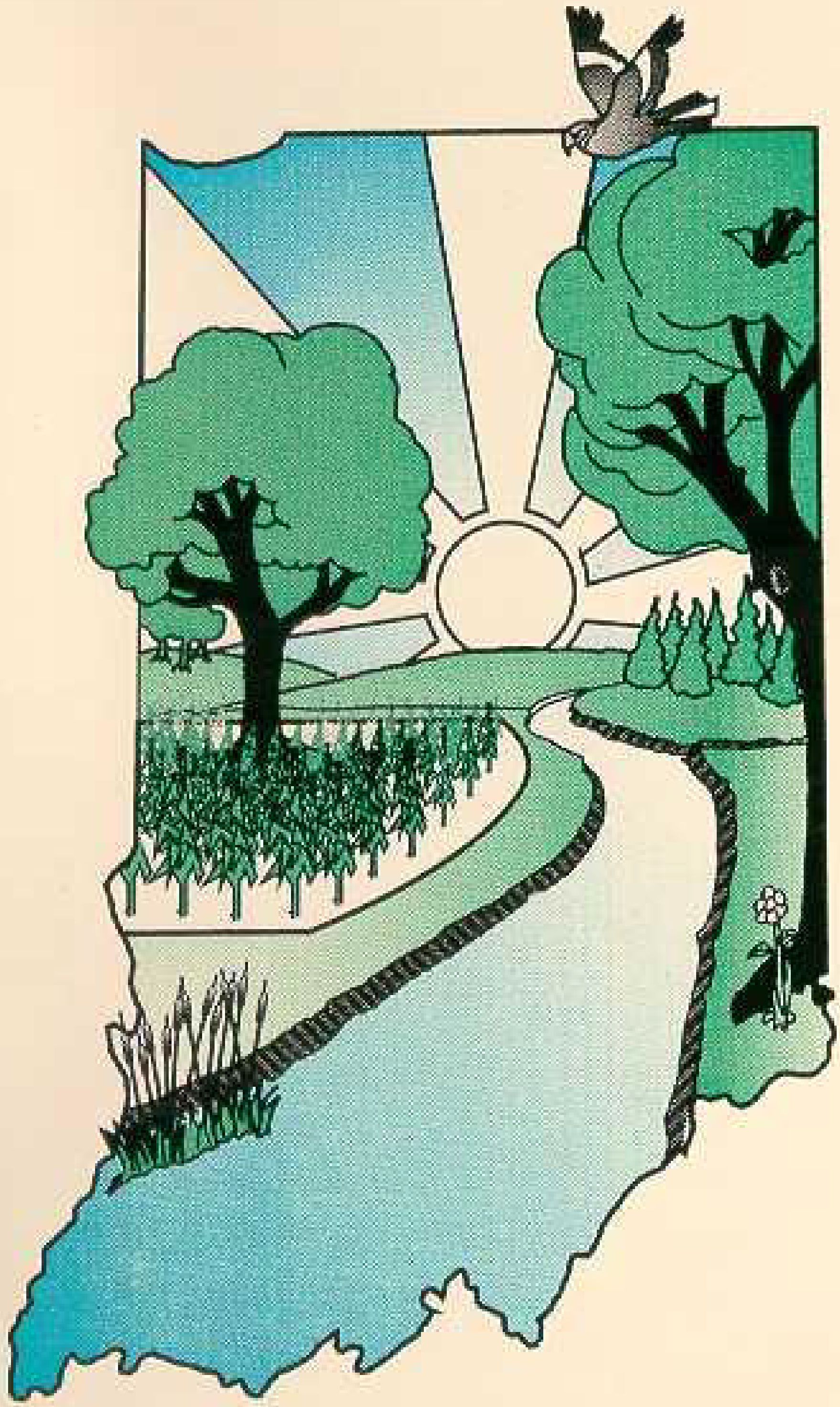
INDIANA DRAINAGE HANDBOOK



An Administrative and Technical Guide for Activities within Indiana Streams and Ditches

Prepared in Accordance
with State of Indiana
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CHRISTOPHER B. BURKE ENGINEERING, LTD.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
TEL: (317) 266-8000
FAX: (317) 632-3306
E-Mail: cbbel@cbbel-in.com

Acknowledgements and Disclaimer

This handbook was developed by Christopher B. Burke Engineering, Ltd. (CBBEL) in accordance with State of Indiana Public Law 329-1995. Principal editors, authors, and support staff within CBBEL included: Christopher B. Burke (Technical Editor), Siavash E. Beik (Project Manager & Principal Author), Kerry M. Daily, Mark J. O'Leary, Jon D. Stolz (Meeting Facilitator), Jedd M. Anderson, and Elaine A. Eichelberger. The final printing of the Handbook was undertaken by Perfect Impressions Printing.

An eleven-member, legislatively-created work group reviewed and oversaw the overall development of Handbook, and provided valuable input to CBBEL project team throughout the development phase. The following is a listing of work group member names and their affiliations: James Barnett (Indiana Farm Bureau), Dennis Clark (IDEM), Carl Colbert (Tipton County Drainage Board), Kenneth Culp (Jasper County Drainage Board), Greg Deeds (Miami County Surveyor), Karl Glander (Friends of the White River), David Hudak (USFWS), Philip McLoud (USDA-NRCS), James Ray (IDNR), Doug Shelton (USCOE), and Kenton Ward (Hamilton County Surveyor).

Much of the material presented here was adapted from various publications containing best management practices and technical data as well as documents describing various permitting and administrative local, State and Federal programs. In many cases, pertinent text and illustrations were directly utilized within the Handbook with permission and with full credit. A complete list of these publications is provided in Section 6: References. The following is a list of agencies whose publications were extensively used in the preparation of this handbook:

- Indiana Department of Natural Resources.
- USDA-Natural Resources Conservation Service.
- U.S. Army Corps of Engineers.
- United States Department of Agriculture Forest Service.
- North Carolina Department of Environment, Health, and Natural Resources.
- South Carolina Department of Health and Environmental Control.
- Pennsylvania Department of Environmental Resources.
- Ohio Department of Natural Resources.
- DuPage County (Illinois) Department of Environmental Concerns.

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LIST OF APPENDICES

SUMMARY OF OCTOBER 1999 REVISIONS

The “Indiana Drainage Handbook” was originally published in October 1996. The Handbook was updated and reprinted in October 1999. An update package, including all revised and reformatted pages of the Handbook, was put together as the “Indiana Drainage Handbook - October 1999 Update Package” and sent to all registered users of the October 1996 version of the Handbook.

The following is a list of revisions made to the October 1996 version as part of the October 1999 update. Page numbers referenced in the revision list are the October 1999 updated page numbers.

To accommodate the required space for some of the revisions, several pages were also required to be reformatted/reprinted. The “Indiana Drainage Handbook - October 1999 Update Package” included these reformatted pages.

Page Number	Revision
i	Revised TABLE OF CONTENTS to include heading for the “SUMMARY OF OCTOBER 1999 REVISIONS.”
v	Revised the “Last Print/Revision Date.”
viii	Revised the list to include renamed and new appendices.
ix to xii	Added pages providing a summary of October 1999 Revisions.
2.2-2	Revised “Section 2.26" to “Section 2.34" in last sentence on page. Also revised the “Last Print/Revision Date.”
2.3-1	Revised third paragraph of **Section 2.31**.
2.3-5	Revised title of upper left drawing for Exhibit 2.3a . Also, revised Indiana Administrative Code references for the Public Freshwater Lakes Rule from “310 IAC 6-2" to “312 IAC 11" and reference for the Navigable Waterways Rule from “310 IAC 21-1" to ”312 IAC 6" under **Other IDNR-Administered Statutes and Rules** section.
2.3-6	Revised last paragraph of **Section 2.32** to reflect correct references to renamed appendices. Also changed the heading of the left-most drawing in Exhibit 2.3b.
2.3-7	Added new second sentence to paragraph under **Other Exemptions** section. Revised first exemption listing to read “Utility line crossings and relocation projects” and added information regarding Obstruction Removal for River and Stream Maintenance under the **Other Exemptions** section. Also revised reference to a renamed appendix.

SUMMARY OF OCTOBER 1999 REVISIONS (continued)

Page Number	Revision
2.3-8	Added a heading and a new second sentence to first paragraph describing SEA 368 Review Process in **Section 2.34**. Added new second sentence under Item (1) of SEA 368 Review Process.
2.3-9	Changed from “three (3)” to “four (4)” primary pieces of information in first sentence of **Section 2.35** and added new Item (3). Revised reference to renamed appendices and revised last sentence of last paragraph.
2.3-11	Revised last sentence of paragraph under **General Public Notice** section. Also changed the reference to a renamed appendix in last sentence of page.
2.3-12	Revised last sentence/paragraph under **Inter-Department Consultation** section. Also revised paragraph under **Final Processing** section and completely revised paragraph under **Section 2.37**. Revised the “Last Print/Revision Date.”
2.4-1	Revised second sentence of first paragraph under **Section 2.42**.
2.4-2	Revised first paragraph of this page and reference to a renamed appendix. Also, revised both paragraphs under **Section 2.43**, last sentence of **Section 2.44,** and entire **Section 2.45**.
2.4-3	Revised second sentence of second paragraph and added new third paragraph to **Section 2.46**. Also revised first sentence of **Section 2.47** and revised the “Last Print/Revision Date.”
2.5-1	Added “1899" to first sentence of **Section 2.51** after “River and Harbors Act of” text.
2.5-5	Revised reference to a renamed appendix at the end of third paragraph.
2.5-8	Revised reference to a renamed appendix at the end of the first paragraph under **Section 2.56**.
2.5-17	Revised the “Last Print/Revision Date.”
2.6-1	Revised “wetlands” to “COE 404 permit” near end of **Section 2.62**.
2.6-2	Added new second sentence to second paragraph under **Section 2.65** and revised the “Last Print/Revision Date.”

SUMMARY OF OCTOBER 1999 REVISIONS (continued)

Page Number	Revision
2.7-1	Revised "Resource" to "Resources" in first sentence on page.
2.7-2	Revised the "Last Print/Revision Date."
3.3-4	Deleted extra period at end of sentence under **Closed Tile Drains** section.
4.3-1	Deleted extra period at end of last sentence under **Mitigation Measures** section.
5.8-1	Added a new third paragraph.
5.802-1	Deleted "Pollutant Removal" from items included under "PURPOSE."
5.802-4	Revised the "Last Print/Revision Date."
5.804-1	Added the word "Minimum" in the beginning of the last bullet item of this page. Also, added a sentence to this bullet item.
5.804-3	Revised the "Last Print/Revision Date."
Appendix E.1	Updated IDNR Permit Application information (formerly Appendix E.3).
Appendix E.2	Updated listing of Public Freshwater Lake Wetland Review Maps (formerly Appendix E.1).
Appendix E.7	Updated IDNR Organizational Chart and Environmental Biologist contact information (formerly Appendix E.5).
Appendix F.1	Added new Appendix for Section 401 WQC Application Form and information.
Appendix F.2	Updated listing of IDEM Special Streams and Lakes (formerly Appendix F.1).
Appendix F.3	Added new Appendix for IDEM February 8, 1997 Decision Letter Regarding COE Nationwide Permits.
Appendix F.4	Updated exhibit listing Section 401 WQC staff and IDEM Organizational Chart (formerly Appendix F.2).
Appendix G.2	Updated entire Appendix (formerly Appendix G.1).

SUMMARY OF OCTOBER 1999 REVISIONS (continued)

Page Number	Revision
Appendix G.4	Updated contact information for COE Louisville District Office.
Appendix H.2	Added Tippecanoe and Knox Counties to list for Bald Eagle, Wabash River. Add Knox County to list for Bald Eagle, West Fork White River. Deleted Patoka River counties, Pigeon Creek counties, Little Pigeon Creek counties, Muscatatuck River counties and Wabash River county for Copperbelly Watersnake. Deleted footnote 2 regarding Copperbelly Watersnake.
Appendix I	Updated USDA NRCS fax number.

SECTION 1

INTRODUCTION

SECTION 1.1
PURPOSE

The purpose of the Indiana Drainage Handbook ("Handbook") is to serve as an administrative and technical guide for drainage activities within Indiana streams and ditches. Pursuant to its enabling legislation, the Handbook (1) explains and clarifies federal, state, and local laws and regulations affecting drainage improvement activities within the State of Indiana, (2) provides descriptions of specific "Best Management Practices" which define how work should be done with a minimum of adverse environmental impact, and (3) explains procedures for timely access to agencies' drainage-related personnel.

The Handbook is intended for use by both the regulatory agencies and those doing drainage work. A clear understanding of the applicable regulations and practices provided in the Handbook, and how they should be applied, should ease the process of obtaining permits for drainage improvement activities. Such improved understanding should also result in minimizing the adverse impacts of these activities on human life and property as well as on fish, wildlife, or other aquatic and botanical resources.

The practices contained in the Handbook are intended to be selected and applied on a case by case basis and for an appropriate reach of a subject ditch or stream. **Nothing in this Handbook is intended to force the application of a practice or its indiscriminate utilization along the entire length of a stream or ditch.** Such indiscriminate utilization of a practice along the entire reach of a drainageway may not only be cost prohibitive, but may also be ineffective in many settings. Planning and selection principles explained later in Section 4 of this Handbook should be utilized to allow selection and use of the most appropriate practice for each specific reach of a drainageway.

SECTION 1.2
SCOPE

This Handbook is intended as an administrative and technical guide for both regulating agencies and those engaged in drainage improvement work within the State of Indiana. The Handbook is not intended as an all-inclusive technical resource. With regard to the "Best Management Practices", the scope of this handbook is limited to describing each practice and pointing out significant considerations associated with each. The intention is not to offer detailed design and construction specifications for the practice. However, a list of technical references provided for each practice may be utilized by the Handbook's users to access more detailed information.

It should also be noted that the activities and practices described in the Handbook are not all-inclusive. Drainage improvement activities may also be accomplished through innovative or non-standard practices which may not have been included in this handbook.

The Handbook addresses both "regulated drains" (those that fall under the jurisdiction of County Drainage Boards) as well as other drainageways (including streams, ditches, and tile drains) that are outside the jurisdiction of County Drainage Boards. The scope of the Handbook is limited to drainage improvement activities that take place within or immediately adjacent to Indiana drainageways.

As an administrative guide, the Handbook is a clarification of existing programs with no intentions to impose any new policies, procedures, or regulations. The prescribed use of this manual is as an advisory guidebook.

The Indiana Drainage Handbook has been developed as a companion manual to the "Indiana Handbook for Erosion Control in Developing Areas." The erosion control handbook provides Engineers, developers, builders, contractors, government officials, and others with guidelines and specific practices for controlling soil erosion and sedimentation associated with runoff from construction activities. In addition to addressing practices, the erosion control handbook discusses the philosophy and planning procedures critical to developing an effective erosion and sediment control plan as well as information pertaining to compliance with 327 IAC 15-5, commonly referred to as "Rule 5."

Although there are several practices that are duplicated in this and the erosion control handbook, each handbook is unique in its application. Depending on the nature of projects and activities involved, the users may choose to maintain a copy of each document. For more information or to order a copy of the erosion control handbook, please contact the IDNR-Division of Soil Conservation (see Section 6: References).

SECTION 1.3
BACKGROUND

The publication and distribution of the Indiana Drainage Handbook is one of the major recommendations of a 1994 legislatively-created task force which examined issues related to permitting of drainage improvement projects in Indiana. The following is a summary of major events leading to the initiation of this handbook.

***1994 Legislative Session*:** During the 1994 Legislative Session, Senate Bill (SB) 321 was introduced. This bill would have generally stripped the Indiana Department of Natural Resources (IDNR) and the Indiana Department of Environmental Management (IDEM) of regulatory overview of County Regulated Drain projects. SB 321 was eventually set aside and a temporary compromise was reached: Senate Concurrent Resolution (SCR) 38. SCR 38 urged that an interim study committee task force be established to examine state and local laws regarding drainage and make recommendations back to the legislators. This interim study committee formally became the Drainage Task Force.

***Drainage Task Force*:** Working through the Water Resource Study Committee (WRSC), the Drainage Task Force began meeting in June of 1994. The Task Force was comprised of representatives of county surveyors, state and federal regulatory agencies, agricultural interest groups, and environmental interest groups. The task force met through the month of September 1994 and grappled with many issues, including: permit processing time and conditions, wetland definitions, property rights, agency coordination, and consistency between the agencies, just to name a few. A final report dated October 3, 1994 was presented to the WRSC on December 15, 1994. A copy of this report is provided as Appendix "B".

***Task Force Recommendations*:** The Final Report of the Drainage Task Force was presented to the WRSC on December 15, 1994 with eight recommendations: (Although not specifically pointed out in the Task Force Report, references to the "permitting agencies" were made in the recommendations with the understanding that the Indiana General Assembly did not have control over <u>Federal</u> permitting agencies and could therefore only "encourage" rather than "require" these agencies to take certain actions.)

1. A Memorandum of Understanding (MOU) should be developed between county surveyors/drainage boards, IDNR, IDEM and if possible the U.S. Army Corps of Engineers (COE) and the U.S. Fish and Wildlife Service (USFWS) to allow early coordination through consultations and on-site visits conducted <u>prior</u> to formal permit application.

2. Permitting agencies should be required to consider each project on the basis of its own merits. Agencies should evaluate the potential positive and negative cumulative impacts of both implementing and not implementing a project.

3. A small technical work group should be created to develop a manual of technical and administrative measures related to drainage projects.

4. Permitting agencies should work with permittees to establish procedures allowing for two-phase permitting of projects:

   - Phase A: Formal permit procedure (similar to current process).

- Phase B: After final inspection, all **maintenance** activities would be under the control of the permittee.

5. State regulatory agencies should work with county surveyors/drainage boards to devise a regulated drain classification system.

6. If it is determined that amelioration of environmental impacts results in an environmental "enhancement" beneficial to persons outside the project area, then the costs of the enhancement should be borne by the environmentally-benefited public at large.

7. Efforts to provide wetland delineator training should be encouraged and supported.

8. Agencies should develop a consistent policy for wetland mitigation with respect to impacts arising from land improvement, particularly with respect to drainage maintenance and reconstruction activities in Indiana.

At its December 15, 1994 meeting, the WRSC specifically endorsed Recommendation No. 3 through Preliminary Draft (PD) 3912.

1995 Legislative Session**:** During the 1995 Legislative Session, two separate measures were introduced that dealt with county surveyor/drainage boards and the state regulatory agencies. These measures were Senate Enrolled Act (SEA) 303 and SEA 368. SEA 368 was a rebirth of SB 321 and sought to exclude drainage board projects from IDNR and IDEM regulatory oversight. Through the hearings regarding this act, SEA 368 was modified into a formal early coordination process for county drainage board projects and mandated certain responses from the state regulatory agencies. The final version of SEA 368 also, under certain conditions, prohibited IDNR from requiring specific conditions on county drainage board project applications.

SEA 303 was the formal legislative version of PD 3912 which would create a work group authorized to produce the recommended handbook. After much discussion and debate, SEA 303 was passed by both chambers of the legislature and signed into law. SEA 303 mandated the creation of a "work group to develop a technical and administrative handbook for drainage projects." A copy of the act is included as Appendix "C".

Work Group**:** The 11-member work group created by SEA 303 included four (4) representatives from county surveyors and drainage boards (appointed by the governor), one (1) representative from an environmental organization (appointed by the governor), one (1) representative from an agricultural organization (appointed by the governor), and one (1) representative from each of the following agencies: IDEM, IDNR, COE, USFWS, and the Natural Resource Conservation Service (NRCS). A list of the members is provided in Appendix "D". As specified in SEA 303, the work group would be directed by an individual contracted by the IDNR who will facilitate the work group, write/edit the handbook, conduct public meetings, and issue reports. In late November, 1995, IDNR selected Christopher B. Burke Engineering, Ltd. (CBBEL) to put together the Indiana Drainage Handbook with the help of the work group.

***Legislatively-mandated Topics to be Discussed in the Indiana Drainage Handbook*: ** As stated in SEA 303, the handbook is to include, at least:

1. Technical descriptions of drainage project construction techniques.

2. Best Management Practices (BMPs) for drainage projects.

3. Explanations of agency permitting processes and procedures.

4. Addresses and telephone numbers of agency employees who are responsible for permitting.

5. Descriptions of compensatory measures for unavoidable environmental damage.

6. Descriptions of projects that are exempt from state or federal regulation.

7. A description of the process that allows clear and timely access by applicants to supervisors in agencies.

8. Any other information the work group considers necessary.

SECTION 1.4
ORGANIZATION OF THE HANDBOOK

This handbook is organized into six (6) major sections and a number of appendices:

Section 1 provides an introduction to the Handbook and summarizes the purpose, scope, background, organization, and a guide on how the Handbook may be utilized.

Section 2 explains the agencies' permitting processes and procedures. An informal description of permits, exempt projects, early coordination process, application requirements, agency review process, and timely access to regulatory personnel are discussed in detail. Updated copies of application forms and other pertinent documents are provided as appendices to the Handbook.

Section 3 provides a brief definition of drainage improvement activities and practices, provides a table of required authorizations and processing methods, and describes mitigation requirements for drainage improvement projects.

Section 4 outlines the planning process, enumerates factors to be considered in selection of appropriate practices, and provides a guide for selecting of appropriate practices for various drainage improvement activities.

Section 5 describes and illustrates various practices associated with drainage improvement activities including their purpose, applicability, advantages, constraints, design and construction guidelines, maintenance, and list of resources where more detailed information may be found.

Section 6 provides the full name and description of references listed for various practices, and information on where references may be obtained.

The **Appendices** contain a glossary of terms as well as reproductions of Drainage Task Force 1994 Report, Senate Enrolled Act 303, and pertinent documents pertaining to drainage-related programs administered by various agencies.

SECTION 1.5
HOW TO USE THIS HANDBOOK

The Handbook can be used in several different ways. It may be used purely as an **administrative guide** or reference to look up regulatory requirements of different agencies and establish an understanding of authorizations, processing methods, and mitigation measures required for specific activities and practices. Similarly, the Handbook may be utilized as a **technical guide** assisting the user with the planning process, selection of appropriate practices for various activities, and a detailed description of each practice for planning, design, and implementation purposes. Finally, the Handbook may be utilized as a **comprehensive administrative and technical guide** to enable the user to select appropriate best management practices with a clear understanding of the regulatory requirements and environmental impacts associated with them.

Most users will find it helpful to sequence their review and utilization of the Handbook according to the following steps:

1. **Section 2** of the Handbook should be reviewed to gain a basic understanding or to further clarify the user's understanding of various regulatory programs affecting drainage improvement activities in Indiana.

2. **Sub-section 3.1** may be reviewed to familiarize the user with the Handbook's definition of various drainage improvement activities and practices.

3. **Sub-sections 3.2 and 3.3** may be reviewed to enable the user to determine what types of authorizations, processing methods, and potential mitigation measures may be involved with specific key practices of a project, as initially planned.

4. **Sub-sections 4.1 and 4.2** may be reviewed to gain more insight on the planning process and factors to be considered in selecting practices appropriate for a specific situation. **Sub-section 4.3** may then be consulted to assist in selection of both complementary and alternative practices for a drainage improvement activity. For the selection process to be successful, the user may have to review a detailed description of alternative practices involved (Section 5) and also refer back to Sub-section 3.2 so that the differences in processing methods for alternative practices may be considered as a factor in the selection process.

