature lets the funding agency know that you have discussed the project with us and are willing to allow us move forward with the final design based on the concept presented. This does not allow us permission to proceed with construction. We will seek your approval for construction after we have produced final designs. Please return this page in the envelope provided.

Thank you,

John Richardson
Watershed Ecologist for Cardno JFNew
Cell: 574 229 8750
Email: john.richardson@cardno.com

Robert or June Spearman

Enc: Hasse Ct. Ravine Concept Plans

Sources:2010 Aerial USDA/NRCS

Legend

Project Area

N

1 inch = 50 feet

Job No. 0906109.01

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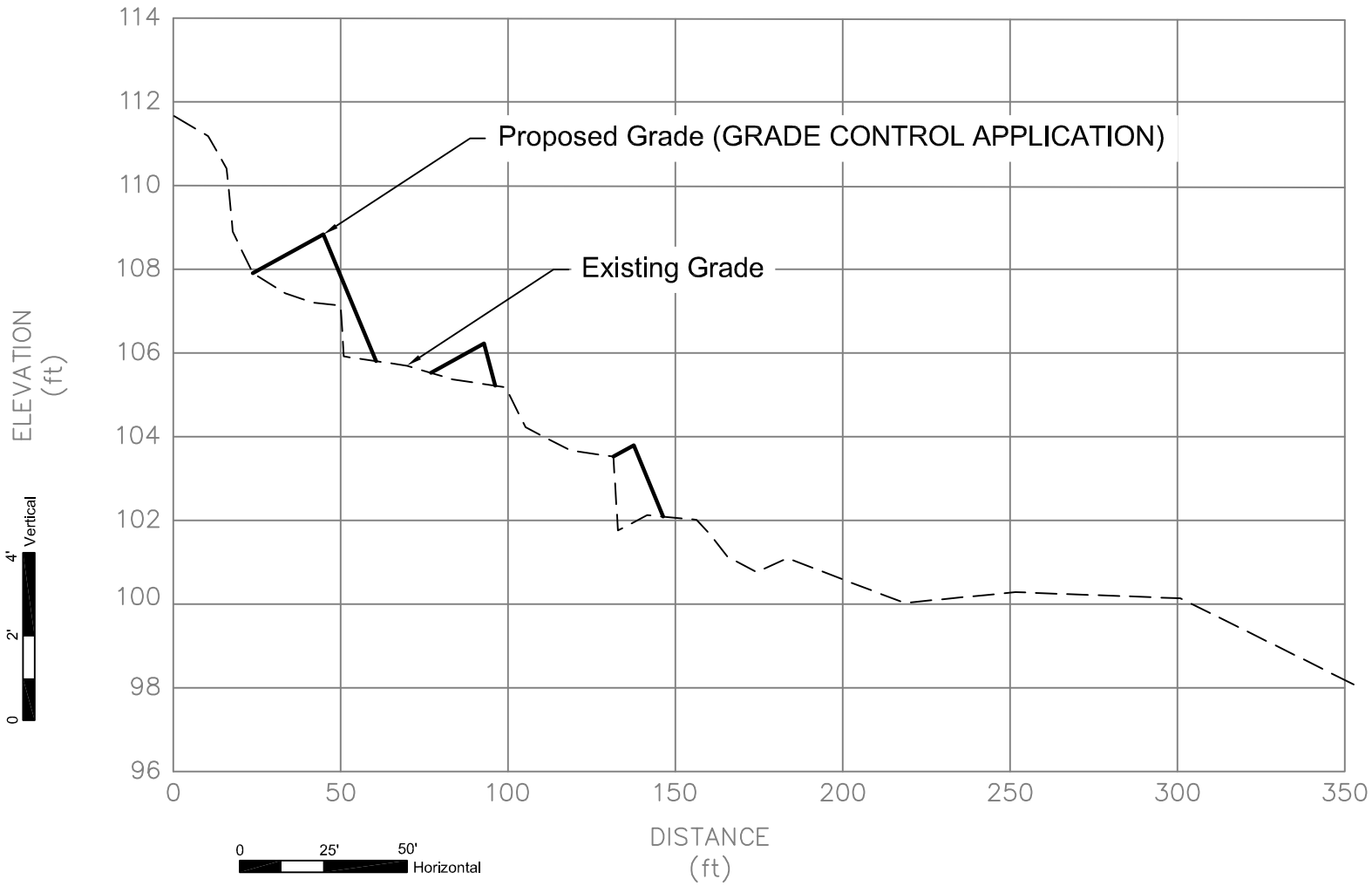
Figure 3: Plan View

Spearman and Stiffler Properties
Dewart Lake Protective Association
Section 24, T34N, R6E
Dewart Lake, Kosciusko County, Indiana



Job No. 0906109.01

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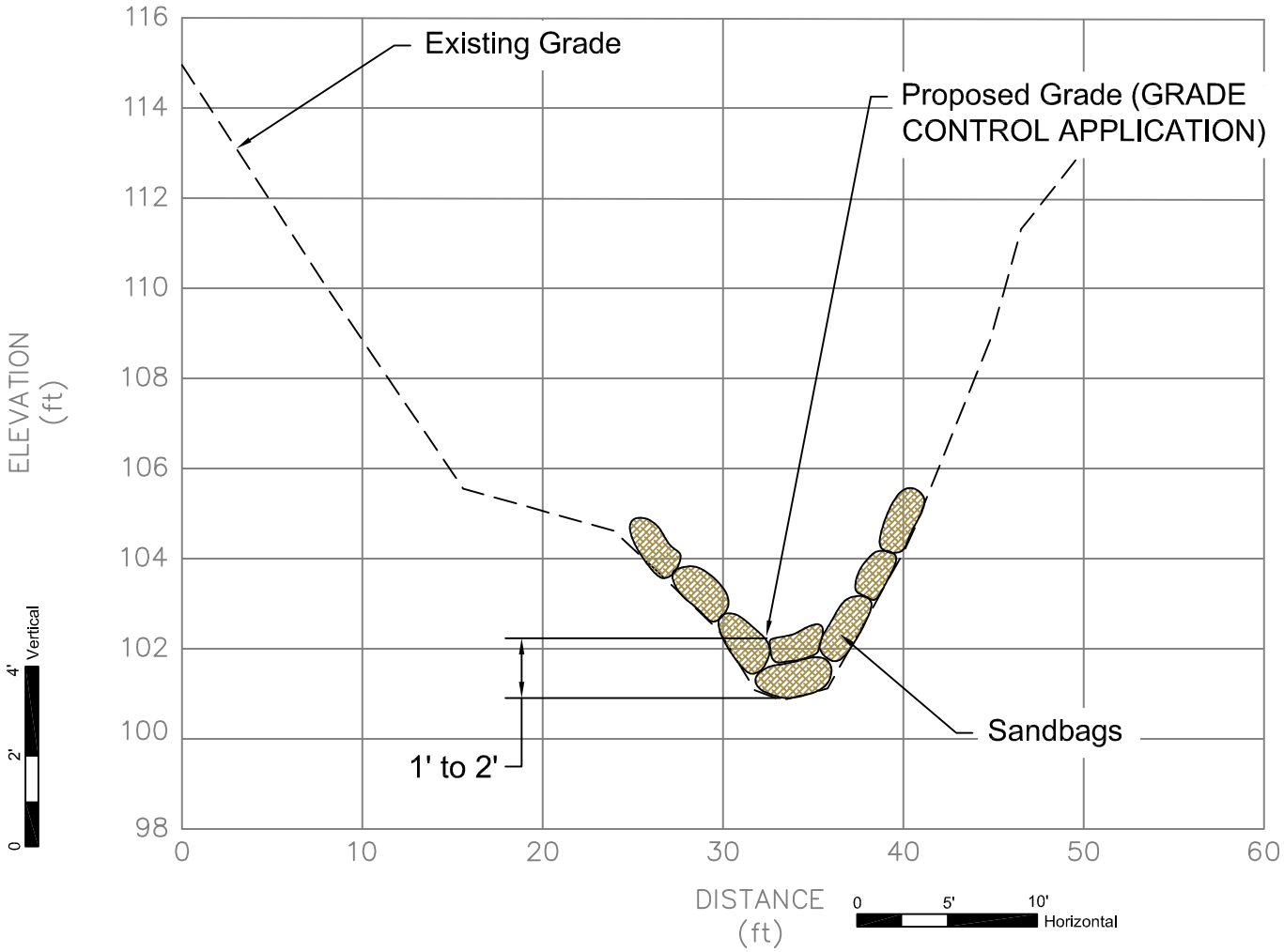
Figure 4: Longitudinal Profile

Spearman and Stiffler Properties
Dewart Lake Protective Association
Section 24, T34N, R6E
Dewart Lake, Kosciusko County, Indiana



Job No. 0906109.01

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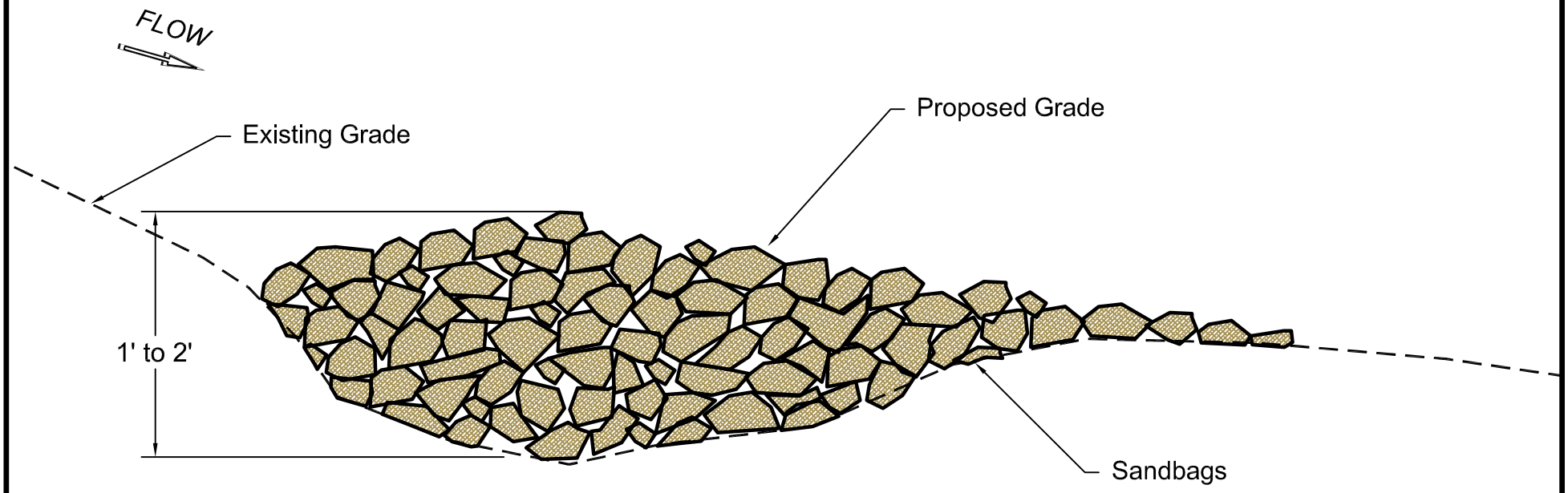
Figure 5: Typical Grade Control Cross Section

Spearman and Stiffler Properties
Dewart Lake Protective Association
Section 24, T34N, R6E
Dewart Lake, Kosciusko County, Indiana



Horizontal

Job No. 0906109.01

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Figure 6: Typical Grade Control Profile View

Spearman and Stiffler Properties
Dewart Lake Protective Association
Section 24, T34N, R6E
Dewart Lake, Kosciusko County, Indiana

January 11, 2012

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Brandon Dennis
Executive Director
Quaker Haven Camp
111 EMS D16C LN
Syracuse, IN 46567

Subject: Preliminary landowner agreement
21 EMS D16A LN, sink hole remediation
Conceptual design plans

Dear Brandon:

Thank you for granting us access to your property to assess the eroding hillside near the corner of EMS D16 LN and 900 N. As a reminder we are currently working on behalf of the Dewart Lake Protective Association who received a Lake and River Enhancement grant from the state of Indiana to find ways to reduce the amount of sediment and nutrients that flow to Dewart Lake. Your property is one of several we have identified for potential construction projects that would help the lake with this goal. Below is a description of the proposed conceptual design to stabilize the eroding hillside and attached are supporting figures of the design.

The conceptual design is to construct a vegetated swale from the top of the bank where the sink hole has developed to the base of the slope. The existing sinkhole that has been created would first need to be clean out and the profile of the vegetated swale created. The initial profile used to shape the vegetated swale would be on average 15 feet wide by 4 feet deep and extend from the top of the bank to the toe of the slope or approximately 45 feet. Once the swale profile and dimensions have been created, existing concrete previously used to try to stabilize the sinkhole will be placed on the bottom of the swale to backfill the bottom third of the swale. Utilizing the existing concrete pieces will allow the swale bed elevation to be built up without having to bring in new fill material. Once the concrete has been placed the swale will be backfilled using excess spoils on site and backfilled so that the average depth of the swale will be 2 feet. Once the final grade of the swale is constructed the swale area will be seeded with a native slope stabilization seed mix and covered with turf reinforcement mat and the sides of the swale covered with a straw/coconut erosion control blanket. All areas disturbed during construction activities on the slope will be seeded with a native slope stabilization seed mix and covered with erosion control blanket. All access areas will be returned to preconstruction conditions.

We have identified grant funding that will pay 100 percent of the cost of the project as proposed on the attached sketches. In order to proceed with a request for construction funding, which would include money for producing final design documents for your review and approval, we would appreciate your signature below. Your signature lets the

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funding agency know that you have discussed the project with us and are willing to allow us to move forward with the final design based on the concept presented. This does not allow us permission to proceed with construction. We will seek your approval for construction after we have produced final designs. If you agree with the proposed conceptual design please indicate this at the bottom of the page and return to me in the postage paid envelope provided.

Cardno JFNew and the Dewart Lake Protective Association thank you for your consideration of the proposed water quality improvement project. Please feel free to comment on the proposed project and contact me at 574-586-3400 or Ken Brehob of the DLPA (574-658-3636) with any questions you may have.

Sincerely,

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

Enc: Conceptual Design Plan Set

_✓_ Yes, I agree with the proposed conceptual design
____ No, I do not agree with the proposed conceptual design

Brandon Dennis (Printed Name)

Brandon Dennis X (Signed)

Cardno JFNew

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January 12, 2012

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USA

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www.cardnojfnew.com

Michael Dewitt
3934 E US Highway 30
Warsaw, IN 46580

Subject: Dewart Lake Water Quality Improvement Project
900 N and EMS D16B Gully Conceptual Design Plans

Dear Michael Dewitt:

Cardno JFNew is an environmental consulting firm working with the Dewart Lake Protective Association (DLPA) to find ways to reduce the amount of sediment and nutrients that flow into Dewart Lake. Your property at the corner of 900 N and EMS D16B borders an identified eroding gully that has formed on the hillside boundary with Quaker Haven Camp (See Figure 1). The sediment eroded from this gully, as you are probably aware, makes its way across your property and is eventually deposited into the lake. From a visit to the site and a parcel boundary search online it appears that your property line is positioned at approximately the base of the hillside, if not up the slope slightly near the location of the existing gully. We have developed a conceptual design to stabilize the existing gully and want to inform you of the project due to your close proximity to the project. Also, we would like to know if you would be opposed to the project extending into your property only to the base of the hillside.