5. **Section 5** should be referenced to gain an insight on the detailed description of pertinent practices being considered, to ensure the appropriateness of the practice for specific circumstances of the project.

6. Following the initial planning stage and final selection of appropriate practices, **Sub-section 3.2** should be consulted again to determine the required permits and then appropriate permit packages may be put together according to guidelines provided in **Section 2** and appropriate **appendices**.

SECTION 1.6
FUTURE REVISIONS AND UPDATES

It is anticipated that the Handbook will be periodically reviewed and updated. While the work group which originally oversaw development of the Handbook was created by the Legislature, such formality will not be required for technical revisions or updates. Technically oriented representatives of the disciplines comprised by the original work group will be brought together, as necessary, to consensually develop needed changes. The meetings will be coordinated by IDNR and measures will be taken to assure that all affected parties will be properly represented.

The organization of the Handbook and its page numbering system has been specifically designed to accommodate revisions or updates. Users who wish to receive the new and revised material as it becomes available must **fill out and return the registration form** which is placed inside the back cover. Any comments, questions, or suggestions concerning this Handbook should be directed to:

Indiana Department of Natural Resources
Division of Water
402 West Washington Street, Room W264
Indianapolis, IN 46204-2748
Telephone (317) 232-4160   Fax (317) 233-4579

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T.O.C.

SECTION 2

DESCRIPTION OF PERMITTING PROCESSES RELATED TO DRAINAGE IMPROVEMENT PROJECTS

SECTION 2.1
OVERVIEW

Natural Streams and wetlands are of vital importance to the natural resources and environment of the State. Various local, State, and Federal programs have evolved to protect and safeguard these vital resources while promoting and allowing the use of these resources to enhance the public welfare.

Local governments, including counties, cities, river basin commissions, drainage districts, conservancy districts, and levee districts, are responsible for protecting and promoting the responsible use of water resources within their jurisdictions. Through the Drainage Code, the County Drainage Board and the County Surveyor of each county are responsible for the maintenance and proper functioning of all Regulated Drains, open and tiled, in the county. Each year, the Surveyor must report on the condition of each Regulated Drain and, if necessary, recommend maintenance or reconstruction projects to the Drainage Board. The Drainage Boards and Surveyors must also respond to petitions by the public to create or dedicate new Regulated Drains, reconstruct existing Regulated Drains, and perform regular maintenance activities.**#**

The Indiana Department of Natural Resources (IDNR) is the advocate for and steward of the State's natural resources. The IDNR develops and implements policies and programs for the conservation, management, utilization, and protection of the State's natural resources. The IDNR is proactive in protecting the State's natural resources for use and enjoyment by future generations of Indiana. In general, the IDNR reviews and approves plans for any work within the floodway of a stream or along the shoreline of a public freshwater lake **before** work on the project may begin. The laws passed by the legislature and subsequent rules promulgated by IDNR have sought to protect the lives and property of individuals and the public and also the existing resources along and within Indiana's waters. The safety of the public at large and impacts to adjoining land owners are taken into account during the technical or engineering review of a proposed project. The integrity of fish, wildlife and botanical resources are also safeguarded through an environmental review of a proposed project.**#**

The Indiana Department of Environmental Management (IDEM) is the water pollution control agency for the State of Indiana. IDEM has the responsibility and authority to prevent any pollution that is determined to be unreasonable and against the public interest in view of the conditions in any stream or any waters of the state.**#**

The U.S. Army Corps of Engineers (COE) regulatory program is one of the oldest in the Federal Government. Initially it served a fairly simple, straightforward purpose: to protect and maintain the navigable capacity of the nation's waters. Changes to the initial legislation and the addition of new legislation have, over time, expanded the noted purpose to include the protection of the Nation's aquatic resources, including wetlands. The COE goal in implementing this program, has been to make authorizing decisions that recognize the rights of the property owner while protecting the interests of the public at large, and to do this in the shortest possible time. Through this program, consultation with state agencies, local agencies, and the public at large, the COE takes into account many factors in determining whether or not to approve projects which impact waters of the United States.**#**

The U.S. Fish and Wildlife Service (USFWS) is charged with the stewardship of the nation's fish and wildlife resources. Although the primary legal focus of USFWS is on federally protected species ("Trust Resources"),the mission of the USFWS is to provide the leadership to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of all citizens.

It is with this mission in mind that the U.S. Fish and Wildlife Service (USFWS) provides input to the regulatory process governing waters and freshwater wetlands. The USFWS reviews, investigates, and cooperates fully in providing ecological advice in the form of comments and recommendations on proposals for federal or federally permitted or assisted activities and developments in or affecting the nation's waters or wetlands. As a reviewer of federal agency actions that affect water resources, the USFWS operates primarily under the authority of the Fish and Wildlife Coordination Act which requires equal consideration of fish and wildlife resources with other project features. The USFWS also fulfills its mandates under Section 7 of the Endangered Species Act by reviewing permit applications to ensure that the continued existence of an endangered or threatened species is not further jeopardized, and/or that critical habitat for such species is not destroyed or adversely modified.**#**

The Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service or SCS) has been and continues to be the leading agency in developing and providing technical advice to farmers and others involved in activities related to soil and water resources throughout the Nation.

The Food Security Act (FSA) of 1985, through the "Swampbuster" provision, prohibits farmers who participate in USDA programs from converting wetlands and then producing an agricultural commodity on the converted wetland. The Food, Agriculture, Conservation and Trade Act (FACTA) of 1990 extended this prohibition such that a violation occurs when a wetland is converted even if an agricultural commodity has not been actually produced. The Food Security Act and the Food, Agriculture, Conservation and Trade Act also state that Prior Converted Cropland areas will <u>not</u> be classified as wetlands for regulation under the Clean Water Act. Through the passage of the above-noted acts, NRCS is now also involved in the delineation of wetlands for farmers participating in the U.S. Department of Agriculture (USDA) programs. Through an agreement with the Corps of Engineers (COE) and the Environmental Protection Agency (EPA), the wetland delineations made by NRCS personnel are accepted for determining jurisdictional wetland boundaries.**#**

Whenever a project is to be undertaken within or near a channel, drain, waterway or tile, the applicant should first check the appropriate local, state, and federal regulations to see what type of permits and approvals may be necessary **before** the work may begin. The types of approvals and number of agencies to deal with will depend on the type of project, the project location, and the general size of the waterbody or channel involved. **A summary of required authorizations and processing methods for specific drainage improvement activities and practices is provided in Section 3.**

This Section will present the general processes, requirements, and procedures for the local, state, and federal agencies that are usually involved in the review of plans for **Drainage Improvement Projects**. Other agencies, such as the Federal Emergency Management Agency (FEMA), may also be involved at the applicant's discretion. There may also be laws and regulations which are not addressed in this handbook but can apply to drainage improvement activities. An example is 327 IAC 15-5 (Known as "Rule 5") which is administered by IDEM, with assistance from IDNR and SWCDs. "Rule 5" requires submission of erosion control plans and implementation of erosion control practices for projects that involve more than five acres of land-disturbing activity.

SECTION 2.2
PERMITS/CODES ADMINISTERED BY LOCAL GOVERNMENTS

2.21 Introduction

This Section addresses regulations and approvals that are most often required at the local level. In many instances, the County Surveyor and/or Drainage Board through a local Drainage Ordinance, must review and approve plans for any project that will affect surface water flows. Through the Indiana Drainage Code, the Drainage Boards and Surveyors also have review and approval authority for most activities within the statutory right-of-entry easement along the County Regulated Drains.

2.22 Permits Required According to Local Ordinances

Local permits or approvals are generally required for most land disturbing activities that will either alter existing land grades or result in increased runoff from a parcel. For **Drainage Improvement Projects** in unincorporated areas, the County Surveyor's Office should be contacted before beginning work to determine if any permits are required. For work within an incorporated city or town, contact the County Surveyor's Office and/or the Engineering or Public Works Department. Regulated Drain maintenance, reconstruction or construction projects undertaken by a County Drainage Board are usually, but not always, exempt from the local permit requirements.

Two laws passed by the 1996 State Legislature have added new duties and responsibilities for the Drainage Boards and County Surveyors. These two similar laws, Senate Enrolled Act (SEA) 336 and House Enrolled Act (HEA) 1277, provide an opportunity for people who feel they are being impacted by problems affecting mutual or private drains as well as an obstruction in any stream or watercourse. The stream or watercourse does <u>not</u> have to be a part of the Regulated Drain system for the County Drainage Board or Surveyor to become involved. The laws provide a process for disputes regarding obstructions to be settled by the County Drainage Board. These laws were incorporated into the Drainage code as a new Section, IC 36-9-27.4.

2.23 Indiana Drainage Code (IC 36-9-27)

<u>Description</u>

The Indiana Drainage Code outlines the duties and responsibilities of the County Drainage Boards. The Code also describes the Regulated Drain-related responsibilities of the County Surveyor.

The Indiana Drainage Code was enacted by the state legislature in 1965 and became effective in 1966. The Drainage Code replaced the former "Legal Drain" program which was usually under the auspices of a County Circuit Court or the County Commissioners. Through the Drainage Code, the County Drainage Boards and the County Surveyors are responsible for the maintenance and operating functions of all Regulated Drains, open and tiled, in the county. Each year, the County Surveyor must report on the condition of each Regulated Drain and, if necessary, recommend maintenance or reconstruction projects to the Drainage Board. The Drainage Boards and Surveyors must also respond to petitions by the public to create or dedicate new Regulated Drains, reconstruct existing Regulated Drains and perform regular maintenance activities.

Right-of-Entry Easement

Section 33 of the Drainage Code describes the right-of-entry easement along all Regulated Drains. Any work within the right-of-entry easement area should be submitted to the Surveyor and/or Drainage Board for review and approval before work on the project begins. The easement is measured at right angles from:

(1) The centerline of a tiled drain; or

(2) The top edge of each bank of an open drain.

The easement extends 75 feet from the above noted points along both sides of a drain, but may be reduced to 25 feet for open drains and 15 feet for tile drains (See Subsection (e) of the Code). Section 33 also states that permanent structures may not be placed within the easement without the written consent of the Drainage Board. Trees, shrubs and woody vegetation may not be planted within the easement area without the written consent of the Drainage Board and may be removed by the Surveyor if necessary for the proper operation of the drain.

Early Coordination Process for Drainage Board Projects

Section 53.5 of the Drainage Code was added by the 1995 Legislature through the passage of Senate Bill 368. This section details a process for pre-application meetings and correspondence between a County Surveyor or County Drainage Board, the IDNR, and IDEM (a representative from the local SWCD may also be involved). Through this process, an on-site field meeting can be held and the regulatory agencies will provide a list of conditions that would appear on a permit or certification for the proposed project. This Section also specifically defines construction from one side of a drain. It must be noted that Section 53.5 deals with Regulated Drain maintenance or reconstruction projects only. However, the process would be appropriate for all drainage improvement projects such as those undertaken by cities and towns, conservancy districts, drainage districts, levee districts, river basin commissions, or private entities. The early coordination process is discussed in detail in Section 2.34 of this handbook.

SECTION 2.3
PERMITS/CODES ADMINISTERED BY IDNR

2.31 Introduction and Definitions

This Section addresses the various laws and rules administered by the Indiana Department of Natural Resources (IDNR). The Indiana General Assembly empowered the IDNR with the responsibility to oversee various construction activities within, over, and/or under the State's waterways through the creation of a number of regulatory programs. For many of these programs, IDNR has subsequently promulgated administrative rules to further define and clarify its authority.

The laws passed by the legislature and subsequent rules promulgated by IDNR have sought to protect the lives and property of individuals and the public and also the existing resources along and within Indiana's waters. The safety of the public at large and impacts to adjoining land owners are taken into account during the technical or engineering review of a proposed project. The integrity of fish, wildlife and botanical resources are also safe-guarded through an environmental review of a proposed project.

In general, the IDNR reviews and approves plans for any work within the floodway of a stream or along the shoreline of a public freshwater lake **before** work on the project may begin. However, many Regulated Drain projects are exempt from the IDNR permit requirements through certain sections of the Flood Control Act (IC 14-28-1) and the Flood Hazard Areas Rule (310 IAC 6-1). If not exempt, more than one regulatory statue may apply to a certain drainage improvement project which could include; Flood Control Act (IC 14-28-1), Lake Preservation Act (IC 14-26-2), Lowering of the Ten Acre Lake Act (IC 14-26-5) (formerly referred to as the “Ditch” Act), Navigable Waterways Act (IC 14-29-1), Sand and Gravel Permits Act (IC 14-29-3), and the Construction of Channels Act (IC 14-29-4). A permit issued under the Flood Control Act will also cover authorization under the Navigable Waterways Act; however, occasionally, more than one permit may be required for the same project. For example, if a project is designed to dredge a waterway that drains more than a square mile and is within one-half (½) mile of a freshwater lake, then two(2) permits will be required, one under the Flood Control Act and one under the Lowering of the Ten Acre Lake Act. The application review process will have included all applicable statutes and rules.

Definitions

The following is a partial listing of terms that have been defined through various statutes and administrative rules specifically for administering the IDNR-related statutes. It should not be assumed that these definitions will always agree with other agency definitions or definitions found in other laws or ordinances. More common terms contained in the IDNR-related statues are contained in Appendix "A": Glossary of Terms.

Adversely affect the efficiency of, or unduly restrict the capacity of, the floodway: an increase in the elevation of the regulatory flood of at least fifteen-hundredths (0.15) of a foot as determined by comparing the regulatory flood elevation under the project condition to that under the base condition. This definition does not apply to a dam regulated under IC 14-27-7 and IC 14-28-1, a flood control project authorized under IC 14-28-1-29 or an area for which a flood easement is secured and recorded with the county recorder.

Base Condition: the condition of the flood plain on January 1, 1973 but without any unauthorized dam or levee. If an activity after December 31, 1972, lowered the regulatory flood profile, the flood plain under the lower profile is the base condition.

Channel: an artificial channel; or the improved channel of a natural watercourse; connecting to any river or stream in Indiana for the purpose of providing access by boat or otherwise to public or private industrial, commercial, housing, recreational, or other facilities.

Cumulative Effects: the impact which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what person undertakes the other actions. Cumulative effects can result from individually minor but cumulatively significant actions taking place over a period of time. Each of the following elements is considered when assessing the impact of cumulative effects within the floodway:

(1) Adverse impacts on the efficiency of or undue restrictions upon the capacity of the floodway.

(2) Unreasonable hazards to the safety of life or property.

(3) Unreasonable detrimental effects upon fish, wildlife or botanical resources.

Floodway: the channel of a river or stream and those portions of the flood plains adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood of any river or stream.

Flood Easement: a right of use over the property of another person acquired to convey or impound floodwater.

Navigable Waterway is defined by rule in 2 parts:

<u>navigable</u> - a waterway which has been declared to be "navigable" or a "public highway" by one or more of the following:

(1) A court.

(2) The Indiana General Assembly.

(3) The United States Army Corps of Engineers.

(4) The Federal Energy Regulatory Commission.

(5) A board of county commissioners under IC 14-29-1-1.

(6) The commission following a completed proceeding under IC 4-21.5.

<u>waterway</u> - a river, stream, creek, run, canal, channel, ditch, lake, reservoir, or embayment

Ordinary High Water Mark: the line on the shore of a waterway established by the fluctuations of water and indicated by physical characteristics. Examples of these physical characteristics include the following:

(1) A clear and natural line impressed on the bank.

(2) Shelving.

(3) Changes in the character of the soil.

(4) The destruction of terrestrial vegetation.

(5) The presence of litter or debris.

Also, the shore of Lake Michigan at five hundred eighty-one and five-tenths (581.5) feet, IGLD, 1985 (five hundred eighty-two and two hundred fifty-two thousandths (582.252) feet, NGVD, 1929).

One-sided Construction: a project involves construction on only one (1) side of a regulated drain if the work is limited to the entire area below the top of the banks and within the drainage easement on one (1) side of the stream or open drain.

Project Condition: the condition of the flood plain with existing structures, obstructions, deposits, excavations, and the project.

Regulatory Flood: the flood having a peak discharge which can be expected to be equaled or exceeded on the average of once in a one hundred (100) year period, as calculated by a method and procedure which is acceptable to and approved by the commission. This flood is equivalent to a flood having a probability of occurrence of one percent (1%) in any given year. The term is also sometimes referred to as the one hundred (100) year frequency flood. "Commission" as used in the definition means the Natural Resources Commission, however, in practice the determination of acceptability is made by IDNR.

Rural Area: an area where the flood protection grade of each residential, commercial, or industrial building impacted by the project is higher than the regulatory flood elevation under the project condition, and where the area lies outside the corporate boundaries of a consolidated city or an incorporated town and outside the territorial authority for comprehensive planning established under IC 36-7-4-205 (b).

Significant Environmental Harm: damage to natural or cultural resources, the individual or cumulative effect of which is found by the Director of IDNR to be obvious and measurable (based upon the opinion of a professional qualified to assess the damage) and which:

(1) creates a condition where recovery of affected resources is not likely to occur within an acceptable period; and

(2) cannot be adequately mitigated through the implementation of a mitigation plan approved by the Director of IDNR.

Total Length: the length of a stream, expressed in miles, from the confluence of the stream with the receiving stream to the upstream extremity of the stream, as indicated by the solid or dashed, blue or purple line depicting the stream on the most current edition of the seven and one-half (7½) minute topographic quadrangle map published by the United States Geological Survey, measured along the meanders of the stream as depicted on the map.

Unreasonable detrimental effects upon fish, wildlife, or botanical resources: damage to fish, wildlife, or botanical resources which is found likely to occur by the Director of IDNR based upon the opinion of a professional qualified to assess the damage and which creates a condition where recovery of the affected resources is not likely to occur within an acceptable period; and cannot be mitigated through the implementation of a mitigation plan approved by the Director of IDNR.

Unreasonable hazard to the safety of life or property: a condition which is likely to be caused by the design or construction of a project and which is likely to result during the regulatory flood in either of the following: the loss of human life or damage to public or private property to which the permit applicant has neither ownership nor flood easement.

2.32 Description

<u>Indiana "Flood Control Act" (IC 14-28-1) and Flood Hazard Areas Rule (310 IAC 6-1)</u>

The Indiana Flood Control Act was passed by the state legislature in 1945. In the Flood Control Act's preamble, the General Assembly declared that "... the loss of lives and property caused by floods and the damage resulting from floods is a matter of deep concern to Indiana affecting the life, health, and convenience of the people and the protection of property." Furthermore, "... the channels and that part of the flood plains of rivers and streams that are the floodways should not be inhabited and should be kept free and clear of interference or obstructions that will cause any undue restriction of the capacity of the floodways."

Within the Flood Control Act, the General Assembly created a permitting program to ensure that "... all flood control works and structures and the alteration of natural or present watercourses of all rivers and streams in Indiana ... be regulated ... according to sound and accepted engineering practices so as to best control and minimize the extent ... and reduce the height and violence of floods ... ." Simply stated, the two (2) fundamental provisions of the Act's regulatory program are:

(1) An abode or place of residence may not be constructed or placed within a floodway.

(2) Any structure, obstruction, deposit, or excavation within a floodway must receive written approval from the Director of the Department of Natural Resources for the work before beginning construction.

The Department's regulatory authority under the Flood Control Act is **limited to the floodway** area produced by the regulatory flood. Many of these floodways throughout the state have been delineated through studies performed for the National Flood Insurance Program (NFIP). These floodway maps are generally available for public inspection in the local plan commission's or building commissioner's office. They are also available in the IDNR Division of Water's office.

Floodways exist for all waterways **even if they have not been mapped**. It should not be assumed that because the floodway of a watercourse is unmapped that the Department does not have any regulatory authority under the Flood Control Act. If a project is proposed in an unmapped area, consultation with the Division of Water staff is advised.

The Flood Hazard Areas rule was promulgated not only for the Flood Control Act but the Floodplain Management Act as well. It contains jurisdictional information, key definitions, project performance standards, and design criteria for specific regulatory exemptions. Several of the rule's sections have not been updated and conflict with the provisions of the Flood Control Act. In these instances the wording in the Act takes precedence over that of the rule.

Indiana "Lowering of Ten Acre Lakes Act" or "Ditch Act" (IC 14-26-5)

The Lowering of Ten Acre Lakes Act states that a person may not "... locate, make, dig, dredge, construct, reconstruct, repair, or reclean ... a ditch or drain having a bottom depth lower than the normal water level of a lake within one-half (½) mile of the lake without a permit from the Department." Additionally, it restricts a person's ability to "... order or recommend the location, establishment, construction, reconstruction, repair, or recleaning" of a ditch and/or drain under the same conditions. The requirements of the "Ditch Act" do not apply to lakes that are less than ten (10) acres in size.

The Act's regulatory program was established to provide safeguards against the lowering of a freshwater lake's water level as the result of a ditch and/or drain activity. Since many of the lakes in northern Indiana are underlain by, and connected to, sand and/or gravel layers, the area of regulatory control extends up to ½ mile landward of the lake shoreline. The penetration of a sand or gravel layer while performing work on a ditch and/or drain could result in a lowering of the lake's level and related environmental damage. The location of the ditch and/or drain with respect to the lake (entering, exiting, under or alongside) has no bearing on the regulatory requirement (see Exhibit 2.3a). Regulated activities typically include: ditch construction and/or reconstruction; tile drain installation and/or repair; and the installation of pipelines having non-watertight joints.

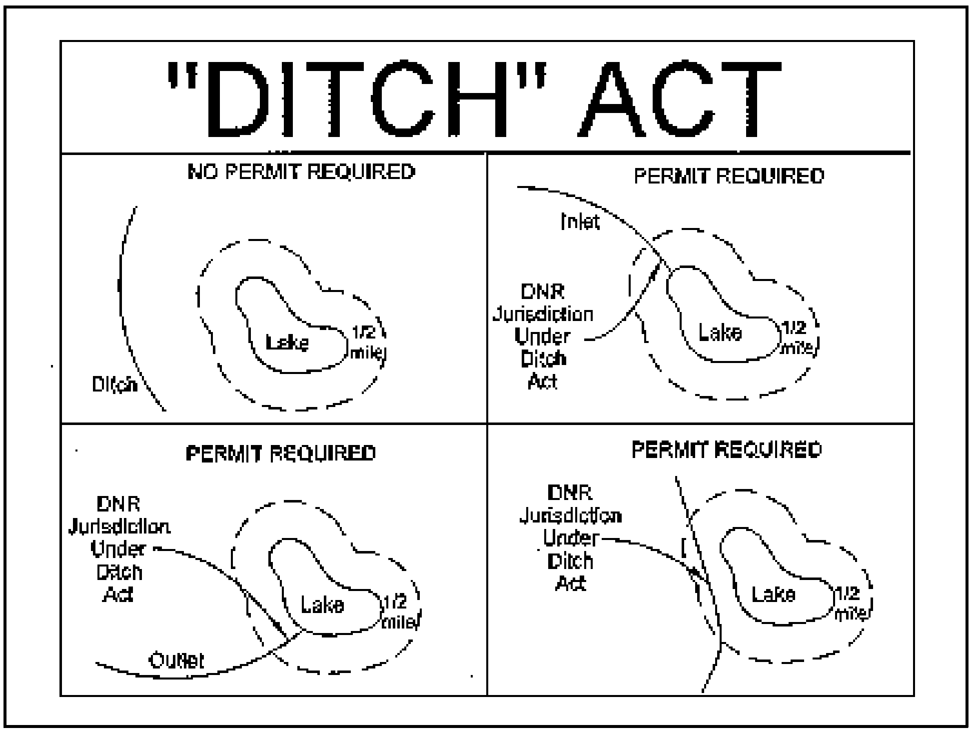

Exhibit 2.3a: IDNR Jurisdiction Limit under the Ditch Act (Source: IDNR)

Other IDNR-Administered Statutes and Rules

There are several other laws and administrative rules that IDNR administers. The most well known of these additional statutes and rules include the Lakes Preservation Act (IC 14-26-2) and the associated Public Freshwater Lakes Rule (312 IAC 11), and the Navigable Waterways Act (IC 14-29-1) and associated Navigable Waterways Rule (312 IAC 6). The IDNR also regulates mineral extraction from navigable streams through the Sand and Gravel Permits Act (IC 14-29-3) and the construction of channels connected to navigable streams through the Construction of Channels Act (IC 14-29-4). However, the vast majority of drainage improvement projects undertaken in Indiana will only involve the Flood Control Act and/or the Lowering of Ten Acre Lakes Act.

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In association with the Public Freshwater Lakes Act, IDNR has developed reviews of many lakes which identify wetland areas along the shores of the lakes. Copies of the "Public Freshwater Lake Wetland Review Maps" are available from the IDNR-Division of Fish and Wildlife. A listing of available review maps is provided in Appendix "E.2". IDNR has also published a roster of declared Navigable Waterways in association with the Navigable Waterways Act. The roster is provided in Appendix "E.3" and can also be obtained at the IDNR Internet address provided in Appendix “E.7."

2.33 Exempt Projects

The Flood Control Act and the Flood Hazard Areas Rule exempt a number projects either as a function of the watershed's physical parameters, by the project type, or through the establishment of jurisdictional limits.

Exemptions Through Jurisdictional Limits

(1) Portions of a project outside of the floodway are not subject to IDNR regulation.

(2) Projects where a waterway's drainage area at the downstream end of the project site is less than 1 square mile (640 acres) are not subject to IDNR regulation.

Primary Exemptions

(1) A reconstruction or maintenance project (as defined in the "County Drainage Code", IC 36-9-27) on an open stream or an open regulated drain, if the total length of the stream or drain is less than or equal to 10 miles (see Exhibit 2.3b).

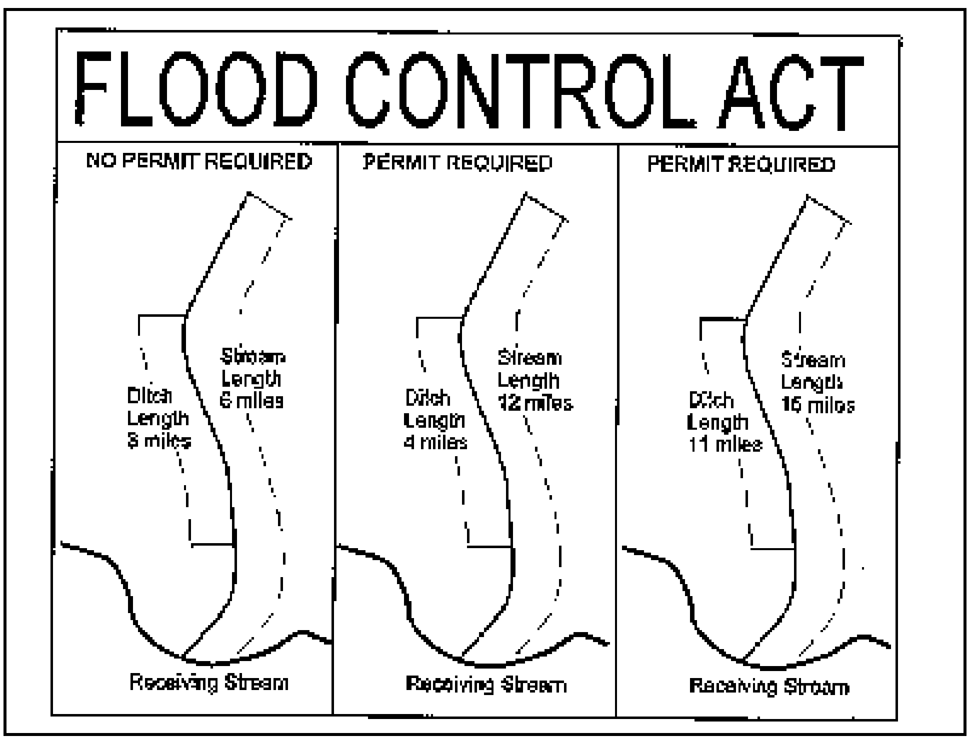

Exhibit 2.3b: Definition of Stream Length with regards to IDNR Permit (Source: IDNR)

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(2) State or county road bridge projects where the drainage area at the bridge structure is less than 50 square miles and the project site is in a rural area.

Other Exemptions

To qualify for any of the following project exemptions, IDNR should be contacted to ensure that the exemption criteria are met.

(1) Utility line crossings and relocation projects.

(2) Obstruction Removal for River and Stream Maintenance (See text of Flood Hazard Areas Rule for additional determinations and specific exemption criteria).

(3) Residential additions and reconstructions (See text of Flood Control Act and Flood Hazard Areas Rule for specific exemption criteria).

(4) Wetland restoration projects (See text of Flood Hazard Areas Rule for additional determinations and specific exemption criteria).

The form to apply for the Obstruction Removal for River and Stream Maintenance exemption is provided in Appendix “E.5" and can also be obtained at the IDNR Internet address provided in Appendix “E.7."

There are currently no exemptions for ditch and/or drain work subject to regulation under the Lowering of Ten Acre Lakes Act.

2.34 Pre-Application Consultation/Early Coordination Process

Before beginning any drainage improvement project, early coordination with IDNR is strongly encouraged by the agency. Pre-application consultation with IDNR can be used to clarify permit requirements, processing procedures, and verify the need for a permit application submittal.

Written comments concerning a project from the IDNR-Division of Fish and Wildlife can be obtained prior to submittal of the official application to IDNR. These comments would be used on the subsequent permit application as long as the project has not been revised. To invoke this Early Coordination process, the applicant must submit a written request to the Division of Fish and Wildlife that includes the following:

(1) Brief project proposal.

(2) Project location on a U.S.G.S. Quadrangle Map.

(3) Drawing of the disturbed area due to the project.

Once a request has been received, the Division will schedule a field meeting with the applicant. The address and phone number of the Division of Fish and Wildlife are included in Appendix "E.7".

SEA 368 Review Process

In addition to the above process, a formal early coordination procedure for Drainage Board projects was established by the creation of Section 53.5 of the Indiana Drainage Code (IC 36-9-

27) in 1995. The IDNR Division of Water refers to this early coordination as the "SEA 368 Review Process." Section 53.5 states that if a reconstruction or maintenance project is subject to regulation under the Flood Control Act, the Lowering of Ten-Acre Lakes Act or requires an Individual Permit under Section 404 of the federal Clean Water Act, the county surveyor or drainage board shall request an on-site field review of the project. The following process is detailed in the law:

(1) The county surveyor or drainage board, through written notification to the IDNR Division of Water, requests an on-site field review meeting. The information that may be included, but not necessarily required, in the written notification is found in Appendix "E.6" (IDNR Sample SEA 368 Request Submittal).

(2) Within 14 days, the Division contacts the surveyor or the surveyor's designee, and the Indiana Department of Environmental Management (IDEM) to determine the date, time and location of the meeting.

(3) The on-site field review is conducted by one or more staff representatives of:

   (a) The county.

   (b) IDNR, including one engineer from the Division of Water.

   (c) IDEM.

   (d) The local Soil and Water Conservation District (SWCD), if applicable.

(4) Within 30 days of the on-site field review, the Division of Water will provide the county with a summary of the review. The summary will include:

   (a) A narrative and map defining the project location.

   (b) A description of the proposed work.

   (c) A list of conditions that IDNR would place on a permit to mitigate any unreasonable or detrimental effects that may occur as a result of the proposed work.

   (d) A list of conditions that IDEM would place on a certification to comply with Section 401 of the federal Clean Water Act, if it is possible to ensure compliance with Section 401 by placing conditions on the certification.

   (e) A list of any other conditions that IDNR and/or IDEM would place on a permit or certification for the proposed project.

(5) The Department of Natural Resources may <u>not</u> require or recommend the following as conditions on a permit for a regulated drain reconstruction or maintenance project:

   (a) Deed restrictions.

   (b) Conservation easements.

   (c) Tree planting or tree retention within the easement of the regulated drain if:

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(A) the project involves construction on only one (1) side of the drain;

(B) vegetation on the opposite overbank will not be disturbed; and

(C) the county agrees to establish a suitably sized vegetated filter strip consisting of grasses and legumes along the side of the drain on which the construction will occur.

(6) If the county surveyor or drainage board are aggrieved by the permit conditions provided in the summary from the Division of Water, the surveyor or board may enter into further negotiations with IDNR and/or IDEM in order to obtain mutually agreeable permit conditions.

(7) If the permit conditions provided in the summary from the Division of Water are acceptable to the county, the conditions are binding upon IDNR and may not be changed by IDNR as long as the permit application(s) for the project are submitted within 2 years of the on-site filed review.

It must be noted that Section 53.5 only affects Regulated Drain maintenance or reconstruction projects.

2.35 Application Requirements

For any application submittal to IDNR, four (4) primary pieces of information must be provided. These items are:

(1) Completed and signed application form with the correct application fee;

(2) Verification of Public Notice;

(3) Site location that includes the parameters of the project; and

(4) Complete project plans.

An application checklist, blank application forms, and application instructions can be found in Appendix "E.1" or on the at the IDNR Internet address provided in Appendix “E.7." The application fee for Construction In A Floodway Applications is $50.00. If a project is also reviewed under the Lowering of Ten Acre Lakes Act, an additional $25.00 fee must be included. There are no additional fees for review under the Navigable Waterways Act.

Also included in Appendix “E.1" is information concerning the public notice requirements. In general, all adjacent property owners to a project site must be notified of their rights to review project plans and be notified of IDNR decisions regarding the project. Proof of notice to the adjacent property owners must be provided before IDNR can finalize its review of the proposed project.

A complete set of plans must also be submitted with every permit application. For most drainage improvement projects, the submitted plans should include a general project boundary map, scaled plan and profile sheets and channel cross-section drawings. Typical cross-sections for specified reaches of the project may be submitted in lieu of detailed cross-sectional information throughout the project length. Details, specifications and information concerning revegetation of disturbed areas, riprap placement, etc., should also be included in the submittal package. Although not required, a detailed project narrative and/or description will also aid in the processing of the application. Applications to IDNR are made through the IDNR Division of Water.

2.36 Overview of the Agency Application Review Process

Review Criteria

As noted earlier, each separate statute contains certain criteria by which a project is judged to be acceptable or not. Conditions may also be added to an authorization in order to bring a project design up to the standards of the criteria noted in the statute.

Flood Control Act: The Flood Control Act places the burden of proving the project's approvability on the applicant. Using the applicant's submitted information, IDNR determines a project's approvability by evaluating both its singular and cumulative impacts against the criteria stipulated in the Act:

(1) whether or not the project will adversely affect the efficiency of, or unduly restrict the capacity of, the floodway;

(2) whether or not the project will constitute an unreasonable hazard to the safety of life or property; and

(3) whether or not the project will result in unreasonably detrimental effects upon fish, wildlife, or botanical resources.

Lowering of Ten Acre Lakes Act: In assessing a project under the Lowering of Ten Acre Lakes Act, IDNR evaluates its impact on "... land, water, lakes, fish, wildlife, and botanical resources that may be affected by the proposed work". This is accomplished through the following criteria:

(1) whether or not the project will endanger the lake level; and

(2) whether or not the project will result in unreasonably detrimental effects upon fish, wildlife, or botanical resources.

Navigable Waterways Act: If a project subject to permit under the Flood Control Act is also located within a navigable waterway, it does not require a separate permit under the Navigable Waterways Act since the Navigable Waterways Act evaluation criteria are applied during the project review as well. In these cases, the following criteria must also be assessed:

(1) whether or not the project will unreasonably impair the navigability of the waterway;

(2) whether or not the project will cause significant harm to the environment; and

(3) whether or not the project will pose an unreasonable hazard to life or property.

General Public Notice

All permit applications submitted to IDNR, although already noticed to the adjoining property owners to the project site by the applicant, must be placed on a general public notice upon receipt by the agency. This latter general public notice is conducted by IDNR staff, not the applicant. Unless an emergency has been declared by the Director of IDNR, an application cannot be acted

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upon until 30 days (from the date of the general public notice) has elapsed. At any time during the review process by the agency, a public hearing may be requested by the public if the provisions under 312 IAC 2-3 have been satisfied.

Inter-Department Consultation

For drainage improvement projects reviewed under the auspices of the Flood Control Act and/or the Lowering of Ten Acres Lakes Act, a two-part, simultaneous review takes place. One aspect of the review involves the project's impact upon the efficiency of, or the capacity of the floodway. This hydraulic assessment of possible impacts on the floodway also takes into consideration the project's potential to create an unreasonable hazard to the safety of life or property upstream or downstream of the project site. This portion of the project review is performed by staff of the Division of Water. By their nature, drainage improvement projects do not normally adversely impact the efficiency or capacity of the floodway, as long as any excavated material is disposed of properly. If a proposed project includes building "spoil banks" along the top-of-banks of a channel, or includes channel relocation, bridge/culvert crossings, or other types of control structures, the review time will be increased and hydraulic modelling may be required by the applicant or IDNR.

The second aspect of the project review by IDNR involves the proposed project's environmental impacts. This portion of the project review is undertaken by staff of several IDNR Divisions and coordinated by a staff member of the Division of Fish and Wildlife. The Divisions involved in the project review and their areas of expertise are given below:

(1) ***Division of Soil Conservation*** - reviews project plans to determine if proper soil conservation practices are being incorporated into the design to reduce sedimentation of waterways or adjoining properties.

(2) ***Division of Outdoor Recreation*** - reviews project sites to determine if recreational sites developed with Land and Water Conservation Fund grants will be impacted. The Outdoor Recreation Division also informs Division of Fish and Wildlife if project will occur along one of Indiana's listed Scenic Waterways (see Appendix "E.4").

(3) ***Division of Nature Preserves*** - reviews project sites against the Natural Heritage Database for reports of endangered, threatened or specially listed plant or animal species. This information is forwarded to the Division of Fish and Wildlife.

(4) ***Division of Forestry*** - reviews project plans for impacts to Indiana's hardwood resources.

(5) ***Division of Fish and Wildlife*** - receives information noted above from other IDNR Divisions and conducts field inspections to make determination of whether or not the project will result in unreasonably detrimental effects upon fish, wildlife, or botanical resources. The Fish and Wildlife Division also utilizes "National Wetland Inventory (NWI) Maps" and the "Public Freshwater Lake Wetland Review Maps" for those lakes listed in Appendix "E.2" as tools in their evaluation.

If the project will occur along a Navigable Waterway, two additional Divisions of the IDNR become involved in the project review. These Divisions and their responsibilities are:

(1) ***Division of Law Enforcement*** - reviews project plans to determine impacts upon navigability and boater safety.

(2) ***Division of Historic Preservation and Archaeology*** - reviews project plans and site to determine if any known historical, architectural, or archaeological sites listed in or eligible for inclusion in the National Register of Historic Places will be impacted by the proposed project.

Under current procedures, it is the joint responsibility of the Divisions of Water and Fish & Wildlife to ensure that a project will not cumulatively impact the efficiency of or unduly restrict the capacity of the floodway; cause unreasonably detrimental effects upon fish, wildlife or botanical resources; or constitute an unreasonable hazard to the safety of life or property.

Final Processing

Once the environmental review has been completed, final comments are then combined with the hydraulic review results and the final authorization documents are presented to the Director of the Division of Water for approval. If a public hearing through the IDNR has been held, the transcript of this proceeding is included in the final documents presented to the Division of Water Director. Final approval documents will include specific and general permit conditions and information concerning appeal procedures.

2.37 Procedures for Timely Access to IDNR Regulatory Personnel

All initial calls to the IDNR Division of Water are answered by the Customer Service Center. An in-state toll free number to the Division is provided in Appendix “E.7.” Once an application has been submitted, a distinct number is assigned to that application for tracking and identification. Within the Division of Water, public notice, tracking of status, and other administrative duties relating to the final processing of an application is the responsibility of the Technical Service Center. An application is assigned to a particular technical staff person, and all administrative and technical questions related to that application may be addressed by that individual. Callers should refer to the application by number when calling the Division. A listing of IDNR personnel, addresses, phone numbers, fax number and IDNR-Division of Water Internet address is included in Appendix "E.7".

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SECTION 2.4
PERMITS/CODES ADMINISTERED BY IDEM

2.41 Introduction

The Indiana Department of Environmental Management (IDEM) has been designated as the water pollution control agency for the State of Indiana. The Commissioner of IDEM has the authority to prevent any pollution that is determined to be unreasonable and against the public interest in view of the conditions in any stream or any waters of the state. As the water pollution control agency for the state, IDEM is responsible for providing certification for discharges of dredged or fill material according to Section 401 of the Clean Water Act (33 U.S.C. 1341). Without Section 401 Water Quality Certification (WQC) or a waiver of certification, a permit may not be issued under Section 404 of the Clean Water Act (33 U.S.C. 1344).

For purposes of water pollution control laws and environmental management laws, **"Waters" (of the State) are defined as:** The accumulations of water, surface and underground, natural and artificial, public and private, or a part thereof, that are wholly or partially within, flow through, or border upon Indiana. The term does not include a private pond or an off-stream pond, reservoir, or facility built for reduction or control of pollution or cooling of water before discharge unless the discharge from the pond, reservoir, or facility causes or threatens to cause water pollution.

2.42 Description

Indiana's Water Quality Standards (Standards) are applied through the Section 401 WQC process for Section 404 approvals. In general, if a project requires a Section 404 permit from the COE, Section 401 WQC is required by IDEM. The Standards are the "measuring stick" for determining if a proposed project or activity will adversely impact the quality of the waters of the State.

Section 401 of the Clean Water Act (33 U.S.C. 1341)
Section 404 of the Clean Water Act (33 U.S.C. 1344) requires an individual to obtain a permit from the U.S. Army Corps of Engineers (COE) for dredging and filling in "Waters of the United States," which includes wetlands. Section 401 of the Clean Water Act requires the individual to obtain certification from the state that the discharge of the dredge or fill material will not violate the water quality standards of the state. As stated previously, approval under Section 404 cannot occur until Section 401 WQC has been obtained or waived by IDEM. Under Section 401, the water pollution control agency for a state must act on a certification request within a reasonable time, not to exceed one year. For IDEM, this "reasonable time" has been set as 60 days from the receipt of a complete application.

Indiana Water Quality Standards (327 IAC 2)
The Standards include policies of maintenance of existing uses and non-degradation of water quality in waters of the State. IDEM's granting of Section 401 WQC to an applicant indicates that a proposed project will comply with the Standards. Section 401 of the Clean Water Act also provides that compliance with the Standards may include limitations, conditions or any other provisions on the certification which are deemed necessary by IDEM to assure that the Standards will not be violated.

The Standards also include several lists of streams. Portions of 4 streams, the Indiana portion of Lake Michigan, and all waters incorporated in the Indiana Dunes National Lakeshore have been designated as State Resource Waters. The Standards also list Designated Salmonid Streams in Indiana and Exceptional Use Streams. These stream listings are given in Appendix "F.2".

Jurisdictional Limits

If a permit or authorization is not required from COE under Section 404 of the Clean Water Act, then 401 WQC from IDEM is not required. Section 5 of the Indiana Water Quality Standards provides the limits to which the Standards are applied. The Standards cease to be applicable when stream flows are less than the average minimum 7 consecutive day low flow which occurs once every 10 years ($7Q_{10}$).

2.43 Exempt/Waived Projects

As will be discussed in Section 2.5, most Section 404 authorizations are grouped either under "Individual Permit" (IP) or under "Nationwide Permit" (NWP). Many, but not all, of the activities covered under a COE Nationwide Permit have been granted a blanket Water Quality Certification by IDEM. (A complete listing of the COE NWP's can be found in Appendix "G.2"). However, several categories of Nationwide Permits have not been given a blanket Water Quality Certification by IDEM.

If IDEM has not given a blanket WQC for a particular NWP, then an individual WQC from IDEM will be necessary. The COE will normally inform the applicant if the project needs an individual WQC. The applicant may also request a list of the NWPs for which IDEM has granted blanket certification and NWPs that IDEM has certified with special conditions. Appendix “F.3" is a copy of an IDEM letter, dated February 8, 1997, in which IDEM’s decision on each of the 39 Nationwide Permits (issued by the COE in December 1996) is listed. Any project which will be processed by the COE as an Individual Permit (IP) requires an individual Section 401 WQC from IDEM.

2.44 Pre-Application Consultation/Early Coordination Process

IDEM encourages applicants to contact its appropriate personnel before they apply for certification in order to discuss the various aspects of a project. A pre-application meeting is a good way to find out what concerns IDEM may have, what aspects of the project may be changed in order to avoid or minimize impacts, and what type of mitigation may be required in order to receive WQC. Pre-application meetings often help avoid delays during the review process. Additionally, IDEM staff participate in the early coordination process mentioned in Section 2.2 of this Handbook and described in detail in Section 2.3. Additional information pertaining to the Section 401 WQC program can be found on the at the IDEM Internet address provided in Appendix “F.4."

2.45 Application/Permit Requirements

As stated above, any project which will be processed as an Individual Permit by the COE for Section 404 review and activities under the NWP's listed in Section 2.5 require Section 401 WQC. Applications for Section 401 WQC must be submitted on the Section 401 WQC Application Form attached as Appendix “F.1".

2.46 Overview of the Application Review Process by the Agency

In general, IDEM has 60 calendar days to review a given 401 WQC application and render a decision to either grant, deny, or waive WQC. Failure to respond within the 60 day timeframe will typically result in automatic waiver by IDEM, unless the COE extends the period of review. IDEM may request an extension of time for review, but it is at the COE's discretion as to whether an extension is permissible, and if so, for how long.

The 60-day review period for Individual Permits starts on the date of issuance of the public notice by the COE, which is also the start date for the 30-day comment period (Note that the 401 WQC is not a comment to the COE and therefore not restricted to the 30 day period). All Nationwide Permit-related applications or notifications are reviewed within 60 calendar days from the date of the start of the IDEM Public Notice, unless additional time is granted by the COE. If IDEM determines that the application is incomplete, the application will be held until the necessary information is required and the timeframe will not begin until the date the requested information is received.

IDEM is required to public notice all applications for WQC. For COE Individual Permits, a Joint Public Notice is mailed out by the COE. For all Nationwide Permits, IDEM sends a copy of the Public Notice to all adjacent property owners and individuals/organizations that have requested to receive copies of the Public Notice. There is typically a 21-day response time for the public to submit written comments to IDEM. IDEM considers all written comments pertaining to water quality during the project review. An individual/organization may request a public meeting or public hearing to present information relevant to water quality.