The conceptual design to stabilize the gully is to create a vegetated swale from the top of the hillside to the base of the slope or basically your northern property line. To achieve this, the existing gully would be cleaned out, re-graded to the proper dimensions and backfilled so that the final dimensions of the swale are approximately 15 ft width x 2 ft deep x 45 ft long (Figure 2). Once the final grade of the swale is constructed the swale area will be seeded and covered with erosion control blankets. There will be little to no disturbance to the existing hillside outside of the existing gully footprint and the work will be performed by an excavator positioned on Quaker Haven Camp property. The work will stop the deposition of sediment that is currently occurring due to the eroding gully, and will not increase overland runoff to your property.

We have identified grant funding that will pay 100 percent of the cost of the project as proposed on the attached sketches. The DLPA will have submitted for funding by January 15th and if approved would begin construction in the fall of 2012. As mentioned, the repair work would extend to the bottom of the hillside onto your property slightly. Therefore, we are asking for your signature to allow the proposed work to extend onto your property as specified. There will be no cost to you for this project. Please indicate at the bottom of this letter if the proposed project is acceptable to you and return to me in the postage paid envelope.

01/17/2012 13:40 5745943849 THE CAR COMPANY PAGE 01/04

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Michael Dewitt
January 12, 2012

The Dewart Lake Protective Association thanks you in advance for your consideration of the proposed water quality improvement project. Please feel free to comment on the proposed project and contact me at 574-586-3400 or Ken Brehob of the DLPA (574-658-3636) with any questions you may have.

If you sell the property between now and the fall of 2012 we would appreciate if you contacted us, as this agreement would become void.

Sincerely,

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

_____ (Printed Name)

_____ X (Signed)

Enc: Conceptual Design Plan Set

01/17/2012 13:40 5745943849 THE CAR COMPANY PAGE 02/04

Figure 1. View looking up at the eroding hillside.
Note: the two trees at the top of the bank which are leaning into the ravine will need to be removed to shape the vegetated swale.

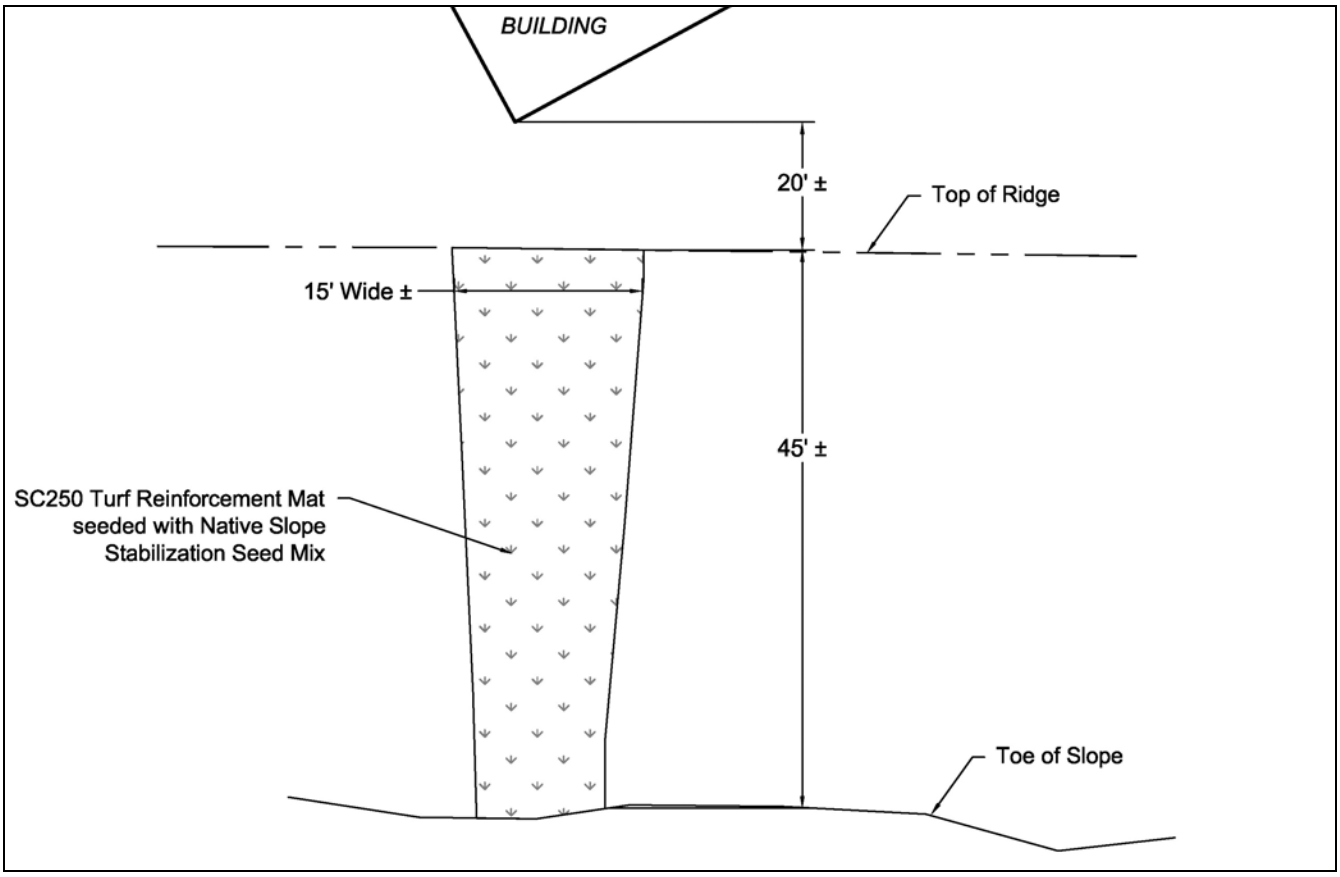

Figure 2. Conceptual drawing of vegetated swale.

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December 13, 2011

Subject: Cable Run erosion work, preliminary landowner agreement

Dear Roy and Inez Caywood:

Provided with this letter are the conceptual design plans proposed for water quality improvement projects within the Cable Run drainage that is located on your property. These are not final design plans, but will serve as the template to complete final design upon the receipt of funding for the project. Please sign this form at the bottom and return to me in the provided postage paid envelope if you agree with the proposed conceptual plans. By signing this letter you are granting permission to proceed with final design of the proposed projects when funding becomes available. As a reminder, your participation with the proposed project is voluntary and there will be no monetary commitment required on your part.

Cardno JFNew and the Dewart Lake Protective Association thank you for your consideration of the proposed water quality improvement projects. Please feel free to comment on the proposed water quality improvement projects and contact me at 574-586-3400 with any questions you may have.

Sincerely,

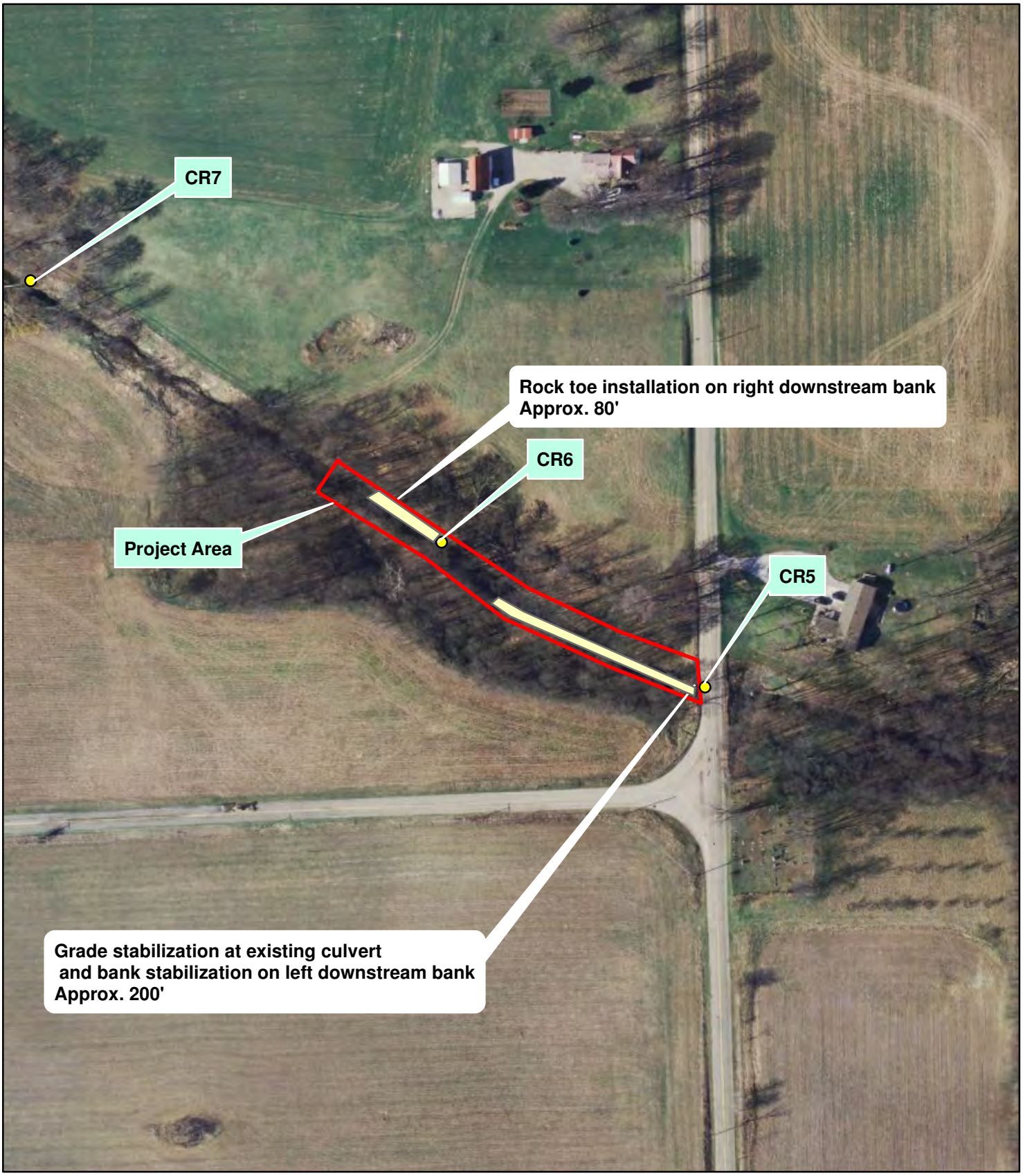
Thomas Estrem

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

__X__ Yes, I agree with the proposed conceptual design
____ No, I do not agree with the proposed conceptual design

ROY D. CAYWOOD (Printed Name)

Roy D Caywood X (Signed)



Sources: 2010 Aerial USDA/NRCS

Legend

Project Area

N

1 inch = 150 feet

Job No. 0906109.01

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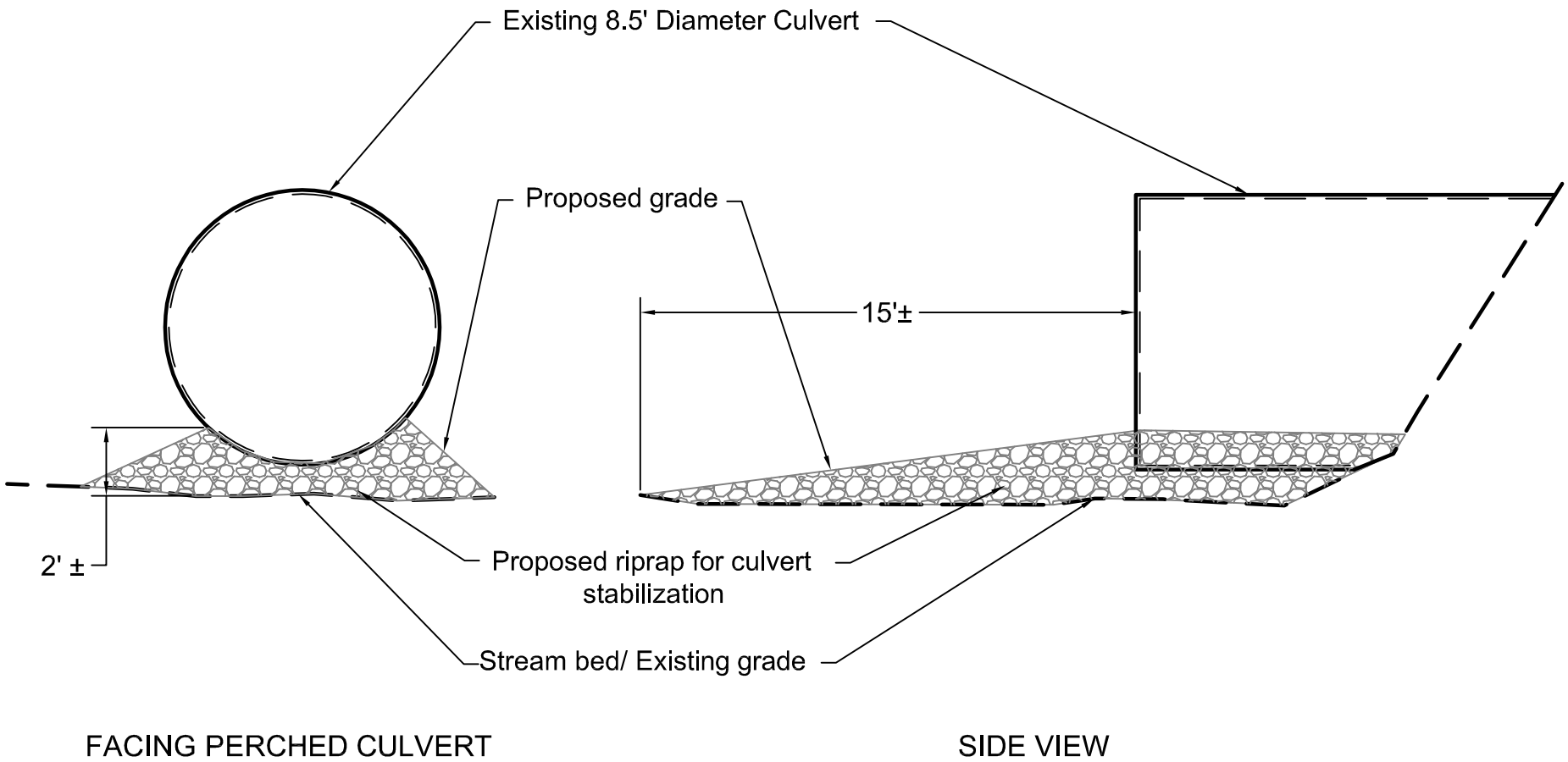
Figure 3: Plan View

Caywood Property
Dewart Lake Protective Association
Section 31, T34N, R7E
Dewart Lake, Kosciusko County, Indiana