The review of an application for 401 WQC typically involves the review of the submitted information, a site inspection by a project manager, and possibly consultation with other regulatory agencies. During the site inspection, the quality of the water resource is evaluated with regards to the plant and animal species present and using the resource. Using the Minimum Surface Water Quality Standards (Section 6 of 327 IAC 2) as a guide, IDEM determines whether or not the proposed project will degrade the quality of the water at the site. If degradation of the water quality can be eliminated (or minimized to a reasonable level) by mitigation or plan revisions, these items will be recommended in order to avoid denial of WQC.

2.47 Procedures for Timely Access to IDEM Regulatory Personnel

Within the IDEM Water Quality Standards Section of the Planning Branch, 4 Project Managers have been assigned to separate portions of the State, along with a 401 Administrator and a staff person dedicated to monitoring mitigation sites. Each project manager can be contacted for information regarding either a future project in his/her section or the current status of the review of a project in that section. A diagram of the State and a county listing for the project managers is included in Appendix "F.4". A listing of IDEM personnel, addresses, phone numbers, fax number and IDEM’s Internet address is also included in Appendix "F.4".

SECTION 2.5
PERMITS/CODES ADMINISTERED BY COE

2.51 Introduction and Definitions

The U.S. Army Corps of Engineers (COE) was granted regulatory authority in accordance with two federal laws, Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344). The following material is based upon a review of current available information regarding these regulations and their associated rules, guidelines, and policy documents pertaining to drainage improvement activities. Further information regarding this subject may be found by directly contacting the COE. One good source of information regarding this subject is the "South Carolina's Developer's Handbook for Freshwater Wetlands", dated July 1995. Pertinent material and text from the latter source has been extensively utilized in the preparation of the material presented in this section.

COE has been involved in the regulation of the nation's water resources since the 1890's. Until 1968, the primary thrust of the COE regulatory program was the protection of navigation. As a result of several laws and judicial decisions, the regulatory program has been broadened to include the regulation of dredged or discharged materials into all "Waters of the United States." Through Section 404 of the Clean Water Act, consultation with other federal agencies and the public at large, the COE takes into account many factors in determining whether or not to approve projects which impact either navigation or waters of the United States. The goal in implementing this program has been to make authorizing decisions in the shortest time possible that recognize the rights of property owners while protecting the interests of the public at large.

The following terms and definitions are used throughout this particular Section of the Handbook. These terms may be defined differently in another section describing a separate state or federal regulatory program. Thus, care should be taken to utilize these specific terms only for COE-related purposes.

Activities: structures and/or work within a navigable water of the United States.

Headwaters: non-tidal rivers, streams, lakes and their impoundments, including adjacent wetlands, that are part of a surface tributary system to an interstate or navigable water of the United States upstream of the point of the river or stream at which the average annual flow is less than five (5) cubic feet per second.

Discharge of Dredged Material: any addition of dredged material into, including any redeposit of dredged material within, the waters of the United States. The term includes, but is not limited to, the following:

(1) The addition of dredged material to a specified discharge site located in waters of the United States.

(2) The runoff or overflow from a contained land or water disposal area.

(3) Any addition, including any redeposit of dredged material, including excavated material, into waters of the United States that is incidental to any activity, including mechanized land clearing, ditching, channelization, or other excavation.

Navigable Waters of the United States: those waters subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past or may be susceptible to use to transfer interstate or foreign commerce. A listing of COE-recognized Navigable Waters of the United States in Indiana is provided in Appendix "G.3".

Ordinary High Water Mark: that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Waters of the United States: the term "Waters of the United States" means:

(1) All waters which are currently used or were used in the past or may be susceptible to use to transfer interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.

(2) All interstate waters including interstate wetlands.

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams) mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

    (a) Which are or could be used by interstate or foreign travelers for recreational or other purposes.

    (b) From which fish or shell fish are or could be taken and sold in interstate or foreign commerce.

    (c) Which are used or could be used for industrial purpose by industries in interstate commerce.

(4) All impoundments of waters otherwise defined as waters of the United States under the definition.

(5) Tributaries of waters identified in items (1) through (4) of this definition.

(6) The territorial seas.

(7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6) noted above.

Wetlands: those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

2.52 Description

There are two main federal laws from which the COE derives its regulatory powers and authority: the Clean Water Act and the Rivers and Harbors Act. The specific regulatory sections of these laws, their associated federal rules and other related information is described below.

Section 404 of the Clean Water Act (33 U.S.C. 1344) and Regulatory Program Rules (33 CFR 320-330)

Section 404 of the Clean Water Act authorizes the COE to issue permits, after notice and opportunity for public hearing, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. The selection of the disposal sites will be in accordance with guidelines developed by the Administrator of the Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. Furthermore, the Administrator of the EPA can deny, prohibit, restrict or withdraw the use of any defined area as a disposal site whenever the Administrator determines, after notice and opportunity for public hearing and after consultation with the Secretary of the Army, that the discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas.

Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) and Regulatory Program Rules (33 CFR 320-330)

Section 10 of the Rivers and Harbors Act prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water of the United States, the excavating from or depositing of materials in such waters, or the accomplishment of any other work affecting the course, location condition, or capacity of such waters must receive the prior approval of the COE.

Activities Requiring COE Approval

The following activities specified in 33 CFR Parts 320 - 330, that may be associated with drainage improvement projects, normally require a Department of the Army (DA) permit:

- Dikes and/or dams in navigable waters of the United States.

- Structures and/or work in or affecting navigable waters of the United States.

- The discharge of dredged or fill material into waters of the United States.

- Structures or work outside the limits of navigable waters of the United States, if these activities affect the course, location, or condition of the waterbody in such a manner as to impact on its navigable capacity.

- A canal or other artificial waterway is subject to regulation if it constitutes a navigable water of the United States, or if it is connected to navigable waters of the United States in a manner which affects their course, location, condition, or capacity, or if at some point in its construction or operation it results in an effect on the course, location, condition, or capacity of navigable waters of the United States.

- The connection to navigable waters of the United States.

- If any discharge of dredged or fill material resulting from the exempted activities listed in 33 CFR Part 323.4 paragraphs (a)(1) through (6) contains any toxic pollutant listed under

Section 307 of the Clean Water Act such discharge shall be subject to any applicable toxic effluent standard or prohibition, and requires a Department of the Army permit.

- Any discharge of dredged or fill material into waters of the United States incidental to any of the exempted activities identified in 33 CFR Part 323.4 paragraphs (a)(1) through (6) must have a Department of the Army permit if it is part of an activity whose purpose is to convert an area of the waters of the United States into a use to which it was not previously subject, where the flow or circulation of waters of the United States may be impaired or the reach of such waters reduced. Where the proposed discharge will result in significant discernible alterations to flow or circulation, the presumption is that flow or circulation may be impaired by such alteration. For example, a permit will be required for the conversion of a cypress swamp to some other use or the conversion of a wetland from silvicultural to agricultural use when there is a discharge of dredged or fill material into waters of the United States in conjunction with construction of dikes, drainage ditches or other works or structures used to effect such conversion. A conversion of a Section 404 wetland to a nonwetland is a change in use of an area of waters of the United States. A discharge which elevates the bottom of waters of the United States without converting it to dry land does not thereby reduce the reach, but may alter the flow or circulation of waters of the United States.

2.53 Processing Methods

This section addresses the various procedures involved in obtaining approval for work that impacts waters of the United States, which includes wetlands. The procedures involved depend on where the project is located, the type of work proposed, and the size of the area affected by the work. There are basically three processes that may be used, the Individual Permit process, the General Permit process, and Letters of Permission process. These three processes are described in detail below.

Individual Permits

An Individual Permit is a Department of the Army authorization that is issued following a case-by-case evaluation of a specific project in accordance with the procedures of the applicable regulations and 33 CFR Part 325, and a determination that the proposed structure or work is in the public interest pursuant to 33 CFR Part 320. In general, if a project involves one or more of the activities which require permits (e.g. fill in U.S. waters) and, one or more of those activities is not exempted and does not qualify for authorization under a General Permit, then an Individual Permit will be required.

General Permits (Nationwide and/or Regional)

A General Permit (GP) means a Department of the Army authorization that is issued on a nationwide or regional basis for a category or categories of activities. This refers to both those permits issued by District or Division Engineers on a regional basis and to Nationwide Permits which are issued by the Chief of Engineers through publication in the Federal Register.

Regional Permits are a type of General Permit. They may be issued by a Division or District Engineer. The issuing authority will determine and add appropriate conditions to protect the public interest. When the issuing authority determines on a case-by-case basis that the concerns for the aquatic environment so indicate, the authority may exercise discretionary authority to override the Regional Permit and require an individual application and review. No Regional Permit can be issued for a period of more than five years.

Nationwide Permits are a type of General Permit issued by COE Headquarters on a nationwide basis. If certain terms and conditions are met, the specified activities can take place without the need for an individual or regional permit. NWPs must be certified by certain agencies in each state before they take effect in the state (see previous Section 2.43 of this Handbook for those NWP's which IDEM has not waived 401 WQC). As stated in 33 CFR 330.6(d)(2), NWPs do not apply, even if a portion of the project is not dependent on the rest of the project, when any portion of the project is subject to an enforcement action by the COE or Environmental Protection Agency.

Several NWP's require advance notification to the COE before commencement of the proposed activity may begin (see Section 2.57 of this Handbook for a listing of these NWP's). The permittee may presume that the project qualifies for the NWP unless the COE responds within 30 calendar days of the receipt of the notification. The prospective permittee may not proceed with the proposed activity before expiration of the 30-day period unless otherwise notified by the COE. The COE may add conditions to ensue compliance with the terms and conditions of the NWP. For some NWP's, the required notification must also contain a wetland delineation.

The NWPs are periodically reviewed, modified, or reissued by COE Headquarters. The current schedule calls for such reconsideration every five years. However, this schedule is subject to change at any time. Persons pursuing activities under the authority of a NWP should make themselves informed of the current status and conditions of the NWP. Activities affecting waters of the United States which do not qualify for one or more GPs may require an Individual Permit. A list of the issued Nationwide Permits and their conditions is provided in Appendix "G.2" (33 CFR 330).

Letters of Permission

Letters of permission are a type of permit issued through an abbreviated processing procedure which includes coordination with federal and state fish and wildlife agencies and a public interest evaluation, but without publishing of an individual public notice. Those activities subject to Section 10 of the Rivers and Harbors Act or Section 404 of the Clean Water Act may be authorized using this process provided the procedures in 33 C.P.R. 325.2(e) I and ii are completed.

2.54 Exempt Projects

When Congress approved the Clean Water Act, it included in the law exemptions for certain activities. Exemptions were written into the law to allow discharges associated with those specific activities to proceed without having to obtain a federal permit pursuant to Section 404. Exemptions have also been determined for projects that might ordinarily be subject to review under Section 10 of the rivers and Harbors Act. The authority for determining whether an activity is exempt rests with both the COE and the EPA. Anyone that believes that an activity they are proposing to undertake is exempt should contact the COE to confirm that the work meets the terms of the relevant exemption before proceeding. Although such verification is not required, it is strongly recommended for all activities with more than minimal impacts to waters of the United States.

Projects Exempt From Section 404 of the Clean Water Act

The following listed activities given in 33 CFR Parts 320 - 330 are exempted from Department of the Army permit requirements under Section 404 of the Clean Water Act. However, if the activity involves a structure or work in or affecting navigable waters of the United States, a permit may be required under Section 10 of the Rivers and Harbors Act of 1899.

1. Normal farming, silviculture and ranching activities such as plowing, seeding, cultivating, minor drainage, and harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices. To fall under this exemption, the activity must be part of an established (i.e., ongoing) farming, silviculture, or ranching operation and must be in accordance with the definitions given in 33 CFR Part 323.4. Activities on areas lying fallow as part of a conventional rotational cycle are part of an established operation. Activities which bring an area into farming, silviculture, or ranching use are not part of an established operation. An operation ceases to be established when the area on which it was conducted has been converted to another use or has lain idle so long that modifications to the hydrological regime are necessary to resume operations.

2. Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.

3. Construction or maintenance of farm or stock ponds or irrigation ditches, or the maintenance (but not construction) of drainage ditches. Discharges associated with siphons, pumps, headgates, wingwalls, weirs, diversion structures, and such other facilities as are appurtenant and functionally related to irrigation ditches are included in this exemption. A drainage ditch is considered to be an entirely man-made channel. As interpreted by COE, **a rechannelized or modified natural channel or a constructed channel that replaces a natural channel are not considered drainage ditches.**

4. Construction of temporary sedimentation basins on a construction site which does not include placement of fill material into waters of the United States. The term "construction site" refers to any site involving the erection of buildings, roads, and other discrete structures and the installation of support facilities necessary for construction and utilization of such structures. The term also includes any other land areas which involve land disturbing excavation activities, including quarrying or other mining activities, where an increase in the runoff of sediment is controlled through the use of temporary sedimentation basins.

5. Any activity with respect to which a State has an approved program under Section 208(b)(4) of the Clean Water Act which meets the requirements of Sections 208(b)(4)(B) and (C).

6. Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment, where such roads are constructed and maintained in accordance with best management practices to assure that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. These best management practices which must be applied to satisfy this provision shall include those detailed best management practices described in the State's approved program description pursuant to the requirements of 40 CFR Part 233.22(I), and shall also include the baseline provisions given in 33 CFR Part 323.4.

T.O.C.

7. Federal projects which qualify under the criteria contained in Section 404(r) of the Clean Water Act are exempt from Section 404 permit requirements, but may be subject to other state or federal requirements.

Exceptions To Exemptions Under The Clean Water Act

Any discharge of dredged or fill material resulting from the activities listed above in paragraphs (1) through (6) containing any toxic pollutant listed under Section 307 of the Clean Water Act requires a Section 404 permit.

In addition, any discharge of dredged or fill material into waters of the United States incidental to any of the activities identified above in paragraphs (1) through (6) must have a permit if it is part of an activity whose purpose is to convert an area of the waters of the United States into a use to which it was not previously subject, where the flow or circulation of waters of the United States may be impaired or the reach of such waters reduced. Where the proposed discharge will result in significant discernible alterations to flow or circulation, the presumption is that flow or circulation may be impaired by such alteration. For example, a permit will be required for the conversion of a wetland from silvicultural to agricultural use when there is a discharge of dredged or fill material into waters of the United States in conjunction with construction of dikes, drainage ditches or other works or structures used to effect such conversion.

Projects Exempt From Section 10 of the Rivers and Harbors Act

The following listed activities given in 33 CFR Parts 320 - 330 are exempted from Department of the Army permit requirements under Section 10 of the Rivers and Harbors Act of 1899. However, if the activity involves the discharge of dredged or fill material into waters of the United States, a Department of the Army permit may be required under Section 404 of the Clean Water Act.

1. Activities commenced or completed shoreward of established federal harbor lines before May 27, 1970.

2. Construction of wharves and piers in any waterbody, located entirely within one state, that is a navigable water of the United States solely on the basis of its historical use to transport interstate commerce.

Grandfathered Nationwide Permits

The following activities were permitted by NWPs issued on July 19, 1977, and unless modified, do not require further permitting:

1. Discharges of dredged or fill material into waters of the United States outside the limits of navigable waters of the United States that occurred before the phase-in dates which began July 25, 1975, and extended section 404 jurisdiction to all waters of the United States. (These phase-in dates are: After July 25, 1975, discharges into navigable waters of the United States and adjacent wetlands; -after September 1, 1976, discharges into navigable waters of the United States and their primary tributaries, including adjacent wetlands, and into natural lakes, greater than five acres in surface area; and after July 1, 1977, discharges into all waters of the United States). (Section 404)

2. Structures or work completed before December 18, 1968, or in waterbodies over which the District Engineer had not asserted jurisdiction at the time the activity occurred provided, in both instances, there is no interference with navigation (Section 10).

T.O.C.

2.55 Pre-Application Consultation/Early Coordination Process

For projects with potentially significant or controversial impacts, it may be advisable to present your project to the permitting and certifying agencies prior to submittal of an application for an Individual Permit. The COE district offices have established local procedures and policies including appropriate publicity programs which will allow potential applicants to contact the COE office to request pre-application consultation. Upon receipt of such request, the office will assure an orderly process which may involve other staff elements and affected agencies and the public. This early coordination process is brief but thorough so that the potential applicant may begin to assess the viability of some of the more obvious potential alternatives in the application. The office will endeavor, at this stage, to provide the potential applicant with all helpful information necessary in pursuing the application, including factors the office must consider in its permit decision making process. Applicants are strongly encouraged to request pre-application meetings as early and as often as needed by calling the district office having jurisdiction over the proposed site by contacting either the Louisville or the Detroit District offices at the phone numbers/addresses listed in Appendix "G.4".

2.56 Application Requirements

The processing of permit applications may vary depending on whether or not the project will be considered for Individual or General Permit. Therefore, the information necessary to review a project and its potential impacts also varies. The information requirements for Individual and Nationwide Permits is described below. A COE application package is contained in Appendix "G.1".

<u>Individual Permits</u>
For Individual Permit applications, the following items, at a minimum, are required:

(1) A completed application form.

(2) The name and address of the applicant.

(3) The location, purpose, intended use and need for the proposed activity.

(4) The names and addresses of adjoining property owners.

(5) The location and dimensions of adjacent structures.

(6) Scheduling of the activity.

In greater detail, the following information is generally required for the processing of an Individual Permit. Information relating to all of the items listed below may not be available or pertinent to a specific project. However, a more complete and organized application package will facilitate the review of the submitted material.

Authorizations: A list of other government authorizations obtained, requested, or required from other federal, interstate, state, or local agencies, including all approvals received or denials already made.

Signature: The application must be signed by the person who desires to undertake the proposed activity (i.e. the applicant) or by a duly authorized agent. When the applicant is represented by an agent, that information must be included on the application or by a separate written statement. An application may include the activity of more than one owner provided the character of the activity of each owner is similar, in the same general area, and each owner submits a statement designating the same agent.

Maps: A location map showing the site of the proposed activity must be furnished. The site must be clearly marked and shown relative to the nearest major waterways, roads, and cities in the area. The source and date of the map used must be written on the map. Maps are considered drawings and must conform to the general requirements given for drawings (i.e., 8 ½" x 11" paper, no coloring, title block, etc.). Maps must have a title block similar to other drawings and must be included in the drawing numbering scheme (i.e., sheet _ of _). Do not provide large size maps. A copy of a portion of a large map is acceptable. Acceptable map sources include United States Coast and Geodetic Survey Charts, United States Geological Survey Maps, other federal, state or county maps or charts available to the public.

General Drawing Requirements: A complete description of the proposed activity is required, including drawings sufficient for public notice. Detailed engineering plans and specs are not required. Drawings must meet the following requirements:

(1) Plans must be drawn with dark pencil or black ink on 8 ½" x 11" paper. Leave at least a ½" unused border area on each sheet. All drawings and writings must be clear, readable, and reproducible using standard (non-color) office copy machines. Do not duplex drawings.

(2) Drawings must be in black and white only. Do not use colored inks or pencils. Instead use shading, hatching, or other annotated graphic symbology.

(3) Drawings should not show the approval, comments, or action of any government agency.

(4) A title block is required for each drawing sheet (including maps). The title block must include the applicant's name, project name, project location, drawing date, drawing number (i.e., sheet _ of _, and sufficient unused space for future revision dates and a 12 digit file number.

(5) Drawings must have all relevant dimensions shown for each view. In addition, it is desirable that a graphic drawing scale be shown. Do not use ratio scales (i.e.,1" = 80') on reduced plans because ratio scaling will give inaccurate information on the reduced copy.

Plan View and Cross-Section View Drawing Requirements: Plan and elevation drawings are required showing the general and specific site location and character of all proposed activities, including the size relationship of the proposed structures to the size of the impacted waters and depth of water in the area. The drawings must include the following information:

(1) Plan and cross section views for each work, structure, fill, and excavation proposed.

(2) Existing and proposed ground contours must be shown on each cross-section view.

(3) Any existing marsh or wetland areas within the project boundaries or impacted by the work must be delineated on the plans.

(4) Each proposed structure, work, fill, or excavation must be clearly shown and located with respect to either a plat line or some fixed immovable object.

(5) Disposal areas for all dredged or fill material must be shown. Cross hatching or shading and appropriate notes must clearly show these areas.

(6) Any proposed or existing retaining structures (e.g. embankments, bulkheads) for dredged or fill material must be shown.

(7) Property boundaries and names of adjacent property owners must be shown on the plans.

(8) The existing and proposed water depths and land elevations must be shown relative to the nearby mean low water contour or elevation.

(9) The mean low water and mean high water contours must be shown on all views.

(10) In non-tidal waters, contour and datum elevation references must be shown as follows:

(a) In federally navigable waters, existing and proposed water depths and land elevations must be shown relative to mean sea level.

(b) In federally non-navigable waters, existing and proposed water depths and land elevations may be shown relative to the nearby ordinary high water contour, or to mean sea level.

(c) In rivers and streams, the ordinary high water contour must be shown on all views. Also, the direction of flow must be shown.

(d) In lakes, the normal high water level of the lake must be shown on the plans.

(11) For projects which encroach upon or lie adjacent to a site on which the federal government has an easement to either deposit dredged material or excavate to improve channel operations, the drawings must clearly show the extent of encroachment or indicate if none is intended.

Dredging: For dredging in navigable waters of the United States, the application must include the method of dredging, the site and plans for disposal of the dredged material and a description of the type, composition and quantity of the material to be dredged.

Fills and Platforms: For construction of a filled area or platform supported by piles or floats, the project description must include the use of the fill or platform and specific structures to be erected on the fill or platform.

Discharges: For the discharge of dredged or fill material into waters of the United States the application must include:

(1) The source of the material.

(2) The purpose of the discharge.

(3) A description of the type, composition and quantity of the material.

(4) The method of transportation and disposal of the material.

(5) The location of the disposal site.

Impoundment Structures: For activities involving the construction of an impoundment structure, the applicant must demonstrate that the structure complies with established State dam safety criteria or that the structure has been designed by qualified persons and independently reviewed (and modified as the review indicates) by similarly qualified persons. No specific design criteria will be prescribed nor will an independent detailed engineering review be made by the District Engineer.

General Permits (Nationwide and/or Regional)
Before doing any work requiring authorization under a NWP for which notification is required (see Sub-section 2.53 under "General Permits"), the prospective permittee must submit written notification to the Army Corps District Engineer in accordance with the notification procedures. For projects which qualify under one or more NWPs, and which do not require notification, other authorizations, or other permits may proceed without notification as long as the project is conducted in complete accordance with the terms and conditions of the NWPs. All notifications must be in writing and must be clear, readable, and reproducible using standard, non-color, office copy machines. All necessary signatures must be originals. Copied or faxed signatures may not be accepted except in unusual or emergency situations and if allowed must be followed up by submittal of originals.

2.57 Overview of the Application Review Process by the Agency

As with the information required to be submitted, the review process varies according to the permit type, either Individual or General.

Individual Permits
The permit process starts with the submittal of an application form and drawings which clearly depict the work being proposed. When an application is received by the COE, it is assigned to a project manager and is given a number for identification purposes. The project manager will be responsible for all actions associated with its processing and will ultimately recommend the final action to the District Engineer or his designee. All questions regarding the application should be directed to the project manager. For questions related exclusively to the State permit or Water Quality Certification process, the applicant should contact the appropriate State agency directly.

One of the important parts of a submittal is a complete written description of the project, the work to be performed, and a concise and accurate statement defining the project's primary purpose. In addition, the dimensions (i.e., length, width, depth) and quantities (i.e., acres, cubic yards) of all impacts to aquatic areas should be provided. For non-water dependent projects and projects with more than minimal impacts, the applicant may help reduce processing time by submitting a written alternatives analysis and a compensatory mitigation proposal along with the application.

The drawings depicting the project must be clear, accurate, and contain all necessary information. The informational requirements for application drawings have been given in the previous section. In addition to the drawings submitted with your application, large scale total development plans with the wetland boundary annotated thereon may also be provided if necessary to adequately review the project.

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An application will be determined to be complete when sufficient information is received to issue a public notice. The public notice is the primary method of advising all interested parties of the proposed activity for which a permit is sought and of soliciting comments and information necessary to evaluate the probable impact on the public interest. The notice must, therefore, include sufficient information to give a clear understanding of the nature and magnitude of the activity to generate meaningful comment.

Initial Review: The project manager, upon receipt of an application, will check to see if all necessary information has been provided. If the project manager determines that the application is incomplete, the project manager will notify the applicant what additional information is required to complete the application.

Public Notice: When the application is determined to be complete, a public notice will be prepared. This notice will be mailed to local, State, and federal agencies, adjacent property owners, and other interested persons or groups that have requested to be placed on the public notice mailing list. The public notice will specify a fixed number of days during which comments may be provided to the permitting and certifying agencies identified in the notice. Because of differences in State and federal review procedures, the comment period may not be the same length of time for each permitting or certifying agency.

Comment Review: When the comment period has ended, an assessment of all comments received will be made by the project manager. If substantive objections have been received, the applicant will be provided copies of these objections. The applicant will then be given an opportunity to attempt to resolve the concerns of the objecting parties or to submit a rebuttal. However, this is not required and the applicant may request that the District Engineer make a decision based on the application as submitted in light of the unresolved objections and with no rebuttal statement from the applicant.

Decision Making: After all the required State permits and certifications are issued, the project manager will begin the decision making process on the federal permit. (Please note that if any of the required State or local permits or certifications are denied, the COE cannot issue the federal permit.)

The decision making process involves an evaluation of the probable impact including cumulative impacts of the proposed activity on the public interest and, if appropriate, includes application of the guidelines given at Section 404(b)(1) of the Clean Water Act as promulgated by the Administrator of the Environmental Protection Agency. The benefits which reasonably may be expected to accrue from a proposal are balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal are considered, including their cumulative effects. The factors considered by the COE include conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production and, in general, the needs and welfare of the people.

As mentioned above, every application involving the discharge of dredged or fill material into waters of the United States must be evaluated for compliance with the "404(b)(1) Guidelines" which are published at 40 CFR Part 230. This review involves an assessment of the project's impacts on the aquatic environment to determine if it is or is not in compliance with the Guidelines. The Guidelines are prejudiced against discharges of dredged or fill material into waters of the United States, including wetlands, for nonwater-dependent activities. For nonwater-dependent projects, the Guidelines compel the COE to place the burden of proof on applicants to conclusively demonstrate that their projects will not cause an unacceptable adverse impact to our nation's aquatic resources and that lesser damaging alternatives are not available. Even if a project is "water-dependent", the Guidelines are designed to hold encroachments into aquatic areas to a minimum.

In keeping with the Guidelines and the National Environmental Policy Act (NEPA), the COE and EPA entered into a Memorandum of Agreement on mitigation. This Memorandum of Agreement requires that the COE use a sequenced approach to evaluating project alternatives. The Memorandum of Agreement specifies that, when assessing a project's impacts, the COE must first ensure that the impacts cannot be avoided (e.g., constructing the proposed facility on an upland, non-aquatic site). If the project must be located in an aquatic area to fulfill its basic purpose, and less damaging sites are not available, the COE must ensure that the project's impacts are minimized to the extent practicable taking into consideration cost, logistics, and existing technologies. Once it is determined that avoidance is not practicable and all efforts have been made to minimize the project impacts to the environment, then, and only then, compensatory mitigation may be considered to compensate for the project's unavoidable impacts. Further discussion on this subject is provided in Section 3.4 of Handbook.

In addition to the 404(b)(1) evaluation, an Environmental Assessment is prepared to determine if an Environmental Impact Statement is required. This is a requirement of the National Environmental Policy Act. If the project manager determines that additional information is required to complete the 404(b)(1) evaluation, the Environmental Assessment, or the public interest review, then the project manager will notify the applicant what additional information is required. Until all necessary information is available to complete these evaluations, the COE cannot reach a decision on the permit application.

If the project has been found to be in compliance with the 404(b)(1) guidelines and the Environmental Assessment has concluded with a Finding of No Significant Impact on the human environment, then a decision document is prepared. This document is the decision maker's written evaluation of all comments and concerns expressed, how these comments were considered in the decision, and why they were either rejected or accepted.

General Permits (Nationwide and/or Regional)

Upon receipt of a notification, the COE will review the notification and determine which of the following actions is appropriate.

Incomplete Notifications: For notifications with incomplete information, the applicant will be instructed what additional items are required to make the notification complete.

No Distribution: For requests for verification involving NWPs 1-4, 6, 8-10, 15, 20, 24, 25, or 36, no public notice or other distribution is required. The COE will review the notification and will notify the prospective permittee whether or not the proposed work appears to meet the terms and conditions of the NWPs.

Distribution: For notifications involving NWPs 5, 7, 12-14, 16-19, 2123, 26-35, and 37-40, the COE must forward copies of the notification to USFWS, IDNR, IDEM and EPA. for notifications of work under these NWPs, the COE must be provided with:

(1) Name, address and telephone number of the prospective permittee.

(2) Location of the proposed project.

(3) Brief description of the proposed project, the project's purpose, direct and indirect adverse environmental impacts the project would cause, any other NWPs or IPs used or intended to be used to authorize any part of the proposed project or any related activity.

(4) Delineation of special aquatic sites, including wetlands, if required by terms of the NWP.

(5) Information regarding presence of any federally listed endangered or threatened species or historic properties that may be affected by the proposed project.

The Decision Period: Except as explained below, for NWPs which require notification, an applicant may presume that his project qualifies for the NWP unless otherwise notified by the COE within a 30 day period following receipt of the notification by the District Engineer. However, the 30 day period allowed for the District Engineers review does not begin until receipt by the District Engineer of a complete notification. The applicant may contact the project manager at any time to determine the status of the notification review.

If the COE notifies the applicant that the notification is incomplete, a new 30 day period will commence upon receipt of the revised notification. If a wetland delineation is required, the 30 day period will not start until the wetland delineation has been completed. The prospective permittee may not proceed with the proposed activity before expiration of the 30 day period unless otherwise notified by the District Engineer. If the COE fails to act within the 30 day period, the District Engineer may use the procedures of 33 CFR 330.5 in order to modify, suspend, or revoke the NWP authorization.

Review of Notifications: The terms and conditions of certain NWPs require the COE to review the proposed activity before the NWP authorizes its construction. However, the COE has the authority to review any activity authorized by NWP to determine whether the activity complies with the NWP. The COE will review all notifications and determine if the individual and cumulative adverse environmental effects are minimal.

Actions for minimizing the adverse effects of discharges are given in the 404(b)(1) guidelines at 40 CFR Part 230, Subpart H. Additional guidance given in the discussion section of 33 CFR part 330 states that interpretation of what is considered minimal is left to the discretion of the District Engineer. The discussion further states that what is considered minimal can vary from state to state, county to county, and watershed to watershed. The factors used in determining what is minimal must be based on the environmental setting of the district and the project. Review of notifications includes the following steps:

(1) Consideration of State and Local Permitting Authorities. The COE will deny without prejudice any activity which has been denied by any State or local authority.

(2) Consideration of Comments. The COE will consider any comments received concerning the proposed activity's compliance with the terms and conditions of a Nationwide Permit or the need for mitigation to reduce the project's adverse environmental effects to the minimal level. The COE will fully consider agency comments received within the time frame specified in the local procedures, but need not provide response to the resource agency. The COE will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered.

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(3) Consideration of Discretionary Authority. As stated in 33 CFR 330.1(d) and 330.4(e), District Engineers have been delegated a discretionary authority to suspend, modify, or revoke individual authorizations under a NWP. This authority may be used to condition or restrict the applicability of a NWP for cases where the COE has concerns for the aquatic environment under the Clean Water Act Section 404(b)(1) Guidelines or for any factor of the public interest. When deciding whether to exercise discretionary authority to modify, suspend, or revoke a case specific activity's authorization under a NWP, the COE shall follow the procedures and guidelines given in 33 CFR Part 330.5.

Decision Options: The decision options following the notification review are as follows:

(1) Authorize Without Modification. If the COE determines that the activity meets the terms and conditions of the NWP, and that the individual and cumulative adverse impacts are minimal, and that no additional conditions are necessary, then the COE will notify the permittee that he/she may proceed in accordance with the provisions of the NWP.

(2) Modify the NWP Authorization. The COE may add activity-specific conditions to ensure that the activity complies with the terms and conditions of the NWP and that the adverse impacts on the aquatic environment and other aspects of the public interest are individually and cumulatively minimal.

(3) Require Mitigation. If the COE determines that the adverse effects are more than minimal, the COE may notify the prospective permittee that measures may be proposed to mitigate the loss of aquatic sites, including wetlands, to reduce the adverse impacts to minimal. The prospective permittee may elect to propose mitigation with the original notification. The COE will consider any proposed mitigation when deciding if the impacts are minimal. The COE shall add activity specific conditions to ensure that the mitigation will be accomplished. If sufficient mitigation cannot be developed to reduce the adverse environmental effects to the minimal level, the COE will not allow authorization under the NWP and will instruct the prospective permittee on procedures to seek authorization under an Individual Permit.

State Approved Mitigation Plan: In determining if a proposed compensatory mitigation plan, which has been approved by the State permitting agency, is sufficient to reduce the adverse ecological effects to the minimal level, the COE will use the following guidelines.

(a) If there were no written concerns or objections received from any resource agency, then the COE will usually consider the mitigation to be sufficient.

(b) If written concerns or objections were received from any resource agency in response to the Public Notice, then the COE will contact that agency to determine if the State approved mitigation plan resolves the agency's concerns.

If the agency states that the concerns have been satisfied, then the COE will usually consider the mitigation to be sufficient. If the agency states that the concerns have not been satisfied then the COE will conduct an evaluation of the mitigation plan. Following this evaluation the COE will decide whether or not the concerns of the resource agency have sufficient merit to modify, condition, or deny the proposed mitigation plan. If the COE determines that the agency's concerns do not have sufficient merit then the COE may accept the mitigation plan. The COE will document the evaluation and factors considered in making this determination in the record.

(4) Require an Individual Permit Application. If the adverse effects are more than minimal and sufficient mitigation is not provided to reduce the adverse environmental effects to the minimal level, the COE will not allow authorization under the NWP and will instruct the prospective permittee on procedures to seek authorization under an Individual Permit.

Thresholds: Projects with total adverse ecological effects which exceed five acres or 10% of the total project area, whichever is greater, will routinely be considered to cause more than minimal adverse ecological effects which cannot be reduced to a minimal level through compensatory mitigation. Therefore, notifications involving these categories of activities will have a greater likelihood than normal of being subject to the exertion of discretionary authority to require an Individual Permit. However, the COE must consider each notification on a case specific basis and these restrictions are intended to be used only as guidelines.

Compensatory Mitigation Plans: As previously stated, authorizations for projects which have more than minimal adverse effects will require mitigation. The mitigation must be sufficient to reduce the adverse effects to the minimal level.

Delineations: For some NWPs, the notification must include a complete delineation of special aquatic sites. Delineations must be in accordance with the current method required by the COE. The applicant may ask the COE to delineate the aquatic sites. There may be some delay if the COE does the delineation. Furthermore, the 30 day review period will not start until the wetland delineation has been completed. Most COE districts define a completed delineation to mean a delineation that has been verified by the COE. For small projects with minimal or near minimal impact to special aquatic sites, the project manager has the discretion to accept an approximate delineation as the verified delineation. Applicants are responsible for providing information with their submittal that evidences a delineation has been conducted and the delineation has been verified by the COE. All delineations of aquatic sites must be shown on the plans submitted for notification review. For agricultural lands, the Natural Resources Conservation Service (NRCS) may be available to perform the delineation (See Section 2.7).

Restoration Plans: When restoration plans are required (e.g. NWPs 33 or 38), they must generally conform with the guidelines and requirements for Compensatory Mitigation Plans.

Other Relevant Issues: The following topics, which are discussed in 33 CFR Parts 320-330, are considered particularly noteworthy and are thus presented here for emphasis.

(1) Piecemealing. In its most elementary form, piecemealing involves the bit-by-bit alteration of a given area by a series of minor authorizations rather than by comprehensive master planning. As pointed out at 33 CFR 320.4(b)(3), while a particular alteration may constitute a minor change, the cumulative effect of a number of changes can result in a major impairment of the resource. In order to discourage piecemealing, the following policy will be used for all NWP authorizations: Once a project avails itself of a NWP authorization, additional NWP authorizations for work which is not clearly shown on the original permit plans will be viewed unfavorably. This position will stand unless a convincing argument can be presented that the additional work is totally unrelated to that which is already permitted and that it was unforeseeable at the time of the prior authorization. It is recognized that there may be an occasional unusual case where the application of this policy may be unreasonable. In those instances, the COE will coordinate with the resource agencies to obtain their views.

(2) Combining NWPs and Individual Permits. 33 CFR 330.6(d) states that subject to the following qualifications, portions of a larger project may proceed under the authority of the NWPs while the COE evaluates an Individual Permit. 33 CFR 330.6(d) states that application for other portions of the same project, but only if the portions of the project qualifying for NWP authorization would have independent utility and are able to function or meet their purpose independent of the total project. When the functioning or usefulness of a portion of the total project qualifying for a NWP is dependent on the remainder of the project, such that its construction and use would not be fully justified even if the COE were to deny the Individual Permit, the NWP does not apply and all portions of the project must be evaluated as part of the Individual Permit process.

When a portion of a larger project is authorized to proceed under a NWP, it is with the understanding that its construction will in no way prejudice the decision on the Individual Permit for the rest of the project. Furthermore, the Individual Permit documentation must include an analysis of the impacts of the entire project, including related activities authorized by a NWP.

(3) Multiple NWPs. As stated in 33 CFR 330.6(d), two or more different NWPs can be combined to authorize a "single and complete project". However, the same NWP cannot be used more than once for a single and complete project.

The term single and complete project is defined at 33 CFR 330.2 to mean the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. For example, if construction of a residential development affects several different areas of a headwater or isolated water, or several different headwaters or isolated waters, the cumulative total of all filled areas should be the basis for deciding whether or not the project will be covered by a NWP. For linear projects, the "single and complete project" (i.e. single and complete crossing) will apply to each crossing of a separate water of the United States (i.e. single waters at that location; except that for linear projects crossing a single waters several times at separate and distant locations, each crossing is considered a single and complete project. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies.

2.58 Procedures for Timely Access to COE Regulatory Personnel

The COE operates 3 field offices in Indiana, located in Indianapolis, Evansville, and South Bend. The main offices for the regulatory programs administered by COE in Indiana are located in Louisville, Kentucky and Detroit, Michigan. Appendix "G.4" lists the addresses of these two offices along with the names and phone numbers of the regulatory review staff.

T.O.C.

SECTION 2.6
PERMITS/CODES ADMINISTERED BY USFWS

2.61 Introduction and Definitions

The United States Fish and Wildlife Service (USFWS) is the federal agency which provides expertise regarding a project's potential impact on federally listed Threatened or Endangered species. The Endangered Species Act of 1973 mandates that other federal agencies must consult with the USFWS on any action which the agencies might authorize, fund or carry-out.

2.62 Description

The Endangered Species Act (16 U.S.C. 1539)
Under the authority of the Endangered Species Act (Act), USFWS must determine whether or not a project will adversely affect a Threatened or Endangered (T/E) species. As stated above, the Act also requires other federal agencies to consult with the USFWS regarding impacts to T/E species when those agencies are involved in a project. Section 7 of the Act contains the formal consultation process. It should be noted that if another federal agency is involved as a project planner, designer, funder or authorization grantor, the project review is handled through that federal agency. With any Drainage Improvement Project that involves Section 404 of the Clean Water Act permitting, the USFWS will generally provide comments to the U.S. Army Corps of Engineers. Section 10 of the Endangered Species Act contains a separate permit procedure for the "taking" of a T/E species when a federal agency will not be involved in a project.

The term "take" is a key concept in the Endangered Species Act. It is generally defined to include almost any act adversely affecting a species, including harassing, harming, pursuing, hunting, capturing, or collecting a listed animal.

2.63 Criteria to Determine Need for a Permit

For any Drainage Improvement Project that will also be reviewed by the COE, a separate permit from the USFWS is not required. Review of the project by USFWS will be initiated and coordinated by COE. If a project will not involve review by COE either for an Individual or General Permit, the USFWS should be contacted to determine if a separate Take Permit is required.

The presence of certain T/E species has been documented or is strongly suspected along several streams in Indiana. A listing of these streams and the T/E species are provided in Appendix "H.2". This appendix also contains a listing of T/E habitats associated with waterways and certain species.

2.64 Pre-Application Consultation/Early Coordination Process

Early coordination with USFWS is strongly encouraged before beginning any drainage improvement project. Staff are available for on-site meetings to discuss possible impacts to T/E species, their habitat and measures that can be undertaken to minimize or avoid the impacts.

2.65 Application/Permit Requirements

For projects involving another federal agency, such as the COE, USFWS is notified of a proposed project by that federal agency. A separate notification/application by the applicant to USFWS is not required.

If a project will affect a listed species but will not involve another federal agency, such as the COE, an individual Take Permit must be processed. The USFWS should be contacted so that the agency can determine whether the project will affect a listed species and whether such a permit is needed. In addition to completing an application form, the applicant must submit to the USFWS a Habitat Conservation Plan which must outline measures that will be implemented to minimize and mitigate the anticipated "take". The Habitat Conservation Plan must also detail measures to monitor the impacts on the affected species, ensure funding will be available for implementing the Plan, and address unforeseen circumstances. An application form for the USFWS Take Permit is provided in Appendix "H.1".

2.66 Overview of the Application Review Process by the Agency

For projects that will affect a listed species but will involve another federal agency, such as the COE, USFWS will provide the federal agency a Biological Opinion detailing the impacts of the project on the affected species. If USFWS concludes that a project will "jeopardize the continued survival of the species", the Biological Opinion may include alternatives, developed with the federal agency and the applicant, that will avoid the impacts to the species. If USFWS determines that the project will not "jeopardize" any species but still incidentally result in "take", the Biological Opinion will include measures to minimize the "take" and also provide an "incidental take statement".

For processing of an individual Take Permit, the application and Habitat Conservation Plan are published in the Federal Register. Action is taken on the application after closure of the public comment period and review of the submitted material by USFWS.

2.67 Procedures for Timely Access to USFWS Regulatory Personnel

The USFWS operates two offices in Indiana, a main office in Bloomington and an additional field office in Warsaw. Appendix "H.3" lists the addresses of these offices.

T.O.C.

SECTION 2.7
REGULATIONS ADMINISTERED BY NRCS

2.71 Introduction

The Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service or SCS) is involved in the delineation of wetlands for farmers participating in certain U.S. Department of Agriculture (USDA) programs. Through an agreement with the Corps of Engineers (COE) and the Environmental Protection Agency (EPA), the wetland delineations by NRCS personnel are accepted for determining jurisdictional wetland boundaries. The following terms have been defined through various federal statutes and rules and are most often used and associated with NRCS programs:

Prior Converted Cropland (PC): wetlands that were drained, dredged, filled, leveled or otherwise manipulated before December 23, 1985 to make production of an agricultural commodity possible and that do not meet specific hydrological criteria, have had an agricultural commodity planted or produced at least once prior to December 23, 1985 and have not since been abandoned. Maintenance or improvement of drainage facilities are allowed with no conditions or permit requirements under the Clean Water Act.

Third Party Conversion (TP): wetlands that are converted after December 23, 1985 by actions of persons other than the person applying for USDA benefits. The 3rd Edition of the National Food Security Act Manual states that conversions determined to have been completed by a county, drainage district or similar entity will be attributed to the person assessed by the entity and <u>are not</u> TP's.

2.72 Description

The Food Security Act (FSA) of 1985, through the "Swampbuster" provision, prohibits farmers who participate in USDA programs from converting wetlands and then producing an agricultural commodity on the converted wetland. The Food, Agriculture, Conservation and Trade Act (FACTA) of 1990 extended this prohibition such that a violation occurs when a wetland is converted even if an agricultural commodity has not been actually produced. The Food Security Act and the Food, Agriculture, Conservation and Trade Act also state that Prior Converted Cropland areas will <u>not</u> be classified as wetlands for regulation under the Clean Water Act.

The Farm Services Agency is responsible for enforcing the provisions of the Food Security Act and the Food, Agriculture, Conservation and Trade Act. If a farmer converts a wetland to produce a commodity crop, the Farm Services Agency determines if USDA payments should be withheld from the farmer. A violation causes the farmer to lose <u>all</u> USDA benefits on <u>all</u> land the farmer controls.

2.73 Application Procedure

While the Food Security Act and the Food, Agriculture, Conservation and Trade Act do not contain specific application forms, process or approvals for drainage improvement projects, consultation with NRCS staff is encouraged before beginning a project. Impacting a wetland by a drainage improvement project, either a private project or a county-sponsored project, may imperil an individual's receipt of USDA benefits for all of that individual's land.

T.O.C.

The 3rd Edition of the National Food Security Act Manual details the responsibilities of the NRCS with respect to wetland delineations and documenting the scope of activities which may qualify for Third Party Conversion exemptions.

2.74 Procedures for Timely Access to NRCS Personnel

Within the NRCS, staff are available for consultations before an activity is undertaken that may impact a wetland or the status of a Prior Converted Cropland. As mentioned before, NRCS wetland delineations are recognized by COE and EPA for determining jurisdictional boundaries. Headquartered in Indianapolis, NRCS staff are also located in most counties in Indiana sharing office space with other state or federal conservation agencies. Address, phone number, and fax number of NRCS headquarters in Indianapolis are included in Appendix "I".

T.O.C.

SECTION 3

REQUIRED PERMITS
FOR DRAINAGE IMPROVEMENT ACTIVITIES

SECTION 3.1
BRIEF DEFINITION OF ACTIVITIES AND PRACTICES

The Handbook groups various drainage improvement practices into different activities. These activities as well as practices grouped under each activity will be discussed in detail in Section 5 (Best Management Practices for Drainage Improvement Projects). However, a brief description of various activities and the associated key practices are provided here as a precursor to discussions contained in sections 3 and 4 of the Handbook.

It should be noted that the activities and practices described in the Handbook are not all-inclusive. Drainage improvement activities may also be accomplished through innovative or non-standard practices which may not have been included in this handbook.

Also it is important to note that practices contained in the Handbook are intended to be selected and applied on a case by case basis and for an appropriate reach of a subject ditch or stream. **Nothing in this Handbook is intended to force the application of a practice or its indiscriminate utilization along the entire length of a stream or ditch.** Such indiscriminate utilization of a practice along the entire reach of a drainageway may not only be cost prohibitive, but may also be ineffective in many settings. Planning and selection principles explained later in Section 4 of this Handbook should be utilized to allow selection and use of the most appropriate practice for each specific reach of a drainageway.