NOT TO SCALE

Job No. 0906109.01

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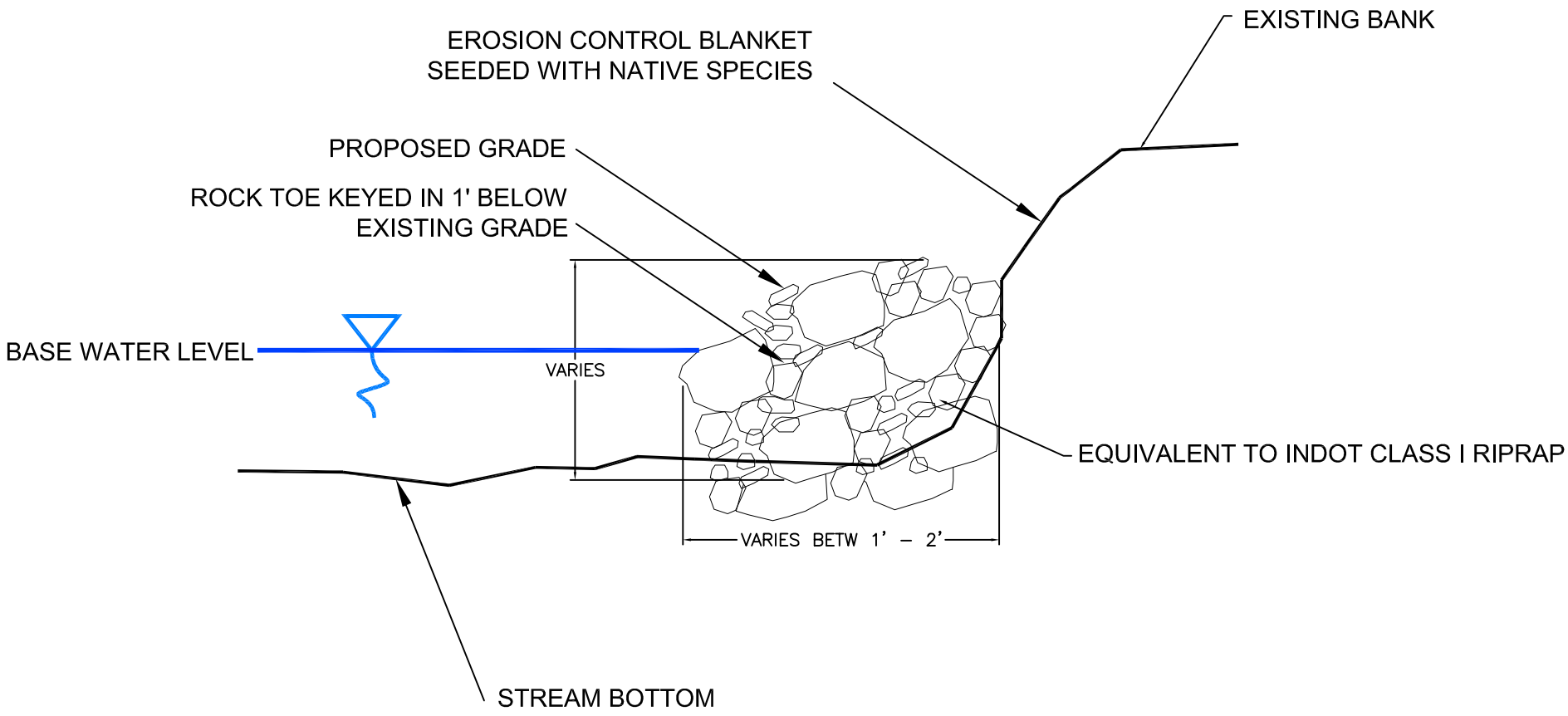
Figure 4: Grade Stabilization at Existing Culvert

Caywood Property
Dewart Lake Protective Association
Section 31, T34N, R7E
Dewart Lake, Kosciusko County, Indiana



NOT TO SCALE

Job No. 0906109.01

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Fax 574.586.3446
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Figure 5: Bank Stabilization

Caywood Property
Dewart Lake Protective Association
Section 31, T34N, R7E
Dewart Lake, Kosciusko County, Indiana

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December 14, 2011

Subject: Cable Run erosion work, preliminary landowner agreement

Dear Larry and Susan Mock:

Provided with this letter are the conceptual design plans proposed for water quality improvement projects within the Cable Run drainage that is located on your property. These are not final design plans, but will serve as the template to complete final design upon the receipt of funding for the project. Please sign this form at the bottom and return to me in the provided postage paid envelope if you agree with the proposed conceptual plans. By signing this letter you are granting permission to proceed with final design of the proposed projects when funding becomes available. As a reminder, your participation with the proposed project is voluntary and there will be no monetary commitment required on your part.

Cardno JFNew and the Dewart Lake Protective Association thank you for your consideration of the proposed water quality improvement projects. Please feel free to comment on the proposed water quality improvement projects and contact me at 574-586-3400 with any questions you may have.

Sincerely,

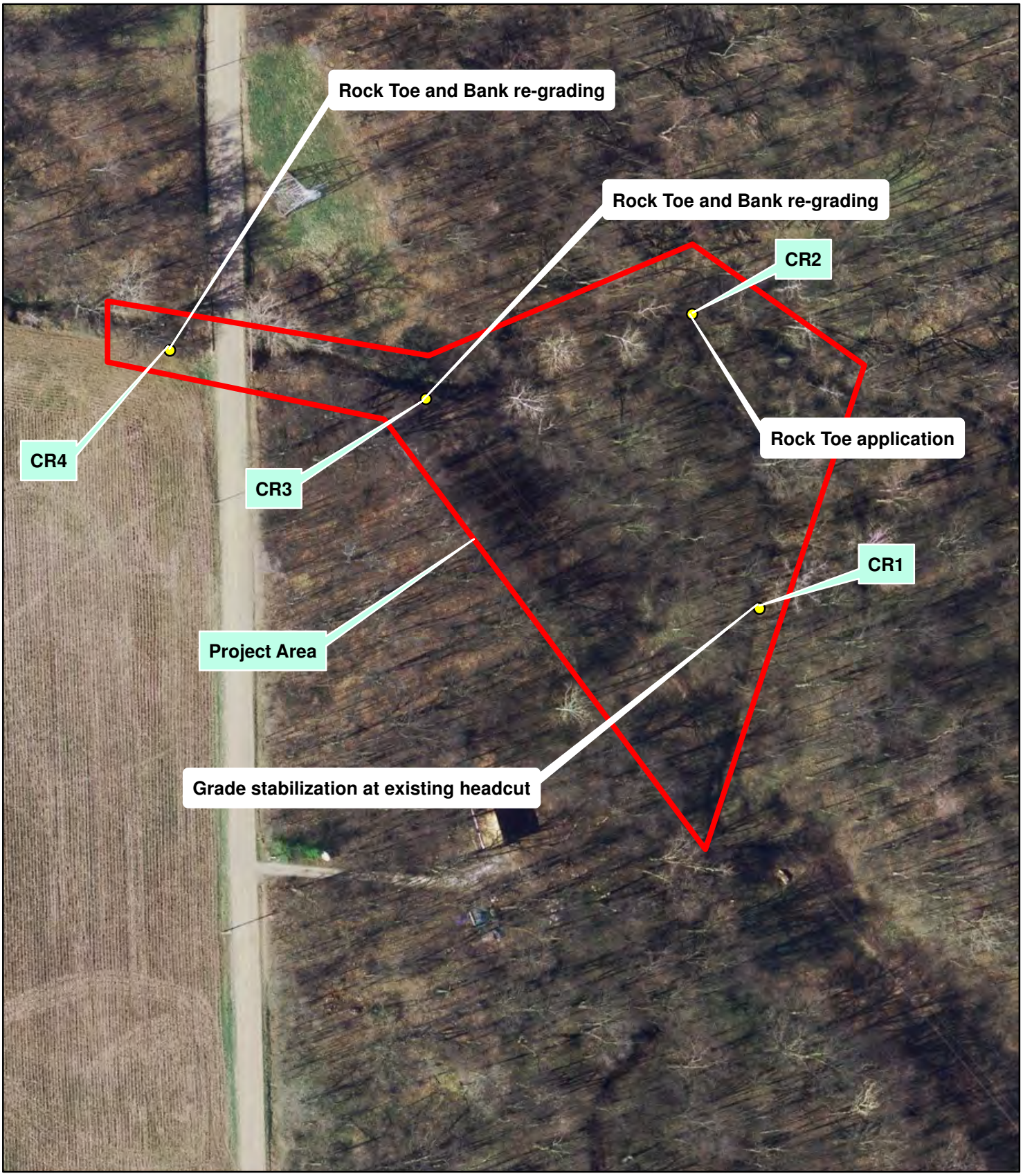
Thomas Estrem

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

✓ Yes, I agree with the proposed conceptual design
____ No, I do not agree with the proposed conceptual design

LARRY & SUSAN MOCK (Printed Name)

Larry Mock X (Signed)



Sources:2010 Aerial USDA/NRCS

Legend

Project Area

N

1 inch = 100 feet

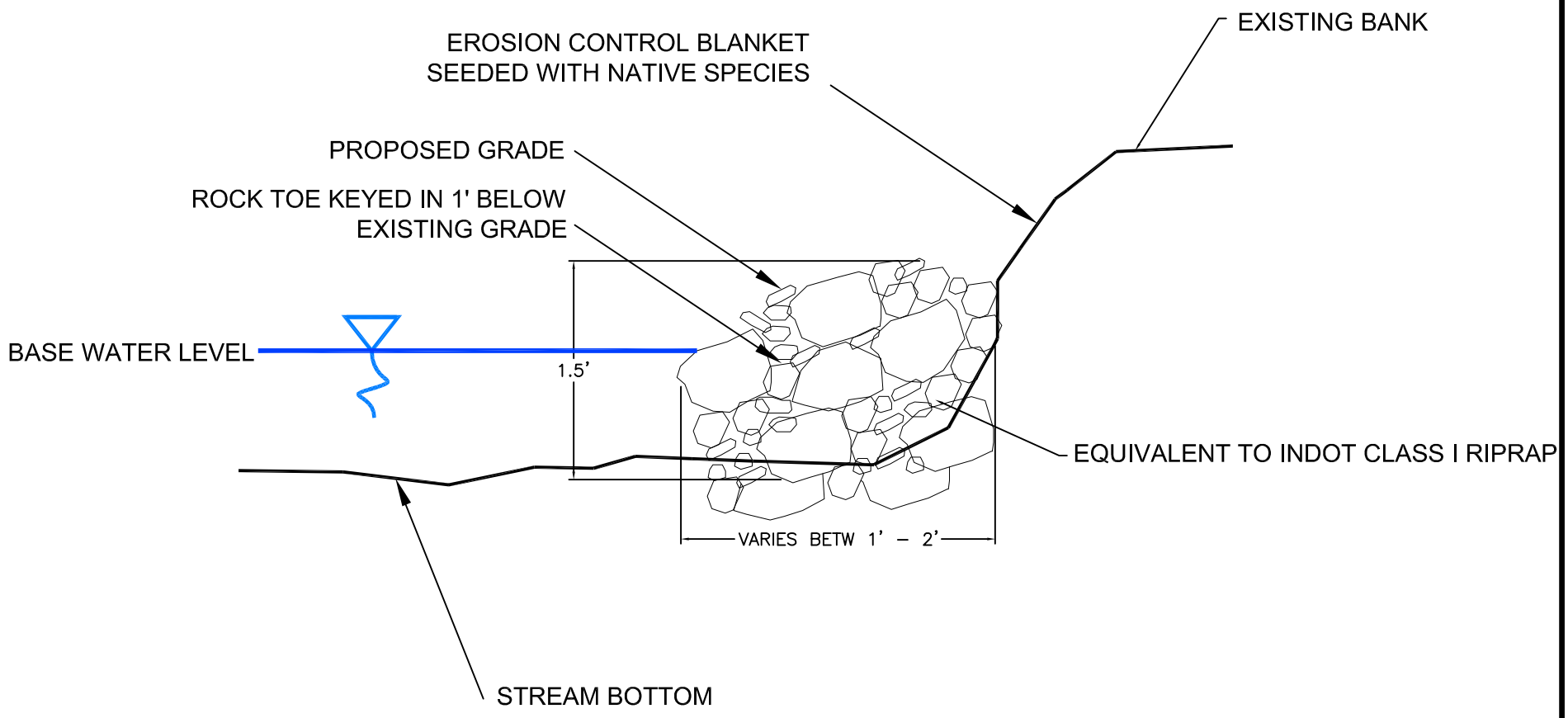
Job No. 0906109.01

Cardno JFNew

708 Roosevelt Road
Walkerton, IN 46574
Phone 574.586.3400
Fax 574.586.3446
www.cardnojfnew.com

Figure 3: Plan View

Mock Property
Dewart Lake Protective Association
Section 32, T34N, R7E
Dewart Lake, Kosciusko County, Indiana



NOT TO SCALE

Job No. 0906109.01

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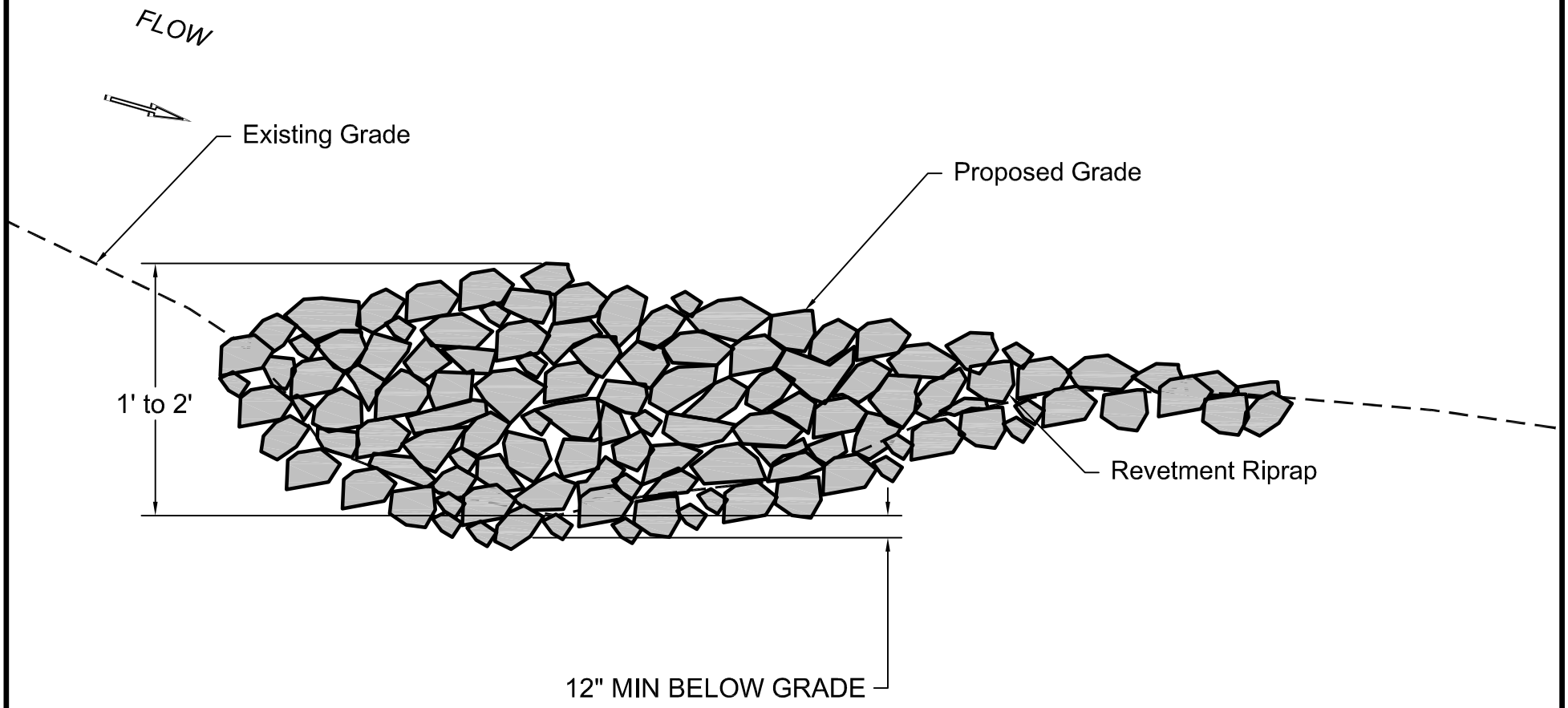
Figure 4: Bank Stabilization