COMMON PRACTICES FOR SITE ASSESSMENT AND PREPARATION : Preconstruction site assessment, site preparation practices, and methods for gaining temporary access to construction site.

Practice 101 Site Assessment: Checklist of environmental, sociological, and other considerations prior to implementing a construction project.

Practice 102 Tree Preservation and Protection: Methods to preserve and protect existing trees from damage during construction.

Practice 103 Temporary Wetland Crossing: instructions for placing wooden "rafts" placed beneath the heavy machinery to more evenly distribute the weight.

Practice 104 Temporary Diversion: A channel and supporting ridge constructed across a slope to collect and divert runoff during construction.

Practice 105 Silt Fencing: Temporary fencing of constructed geotextile fabric (filter fabric). The toe of the fabric is entrenched and is stretched across and attached to supporting posts used to intercept sediment-laden runoff from areas of disturbed soil.

Practice 106 Straw Bale Filter: Temporary barrier of entrenched straw bales used to intercept sediment-laden runoff from small drainage areas of disturbed soil.

Practice 107 Clearing and Grubbing: Removal and disposal of trees, snags, logs, stumps, and shrubs prior to construction.

TILE DRAIN INSTALLATION AND REPAIR : Installation and repairs of various types of tiles.

Practice 201 Tile Drain Installation: Installing tile drains.

Practice 202 Tile Drain Repair/Replacement: Repairing and replacing tile drains.

Practice 203 Breather Pipe: Vertical pipes projecting above ground and connected to underground tile drains that allow for ventilation and inspection.

Practice 204 Tile Drain Inlet: Vertical riser with round holes or slots projecting above ground and connected to underground tile drains to provide an inlet for surface water pipes and also allow for ventilation and inspection.

DEBRUSHING : Controlling and removing living, woody vegetation from channel and overbanks.

Practice 301 Chemical Vegetation Control: Killing woody vegetation with a herbicide (broadcast spraying, stump painting, etc.).

Practice 302 Debrushing Using Hand-held Tools: Removing woody vegetation by means of hand-held tools.

Practice 303 Debrushing Using Heavy Machinery: Removing living woody vegetation by means of heavy machinery.

Practice 304 Stump Removal: Removing stumps from channel and overbanks.

LOGJAM REMOVAL AND RIVER RESTORATION : Removing logjams and/or other obstructions impeding the flow of water.

Practice 401 Logjam Removal Using Hand-held Tools: Typical specifications for removing logjams from channel and overbanks using hand-held tools.

Practice 402 Logjam Removal Using Heavy Machinery: Typical specifications for removing logjams from channel and overbanks using heavy machinery (backhoes, bulldozers, etc.) equipped only with bank brush hooks, snags, and hydraulic thumbs (not equipped with excavation tools).

Practice 403 Large-Scale River Restoration: Typical specifications for restoration of channels to their previous capacity and preventing future obstructions by removing logjams, raking or removing sediment bars, cutting leaning trees, and using brushy material as bank protection. (Note that the term "restoration", as used in this Handbook, does not necessarily imply restoration or improvement of water quality or habitat within the channel or its adjacent area.)

ERODED STREAMBANK REPAIR : Vegetative (bio-engineering), structural, and combined methods for repairing and fortifying stream banks subject to bank erosion.

Practice 501 Live Stakes: Live shrub or woody plant cuttings driven into the channel bank as stakes.

Practice 502 Live Fascines: Sausage-shaped bundles of brush tied together and placed in trenches cut into the bank, parallel to the stream.

Practice 503 Branch Packings: Alternating layers of living branches and soil incorporated into a hole or slumped out area in a slope or a streambank.

Practice 504 Tree Revetments: Anchoring dead, cut trees along an eroding streambank to divert flow and assist in erosion control.

Practice 505 Brush Mattress: Mat of live brush fastened down over an eroded bank.

Practice 506 Vegetative Geogrids: Soil lifts wrapped with natural or synthetic geotextile materials between which are placed layers of live branches.

Practice 507 Live Cribwalls: A rectangular framework of logs, rock, and woody cuttings used to protect an eroding streambank.

Practice 508 Lunkers: Oak or plastic (Eco-wood) rectangular boxes built into the toe of a bank to reduce scour and erosion.

Practice 509 A-Jacks: Concrete or wooden jack-like structures used to armor the toe of the slope; generally integrated with vegetative stabilization techniques.

Practice 510 Stone Riprap: Covering a portion of a channel bank with a layer of stone that approximates the natural slope of the channel bank.

Practice 511 Concrete Retaining Wall: A permanent concrete wall which retains a streambank.

Practice 512 Gabion Retaining Wall: Rock-filled baskets wired together to form a wall or mattress for erosion control along streambanks.

Practice 513 Timber Retaining Wall: A permanent timber wall which retains a streambank.

Practice 514 Sheetpile Retaining Wall: Steel, concrete, wood, or plastic sheet piles that interlock to form a continuous wall along a stream channel.

Practice 515 Composite Retaining Wall: Concrete or wood retaining walls integrated with piling.

CHANNEL EXCAVATION/DREDGING : Deepening and/or widening an existing channel ("Channel" is defined as the area between the tops of the banks. "Overbanks" are defined as areas landward of the top of the banks.)

Practice 601 Channel Bottom Dipping: Deepening a channel and/or removing sediment from the bottom with a bucket from one side of the channel.

Practice 602 Channel Bank Excavation: Excavating the banks (side slopes) of a channel employing one-side construction methods.

Practice 603 Channel Overbank Excavation: Excavating overbank areas (this practice may also include excavation of a portion of the bank that is above the ordinary high water line).

RESTORATION OF CHANNEL TO AS-BUILT CONDITIONS : For the purpose of this Handbook, this activity is defined as all potential maintenance/channel reconstruction practices utilized to restore channel cross sections to their as-built or permitted conditions, both in terms of dimensions and material.

DITCH RELOCATION/CONSTRUCTION AND TRANSITIONS : Relocation of segments of existing streams or ditches as well as construction of new ditches, Channel Tie-ins, Grade Transitions (Chutes), and In-Channel Grade Stabilization Structures to safely convey excess water or stormwater runoff.

Practice 701 Channel with Grass Lining: Typical specifications for construction of grass-lined channels.

Practice 702 Channel with Riprap Lining: Typical specifications for construction of riprap-lined channels.

Practice 703 Channel with Concrete Lining: Typical specifications for construction of concrete-lined channels.

Practice 704 Channel Transitions (Tie-ins): Typical specifications for construction of transitional segments, where one stream or ditch joins with another.

Practice 705 Grade Transitions (Chutes): Typical specifications for construction of short, steep open channels (usually paved with rock, concrete block, or reinforced vegetation) which act as a grade transition to convey high-velocity water down a steep slope without erosion.

Practice 706 In-Channel Grade Stabilization Structure: Structures designed to reduce the channel grade and flow velocity.

SEDIMENT CONTROL AND IN-CHANNEL FLOODWATER RETENTION : Permanent measures to reduce sedimentation and enhance stormwater retention volume.

Practice 801 In-Channel Sediment Basin: Area constructed within a channel designed to reduce flow velocities by increasing the cross sectional area (width and depth) of a channel to allow sediment deposition.

Practice 802 In-Channel Floodwater Retention Basin: On-line stormwater retention area designed to decrease peak flow rates downstream.

Practice 803 Hydraulic Dredging: Removal of sediment using a hydraulic dredge.

Practice 804 Vegetative Filter Strip: vegetated strips planted parallel to natural streams or man-made ditches to trap water born sediment before release into the channel.

STREAM CROSSING CONSTRUCTION AND REPAIR : Repair and installation of culverts, bridges, and fords/low water crossings.

Practice 901 Culverts: Construction and repair of culverts.

Practice 902 Bridges: Construction and repair of bridges.

Practice 903 Fords/Low Water Crossings: Construction and repair of permanent fords and low water crossings.

OUTLET PROTECTION : Measures to reduce erosion at the outfall of tile drains, culverts, or open channels.

Practice 1001 Tile Drain Outlet Extension: Extending the outlet of a small tile drain using a metal pipe segment to stabilize the outlet.

Practice 1002 Riprap-Lined Apron: Armoring the outfall areas of a culvert or channel with a riprap apron.

REVEGETATION AND SITE STABILIZATION : Revegetation and stabilization of channel slopes, overbanks, and other disturbed areas following installation of drainage improvement activities. (See "Eroded Streambank Repair" for additional practices.)

Practice 1101 Mulching: The application of usually organic materials designed to reduce erosion on recently seeded soil.

Practice 1102 Vegetative Stabilization and Seeding: Temporary or permanent stabilization of a site using grasses, forbs, and/or woody vegetation.

Practice 1103 Bonded Fiber Matrix: Incorporation of a soil adhesive/mulch complex into hydroseeded plant mixes to control erosion during plant establishment.

Practice 1104 Erosion Control Blankets and Matting: Installation of synthetic/organic rolls or mats to protect recently planted areas from erosion.

MITIGATION MEASURES: Practices implemented to minimize adverse environmental impacts resulting from project construction activities.

Practice 1201 Wetland Replacement: Restoring or creating wetland areas as an enhancement measure or to compensate for wetland losses during construction.

Practice 1202 Stream Environment Enhancement: Measures to improve wildlife habitat and stream water quality.

Practice 1203 Log Check Dams: In-channel structures designed to reduce erosion and create habitat favorable for wildlife.

Practice 1204 Tree Replacement: Planting trees as an enhancement measure or to compensate for trees lost during construction, where tree planting does not interfere with drain maintenance activities.

OTHER RELATED PRACTICES : Measures related to, but not directly a part of, other categories.

Practice 1301 Debris Disposal: Proper disposal of spoil and debris removed from channels and overbank areas.

Practice 1302 Permanent Limited Livestock Access: Creating, maintaining, and repairing of livestock access areas so that access to the stream is limited to a fenced slot with stone paving sufficient to maintain the integrity of the channel banks.

Practice 1303 Permanent Maintenance Access: Constructing permanent access to streams and channels for the purpose of maintaining the channel.

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SECTION 3.2
REQUIRED AUTHORIZATIONS AND PROCESSING METHODS FOR VARIOUS DRAINAGE IMPROVEMENT ACTIVITIES

Required authorizations and processing methods for drainage improvement activities differ according to the type of practice, the nature of drainageway, and whether the activity disturbs habitats such as wetlands which may be associated with the drainageway corridor.

The quality of habitat found along different classes of open drains varies significantly. For example, the man-made open ditches are not normally associated with a well established riparian habitat as a result of regular debrushing and maintenance. On the other hand, natural streams are normally associated with well established and valuable aquatic resources and habitat, both within the stream channel and along the banks. This suggests that unique sets of authorization and processing methods as well as mitigation measures should be considered for each type of drainageway. However, since many of the agencies' rules and regulations do not currently differentiate between various types of drainageways, the required authorization and processing methods may be summarized in only one table, regardless of the drainageway type. Further discussions on various types of drainageways are contained in Sub-section 3.33.

Table 3.2a summarizes the required authorization and processing methods for key practices noted in Section 3.1 based on agencies' jurisdictions outlined in Section 2. Although as indicated earlier, authorization from various agencies may be required regardless of the type of drainageway, the degree of oversight and the requirement for mitigation measures (if any) will likely vary based on the drain classification. This point will be further discussed in Section 3.3.

In the table, each activity's required authorizations and the processing method associated with each agency are provided in separate columns. When an activity is designated as needing authorization from an agency <u>and</u> the processing method is shown as "EC", the applicant must contact the agency as an individual permit from the agency <u>may</u> or <u>may not</u> be required depending on the specifics of the project. In most cases, the initial contact with the agency <u>may</u> reveal that no permits are required if the work is performed according to the best management practices described in this Handbook. Also, several of the entries within the table have been qualified by numbered or lettered notes. **It is important that description of these notes, provided in the page facing the table, are carefully reviewed**.

In addition to the agencies listed in the table, it may occasionally be necessary to seek separate authorizations from the U.S. Fish and Wildlife Service (USFWS) and/or from the Natural Resources Conservation Service (NRCS). USFWS gets involved when there is a presence or likely presence of listed threatened or endangered species. <u>Separate</u> authorization (take permit) from USFWS is required <u>only</u> when no other federal agencies are involved. Involvement of <u>any</u> federal agency would eliminate the need for an individual take permit from USFWS. NRCS gets involved when a drainage activity results in conversion of a wetland to produce a commodity crop (see section 2 for more detail).

The required authorizations and processing methods, listed in the table, are noted exclusively for practices defined in this handbook. As described earlier, the activities and practices described in the Handbook are <u>not</u> all-inclusive. Drainage improvement activities may be accomplished through innovative or non-standard practices which may not have been included in this handbook. If such innovative or non-standard approaches are being considered, the agencies should be contacted directly to determine the required authorization and processing methods involved.

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Table 3.2a

Required Authorization and Processing Methods for Various Drainage Improvement Activities

ACTIVITY	KEY PRACTICES	REQUIRED AUTHORIZATIONS AND PROCESSING METHODS[1]							GENERAL NOTES
		LOCAL	IDNR		IDEM		COE		
			AUTH.	PROC.	AUTH.	PROC.	AUTH.	PROC.	
Closed Tile Drain Installation and Repair	Tile Drain Installation (P201)	YES[2,3]	YES[5]	EC	NO	N/A	NO[8]	N/A	
	Tile Drain Repair and Replacement (P202)	YES[2,3]	YES[5]	EC	NO	N/A	NO[8]	N/A	
	Breather Pipes and Inlets (P203, P204)	YES[2,3]	NO	N/A	NO	N/A	NO[8]	N/A	
Debrushing	Chemical Vegetation Control (P301)	NO	NO	N/A	NO	N/A	NO	N/A	a
	Debrushing Using Hand-held Tools (P302)	NO	NO	N/A	NO	N/A	NO	N/A	b
	Debrushing Using Heavy Machinery (P303)	YES[3]	NO	N/A	YES[7]	NSA	YES[9]	EC	
	Stump Removal (P304)	YES[3]	YES[5]	EC	YES[7]	SA	YES[9]	GP	
Logjam Removal /River Restoration	Logjam Removal Using Hand-held Tools (P401)	NO	NO	N/A	NO	N/A	NO	N/A	b
	Logjam Removal Using Heavy Machinery (P402)	YES[3]	YES[5]	EC	YES	NSA	YES	EC	b
	Large-Scale River Restoration (P403)	YES[3]	YES[5]	IP	YES	NSA	YES	IP	c
Eroded Streambank Repair	Vegetative Stabilization Methods (P501, P502, P503, P504, P505)	YES[3]	YES[5]	EC	YES	SA	YES	GP	b
	Combined Structural and Vegetative Methods (P506, P507, P508, P509, and other combined practices)	YES[3]	YES[5]	IP	YES	SA	YES	GP	
	Structural Stabilization Methods (P510, P511, P512, P513, P514, P515)	YES[3]	YES[5]	IP	YES	SA	YES	GP	
Channel Excavation /Dredging	Bottom Dipping (P601)	YES[3]	YES[5]	IP	YES	NSA	YES	IP	c
	Bank Excavation (P602)	YES[3]	YES[5]	IP	YES	NSA	YES	IP	c
	Overbank Excavation (P603)	YES[3]	YES[5]	IP	NO	N/A	NO[8]	N/A	
Restoration of Channel to As-built Conditions	All potential practices utilized to maintain/restore a man-made ditch or a previously modified reach of a natural stream to as-built dimensions/shape using the originally permitted material.	YES[3]	YES[5]	EC	YES[7]	NSA	YES[10]	EC	d
Channel Relocation /Cons. and Transition	All practices (P701, P702, P703, P704, P705, P706)	YES[3]	YES[5]	IP	YES	NSA	YES	IP	c
In-channel Sediment Control and Retention Pond	Sediment/Retention Basins (P801, P802)	YES[3]	YES[5]	IP	YES	NSA	YES	GP	
	Hydraulic Dredge (P803)	YES[3]	YES[5]	IP	YES	NSA	YES	GP	
	Vegetative Filter Strip (P804)	YES[4]	NO	N/A	YES[7]	NSA	YES[9]	EC	b
Stream Crossing Construction & Repair	Culverts/Bridges (P901, P902)	YES[3]	YES[5]	IP	YES[7]	NSA	YES	GP	
	Fords/Low Water Crossings (P903)	YES[3]	YES[5]	IP	YES[7]	NSA	YES	GP	
Outlet Protection	Tile Drain Outlet Extension (P1001)	YES[3]	YES[5]	IP[6]	YES	NSA	YES	GP	
	Riprap-Lined Apron (P1002)	YES[3]	YES[5]	IP	YES	SA	YES	GP	
Miscellaneous practices associated with various activities	Temporary Wetland Crossing (P103)	YES[3]	NO	N/A	YES	NSA	YES	GP	
	Temporary Diversion (P104)	YES[3]	YES[5]	EC	YES	NSA	YES[9]	EC	
	Clearing and Grubbing (P107)	YES[3]	YES[5]	EC	YES	SA	YES[9]	GP	
	Debris Disposal Within Floodplain (P1301)	YES[3]	YES[5]	EC	YES[7]	NSA	YES[9]	EC	
	Permanent Maintenance and Limited Livestock Access (P1302, P1303)	YES[3]	YES[5]	IP	YES[7]	NSA	YES[9]	IP	

[See the facing page for abbreviations, superscript numbers (notes), and small letters (general notes) contained in the table]

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ABBREVIATIONS/ACRONYMS:

IDNR	Indiana Department of Natural Resources
IDEM	Indiana Department of Environmental Management
COE	U.S. Army Corps of Engineers
AUTH.	Authorization
PROC.	Processing Method
N/A	Not Applicable
EC	Early Coordination/Notification Process (COE and IDNR have allowed this process so that the applicant may obtain a "prior finding", request confirmation that an individual permit would not be required if certain practice(s) is performed in a manner described in this handbook, or to pre-determine the permit conditions if a permit is determined to be required.)
IP	Individual Permit
GP	General Permit (either Nationwide or Regional)
NSA	No Separate Authorization (Separate application or authorization from IDEM is not required for this activity. The application for IDEM Section 401 Water Quality Certification is made through the COE permit process)
SA	Separate Authorization (Although some projects in the noted category are covered by a COE Nationwide Permit, blanket IDEM Water Quality Certification has been denied for this particular Nationwide Permit. Therefore, these projects would still need an individual IDEM Water Quality Certification.)

NOTES (superscript numbers):

1 In addition to the agencies listed in the table, occasionally it may be required to seek separate authorization from the U.S. Fish and Wildlife Service (USFWS) and/or from the Natural Resources Conservation Service (NRCS). USFWS gets involved when there is a presence or likely presence of listed endangered species. Separate authorization (take permit) from USFWS is required only when no other federal agencies are involved. Involvement of any federal agency would eliminate the need for an individual take permit from USFWS. NRCS gets involved when a drainage activity results in conversion of a wetland to produce a commodity crop(see section 2 for more detail).

2 Authorization is required if the tile is designated as a "Regulated Drain" or it outlets to an open or closed regulated drain.

3 Authorization is required according to most local ordinances. However, note that local Drainage Boards, County Surveyors, and municipalities are normally exempt from their own local stormwater ordinances and codes (except for floodplain zoning ordinances).

4 If this activity involves a "Classified" Filter Strip then applicant must contact the County Surveyor and follow procedures outlined in IC 6-1.1-6.7.

5 Authorization required only if the Indiana Department of Natural Resources (IDNR) has jurisdiction. IDNR has no jurisdiction if (a) the activity is occurring entirely outside the Floodway (if determined), or (b) the drainage area is less than one square mile (640 acres) or (c) the activity is occurring under county's direction and is on a stream or an open drain that is less than 10 miles long, and (d) where the work is not within one half (½) mile of a public freshwater lake.

6 No individual IDNR permit may be required if the tile drain meets certain conditions. The activity may also qualify for an expedited permit process. (See Section 2 for more information.)

7 The Indiana Department of Environmental Management (IDEM) jurisdiction over drainage improvement activities is tied to the U.S. Army Corps of Engineers (COE) jurisdiction. If the project does not require a COE permit, then the Water Quality Certification from IDEM is not needed.

8 The activity does not normally require a COE permit. However, If the activity results in the discharge of dredged or fill material into "waters of the united states", including wetlands, an authorization from the COE is required.

9 Authorization required only if COE has jurisdiction. COE jurisdiction is limited to activities within "waters of the United States" and wetlands which primarily include all streams and ditches below their ordinary high water line and all areas judged as jurisdictional wetlands by COE.

10 For Agricultural purposes, maintenance of man-made drainage ditches are exempt under Section 404 (f)(1)(c) when they are excavated back to original constructed contours. Maintenance of a previously modified reach of a natural stream or drainageway is not exempt from Section 404 for agricultural or non-agricultural purposes.

GENERAL NOTES:

a Anyone applying herbicides for debrushing or to kill stumps must comply with pesticide label use and rate directions. Applications may be done only by or under the direct supervision of a certified applicator, certified by the office of the Indiana Chemist at Purdue University.

b The noted practice(s), when appropriate and if done properly, is considered by most agencies to be preferable over other alternatives.

c Because of potential adverse environmental impacts associated with the noted practice(s), most agencies exercise a high degree of oversight on the activity and frequently require various mitigation measures, as appropriate.

d For the purpose of this Handbook, this activity is defined as all potential maintenance/channel reconstruction practices utilized to restore channel cross sections to their as-built or permitted conditions, both in terms of dimensions and material. The evidence for the as-built conditions such as court records, permits, as-built construction plans, etc. would most likely be requested by regulatory agencies.

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SECTION 3.3
MITIGATION REQUIREMENTS FOR DRAINAGE IMPROVEMENT PROJECTS

Drainage improvement projects may sometimes include activities that can potentially have an unwanted negative impact on the environment. These impacts include disturbing the pools and riffles, trees, and other types of habitat established in the low flow channel, on the banks, or on the overbanks area along a stream or ditch. Occasionally, these projects may also impact wetlands or other aquatic resources adjacent to the project site. Regulating agencies frequently require compensatory mitigation when an unreasonably detrimental environmental impact occurs or is likely to occur as a result of project implementation. Some of these agencies, such as the COE, have established detailed procedures for determining the need for mitigation measures and the process involved. Others, such as the IDNR, may require these mitigation measures in the form of "Special Conditions" when they issue their permits. Despite these differences in the approach, all agencies basically agree on a planning approach which would minimize the need for mitigation measures. This planning approach will be described later in this section.

Due to site-specific nature of mitigation, it is difficult to elaborate on mitigation requirements for each type of activity. However, by explaining the issues involved and clarifying the agencies' positions, it is hoped that the drainage improvement activities may be planned with mitigation as a component. The following material has been prepared based upon a review of current available information regarding the various local, Federal and State regulations, rules, guidelines, and policy documents pertaining to drainage improvement activities. Further information regarding this subject may be found by directly contacting these regulating agencies. One good source of information regarding wetland mitigation is the "South Carolina's Developer's Handbook for Freshwater Wetlands". The IDNR has also drafted informational bulletins regarding wetlands and habitat mitigation. Pertinent material and text from the above-noted publications have been extensively utilized in the preparation of the material presented in this section.