Mock Property
Dewart Lake Protective Association
Section 32, T34N, R7E
Dewart Lake, Kosciusko County, Indiana



Horizontal

Job No. 0906109.01

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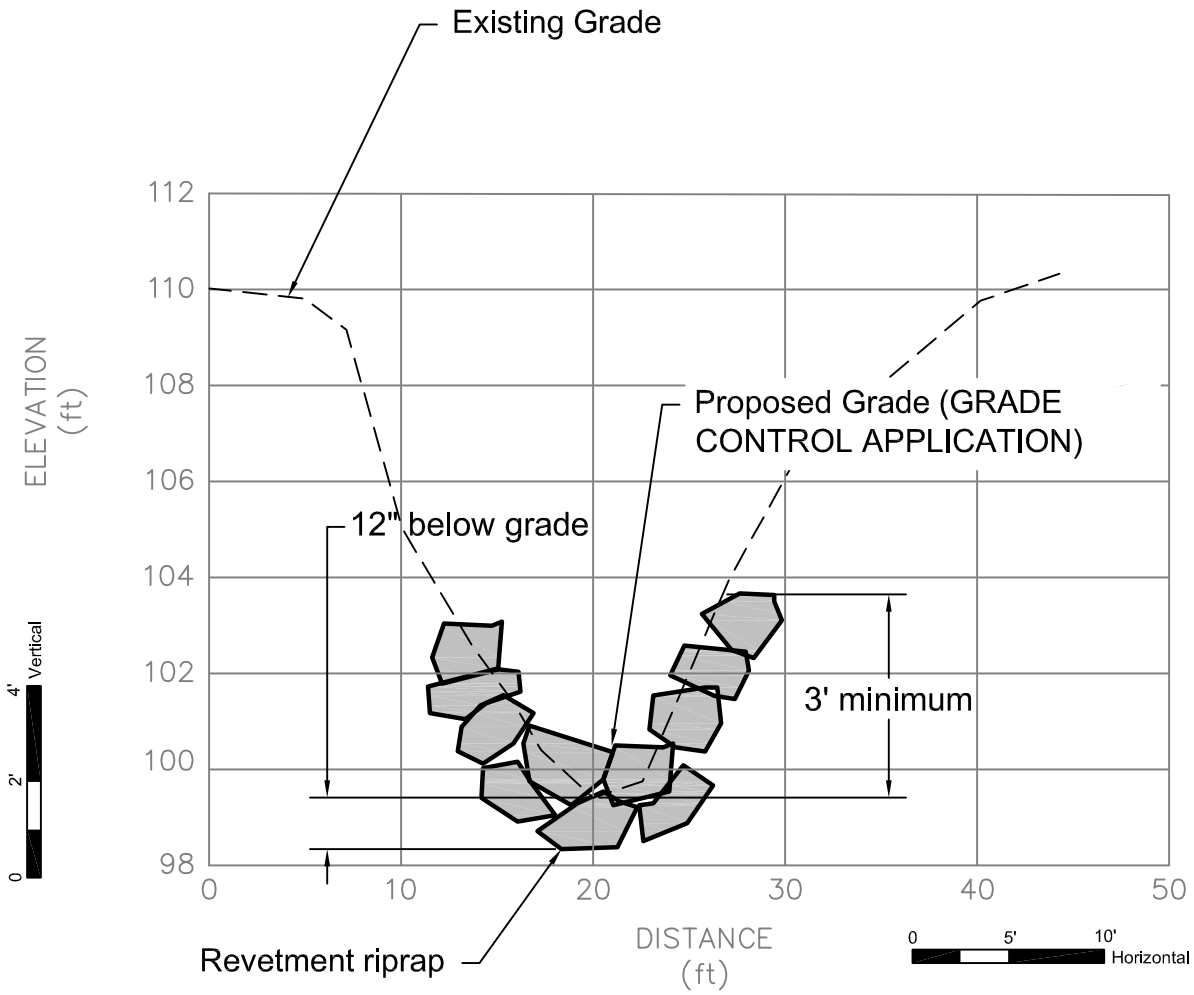
Figure 6: Typical Grade Control Profile View

Mock Property
Dewart Lake Protective Association
Section 32, T34N, R7E
Dewart Lake, Kosciusko County, Indiana



Job No. 0906109.01

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Figure 6: Typical Grade Control Cross Section

Mock Property
Dewart Lake Protective Association
Section 32, T34N, R7E
Dewart Lake, Kosciusko County, Indiana

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January 13, 2012

Subject: Cable Run erosion work, preliminary landowner agreement

Dear Doug Mock:

Thank you for granting us permission to access your property to assess the small drainage which we have identified as a potential area to construct a water quality improvement project. As a reminder we are currently working on behalf of the Dewart Lake Protective Association who received a Lake and River Enhancement grant from the state of Indiana to find ways to reduce the amount of sediment and nutrients that flow to Dewart Lake. Your property is one of several we have identified for potential construction projects that would help the lake with this goal. As I mentioned before briefly in our phone conversation in early December, the area of interest is where there is a headcut or steep drop in the bottom elevation of the stream (See Figure 1). The current location of the headcut is being held in place by tree roots on either side of the drainage, however over time the water will cut around these and the trees will eventually fall in the drainage and the headcut will continue to move upstream. Additionally, immediately downstream of the headcut the banks are actively eroding.

The conceptual design is to construct a rock grade control at the current location of the headcut (Figure 2; Figure 3). The installation of a rock grade control will lock in the current location of the headcut and stop the eventual movement of the cut upstream. The grade control will also help stabilize the stream bed downstream of the headcut and reduce the bank erosion currently occurring. The eroding bank will be cleanup by hand to remove any overhanging soil pieces to create an even grade up the slope. Once the stream bank is cleaned up the bank will be seed with a native slope stabilization seed mix and covered with a biodegradable erosion control fabric made of straw and coconut fiber. It is important to note that the installation of a grade control at the specified location will not result in increased flooding issues. The grade control is only being built up to the current elevation of the streambed on the upstream end. Access to the site is anticipated to occur through the drainage itself and will not impact the upland portion of your property.

We have identified grant funding that will pay 100 percent of the cost of the project as proposed on the attached sketches. In order to proceed with a request for construction funding, which would include money for producing final design documents for your review and approval, we would appreciate your signature below. There is no cost to you for this project. Your signature lets the funding agency know that you have discussed the project with us and are willing to allow us to move forward with the final design based on the concept presented. This does not allow us permission to proceed with construction. We will seek your approval for construction after we have produced final

Cardno JFNew
Shaping the Future

designs. If you agree with the proposed conceptual design please indicate this at the bottom of the page and return to me in the postage paid envelope provided.

Cardno JFNew and the Dewart Lake Protective Association thank you for your consideration of the proposed water quality improvement project. Please feel free to comment on the proposed project and contact me at 574-586-3400 or Ken Brehob of the DLPA (574-658-3636) with any questions you may have.

Sincerely,

Tom Estrem
Ecological Resource Specialist 2, Aquatic Ecologist
for Cardno JFNew
Cell: 574 229 8764
Email: tom.estrem@cardno.com

✓ Yes, I agree with the proposed conceptual design
____ No, I do not agree with the proposed conceptual design

Doyo Mock (Printed Name)

Doyo Mock X (Signed)

Enc: Conceptual Design Figures

Figure 1. Location of headcut/bank erosion and proposed grade control structure.

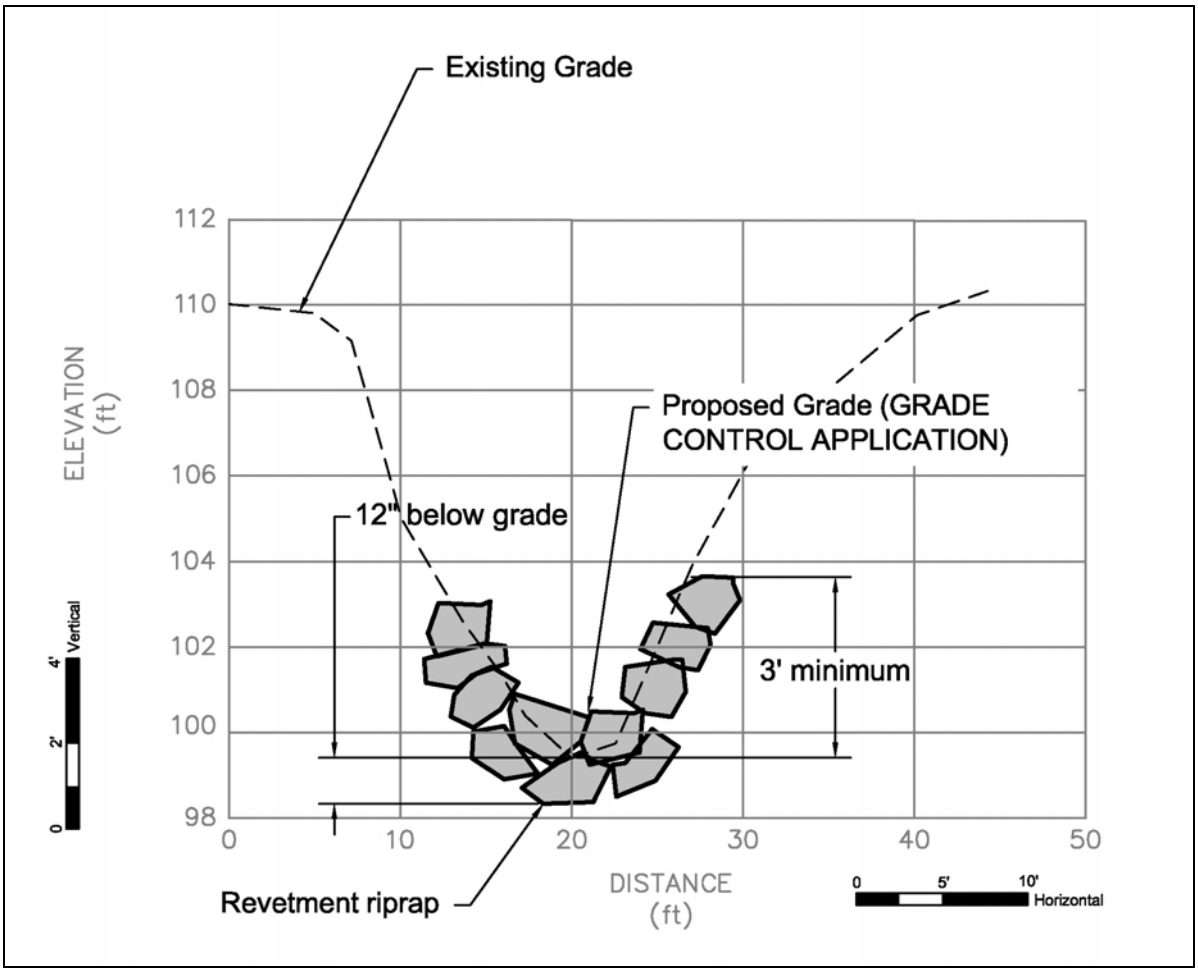


Figure 2. Conceptual drawing of proposed grade control structure.

APPENDIX D

BEHI, HHEI AND NBS SURVEY FORMS AND BANCS MODEL CALCULATIONS

DEWART LAKE PROTECTIVE ASSOCIATION
ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

Cardno JFNew

IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	DNS CR500

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLE	12/10/10	Kosciusko		☐	35.5

1-Substrate (20 points maximum)

Substrate Score: 7

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

Predominant P	Predominant R		Present P	Present R	Predominant P	Predominant R		Present P	Present R
☐	☐	Bldrs/Slabs(10)	☐	☐	☐	☐	Hardpan(4)	☐	☐
☐	☐	Boulders(9)	☐	☐	☐	☐	Detritus(3)	☐	☐
☐	☐	Cobble(8)	☐	☐	☐	☐	Muck(2)	☐	☐
☐	☐	Gravel(7)	☒	☒	☒	☐	Silt(2)	☒	☒
☐	☒	Sand(6)	☒	☒	☐	☐	Sludge(1)	☐	☐
☐	☐	Bedrock(5)	☐	☐	☐	☐	Artificial(0)	☐	☐

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☒ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☒ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☒ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments:

2-Instream Cover (20 points maximum

Instream Cover Score: 5

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☒ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☒ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☒ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments:

3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 5

Sinuosity	Development	Channelization	Stability	Modifications/Other	
☐ High (4)	☐ Excellent (7)	☐ None (6)	☐ High (3)	☐ Snagging	☐ Impound
☐ Moderate (3)	☐ Good (5)	☐ Recovered (4)	☒ Moderate (2)	☐ Relocation	☐ Islands
☐ Low (2)	☐ Fair (3)	☐ Recovering (3)	☐ Low (1)	☐ Canopy Removal	☐ Leveed
☒ None (1)	☒ Poor (1)	☒ Recent or no recovery (1)		☒ Dredging	☐ Bank shaping
				☐ One side channel modifications	

Comments:

4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 5.5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)

L	R	
☐	☐	Wide >50m (4)
☒	☒	Moderate 10-50m (3)
☐	☐	Narrow 5-10m (2)
☐	☐	Very narrow <5m (1)
☐	☐	None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)

L	R	
☒	☒	Forest, Swamp (3)
☐	☐	Shrub or Old field (2)
☐	☐	Residential, Park, New field (1)
☒	☐	Fenced pasture (1)
☐	☐	Conservation Tillage (1)
☐	☐	Urban or Industrial (0)
☐	☐	Mining, Construction (0)
☐	☐	Open Pasture/Rowcrop (0)

Bank Erosion (per bank)

L	R	
☐	☐	None or little (3)
☒	☒	Moderate (2)
☐	☐	Heavy/Severe (1)

Comments:

5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 4

Max pool depth (check one)

☐ >1m (6)
☐ 0.7-1m (4)
☒ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☐ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☒ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☒ Moderate (1) ☐ Intermittent (-2)
☒ Slow (1) ☐ No pool (0)

Comments:

5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 1

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☒ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☒ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☐ Extensive (-1) ☐ Normal/Low (1)
☒ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

6-Gradient (10 points maximum)

Gradient Score: 8

Average width: 20 *Gradient:* 12.6 *(ft/mile)* *Drainage Area:* 2.8 *(square miles)*

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	DNS CR 500

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLE	12/16/10	Koscinsko			35.5

Impacts/Miscellaneous

Major Suspected Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] Suburban
- [x] Channelization
- [ ] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

Miscellaneous QHEI Information

Subjective rating (1-10): 3
Aesthetic rating (1-10): 3
Canopy Cover (% Open): 20

% Riffle: 10
% Run: 80
% Glide:
% Pool: 10

Is reach representative of stream? Yes

General QHEI Notes:

Primary Headwater Habitat Evaluation Form

HHEI Score (sum of metrics 1, 2, 3) : 70

SITE NAME/LOCATION Trib to Cable Run URS CR550

SITE NUMBER _____ RIVER BASIN _____ DRAINAGE AREA (mi²) unknown

LENGTH OF STREAM REACH (ft) _____ LAT. _____ LONG. _____ RIVER CODE _____ RIVER MILE _____

DATE 12/16/10 SCORER TLE COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE - NATURAL CHANNEL ☐ DESNAGGED ☒ RECOVERING ☐ RECENTLY MODIFIED/NOT RECOVERING

1. SUBSTRATE (Estimate percent of every type of substrate present. Check *ONLY* two predominant substrate *TYPE* boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.