3.31 Definition

"Mitigation" is defined as taking special action to eliminate, lessen, or replace environmental values where those values are disturbed by human activities. The Federal and State regulatory programs affecting the drainage improvement projects in Indiana involve the mitigation of harmful effects of <u>necessary</u> drainage improvement activities on wetlands and other aquatic resources as well as on botanical resources and wildlife habitat. These permit programs rely on a sequential approach to mitigate these harmful effects by first **avoiding** unnecessary impacts, then **minimizing** environmental harm, and finally, **compensating** for remaining unavoidable damage to wetland and other aquatic, botanical, or wildlife resources/habitat. Restoration, preservation, and creation of wetlands or replacement of trees are examples of compensation. Best Management Practices for several typical compensating measures that are usually called for by the agencies when such measures are deemed necessary, are provided in Section 5 of this handbook.

A mitigation procedure may be accomplished by various methods. The procedure is often defined in terms of a ratio of units replaced to units altered. As an example, if three (3) acres are required to be replaced or reconstructed for one (1) acre adversely impacted or destroyed, then this mitigation will be described as a ratio of 3:1. The higher the environmental value of the habitat being impacted, the higher the mitigation ratio required. Factors such as proximity of the compensation area to the project area, presence or likely presence of listed Federal or State species, cumulative effects, quality of riparian corridor, community structure and composition, and species diversity, greatly influence the magnitude of the mitigation ratio.

Mitigation ratios required by regulating agencies for wetlands and habitat are frequently greater than 1:1 for several reasons. There is typically a long-term loss of benefits and functions of the impacted resources before a constructed or reconstructed area is fully developed. There is also the risk that the benefits and functions of the original area may not be fully replaced by the mitigation effort. There is a loss of production when a habitat is destroyed, and this production may never be equalled by the replacement area.

3.32 Planning Approach

Compensatory mitigation for disturbances to natural resources is the final alternative which should be considered when a project is planned. The sequence to follow during project planning is (1) identification; (2) avoidance of disturbance; (3) minimization of disturbance; and (4) where avoidance and minimization of disturbances do not dispose of the issue, compensation for any remaining unreasonably detrimental impacts on natural resources. The noted sequence is clearly recognized and prescribed by the Clean Water Act Section 404(b)(1) Guidelines. State regulating agencies, i.e., IDNR and IDEM, have also adopted and required similar procedures. The following is a brief description of the noted sequential steps:

Identification

As a part of the project planning efforts and prior to project design and implementation, a site assessment must be performed to identify the size, type, and location of resources existing on or near the project site. This identification stage should include a review of wetland inventory maps, soil maps, and other available data regarding riparian resources. The presence or absence of other important resources such as endangered species or important cultural resources should also be identified at this stage.

As the planning process continues, this early assessment should be developed into more detailed and certain information. Examples of such detailed information include delineating wetlands or listing and quantifying other aquatic, botanical, and wildlife resources/habitat impacted by the proposed projects. Without first identifying the potentially impacted resources, it is impossible to properly follow the logical sequence of avoiding, minimizing, and compensating prescribed by the regulating agencies. A brief description of the identification process is provided in Section 5.1 as "Practice 101: Site Assessment".

Avoidance

In developing drainage improvement plans for an area containing valuable botanical resources, fish, or wildlife habitat as well as aquatic resources, such as wetlands, every effort should be made to avoid encroachments into these areas. As required under the 404(b)(1) Guidelines, impacts to aquatic resources which can be avoided must be avoided.

Minimization

If the wetlands or habitat areas located within the project limits cannot be totally avoided, then every effort must be made to minimize encroachments into these areas. Early planning is the key to minimizing impacts on the aquatic, botanic, and wildlife resources. Minimization can be attained in a number of ways but is generally considered to have occurred when the disturbances to the sensitive habitat and resources are held to the minimum necessary to achieve the basic purpose. Examples of minimization include, but are not limited to, the following:

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- One-side construction to limit the disturbances to only one side of channel so that some habitat is maintained along the stream reach.

- Marking and preserving trees that do not significantly interfere with the project construction and maintenance.

- Limiting the access points to the stream or ditch to the minimum number possible. Sometimes this can be achieved through accessing the streambank on the inside bend of a meander.

- Obtaining access to the project area through wetlands only where upland access is unavailable.

- Bridging wetlands to the maximum extent practicable taking into consideration cost, logistics, and existing technologies.

- Providing steeper side slopes for access fills (within applicable safety requirements).

- Planning a single access road through wetlands rather than multiple accesses requiring fill or fragmenting aquatic areas or habitat.

Minimization of project encroachments into wetlands or valuable habitat areas can significantly shorten the time required to obtain authorization for the project under the Flood Control Act administered by the IDNR and Nationwide Permits or Individual Permits administered by COE.

Mitigation (Compensatory Mitigation)
If more than negligible adverse impacts (an unreasonably detrimental effect, as defined in the Indiana Flood Control Act.) to the fish, wildlife, and botanical resources/environment remain after appropriate measures have been incorporated to avoid and minimize the adverse impacts, then compensatory mitigation will normally be required. Compensatory mitigation means compensating for the adverse effects by replacing or providing substitute resources or environments. Categories of compensatory mitigation for ecological effects include creation, restoration, enhancement, and, in certain cases, preservation.

Creation: In designing creation mitigation, care must be taken to avoid the selection of high quality upland habitat for conversion. For example, a cut-over area or former agricultural field would be ecologically preferable to a mature forested area as a candidate for alteration. Mature forested areas will generally not be approved as suitable creation areas. Creation of wetlands in non-hydric soils is most often a difficult task. Before proposing this form of compensation, please seek expert guidance. Included within this category are the replacement of trees and brush, as appropriate.

Restoration or Enhancement: For example, filling drainage ditches to allow adjacent hydric soils to return to a natural, functional wetland system. Other examples include creating artificial pools, riffles, and/or shady spots in natural streams to enhance the fish habitat in one reach of a stream as a means of compensating unavoidable losses to other stream reaches.

Preservation: For example, dedication of ecologically significant lands to an appropriate trust entity with provisions that require them to be preserved in their natural state in perpetuity.

A willingness to compensate for wetland and habitat impacts does not necessarily mean that permit will be granted by the regulating agencies. The applicant must demonstrate that all reasonable and practicable efforts have already been made to avoid and minimize wetland and habitat encroachments. Compensation is only the last resort.

3.33 Appropriate Measures

Mitigation requirements for unreasonably detrimental environmental impacts of drainage improvement activities should be determined on a case by case basis. As indicated earlier in Section 3.2, the quality of habitat found along different classes of open drains varies significantly. Although authorization from various agencies may be required regardless of the type of drainageway, the degree of oversight and the requirement for mitigation measures (if any) will likely vary based on the drain classification.

The state and federal agencies, which regulate activities associated with streams, ditches, wetlands, and other bodies of water in Indiana, do not have a documented system for classifying streams or drains. However, most agencies recognize that practical differences exist in the environmental sensitivity of streams and the mitigation requirements associated with their disturbance. These differences are generally based upon the pre-construction conditions of the stream, whether it has been extensively modified in the past, and its importance and quality as a riparian corridor. To aid the users in understanding the differences that exist between various drainageways and for the purpose of this handbook, they have been divided into Closed Tile Drains, Man-Made Open Ditches, and Natural Streams (with or without modifications).

Closed Tile Drains include subsurface pipes made of burned clay concrete, polyvinyl chloride (PVC) or similar materials of various lengths, laid to collect and carry excess water from fields.

Man-made Open Ditches are characterized by long, fairly straight stretches with uniform side slopes, depth, and bottom width with fairly uniform grade. In many cases, these drains are dry or have no flow of water during times of low rainfall. With few exceptions, most of these types of drains are designated as "Regulated Drain" under the Indiana Drainage Code and are maintained or debrushed regularly. Exhibit 3.3a shows a typical man-made open ditch.

Exhibit 3.3a: Typical Example of a Man-Made Ditch with Grass Lining (Source: IDNR Files)

Natural Streams are characterized with natural meanders that follow historic drainage patterns. They often are associated with naturally occurring riparian habitat of brush or woody vegetation, and significant areas of deeper pools suitable for fish and aquatic animals. Natural streams have multiple uses and serve purposes well beyond mere accommodation for drainage. However, some segments of natural streams may have been modified at some time to increase capacity to carry stormwater or designated as "Regulated Drains". These modifications may have included channel straightening, deepening, and reshaping channel banks. In addition, brush and trees may have been removed from one or both banks. Exhibit 3.3b shows a typical natural stream.

Exhibit 3.3b: Typical Example of a Natural Stream (Source: Ohio Stream Management Guide)

As described earlier, compensatory measures for the mitigation of unreasonably detrimental environmental impacts may be achieved in different ways. Several of these methods are described as standard practices later in this handbook. However, not all methods are appropriate for every situation. For example, the replacement of trees within the easement of a regulated, man-made ditch may not be appropriate because these areas are subject to regular debrushing as required for maintaining the functionality of the drain for the purpose it was constructed.

The type of the required mitigating measures and the magnitude of replacement ratios should be appropriate for the purpose and nature (i.e., man-made versus natural) of the drain as well as the environmental benefit of the habitat areas associated with them. Therefore, **it is essential that adequate information regarding the existing habitat and resources within the project area is developed by the applicant (through the sequential approach noted earlier) and be made available so that objective, <u>case by case</u> determination of the mitigation requirements may be made by the regulating agencies.**

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SECTION 4

SELECTION GUIDE FOR DRAINAGE IMPROVEMENT PRACTICES

SECTION 4.1
PLANNING PROCESS

A comprehensive planning process should be considered prior to implementing any drainage improvement activity. Effective planning ensures the successful completion of project, reduces potential for costly delays in project implementation, eliminates future costly repairs, and minimizes the need for mitigation measures required as a result of implementing inappropriate practices. To be successful, a planning process should include the following steps:

- **Identify problems**: Short and long term issues relating to site resources should be identified and listed. For county regulated drains, this is normally done by the county surveyor on an annual basis as required by the Indiana Drainage Code.

- **Determine the project objectives**: What is the desired outcome? How will the site be used? What are site features to enhance? What rules, codes, regulations, ordinances, or restrictions need to be addressed? How will these constraints affect the project scope?

- **Assemble existing Information**: Gather data on soil, water, plant, animal resources, and human resources on and around the site.

- **Define the site on Map**: Use a suitable map with adequate scale to highlight the project area and its surroundings.

- **Identify the participants**: Determine who needs to be involved in the planning and review process.

- **Perform on-site assessment**: Inventory soil, water, plant, and animal resources in and adjacent to the project site. Identify the presence of wetlands and other unique aquatic resources, botanical resources, and wildlife habitat that may be impacted by the project.

- **Determine additional required data and studies**: Prepare necessary work maps, obtain required hydrologic and hydraulic models, delineate wetlands, etc.

- **Analyze resource data**: Quantify resource use and development impacts.

- **Formulate evaluation criteria**: Formulate evaluation criteria based on social, economic, and environmental feasibility and acceptability.

- **Identify solutions**: Identify alternative solutions, plans, or practices to be evaluated.

- **Evaluate and select alternatives**: Evaluate alternative solutions based on social, economical, and environmental feasibility and acceptability. Consider factors described in Section 4.2 and select alternative solutions/practices.

- **Define Necessary Maintenance Activities**: Anticipated Maintenance activities should be clearly defined and responsibilities identified.

- **Prepare an implementation plan**: Implementation plan should identify steps, implementation sequence, time schedule, maintenance schedule, and those responsible for each task.

In addition to the above steps, public involvement as well as early coordination with the regulating agencies should be considered throughout the planning phase. Agencies' pre-application procedures, described in Section 2 of this Handbook, are created for the applicants' convenience and should be taken advantage of in order to improve the chances for smooth and timely completion of drainage improvement projects.

SECTION 4.2
FACTORS TO BE CONSIDERED IN SELECTION OF APPROPRIATE PRACTICES

Several factors should be considered in the selection of an appropriate practice. The most significant of these factors include:

- Physical characteristics of the site such as channel slope, flow velocity, contributing drainage area, erosion potential, accessibility, aesthetic needs, etc.;
- Degree of Effectiveness in achieving the desired outcome (For example, a temporary or stop-gap solution versus a permanent solution, degree of effectiveness compared to alternative practices, and immediate results versus slowly occurring results.);
- Type and purpose of the drainageway, and any maintenance responsibilities involved (For example, a practice involving placement of woody vegetation within the easement of a regulated, man-made drain, may not be appropriate due to periodic debrushing.);
- Ease of maintenance;
- Potential for Adverse Environmental Impacts;
- Original cost and cost of periodic maintenance;
- Cost, time, and efforts involved in securing necessary permits and approvals, including costs associated with required mitigation;
- Extent of direct and indirect benefits such as damage reduction, water quality enhancements, recreational benefits, environmental benefits, social benefits; and
- Comparison of the benefits to be achieved to the costs associated with the implementation of the project. This comparison should also be conducted for the "do nothing" alternative to aid in justifying the need for implementing the project.

SECTION 4.3
PRACTICE SELECTION GUIDE

Tables 4.3a through 4.3j provide guidance in selecting appropriate practices for various activities. Practices associated with each activity are typically selected from three groups of practices:

1. Common Practices for Site Assessment and Preparation (Section 5.1)

2. Key practices associated with a particular activity (Sections 5.2 through 5.10, as applicable)

3. Revegetation and Site Stabilization practices (Section 5.11 as well as Section 5.5)

Selection of a Site Preparation/Access Practice: As indicated in earlier sections, site assessment should be the first order of business, no matter what activity or practice is being considered. Based on this site assessment and the requirements for implementing a practice, appropriate practices for access to the site as well as preparation of the site need to be selected from the list of applicable practices, as appropriate. The selection of an appropriate site preparation or site access practice from a list of alternative practices, is greatly influenced by the choice of the activity's key practice.

Selection of a Key Practice for a Specific Activity: To assist in the selection process, the key practices for each activity have been sub-grouped for their applicability with regards to general site conditions. However, pertinent information for each alternative key practice, provided in Section 5, should be carefully reviewed to determine its appropriateness for the site. Careful consideration should be given to factors described in Section 4.2 before an alternative key practice is selected to perform an activity.

Selection of a Final Site Stabilization Practice: Once the preparatory practice(s) and the activity's key practice(s) are chosen, an appropriate practice must be chosen from the "Revegetation and Site Stabilization" group for final site stabilization. Many of practices grouped under "Eroded Streambank Repair" category (Section 5.5) may also be suitable as a final stabilization practice.

Occasionally and depending on the project, appropriate practices from two other categories may have to be selected as well. These categories include: Mitigation Measures (Section 5.12) and Other Practices (Section 5.13).

Mitigation Measures: Mitigation measures (Section 5.12) must be considered if an activity is expected to cause an unreasonably detrimental impact on the environment. As indicated earlier in Section 3.4, every efforts should be made to avoid or minimize adverse environmental impacts. However, total avoidance of adverse impacts may not always be practical, thus making the mitigation the only feasible alternative when such impacts are judged to have an unreasonably detrimental impact on environment.

Other Practices: An appropriate practice from the "Other Related Practices" group (Section 5.13) may be selected for providing permanent livestock or maintenance access and where debris cleared from a stream or ditch is to be stored within the floodplain.

Table 4.3a
Practice Selection Guide for Tile Installation and Repair Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Tile Installation	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103)
	Any	**Tile Installation:** Tile Drain Installation (P201) Breather Pipe (P203) Tile Drain Inlet (P204)
		Mitigation Measure (if appropriate/required): Wetland Replacement (P1201)
		Outlet Protection: Tile Drain Outlet Extension (P1001) Riprap-Lined Apron (P1002)
Tile Repair and Replacement	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103)
	Any	**Tile Repair and Replacement:** Tile Drain Repair/Replacement (P202) Breather Pipe (P203) Tile Drain Inlet (P204)
		Mitigation Measure (if appropriate/required): Wetland Replacement (P1201)
		Outlet Protection: Tile Drain Outlet Extension (P1001) Riprap-Lined Apron (P1002)

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Table 4.3b
Practice Selection Guide for Debrushing and Logjam Removal/River Restoration Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Debrushing	Any (Sites with no prior Maintenance Access)	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103)
	Vegetation with No Trees or Stumps	**Debrushing:** Chemical Vegetation Control (P301) Debrushing Using Hand-held Tools (P302) Debrushing Using Heavy Machinery (P303)
	Establ. Vegetation with Trees or Stumps	**Debrushing:** Debrushing Using Hand-held Tools (P302) Debrushing Using Heavy Machinery (P303) Stump Removal (P304)
	Any (Sites with no prior Maintenance Access)	**Other Related Practices:** Permanent Maintenance Access (P1303)
Logjam Removal and River Restoration	Any (Sites with no prior Maintenance Access)	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103)
	Individual Logjams Types **I**, **II**, and V (See Section 5.4)	**Logjam Removal:** Logjam Rem. Using Hand-held Tools (P401) Logjam Rem. Using Heavy Machinery (P402)
	Individual Logjams Types **III** and IV (See Section 5.4)	**Logjam Removal:** Logjam Rem. Using Heavy Machinery (P402)
	Stream Reach has Numerous Snags, Log-jams, & Leaning Trees	**Logjam Removal/River Restoration:** Logjam Rem. Using Heavy Machinery (P402) Large-Scale River Restoration (P403)
	All methods	**Other Related Practices:** Debris Disposal (P1301) Permanent Maintenance Access (P1303)

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Table 4.3c
Practice Selection Guide for Eroded Streambank Repair Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Eroded Streambank Repair	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Design Channel Velocity < 6 ft/sec	**Vegetative Streambank Stabilization:** Live Stakes (P501) Live Fascines (P502) Branch Packings (P503) Tree Revetments (P504) Brush Mattress (P505) Vegetative Geogrids (P506) **Structural Streambank Stabilization:** Stone Riprap (P510) Concrete Retaining Wall (P511) Gabion Retaining Wall (P512) Timber Retaining Wall (P513) Sheetpile Retaining Wall (P514) Composite Retaining Wall (P515) **Combination Streambank Stabilization:** Live Cribwalls (P507) Lunkers (P508) A-Jacks (P509) Other Combination Protective Measures
	Design Channel Velocity > 6 ft/sec	**Structural Streambank Stabilization:** Stone Riprap (P510) Concrete Retaining Wall (P511) Gabion Retaining Wall (P512) Timber Retaining Wall (P513) Sheetpile Retaining Wall (P514) Composite Retaining Wall (P515) **Combination Streambank Stabilization:** Live Cribwalls (P507) Lunkers (P508) A-Jacks (P509) Other Combination Protective Measures
	Any (If overbanks are disturbed)	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization and Seeding(P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104)
	Any	**Other Related Practices:** Debris Disposal (P1301) Permanent Maintenance Access (P1303)

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Table 4.3d
Practice Selection Guide for Channel Excavation/Dredging Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Channel Excavation/ Dredging	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Any	**Channel Excavation Practices:** Channel Bottom Dipping (P601) Channel Bank Excavation (P602) Channel Overbank Excavation (P603)
	Any	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104) Eroded Streambank Repair Methods (P501-15)
	Any	**Mitigation Measure (if appropriate/required):** Wetland Replacement (P1201) Stream Environmental Enhancement (P1202) Log Check Dams (P1203) Tree Replacement (P1204)
	Any	**Other Related Practices:** Debris Disposal (P1301) Permanent Livestock Access (P1302) Permanent Maintenance Access (P1303)

Table 4.3e
Practice Selection Guide for Channel Reconstruction/Maintenance Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Restoration of Channel to As-built Conditions	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Any	**Channel Excavation:** Channel Bottom Dipping (P601) Channel Bank Excavation (P602)
	Any	**Revegetation and Site Stabilization:** (Use the same material as original) Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104) Eroded Streambank Repair Methods (P501-15)

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Table 4.3f
Practice Selection Guide for New Channel Construction/Relocation Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Ditch Relocation/Construction and Transitions	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Slopes <5%	**Channel Construction:** Channel with Grass Lining (P701) Channel with Riprap Lining (P702) Channel with Concrete Lining (P703) Channel Transitions (P704)
	Slopes >5%	**Channel Construction:** Channel with Riprap Lining (P702) Channel with Concrete Lining (P703) Channel Transitions (P704) Grade Transitions (Chutes) (P705) In-Channel Grade Stabilization Structure (P706)
	Any	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104) Eroded Streambank Repair Methods (P501-15)
	Any	**Mitigation Measure (if appropriate/required):** Wetland Replacement (P1201) Stream Environmental Enhancement (P1202) Log Check Dams (P1203) Tree Replacement (P1204)
	Any	**Other Related Practices:** Debris Disposal (P1301) Permanent Livestock Access (P1302) Permanent Maintenance Access (P1303)

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Table 4.3g
Practice Selection Guide for Sediment Control Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Sediment Control	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Any	**Sediment Control Measures:** In-channel Sediment Basin (P801) Hydraulic Dredging (P803) Vegetative Filter Strip (P804)
	Any	**Mitigation Measure (if appropriate/required):** Wetland Replacement (P1201) Stream Environmental Enhancement (P1202) Log Check Dams (P1203) Tree Replacement (P1204)
	Any	**Other Related Practices:** Debris Disposal (P1301) Permanent Livestock Access (P1302) Permanent Maintenance Access (P1303)

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T.O.C.

Table 4.3h
Practice Selection Guide for Floodwater Retention Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Floodwater Retention	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Any	**Floodwater Retention:** In-channel Floodwater Retention Basin (P802)
	Any	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104) Eroded Streambank Repair Methods (P501-15)
	Any	**Mitigation Measure (if appropriate/required):** Wetland Replacement (P1201) Stream Environmental Enhancement (P1202) Log Check Dams (P1203) Tree Replacement (P1204)
	Any	**Other Related Practices:** Debris Disposal (P1301) Permanent Livestock Access (P1302) Permanent Maintenance Access (P1303)

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Table 4.3i
Practice Selection Guide for Stream Enclosure/Crossing Construction and Repair Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Stream Crossing Construction and Repair	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	All Weather Access Required	**Stream Enclosure/Crossing:** Culverts (P901) Bridges (P902)
	All Weather Access <u>Not</u> Required	**Stream Enclosure/Crossing:** Culverts (P901) Bridges (P902) Fords/Low Water Crossings (P903)
	Any	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104)

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Table 4.3j
Practice Selection Guide for Outlet Protection Activities

ACTIVITY	SITE CONDITIONS	APPLICABLE PRACTICES
Outlet Protection	Any	**Site Assessment/Preparation/Access:** Site Assessment (P101) Tree Preservation & Protection (P102) Temporary Wetland Crossing (P103) Temporary Diversion (P104) Silt Fencing (P105) Straw Bale Filter (P106) Clearing and Grubbing (P107)
	Small Tile Drain or Stormwater outfall	**Outlet Protection:** Tile Drain Outlet Extension (P1001)
	High velocity outlet of a culvert or channel	**Outlet Protection:** Riprap-Lined Apron (P1002)
	High velocity outlet and significant grade drop	**Ditch Relocation/Const. and Transitions:** Grade Transitions (Chutes) (P705) In-Channel Grade Stabilization Structure (P706)
	Any	**Revegetation and Site Stabilization:** Mulching (P1101) Vegetative Stabilization (P1102) Bonded Fiber Matrix (P1103) Erosion Control Blankets and Matting (P1104)

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T.O.C.

SECTION 5

BEST MANAGEMENT PRACTICES FOR DRAINAGE IMPROVEMENT PROJECTS

SECTION 5.0
IMPORTANT INTRODUCTORY NOTES

This section describes and illustrates, in thirteen (13) sub-sections, various standardized, best management practices associated with activities within streams and ditches. For each practice, a description, purpose, applicability, advantages, constraints, design and construction guidelines, maintenance, and listing of further information sources are summarized. In addition, a summary has been provided for each group of activities briefly introducing the practices in the group and providing additional general information about them.