TYPE			PERCENT	TYPE			PERCENT
☐	☐	BLDR SLABS [16 pts]		☐	☐	SILT [3 pt]	10%
☐	☐	BOULDER (>256 mm) [16 pts]		☐	☐	LEAF PACK/WOODY DEBRIS [3 pts]	5%
☐	☐	BEDROCK [16 pts]		☐	☐	FINE DETRITUS [3 pts]	
☐	☐	COBBLE (65-256 mm) [12 pts]	5%	☐	☐	CLAY or HARDPAN [0 pts]	
☒	☐	GRAVEL (2-64 mm) [8 pts]	60%	☐	☐	MUCK [0 pts]	
☐	☒	SAND (<2 mm) [5 pts]	80%	☐	☐	ARTIFICIAL [3 pts]	

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 5% (A) 15

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES:

(B) 5

TOTAL NUMBER OF SUBSTRATE TYPES:

HHEI Metric Points

Substrate Max = 40: 20

A + B

2. Maximum Pool Depth ***(Measure the maximum pool depth within the 61 meter (200 ft)*** evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check *ONLY* one box):

- ☒ > 30 centimeters [20 pts]
- ☐ > 22.5 - 30 cm [30 pts]
- ☐ > 10 - 22.5 cm [25 pts]
- ☐ > 5 cm - 10 cm [15 pts]
- ☐ < 5 cm [5 pts]
- ☐ NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS 2.5' deep, however is plunge pool @ base of headcut

MAXIMUM POOL DEPTH (centimeters): >30

Pool Depth Max = 30: 20

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check *ONLY* one box):

- ☒ > 4.0 meters (> 13') [30 pts]
- ☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
- ☐ > 1.5 m - 3.0 m (> 4' 8" - 9' 7") [20 pts]
- ☐ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
- ☐ < 1.0 m (≤ 3' 3") [5 pts]

COMMENTS _____ AVERAGE BANKFULL WIDTH (meters) 6

Bankfull Width Max=30: 30

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream☆

RIPARIAN WIDTH L	R	(Per Bank)	FLOODPLAIN QUALITY L	R	(Most Predominant per Bank)	L	R	
☒	☒	Wide >10m	☒	☒	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Moderate 5-10m	☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Narrow <5m	☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	None	☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS _____

FLOW REGIME *(At Time of Evaluation)* (Check *ONLY* one box):

- ☒ Stream Flowing
- ☐ Subsurface flow with isolated pools (Interstitial)
- ☐ Moist Channel, isolated pools, no flow (Intermittent)
- ☐ Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check *ONLY* one box):

☒ None	☐ 1.0	☐ 2.0	☐ 3.0
☒ 0.5	☐ 1.5	☐ 2.5	☐ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☒ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

October 24, 2002 Revision

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? - ☒ Yes ☐ No QHEI Score _____ (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

☐ WWH Name: _____ Distance from Evaluated Stream _____

☐ CWH Name: _____ Distance from Evaluated Stream _____

☐ EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: _____ NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____

County: _____ Township / City: _____

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: _____ Quantity: _____

Photograph Information: _____

Elevated Turbidity? (Y/N): N Canopy (% open): 15%

Were samples collected for water chemistry? (Y/N): N (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): N (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) N Voucher? (Y/N) _____ Salamanders Observed? (Y/N) _____ Voucher? (Y/N) _____

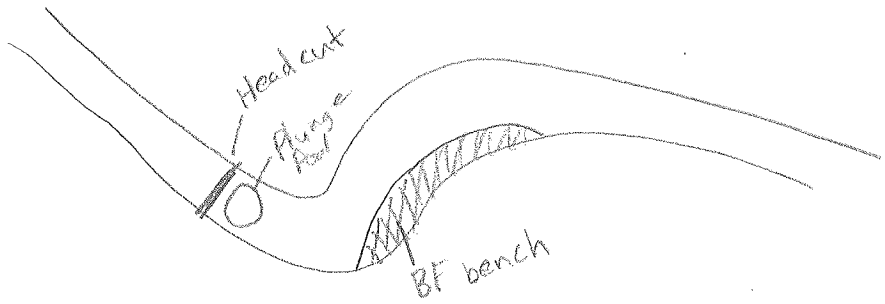
Frogs or Tadpoles Observed? (Y/N) N Voucher? (Y/N) N Aquatic Macroinvertebrates Observed? (Y/N) N Voucher? (Y/N) N

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →



OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	CR550 DWS

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLE	12/14/10	Kosciusko		☐	43

1-Substrate (20 points maximum)

Substrate Score: 12

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

Predominant P	Predominant R	Present P	Present R		Predominant P	Predominant R	Present P	Present R	
☐	☐	☐	☐	Bldrs/Slabs(10)	☐	☐	☐	☐	Hardpan(4)
☐	☐	☐	☐	Boulders(9)	☐	☐	☐	☐	Detritus(3)
☐	☐	☐	☐	Cobble(8)	☐	☐	☐	☐	Muck(2)
☐	☒	☐	☐	Gravel(7)	☒	☐	☐	☒	Silt(2)
☐	☒	☒	☐	Sand(6)	☐	☐	☐	☐	Sludge(1)
☐	☐	☐	☐	Bedrock(5)	☐	☐	☐	☐	Artificial(0)

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☒ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☒ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☒ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments:

2-Instream Cover (20 points maximum

Instream Cover Score: 5

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☒ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☒ Logs and woody debris(1)
☐ Rootmats(1)

Comments:

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☒ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 7

Sinuosity	Development	Channelization	Stability	Modifications/Other	
☐ High (4)	☐ Excellent (7)	☐ None (6)	☐ High (3)	☐ Snagging	☐ Impound
☐ Moderate (3)	☐ Good (5)	☐ Recovered (4)	☒ Moderate (2)	☐ Relocation	☐ Islands
☐ Low (2)	☐ Fair (3)	☒ Recovering (3)	☐ Low (1)	☐ Canopy Removal	☐ Leveed
☒ None (1)	☒ Poor (1)	☐ Recent or no recovery (1)		☐ Dredging	☐ Bank shaping
				☐ One side channel modifications	

Comments:

4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 6

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width L	Riparian width R	(per bank)	Erosion/Runoff-Floodplain quality (past 100 ft Riparian) L	R	(most predominant per bank)	L	R		Bank Erosion L	R	(per bank)
☐	☒	Wide >50m (4)	☐	☒	Forest, Swamp (3)	☐	☐	Conservation Tillage (1)	☐	☐	None or little (3)
☐	☐	Moderate 10-50m (3)	☐	☐	Shrub or Old field (2)	☐	☐	Urban or Industrial (0)	☒	☒	Moderate (2)
☐	☐	Narrow 5-10m (2)	☐	☐	Residential, Park, New field (1)	☐	☐	Mining, Construction (0)	☐	☐	Heavy/Severe (1)
☒	☐	Very narrow <5m (1)	☐	☐	Fenced pasture (1)	☒	☐	Open Pasture/Rowcrop (0)			
☐	☐	None (0)									

Comments:

5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 4

Max pool depth (check one)

☐ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☒ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☒ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☐ Moderate (1) ☐ Intermittent (-2)
☒ Slow (1) ☐ No pool (0)

Comments:

5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 1

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☒ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☒ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☐ Extensive (-1) ☐ Normal/Low (1)
☒ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

6-Gradient (10 points maximum)

Gradient Score: 8

Average width: 20 Gradient: 10.3 (ft/mile) Drainage Area: 1.7 (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	DNS CR 550

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLE	12/16/10	Kosciusko		☐	43

Impacts/Miscellaneous

Major Suspected Impacts (Check all that apply)

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☒ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☐ Urban Runoff
- ☐ Suburban
- ☒ Channelization
- ☐ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

Miscellaneous QHEI Information

Subjective rating (1-10): 4 % Riffle: 20

Aesthetic rating (1-10): 3 % Run: 60

Canopy Cover (% Open): 20 % Glide:

% Pool: 20

Is reach representative of stream? Yes

General QHEI Notes:

OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	UPS CR 550

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLB	12/16/10	Kosciusko			43

1-Substrate (20 points maximum)

Substrate Score: 11

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

Predominant P	Predominant R	Present P	Present R		Predominant P	Predominant R	Present P	Present R	
☐	☐	☐	☐	Bldrs/Slabs(10)	☐	☐	☐	☐	Hardpan(4)
☐	☐	☐	☐	Boulders(9)	☐	☐	☒	☒	Detritus(3)
☐	☐	☐	☐	Cobble(8)	☐	☐	☐	☐	Muck(2)
☐	☐	☒	☒	Gravel(7)	☒	☒	☐	☐	Silt(2)
☒	☒	☐	☐	Sand(6)	☐	☐	☐	☐	Sludge(1)
☐	☐	☐	☐	Bedrock(5)	☐	☐	☐	☐	Artificial(0)

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☒ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☒ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☒ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments:

2-Instream Cover (20 points maximum

Instream Cover Score: 5

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☒ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☒ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☒ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments:

3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 6.5

Sinuosity	Development	Channelization	Stability	Modifications/Other	
☐ High (4)	☐ Excellent (7)	☐ None (6)	☐ High (3)	☐ Snagging	☐ Impound
☐ Moderate (3)	☐ Good (5)	☐ Recovered (4)	☐ Moderate (2)	☐ Relocation	☐ Islands
☒ Low (2)	☐ Fair (3)	☒ Recovering (3)	☒ Low (1)	☐ Canopy Removal	☐ Leveed
☒ None (1)	☒ Poor (1)	☐ Recent or no recovery (1)		☒ Dredging	☐ Bank shaping
				☐ One side channel modifications	

Comments:

4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 8.5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)

L	R	
☒	☒	Wide >50m (4)
☐	☐	Moderate 10-50m (3)
☐	☐	Narrow 5-10m (2)
☐	☐	Very narrow <5m (1)
☐	☐	None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)

L	R	
☒	☒	Forest, Swamp (3)
☐	☐	Shrub or Old field (2)
☐	☐	Residential, Park, New field (1)
☐	☐	Fenced pasture (1)
☐	☐	Conservation Tillage (1)
☐	☐	Urban or Industrial (0)
☐	☐	Mining, Construction (0)
☐	☐	Open Pasture/Rowcrop (0)

Bank Erosion (per bank)

L	R	
☐	☐	None or little (3)
☒	☒	Moderate (2)
☒	☒	Heavy/Severe (1)

Comments:

5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 3

Max pool depth (check one)

☐ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☒ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☐ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☒ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☒ Moderate (1) ☐ Intermittent (-2)
☒ Slow (1) ☐ No pool (0)

Comments:

5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 1

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☒ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☒ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☐ Extensive (-1) ☐ Normal/Low (1)
☒ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

6-Gradient (10 points maximum)

Gradient Score: 8

Average width: 18 Gradient: 10.3 (ft/mile) Drainage Area: 1.7 (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		Cable Run	UPS. CR 550

Surveyor	Sample Date	County	Macro SampleType	Habitat Complete	QHEI Score:
TLE	12/16/10	Kosciusko			43

Impacts/Miscellaneous

Major Suspected Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] Suburban
- [x] Channelization
- [ ] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

Miscellaneous QHEI Information

Subjective rating (1-10): 3
Aesthetic rating (1-10): 3
Canopy Cover (% Open): 15

% Riffle:
% Run:
% Glide:
% Pool:

Is reach representative of stream? Yes

General QHEI Notes:

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Caywood Property	
Station: RDB, ≈80' eroding section		Observers: JR, TE	
Date: 12/13/2011	Stream Type:	Valley Type:	

							BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)							
Study Bank Height (ft) =	3 (A)	Bankfull Height (ft) =	2 (B)	(A) / (B) =	1.5 (C)		6
Root Depth / Study Bank Height (E)							
Root Depth (ft) =	0.5 (D)	Study Bank Height (ft) =	3 (A)	(D) / (A) =	0.16 (E)		7.5
Weighted Root Density (G)							
Root Density as % =	20 (F)			(F) × (E) =	3.3 (G)		9
Bank Angle (H)							
Bank Angle as *Degrees* =	45 (H)						3
Surface Protection (I)							
Surface Protection as % =	<10 (I)						10

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

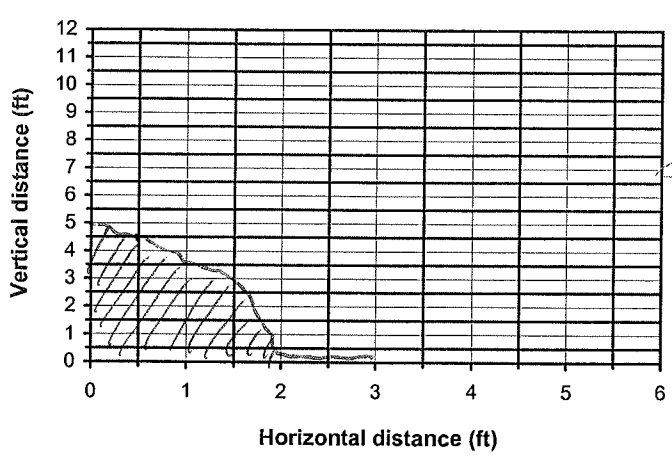
Bank Material Adjustment —

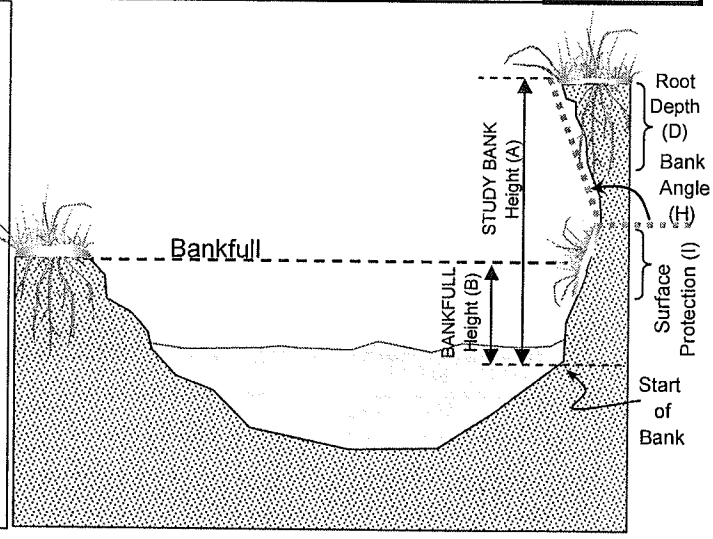
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage —

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: high / 35.5

Bank Sketch





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Bank erosion rate 0.2 ft/yr

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Cable Run Location: Cayuwood Property, just UPS from opening

Station: RDB, 80' section Stream Type: Valley Type:

Observers: TE, JR Date: 12/13/2011

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p/ S).....	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}).....	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1)	Transverse and/or central bars-shortand/or discontinuous.....NBS = High / Very High
	Extensive deposition (continuous, cross-channel).....NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress: 1.18

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	2.0	1.7	1.18	1.18

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)		

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Low

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Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Carwood Property upstream	
Station:		Observers: Estes + Richardson	
Date: 12/13/11	Stream Type: Fc	Valley Type: VII	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	8' (A)	Bankfull Height (ft) =	2' (B)	(A) / (B) =	4.0 (C)	10
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	8 (A)	(D) / (A) =	0.12 (E)	8
Weighted Root Density (G)						
Root Density as % =	25 (F)			(F) × (E) =	3 (G)	10
Bank Angle (H)						
Bank Angle as *Degrees* =	45/80 (H)					6
Surface Protection (I)						
Surface Protection as % =	30 (I)					6

Bank Material Adjustment:

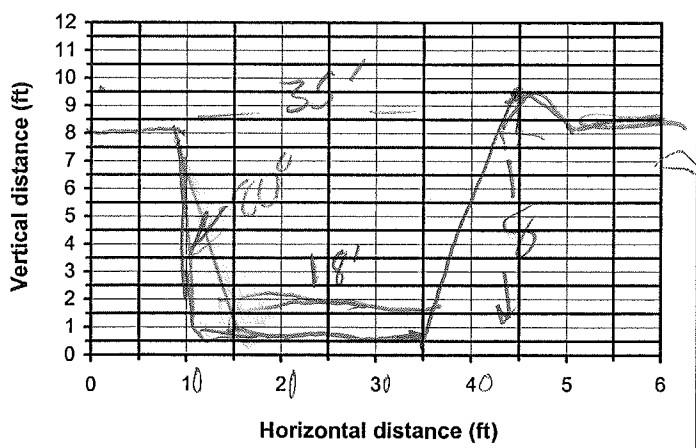
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

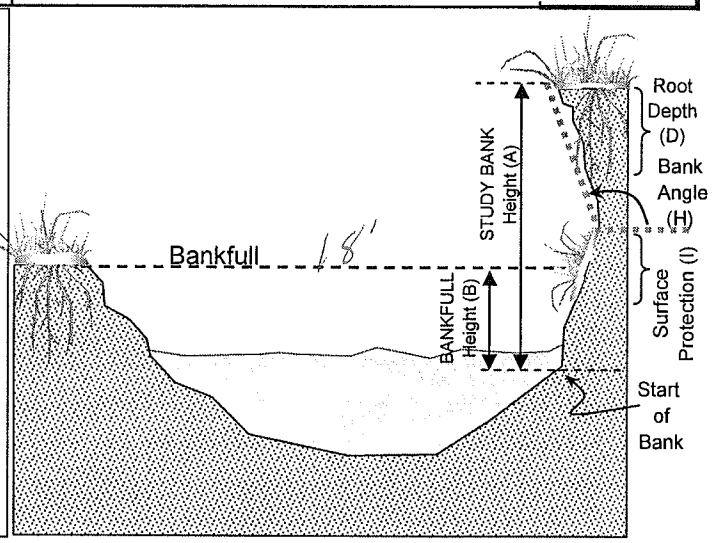
Bank Material Adjustment —

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage —

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Very high / 40

Bank Sketch





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bank erosion rate (BER) in ft/yr = 0.2 at 200 ft section

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Cable Run Location: Cayuwood upstream

Station: Stream Type: F/C Valley Type:

Observers: Estrada + Richardson Date: 12/13/11

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S).....	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} τ_{bkf}).....	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1) Transverse and/or central bars-shortand/or discontinuous.....NBS = High / Very High
Extensive deposition (continuous, cross-channel).....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: 1.2

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
24"	20"	1.2	low

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: low

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Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Caywood / Glenstone	
Station:		Observers: Eastwood + Richards	
Date: 12/13/11	Stream Type: PC	Valley Type: VIII	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	4 (A)	Bankfull Height (ft) =	1.5–2 (B)	(A) / (B) =	2 (C)	8
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	4 (A)	(D) / (A) =	0.25 (E)	6.5
Weighted Root Density (G)						
Root Density as % =	30 (F)			(F) x (E) =	7.5 (G)	9
Bank Angle (H)						
Bank Angle as *Degrees* =	35° (H)					2.5
Surface Protection (I)						
Surface Protection as % =	20 (I)					7

photos by Tim + Tom

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

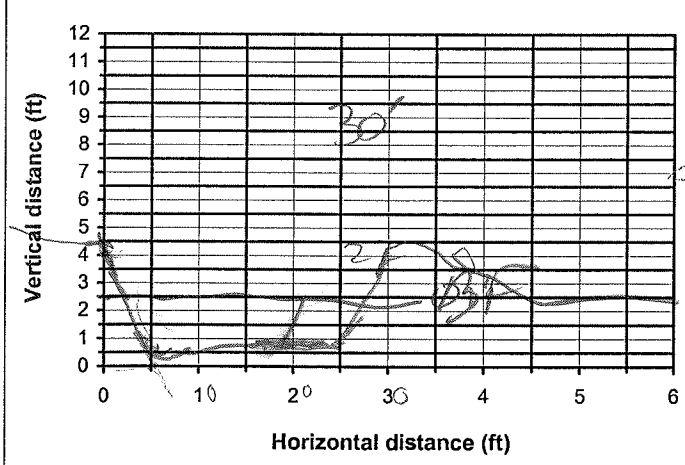
Bank Material Adjustment: 0

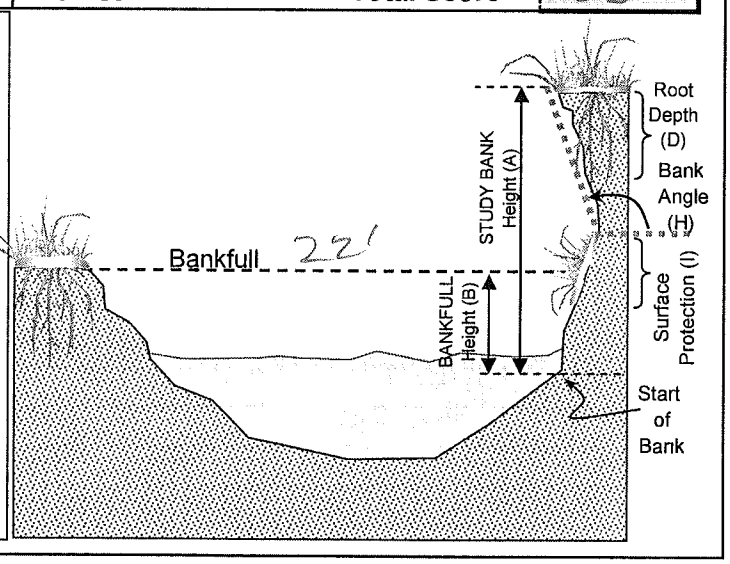
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: –

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: high, 33

Bank Sketch





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Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Mock Property	
Station: UPS County Rd 550, CR3		Observers: TE, JR	
Date: 12/14/2011	Stream Type:	Valley Type:	

							BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)							
Study Bank Height (ft) =	7 (A)	Bankfull Height (ft) =	1.5 (B)	(A) / (B) =	4.6 (C)		10
Root Depth / Study Bank Height (E)							
Root Depth (ft) =	2 (D)	Study Bank Height (ft) =	7 (A)	(D) / (A) =	0.29 (E)		6
Weighted Root Density (G)							
		Root Density as % =	35 (F)	(F) x (E) =	10.15 (G)		8.5
Bank Angle (H)							
				Bank Angle as *Degrees* =	80 (H)		6
Surface Protection (I)							
				Surface Protection as % =	10 (I)		9

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

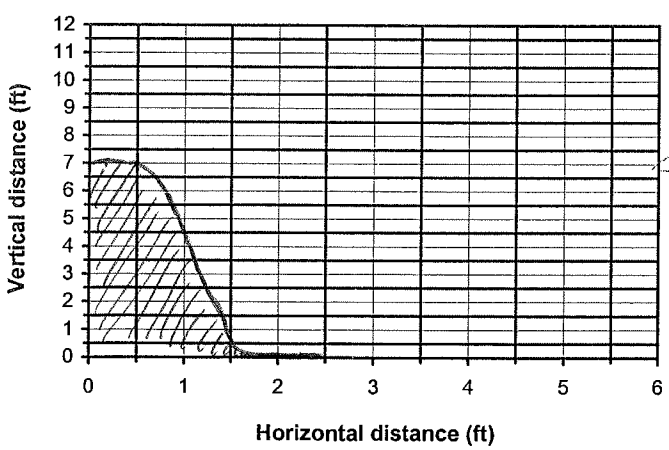
Bank Material Adjustment —

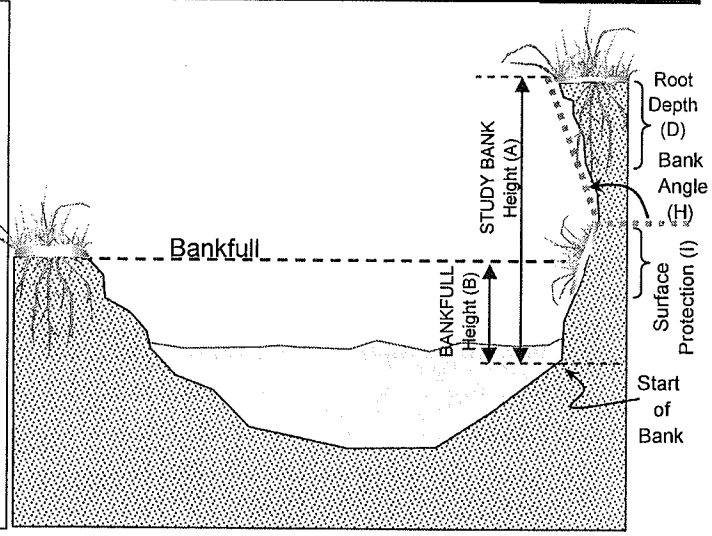
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage —

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: high, 39.5

Bank Sketch





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Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: CABle Run Location: Caywood site - downstream reach

Station: Stream Type: Fc Valley Type: VIII

Observers: Estem & Richardson Date: 12/13/11

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S).....	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}).....	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1) Transverse and/or central bars-shortand/or discontinuous.....	NBS = High / Very High
Extensive deposition (continuous, cross-channel).....	NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow.....	NBS = Extreme

Level II

(2) Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3) Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4) Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: 1.2

Level III

(5) Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
DK	"Two"	1.2	LOW

Bankfull 16-24"

(6) Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7) Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: low

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Bank erosion rate 0.2 ft/year

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Cable Run Location: Mock Property

Station: US County Rd. 550, CR3 Stream Type: Valley Type:

Observers: TE, JR LDB ~100 ft. Date: 12/14/2011

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p/ S).....	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}).....	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1)	Transverse and/or central bars-shortand/or discontinuous.....NBS = High / Very High
	Extensive deposition (continuous, cross-channel).....NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

(2) Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3) Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4) Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: 1.46

Level III

(5) Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
2.2	1.5	1.46	

(6) Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7) Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Low

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Bank erosion rate 0.2 ft/yr

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Cable Run Location: Mack Property

Station: UPS County Rd. 550, CR2 Stream Type: Valley Type:

Observers: JF, JR RDB ~75 ft. Date: 12/14/2011

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p/ S).....	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}).....	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1) Transverse and/or central bars-shortand/or discontinuous.....NBS = High / Very High
Extensive deposition (continuous, cross-channel).....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

(2) Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3) Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4) Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Level III

(5) Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
2.0	1.2	1.66	1.66

(6) Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7) Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: 1.66

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Moderate

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Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Mock Property	
Station: UPS County Rd. 550, CR2, RDB		Observers: TF, JR	
Date: 12/14/2011	Stream Type:	Valley Type:	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	2 (A)	Bankfull Height (ft) =	1.5 (B)	(A) / (B) =	1.33 (C)	5
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	.5 (D)	Study Bank Height (ft) =	2 (A)	(D) / (A) =	0.25 (E)	6.5
Weighted Root Density (G)						
Root Density as % =	5 (F)			(F) x (E) =	1.25 (G)	10
Bank Angle (H)						
Bank Angle as *Degrees* =	90 (H)					8
Surface Protection (I)						
Surface Protection as % =	0 (I)					10

Bank Material Adjustment:

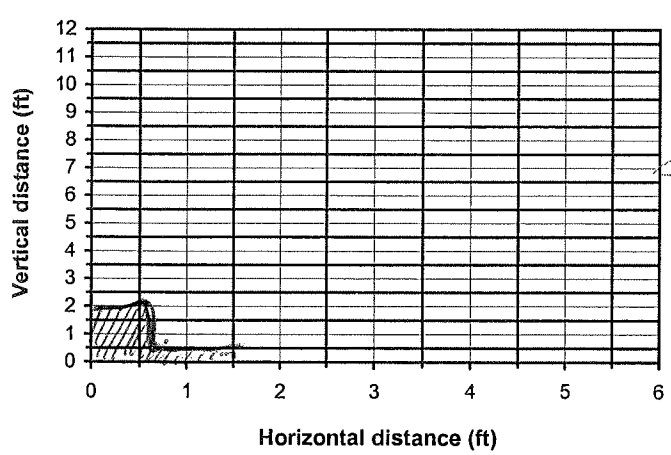
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

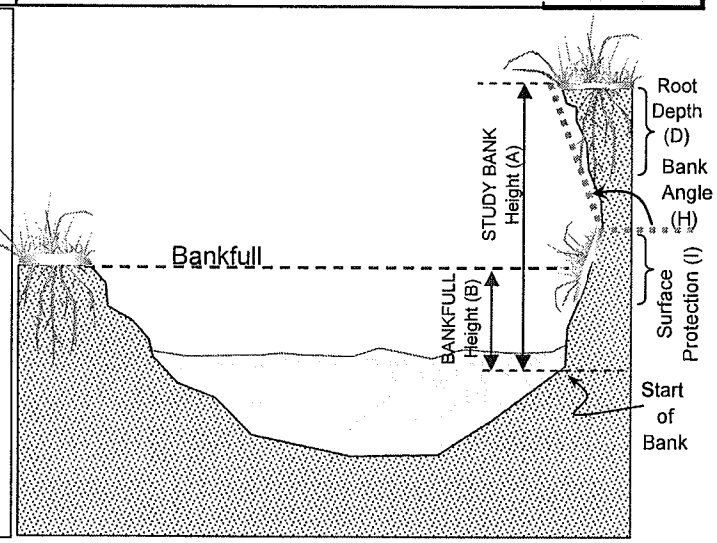
Bank Material Adjustment —

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage —

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	high / 39.5

Bank Sketch





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Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Cable Run		Location: Mock Property	
Station: DNS at County Rd. 550, LDB		Observers: JR, TLE	
Date: 12/14/2011	Stream Type:	Valley Type:	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	8 (A)	Bankfull Height (ft) =	1.5 (B)	(A) / (B) =	5.3 (C)	10
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	8 (A)	(D) / (A) =	0.13 (E)	8
Weighted Root Density (G)						
Root Density as % =	0 (F)			(F) × (E) =	0 (G)	10
Bank Angle (H)						
Bank Angle as *Degrees* =	90 (H)					8
Surface Protection (I)						
Surface Protection as % =	0 (I)					10

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

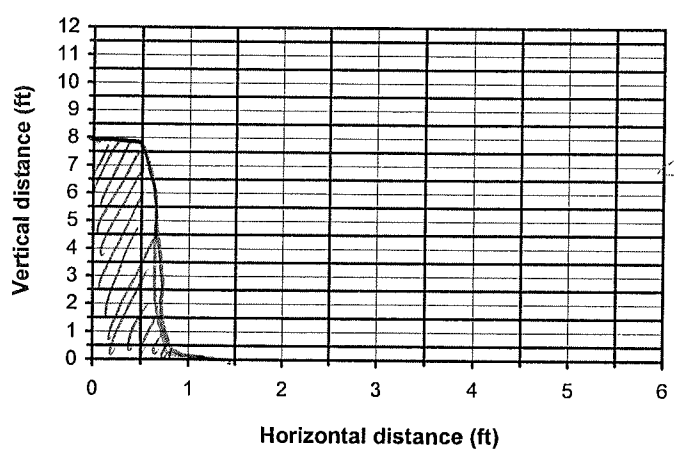
Bank Material Adjustment —

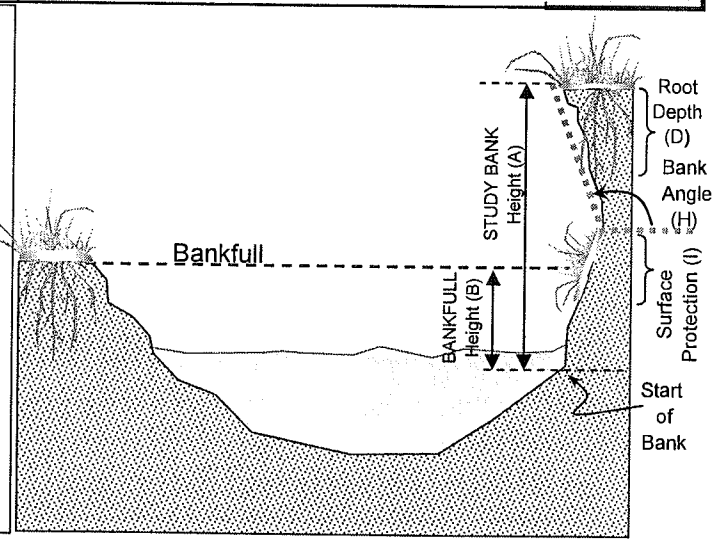
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage —

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: Extreme; 46

Bank Sketch





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Bank erosion rate 0.2 ft/yr

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Cable Run Location: Mac R Property

Station: DWS 550, LDB Stream Type: Valley Type:

Observers: JE, JR ~30 ft. Date: 12/14/2011

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS.....	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf}).....	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S).....	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif}).....	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf}).....	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}).....	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient.....	Level IV	Validation

Level I

(1) Transverse and/or central bars-shortand/or discontinuous.....NBS = High / Very High
Extensive deposition (continuous, cross-channel).....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: 1.33

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
2.0	1.5	1.33	

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: LOW

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Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches (Rosgen, 2006b).

Stream: Cable Run				Location: Caywood Property, Project 3			
Graph Used:			Total Bank Length (ft): 300			Date: 12/15/2011	
Observers: TE, JR				Valley Type:		Stream Type:	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Station (ft)	**BEHI Rating (Worksheet 3-11) (adjective)**	**NBS Rating (Worksheet 3-12) (adjective)**	**Bank Erosion Rate (Figure 3-9 or 3-10) (ft/yr)**	**Length of Bank (ft)**	**Study Bank Height (ft)**	**Erosion Subtotal [(4)×(5)×(6)] (ft^3/yr)**	**Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}**
1. CR5, LDB	Very high	low	0.2	200	6	240	0.06
2. CR6, RDB	high	low	0.2	40	3	24	0.03
3. CR7, RDB	high	low	0.2	60	3	36	0.03
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
Sum erosion subtotals in Column (7) for each BEHI/NBS combination					**Total Erosion (ft^3/yr)**	300	
Convert erosion in ft^3/yr to yds^3/yr {divide Total Erosion (ft^3/yr) by 27}					**Total Erosion (yds^3/yr)**	11.11	
Convert erosion in yds^3/yr to tons/yr {multiply Total Erosion (yds^3/yr) by 1.3}					**Total Erosion (tons/yr)**	14.44	
Calculate erosion per unit length of channel {divide Total Erosion (tons/yr) by total length of stream (ft) surveyed}					**Total Erosion (tons/yr/ft)**	0.05	

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Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches (Rosgen, 2006b).

Stream: Cable Run				Location: Mock Property, ~~[illegible]~~ Project 5			
Graph Used:			Total Bank Length (ft):			Date: 12/14/2011	
Observers: TE, JR				Valley Type:		Stream Type:	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Station (ft)	**BEHI Rating (Worksheet 3-11) (adjective)**	**NBS Rating (Worksheet 3-12) (adjective)**	**Bank Erosion Rate (Figure 3-9 or 3-10) (ft/yr)**	**Length of Bank (ft)**	**Study Bank Height (ft)**	**Erosion Subtotal [(4)×(5)×(6)] (ft^3/yr)**	**Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}**
1. CR2	high	Moderate	0.2	75	2	30	0.019
2. CR3	high	low	0.2	100	7	140	0.067
3. CR4	Extreme	low	0.2	30	8	48	0.077
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
Sum erosion subtotals in Column (7) for each BEHI/NBS combination					**Total Erosion (ft^3/yr)**	218	
Convert erosion in ft^3/yr to yds^3/yr {divide Total Erosion (ft^3/yr) by 27}					**Total Erosion (yds^3/yr)**	8.07	
Convert erosion in yds^3/yr to tons/yr {multiply Total Erosion (yds^3/yr) by 1.3}					**Total Erosion (tons/yr)**	10.49	
Calculate erosion per unit length of channel {divide Total Erosion (tons/yr) by total length of stream (ft) surveyed}					**Total Erosion (tons/yr/ft)**	0.05	

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APPENDIX E

PERMITS

DEWART LAKE PROTECTIVE ASSOCIATION
ENGINEERING FEASIBILITY STUDY
KOSCIUSKO COUNTY, INDIANA

Cardno JFNew

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

CERTIFICATE OF APPROVAL
CONSTRUCTION IN A FLOODWAY

MAILED: May 09, 2012

APPLICATION # : FW-26535

STREAM : Cable Run

APPLICANT : Dewart Lake Protective Associates Incorporated
PO Box 152
Syracuse, IN 46567

AGENT : Cardno JFNew
John B Richardson
708 Roosevelt Road
Walkerton, IN 46574-1220

AUTHORITY : IC 14-28-1 with 312 IAC 10

DESCRIPTION : The project includes the construction of five (5) 2' wide by 2' high rock toe structures, three (3) riffle grade control structures and streambed stabilization at the existing culverts. The combined length of the project is approximately 1890'. The rock control structures and the riffle grade control structures will be constructed with riprap and will be keyed in approximately 1' below the existing grade of the streambed and bank sides. The existing culvert will be grade stabilized with riprap. The streambed stabilization will extend approximately 115' downstream. Details of the project are contained in information received electronically at the Division of Water on January 17, 2012 and in plans and information received at the Division of Water on March 16, 2012.

LOCATION : DOWNSTREAM: Beginning approximately 3200' south and 700' east of the East 900 North and North 550 East intersection and extending approximately 4500' west near Syracuse, Turkey Creek Township, Kosciusko County
Section 31, T 34N, R 7E, North Webster Quadrangle
UTM Coordinates: Downstream 4579364 North, 604320 East
UPSTREAM: Kosciusko County
Section 32, T 34N, R 7E
UTM Coordinates: Upstream 4578992 North, 605625 East

APPROVED BY : Shirley A. Fitzwater
Shirley A. Fitzwater, Environmental Manager
Division of Water

APPROVED ON : May 9, 2012

Included: Notice Of Right To Administrative Review - General Conditions - Special Conditions - Service List

Attachments: Elec App AB Requirements and Information for denials.pdf

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

NOTICE OF RIGHT TO ADMINISTRATIVE REVIEW

APPLICATION #: FW- 26535

This signed document constitutes the issuance of a permit by the Department of Natural Resources, subject to the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

The permit or any of the conditions or limitations which it contains may be appealed by applying for administrative review. Such review is governed by the Administrative Orders and Procedures Act, IC 4-21.5, and the Department's rules pertaining to adjudicative proceedings, 312 IAC 3-1.

In order to obtain a review, a written petition must be filed with the Division of Hearings within 18 days of the mailing date of this notice. The petition should be addressed to:

Mr. Stephen L. Lucas, Director
Division of Hearings
Indiana Government Center North, Room N501A
100 North Senate Avenue
Indianapolis, Indiana 46204

The petition must contain specific reasons for the appeal and indicate the portion or portions of the permit to which the appeal pertains.

If an appeal is filed, the final agency determination will be made by the Natural Resources Commission following a legal proceeding conducted before an Administrative Law Judge. The Department of Natural Resources will be represented by legal counsel.

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

GENERAL CONDITIONS

APPLICATION #: FW- 26535

(1) If any archaeological artifacts or human remains are uncovered during construction, federal law and regulations (16 USC 470, et seq.; 36 CFR 800.11, et al) and State Law (IC 14-21-1) require that work must stop and that the discovery must be reported to the Division of Historic Preservation and Archaeology within 2 business days.

Division of Historic Preservation and Archaeology
Room W274
402 West Washington Street
Indianapolis, IN 46204

Telephone: (317) 232-1646, FAX: (317) 232-8036

(2) This permit must be posted and maintained at the project site until the project is completed.

(3) This permit does not relieve the permittee of the responsibility for obtaining additional permits, approvals, easements, etc. as required by other federal, state, or local regulatory agencies. These agencies include, but are not limited to:

Agency	Telephone Number
Kosciusko County Drainage Board	(574) 372-2367
St. Joseph River Basin Commission	(574) 287-1829
US Army Corps of Engineers	(313) 226-6828
Indiana Department of Environmental Management	(317) 233-8488 or (800) 451-6027
Local city or county planning or zoning commission	

(4) This permit must not be construed as a waiver of any local ordinance or other state or federal law.

(5) This permit does not relieve the permittee of any liability for the effects which the project may have upon the safety of the life or property of others.

(6) This permit may be revoked by the Department of Natural Resources for violation of any condition, limitation or applicable statute or rule.

(7) This permit shall not be assignable or transferable without the prior written approval of the Department of Natural Resources. To initiate a transfer contact:

Mr. Michael W. Neyer, PE, Director
Division of Water
Room W264
402 West Washington Street
Indianapolis, IN 46204

Telephone: (317) 232-4160, Toll Free: (877) 928-3755
FAX: (317) 233-4579

(8) The Department of Natural Resources shall have the right to enter upon the site of the permitted activity for the purpose of inspecting the authorized work.

(9) The receipt and acceptance of this permit by the applicant or authorized agent shall be considered as acceptance of the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SPECIAL CONDITIONS

APPLICATION #: FW- 26535

PERMIT VALIDITY : This permit is valid for 24 months from the "Approved On" date shown on the first page. If work has not been initiated by May 09, 2014 the permit will become void and a new permit will be required in order to continue work on the project.

This permit becomes effective 18 days after the "MAILED" date shown on the first page. If both a petition for review and a petition for a stay of effectiveness are filed before this permit becomes effective, any part of the permit that is within the scope of the petition for stay is stayed for an additional 15 days.

CONFORMANCE : Other than those measures necessary to satisfy the "General Conditions" and "Special Conditions", the project must conform to the information received by the Department of Natural Resources on: January 17, 2012 and March 16, 2012. Any deviation from the information must receive the prior written approval of the Department.

Number	Special Condition
(1)	minimize and contain within the project limits inchannel disturbance and the clearing of trees and brush
(2)	do not work in the waterway from April 1 through June 30 without the prior written approval of the Division of Fish and Wildlife
(3)	do not cut any trees suitable for Indiana bat roosting (greater than 3 inches dbh, living or dead, with loose hanging bark) from April 1 through September 30
(4)	use minimum average 6 inch graded riprap stone extended below the normal water level to provide habitat for aquatic organisms in the voids
(5)	minimize the movement of resuspended bottom sediment from the immediate project area
(6)	appropriately designed measures for controlling erosion and sediment must be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized
(7)	seed and protect all disturbed streambanks and slopes that are 3:1 or steeper with erosion control blankets (follow manufacturer's recommendations for selection and installation) or use an appropriate structural armament; seed and apply mulch on all other disturbed areas
(8)	install an exclusion/drift fence around all construction areas prior to the inclusive dates March 1-June 30, to prevent Blanding's Turtles and Spotted Turtles from entering the area while searching for suitable nest sites and later during construction; any turtles, regardless of species, found within the construction boundary prior to or during construction should be relocated to the other side of the drift fence and away from the work area
(9)	revegetate all bare and disturbed areas within the project area using a mixture of grasses, sedges, wildflowers, shrubs, and trees native to Northern Indiana and specifically for stream bank/floodway stabilization purposes as soon as possible upon completion

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SPECIAL CONDITIONS

APPLICATION #: FW- 26535

(10) conduct work along the banks and within the stream during low flow conditions to reduce sedimentation in the stream

(11) except for the material used as backfill as shown on the above referenced project plans on file at the Division of Water, place all excavated material landward of the floodway *

(12) all work must conform with the existing bank at the upstream and downstream limits of the project site

(13) do not leave felled trees, brush, or other debris in the floodway *

(14) riprap placed for bank stabilization must conform to the bank

(15) upon completion of the project, remove all construction debris from the floodway *

(16) * Note: for regulatory purposes, the floodway is defined as the area inundated by the base flood as shown on Panels 40C and 45C of the Kosciusko County Flood Insurance Rate Map dated February 4, 1987

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SERVICE LIST

APPLICATION #: FW- 26535

Dewart Lake Protective Associates Incorporated
PO Box 152
Syracuse, IN 46567

Cardno JFNew
John B Richardson
708 Roosevelt Road
Walkerton, IN 46574-1220

Steve and Roberta Anderson
5847 North 200 East
Leesburg, IN 46538

Charles Baker
5086 East 875 North
Syracuse, IN 46567

Jacob and Jill Baker
5086 East 875 North
Syracuse, IN 46567

Roy and Inez Caywood
8631 North 500 East
Syracuse, IN 46567

Eldred and Barbara Ehmen
8188 North 500 East
Syracuse, IN 46567

Allen and Delores Gerber
5295 East 875 North
Syracuse, IN 46567

David and Penelope Hall
8612 North 550 East
Syracuse, IN 46567

Larry and Annette Helman
8366 North 550 East
Syracuse, IN 46567

Indiana Department of Natural Resources
Division of Law Enforcement
District 1 Headquarters
9822 North Turkey Creek Road
Syracuse, IN 46567

Stuart and Angie Kleopfer
8755 North 500 East
Syracuse, IN 46567

Kosciusko County Area Plan Commission
Matthew M Sandy
Court House, 3rd floor
100 West Center Street
Warsaw, IN 46580-2873

Kosciusko County Drainage Board
County Surveyor
Courthouse, Room 103
100 West Center Street
Warsaw, IN 46580-2872

Kosciusko County SWCD
Linda Hixson
217 East Bell Drive
Warsaw, IN 46582

Danny and Lisa Millert
5508 East 800 North
Syracuse, IN 46567

Thurlow and Mary Mock
6736 East 800 North
Syracuse, IN 46567

Larry and Susan Mock
6785 East Eli Lily Road
Syracuse, IN 46567

Doug Mock
111 Timberlake Circle
Inman, SC 29349

Roberts Family Farmland LLC
8464 North Syracuse-Webster Road
Syracuse, IN 46567

Robert and Jo Helpler Schiffer
206 East Pickwick Drive
Syracuse, IN 46567

St. Joseph River Basin Commission
Karen M Mackowiak
227 West Jefferson Boulevard, #1120
South Bend, IN 46601-1830

Thomas and Karen Stiver
PO Box 335
Syracuse, IN 46567

David and Kathy Stoffel
8357 North 500 East
Syracuse, IN 46567

US Army Corps of Engineers
Detroit District
477 Michigan Avenue
Detroit, MI 48226-2550

Harold and Christine Waldrop
8536 North 500 East
Syracuse, IN 46567

Charles and Joanne White
7004 East 100 North
Syracuse, IN 46567

Gregg Wiggs
5397 East 900 North
Syracuse, IN 46567

Staff Assignment:

Administrative	: Shirley A. Fitzwater
Technical	: Shirley A. Fitzwater
Environmental	: J. Matthew Buffington
Fish and Wildlife	: Lori White

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

Mitchell E. Daniels Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

June 21, 2012

VIA CERTIFIED MAIL 91 7190 0005 2710 0021 9268

Mr. Kenneth Brehob
Dewart Lake Protective Association
PO Box 152
Syracuse, IN 46567

Dear Mr. Brehob:

Re: Section 401 Water Quality Certification
Project: Cable Run Bank Stabilization
IDEM No.: 2012-155-43-JPS-A
County: Kosciusko

The Office of Water Quality has reviewed your application for Section 401 Water Quality Certification dated January 17, 2012, and received January 30, 2012. According to the application, you propose to stabilize 1890 linear feet of the banks of Cable Run with rock toe protection and install three grade control structures consistent with existing stream bed elevations. The project is located approximately 0.5 mile north of 800 North on 500 East and 550 East (Northwest ¼ of Section 31 and Section 32, Township 34 North, Range 7 East, Leesburg and North Webster U.S.G.S Quad. Maps), South of Syracuse, in Kosciusko County.

Based on available information, it is the judgment of this office that the proposed project will comply with the applicable provisions of 327 IAC 2 and Sections 301, 302, 303, 306, and 307 of the Clean Water Act if you comply with the conditions set forth below. Therefore, subject to the following conditions, the Indiana Department of Environmental Management (IDEM) hereby grants Section 401 Water Quality Certification for the project described in your application received January 30, 2012 and modifications received June 18, 2012. Any changes in project design or scope not detailed in the application described above or modified by the conditions below are not authorized by this certification.

CONDITIONS OF THE SECTION 401 WATER QUALITY CERTIFICATION:

You shall:

1) Deposit any dredged material in a contained upland disposal area to prevent sediment runoff to any waterbody.

2) Install erosion control methods prior to any soil disturbance to prevent soil from leaving the construction site. Appropriate erosion control methods include, but are not limited to, straw bale barriers, silt fencing, erosion control blankets, phased construction sequencing, and earthen berms. Monitor and maintain erosion control structures and devices regularly, especially after rain events, until all soils disturbed by construction activities have been permanently stabilized.

3) Install silt fence or other erosion control measures around the perimeter of any wetlands and/or other waterbodies to remain undisturbed at the project site.

4) Allow the commissioner or an authorized representative of the commissioner (including an authorized contractor), upon the presentation of credentials:

   a) to enter your property, including impact and mitigation site(s);
   b) to have access to and copy at reasonable times any records that must be kept under the conditions of this certification;
   c) to inspect, at reasonable times, any monitoring or operational equipment or method; collection, treatment, pollution management or discharge facility or device; practices required by this certification; and any mitigation wetland site;
   d) to sample or monitor any discharge of pollutants or any mitigation site.

5) Complete all approved discharges no later than two (2) years of the date of issuance of this Section 401 Water Quality Certification. You may request a one (1) year extension to the Section 401 Water Quality Certification by submitting a written request ninety (90) days prior to the deadline stated above. The written request shall contain an account of which discharges and mitigation have been completed and list the reasons an extension is requested.

6) Allow no construction equipment, temporary run-arounds, coffer dams, temporary causeways, temporary crossings, or other such structures to enter or be constructed within Cable Run, unless specifically stated, depicted, or detailed in the aforementioned correspondence and project plans. A modification of this Section 401 Water Quality Certification is required from this office if any of the aforementioned items are needed for project construction.

7) Remove any temporary causeway or other approved temporary structures used to facilitate construction or access upon completion of construction activities.

This certification does not relieve you of the responsibility of obtaining any other permits or authorizations that may be required for this project or related activities from IDEM or any other agency or person. You may wish to contact the Indiana Department of Natural Resources at 317-232-4160 (toll free at 877-928-3755) concerning the possible requirement of natural freshwater lake or floodway permits. In addition, you may wish to contact IDEM's Storm Water Permits Section at 317-233-1864 concerning the possible need for a 327 IAC 15-5 (Rule 5) permit if you plan to disturb greater than one (1) acre of soil during construction.

This certification does not:

(1) authorize impacts or activities outside the scope of this certification;
(2) authorize any injury to persons or private property or invasion of other private rights, or any infringement of federal, state or local laws or regulations;
(3) convey any property rights of any sort, or any exclusive privileges;
(4) preempt any duty to obtain federal, state or local permits or authorizations required by law for the execution of the project or related activities; or
(5) authorize changes in the plan design detailed in the application.

Failure to comply with the terms and conditions of this Section 401 Water Quality Certification may result in enforcement action against you. If an enforcement action is pursued, you could be assessed up to $25,000 per day in civil penalties. You may also be subject to criminal liability if it is determined that the Section 401 Water Quality Certification was violated willfully or negligently.

This certification is effective eighteen (18) days from the mailing of this notice unless a petition for review and a petition for stay of effectiveness are filed within this 18-day period. If a petition for review and a petition for stay of effectiveness are filed within this period, any part of the certification within the scope of the petition for stay is stayed for fifteen (15) days, unless or until an Environmental Law Judge further stays the certification in whole or in part.

This decision may be appealed in accordance with IC 4-21.5, the Administrative Orders and Procedures Act. The steps that must be followed to qualify for review are:

1) You must petition for review in writing that states facts demonstrating that you are either the person to whom this decision is directed, a person who is aggrieved or adversely affected by the decision, or a person entitled to review under any law.

2) You must file the petition for review with the Office of Environmental Adjudication (OEA) at the following address:

   Office of Environmental Adjudication
   100 North Senate Avenue
   IGCN Room N501
   Indianapolis, IN 46204

3) You must file the petition within eighteen (18) days of the mailing date of this decision. If the eighteenth day falls on a Saturday, Sunday, legal holiday, or other day that the OEA offices are closed during regular business hours, you may file the petition the next day that the OEA offices are open during regular business hours. The petition is deemed filed on the earliest of the following dates: the date it is personally delivered to OEA; the date that the envelope containing the petition is postmarked if it is mailed by United States mail; or, the date it is shown to have been

deposited with a private carrier on the private carrier's receipt, if sent by private carrier.

Identifying the certification, decision, or other order for which you seek review by number, name of the applicant, location, or date of this notice will expedite review of the petition.

Note that if a petition for review is granted pursuant to IC 4-21.5-3-7, the petitioner will, and any other person may, obtain notice of any prehearing conferences, preliminary hearings, hearings, stays, and any orders disposing of the proceedings by requesting copies of such notices from OEA.

If you have procedural questions regarding filing a petition for review you may contact the Office of Environmental Adjudication at 317-232-8591.

If you have any questions about this certification, please contact Mr. Jared Sanders, Project Manager, of my staff at 317-234-6352 or you may contact the Office of Water Quality through the IDEM Environmental Helpline (1-800-451-6027).

Sincerely,

Mary E. Hollingsworth, Branch Chief
Surface Water, Operations & Enforcement Branch
Office of Water Quality

cc: Ryan Cassidy, USACE-Detroit District (Michiana Field Office)
Liz McCloskey, USFWS
Lori White, IDNR
John Richardson, Cardo JFNew

DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
U.S. ARMY CORPS OF ENGINEERS
MICHIANA BRANCH
2422 VIRIDIAN DRIVE SUITE # 200
SOUTH BEND, IN 46628-3489

June 27, 2012

REPLY TO ATTENTION OF:
Engineering & Technical Services
Regulatory Office
File No. LRE-2012-00064-143-R12

Mr. Kenneth Brehob
Dewart Lake Protective Association
P.O. Box 152
Syracuse, Indiana 46567

Dear Mr. Brehob:

Reference your application for a Department of the Army (DA) permit to discharge riprap into Cable Run for a stream bank stabilization/enhancement project located between CR 550 East and the inlet to Dewart Lake, near Syracuse, Indiana (Sections 31 and 32, Township 34 North and Range 7 East, Kosciusko County).

Under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, Chicago, Louisville and Detroit Districts reissued Regional Permit 99-100-003-1 on December 15, 2009 for certain activities having minimal impact in Indiana. We have verified that your proposed work shown on the enclosed plans and described below is authorized under the Regional Permit. You may proceed with the work subject to the enclosed general conditions, and any noted special conditions and Indiana Department of Environmental Management (IDEM) Section 401 Water Quality Certification.

The following work is authorized under Section 404:

(Caywood Property West of CR 500 East)

Discharge 16 cubic yards (cys) of riprap into a 20 foot long by 1.5 foot wide by 15 foot deep area of stream for construction of a rock ramp at the west end of the CR 500 east culvert. Discharge 33 cys of riprap into an approximate 100 foot long by 1.5 foot wide by 2 foot deep area of stream (both banks) for bank stabilization immediately west of cross-section 0+23.8. Discharge 9 cys of riprap into an 80 foot long by 1.5 foot wide by 2 foot deep area of stream at cross-section 3+25 (north bank). Discharge 7 cys of riprap into a 60 foot long by 1.5 foot wide by 2 foot deep area of stream approximately 600 feet west of cross-section 3+25 (north bank).

(Mock Property East of CR 550 East)

Discharge 117 cys of riprap into a 700 foot long by 1.5 wide by 1.5 foot deep area of stream (both banks) for bank stabilization (see schematic). Discharge a total of 24 cys of riprap into a 14 foot long by 1.5 foot wide by 15 foot deep area of stream for (2) separate grade control structures (see attached schematic for locations).

(Mock Property West of CR 550 East)

Discharge 22 cys of riprap into a 150 foot long by 1.5 foot wide by 2 foot deep area stream for placement of a rock toe (both banks) immediately west of CR 550 East.

Special Conditions:

1. The permittee shall adhere to the conditions of the Section 401 Water Quality Certification specified by the Indiana Department of Environmental Management (as attached).

2. All fill shall consist of clean, inert materials from an upland source.

3. Measures must be adopted to prevent potential pollutants from entering the watercourse. Construction materials and debris, including fuels, oil, and other liquid substances, will not be stored in the construction area in a manner that would allow them to enter the watercourse as a result of spillage, natural runoff, or flooding.

4. Upon completion of construction, the permittee shall restore any vegetation disturbed or destroyed during project implementation.

5. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

Any construction activity other than that shown on the plans may not qualify for the Regional Permit. If you plan changes or additional activities from those depicted on the plans, please submit them to this office for review prior to construction.

Upon completion of the work authorized by this RGP, the enclosed Completion Report form must be completed and returned to this office. This verification is valid until December 15, 2014, or 1 year from the date of this letter, whichever occurs later, unless the regional permit is modified, suspended or revoked.

Also enclosed with this letter is a Preliminary Jurisdictional Determination (PJD). This determination advises an interested party that the Corps of Engineers believes there may be waters and/or wetlands of the United States on the property that fall under the Corps' regulatory authority. A PJD enables the Corps and a permit applicant or other affected party to resolve certain jurisdiction and permit issues without expending time on making an official determination of the Corps' jurisdiction. At any time, an applicant/affected party may request an approved jurisdictional determination, which would provide an official determination of

jurisdictional waters on a site. An approved jurisdictional determination can be administratively appealed (information regarding the appeals process would be provided to you should the situation arise).

If you have questions, please contact me at the above address or telephone (574) 232-1952 Ext- 21964 / E-Mail Ryan.D.Cassidy@usace.army.mil. Please refer to File No. LRE-2012-00064-143-R12 in all future communications with this office.

We are interested in your thoughts and opinions concerning your experience with the Detroit District, Corps of Engineers Regulatory Program. If you are interested in letting us know how we are doing, you can complete an electronic Customer Service Survey from our web site at: **http://per2.nwp.usace.army.mil/survey.html**. Alternatively, you may contact us and request a paper copy of the survey that you may complete and return to us by mail or fax. Thank you for taking the time to complete the survey, we appreciate your feedback.

Sincerely,

ORIGINAL SIGNED BY

Ryan D. Cassidy
Regulatory Project Manager
Michiana Branch

Enclosures

Copy Furnished

IDEM/Sanders, w/encl.
IDNR/Division of Water, w/encl. (FW-26535)