The practices contained in the Handbook are intended to be selected and applied on a case by case basis and for an appropriate reach of a subject ditch or stream. **Nothing in this Handbook is intended to force the application of a practice or its indiscriminate utilization along the entire length of a stream or ditch.** Such indiscriminate utilization of a practice along the entire reach of a drainageway not only may be cost prohibitive, but may also be ineffective in many settings. Planning and selection principles explained earlier in Section 4 of this Handbook should be utilized to allow selection and use of the most appropriate practice for each specific reach of a drainageway.

The activities and practices described in the Handbook are not all-inclusive. Drainage improvement activities may also be accomplished through innovative or non-standard practices which may not have been included in this handbook.

T.O.C.

SECTION 5.1

COMMON PRACTICES FOR SITE ASSESSMENT AND PREPARATION

SECTION 5.1
COMMON PRACTICES FOR SITE ASSESSMENT AND PREPARATION

This section of the Handbook contains practices that are commonly used for site assessment and preparatory work associated with activities within drainageways. Not all site preparation techniques are provided in this Handbook. Many of these and other site preparation and stabilization techniques are discussed in detail within the Indiana Handbook for Erosion Control in Developing Areas. The latter document, also published by the IDNR, is considered as a companion to the Indiana Drainage Handbook.

A site assessment is the first critical step prior to implementing any drainage improvement project. Data collecting individuals, such as survey crew, can help with this process by taking detailed photos on existing site conditions as the survey is being performed. Designers should then float or walk the site equipped with a copy of these survey notes and should expand and/or add to these notes before or during the design phase.

Selecting an appropriate management practice should be based on the results of the noted site assessment. Special consideration should be given to environmental concerns (i.e. water quality and wildlife habitat issues), and social concerns such as the aesthetics of a given project. Site assessments should also identify sensitive areas and resources to be protected. Bank stabilizing trees should be identified and protected to the extent practical. Wetland crossings, if necessary, should be located in areas where impacts would be minimal, if not negligible.

Clearing and grubbing, are often necessary for large-scale construction projects. It is important that these activities only take place within clearly identified areas that are protected against siltation and erosion. The potential for siltation is often greatest during clearing and grubbing activities, and around stockpiles of topsoil.

Many measures may be taken to minimize erosion and contain siltation on site. At the very least, silt fencing or a straw bale filter should be properly installed around areas of impact, particularly along streams and ditches. Generally, silt fencing is more effective and requires less maintenance than a straw bale filter. Temporary diversion dikes may be recommended for construction sites along slopes. Diversion dikes channel sediment-laden runoff away from areas of concern.

Several of the practices contained in this section are utilized to avoid or minimize unreasonably detrimental impacts on the environment. These practices are often called for as part of construction plans.

T.O.C.

PRACTICE 101
SITE ASSESSMENT

DESCRIPTION
- On-site assessment of existing conditions.

Exhibit 101a: Site Assessment (Source: NRCS files)

PURPOSE
- To determine existing conditions prior to implementing a project.

WHERE APPLICABLE
- Applicable for all projects.

ADVANTAGES
- Saves time in the long run.
- Identifies sensitive areas to protect.
- Identifies best access areas.

CONSTRAINTS
- Gathering necessary information can be expensive and time consuming.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Flagging.

Installation

<u>Resource Protection</u>
- Use a suitable map with adequate scale to highlight the project area and its surroundings.
- Identify and make arrangements with other site visit participants and landowners.
- Assemble existing information on soil, water, plant, animal, and human resources on and around the area.
- Clearly define the objectives of the site visit and the determinations to be made.
- Identify, delineate, and flag wetlands if necessary.
- Identify and mark/flag trees and/or important habitat to protect

(Practice 102).
- Determine whether threatened or endangered species, or potential habitat for them exist on site. Identify important areas with flagging.

Site Access
- Identify which side of the channel would be best to work from. When conditions allow, limiting work to north and east sides would be environmentally more beneficial as leaving trees on south and west sides provides shading to the stream.
- Identify appropriate access to the channel, and in the channel (fords, bridges, etc.), if necessary (Practice 103, 903).
- Determine whether clearing and grubbing, debrushing, or other preparatory activities will be necessary (Practice 107, Activity 5.3).
- Identify disposal areas for organic debris, if necessary (Practice 1301).
- Identify any other potential factors that could limit or complicate proposed activities.

Special Considerations
- Data collecting individuals, such as survey crew, can help with this process by taking detailed notes on existing site conditions as the survey is being performed. Designers should then float or walk the site equipped with a copy of the survey notes and expand and/or add to these notes before or during the design phase.
- Site assessment may be conducted at several stages along the planning phase. Initial site assessments may involve only observation of the site and its conditions. As the planning phase progresses, more detailed site assessment activities may be undertaken, as necessary.

MAINTENANCE
- Not applicable.

REFERENCES

Related Practices
- Practice 102 Tree Preservation and Protection.
- Practice 103 Temporary Wetland Crossing.
- Practice 107 Clearing and Grubbing.
- Practice 903 Fords/Low Water Crossing.
- Practice 1301 Debris Disposal.
- Activity 5.3 Debrushing.

Other Sources of Information
- COE Streambank Protection Guidelines.
- Indiana Erosion Control Handbook.
- Illinois Urban Manual.
- Illinois Stormwater BMPs.

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PRACTICE 102
TREE PRESERVATION AND PROTECTION

DESCRIPTION

- Methods to preserve and protect desirable existing trees from damage during construction. (Note: This practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 102a: Tree preservation and protection (Source: IDNR Files)

PURPOSE

- To preserve and protect trees that have present or future value for their use in erosion protection, landscape and/or aesthetic value, or for other environmental benefits.

WHERE APPLICABLE

- Applicable to nearly every project.

ADVANTAGES

- Stabilize the soil and prevent erosion.
- Reduce stormwater runoff by intercepting rainfall, promoting infiltration, and lowering the water table through transpiration.
- Provide wildlife habitat.
- Increase property values and improve site aesthetics.
- Provides stream shading and cooling.

CONSTRAINTS

- Preserving and protecting trees may impede the maneuverability of large equipment.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Standard steel posts or wood posts with a minimum cross sectional area of 3.0 sq.in.
- 40" high snow fence or 40" high plastic web fencing.

Installation

- Place barriers around protected and preserved trees to prevent the approach of equipment at the drip line of trees to be retained.
- Do not cut tree roots inside the tree drip line.
- Do not place equipment, construction materials, topsoil, or fill dirt within the limit of the drip line of the trees to be saved.
- Remove barriers during final site cleanup.

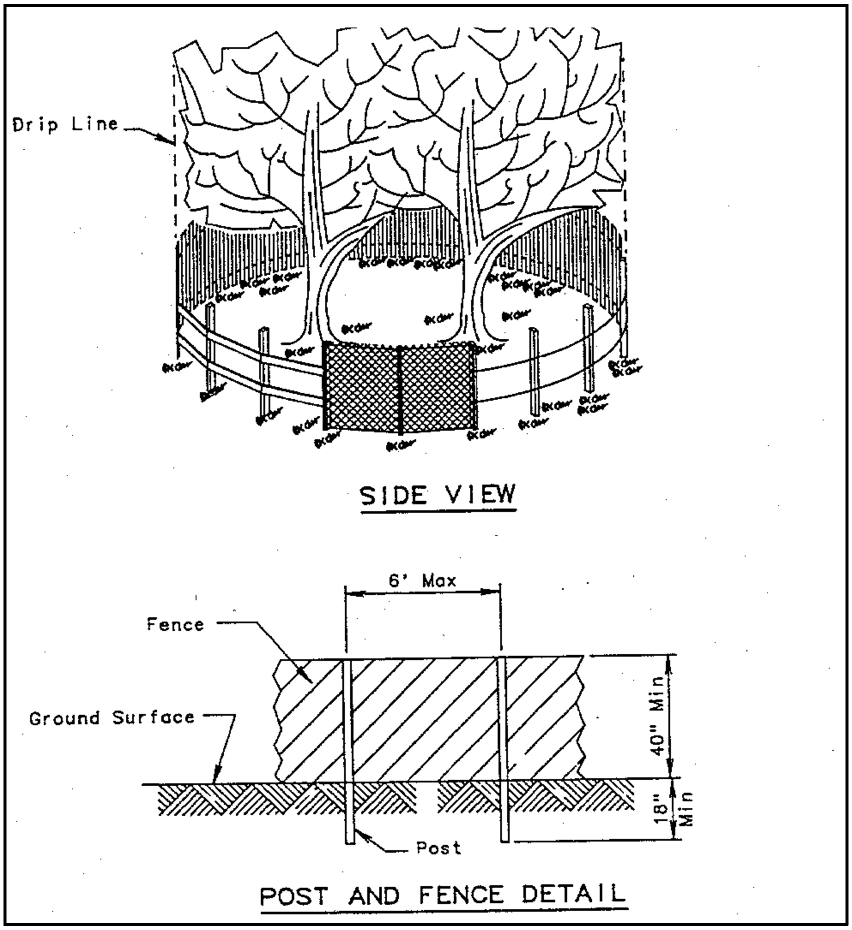

Exhibit 102b: Tree Preservation - Installation Detail (Source: NRCS Files)

Special Considerations

- Select trees to be saved prior to implementing construction activities. In general, leaving larger trees (8" or larger) will provide more shading, habitat, and food sources.
- Thinning undesirable trees ahead of time gives existing trees a chance to adjust to a more open environment.
- Prune low-hanging limbs of preserved trees that could otherwise be broken off by equipment.
- Try to leave trees in groups to avoid sun scald, frost cracks, excessive branching, and windthrow.
- In many cases, dead trees and cavities are important components of wildlife habitat. Unless the elimination of these features are essential for the project, these features may be left undisturbed.

MAINTENANCE

- Repair damaged roots by cutting off the damaged areas and painting with tree paint. Spread peat moss, wood chips or moist topsoil over exposed roots.
- Repair damage to bark by trimming around damaged areas. Taper the cut to provide drainage, and paint with tree paint.
- Cut all damaged limbs above the tree collar at the trunk or main branch. Use three separate cuts for each branch to avoid peeling bark from healthy areas of the tree.

REFERENCES

Related Practices

- Practice 1102 Vegetative Stabilization.
- Practice 1202 Stream Environment Enhancement.

Other Sources of Information

- North Carolina Erosion Control Manual.
- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.

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PRACTICE 103
TEMPORARY WETLAND CROSSING (Drag Line Mat)

DESCRIPTION

- A series of wooden "rafts" placed beneath the tread of heavy machinery to more evenly distribute the weight.

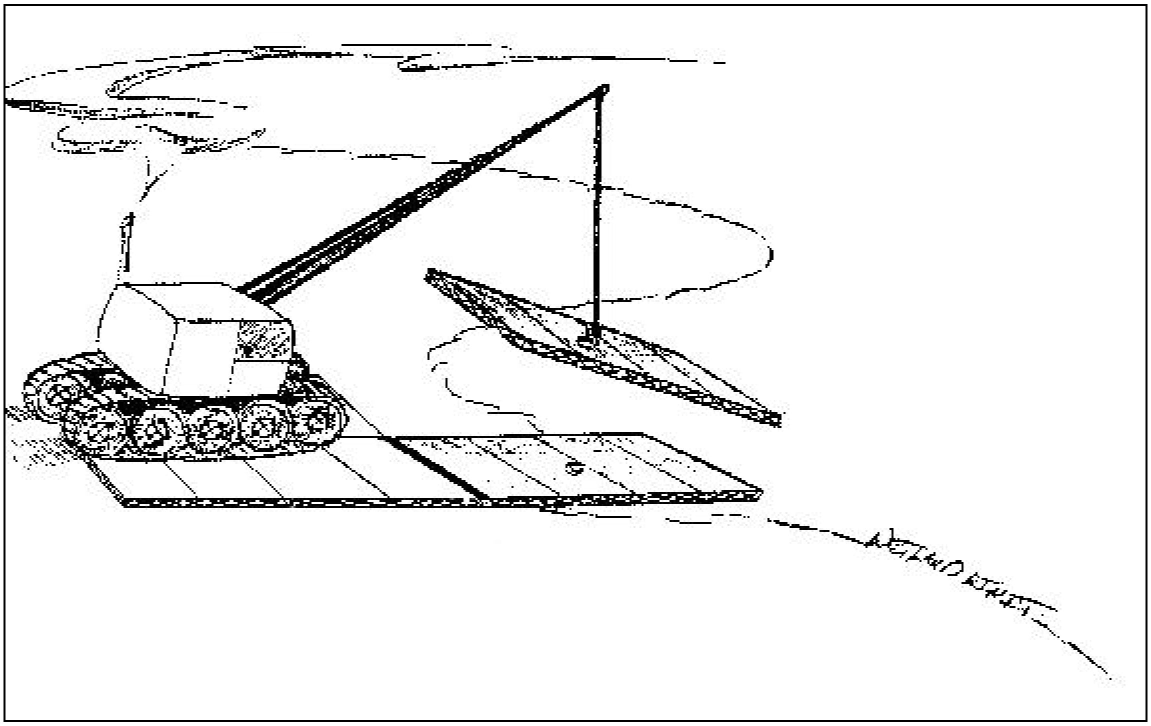

Exhibit 103a: Temporary Wetland Crossing (Source: CBBEL Files)

PURPOSE

- To reduce the impact of heavy machinery in wetlands or other sensitive or soft areas.

WHERE APPLICABLE

- Shallow wetlands.
- Soft soils or other sensitive areas.

ADVANTAGES

- Allows access through shallow wetlands or other sensitive areas.
- Minimizes adverse impacts to wetlands or other sensitive areas by more evenly distributing the weight.

CONSTRAINTS

- Only useful with machinery equipped with a boom such as a back hoe or drag line.
- Minor soil displacement is inevitable.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- 4 drag line mats, each constructed from 5 pieces of 20' long, 12" x 12" treated wooden beams cabled together.

Installation

- 2 drag line mats are placed in front of the machinery so that each mat is centered by each tractor tread, and two mats are placed behind the machinery.
- Machinery operator drives onto mats in front of the machine.
- Machinery operator uses boom to lift the two mats behind the

machine, and lines them up in front of the mats the machine is on.
- Operator drives onto the two mats just placed in front of the mats the machine is on.
- Operator uses boom to retrieve the 2 mats now behind the machine, and places them in front of the machine as described above.
- Piggy back process continues until operator reaches the final destination.

Special Considerations
- Only useful if water is $\leq$ 6" deep.

MAINTENANCE
- Periodically inspect the mats to make sure they maintain their structural integrity.

REFERENCES

Related Practices
- Practice 901 Culverts.
- Practice 902 Bridges.
- Practice 903 Fords/Low Water Crossings.

Other Sources of Information
- CBBEL Files.

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T.O.C.

PRACTICE 104
TEMPORARY DIVERSION

DESCRIPTION

- A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade to protect work areas and divert runoff. (Note: this practice is also included in the Indiana Erosion Control Handbook.)

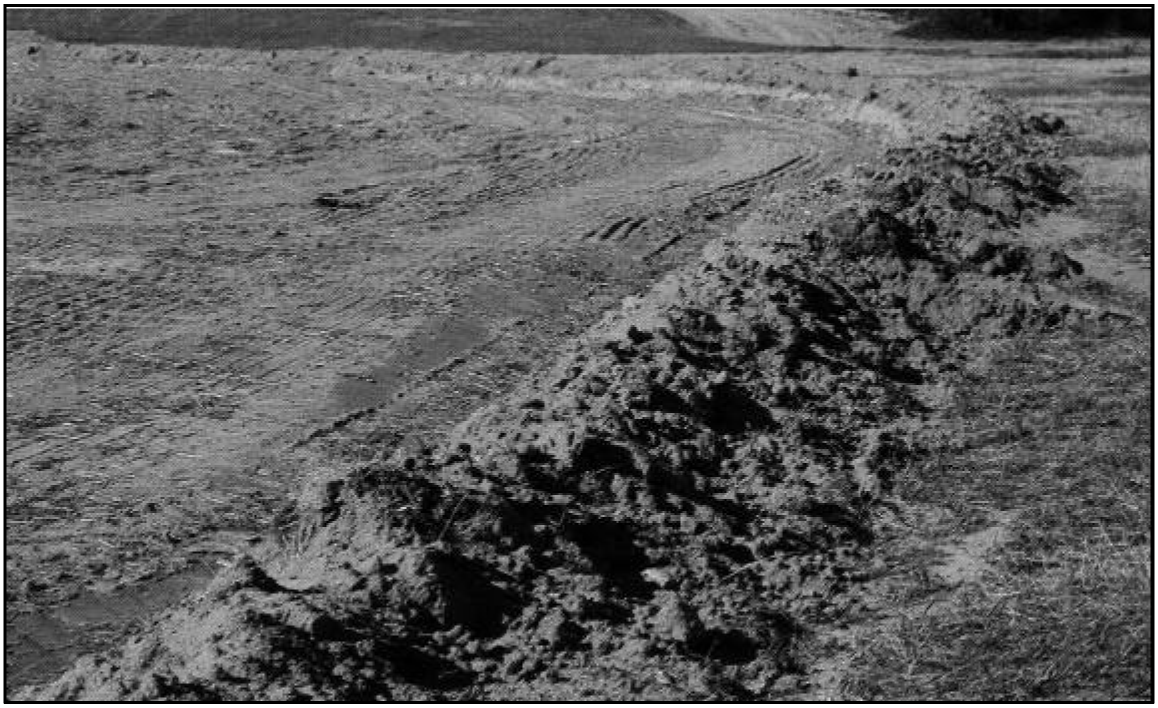


Exhibit 104a: Temporary Diversion (Source: North Carolina Erosion Control Manual)

PURPOSE

- To protect work areas from runoff and divert water to a stable outlet. Temporary diversions may be planned to function one year or more or may be rebuilt at the end of each day's operation to protect freshly graded cuts and fills.

WHERE APPLICABLE

- Up-slope side of a construction site where runoff can be diverted and disposed of properly to control erosion.
- Above disturbed existing slopes, and above cut or fill slopes before stabilization to prevent erosion and runoff over the slope, and to maintain acceptable working conditions.
- Down-slope side of the work area to divert excess runoff to stabilized outlets.

ADVANTAGES

- Prevent surface runoff from entering the disturbed area when placed up-slope of a construction area.
- Divert sediment-laden runoff to on-site sediment traps or basins when placed down-slope from the construction area.

CONSTRAINTS

- May only serve a drainage area $\leq$ 3 acres.
- Peak runoff capacity $\leq$ 2-year frequency, 24-hour storm event.
- Grade should be stable and positive towards outlet, but not exceeding 1%.

- Side slopes of the ridge must not exceed 2:1 (1V:2H). 3:1 (1V:3H) or flatter side slopes are desirable if the ridge and channel are to be vegetated and mowed.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Soils available on site and grading equipment.

Installation

- Temporary diversions are usually constructed by excavating a channel and using the spoil to form a ridge or dike on the downhill side.

- Site Preparation:
  1. Mark diversion location.
  2. Remove all trees, brush, stumps, or other debris from the site and dispose of properly (See Activity 5.3 Debrushing, Practice 107 Clearing and Grubbing, and Practice 1301 Debris Disposal).
  3. Set grade and alignment to fit site needs and topography, maintaining a stable, positive grade towards outlet, and realigning or elevating the ridge as needed to avoid reverse grade.

- Construction:
  1. Construct the diversion to dimensions and grades shown in Exhibit 104b.

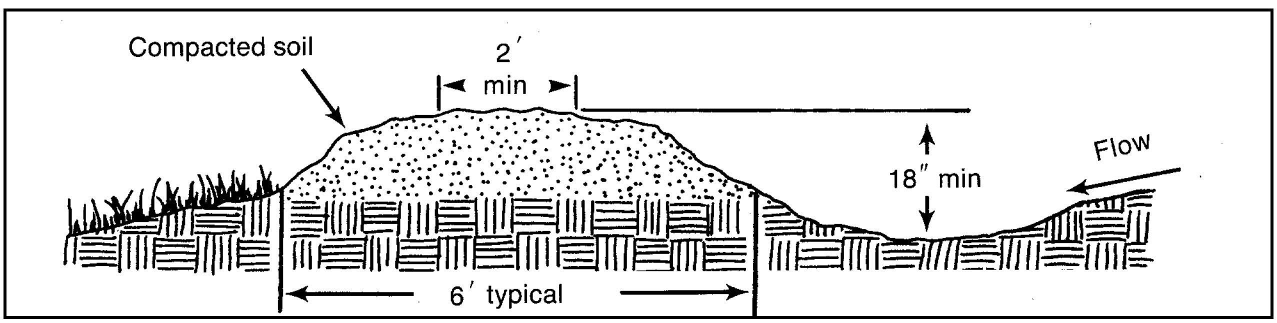


Exhibit 104b: Proper construction of a Temporary Earthen Diversion Dike (Source: North Carolina Erosion Control Manual)

  2. Build the ridge higher than the design elevation, and compact with wheels of construction equipment to design height, plus 10%.
  3. Leave sufficient area along the dike to permit access by machines for maintenance.
  4. Install outlet protection and sediment traps, if necessary, as part of the diversion.

- Stabilization:
  1. Establish vegetation on the ridge immediately following construction, unless the diversion will be in place less than 30 days.

Special Considerations

- Water diverted from construction site must not damage adjacent properties.
- Diversions should have a stable outlet with adequate capacity.
- Diversion dikes should be protected from ongoing construction activities (See Practice 103 Temporary Wetland Crossing and Practice 903 Fords/Low Water Crossings).
- Channel velocity should not exceed that considered erosive for soil and planned vegetation lining.

MAINTENANCE

- Inspect the dike weekly and after every storm event.
- Remove debris and sediment from the channel immediately.
- Repair dike to original height as necessary.
- Maintain outlets, and repair as necessary to prevent gullying.
- Once the work area has stabilized, remove the diversion ridge, fill and compact the channel to blend with the surrounding area, and stabilize all disturbed areas.

REFERENCES

Related Practices

- Activity 5.3 Debrushing.
- Practice 107 Clearing and Grubbing.
- Practice 1102 Vegetative Stabilization.
- Practice 1301 Debris Disposal.

Other Sources of Information

- Illinois Urban Manual.
- NRCS Standard Specifications.
- Indiana Erosion Control Handbook.
- North Carolina Erosion Control Manual.

Last Print/Revision Date: October 13, 1996

PRACTICE 105
SILT FENCING

DESCRIPTION

- Temporary barrier of entrenched geotextile fabric (filter fabric) stretched across and attached to supporting posts used to intercept sediment-laden runoff from small drainage areas of disturbed soil. (Note: this practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 105a: Silt Fencing (Source: North Carolina Erosion Control Manual)

PURPOSE

- Cause the deposition of transported sediment load from sheet flows leaving disturbed areas.

WHERE APPLICABLE

- Situations when sediment laden runoff from small drainage areas are a concern.

ADVANTAGES

- Silt fences capture and retain sediment on the construction site thus protecting waterways, streets and other areas outside of the construction limits from sedimentation.
- Silt fences often serve to define construction limits to equipment operators as well as bystanders.
- Silt fences are usually more effective and less expensive than a Straw Bale Filter (Practice 106).

CONSTRAINTS

- Not appropriate where the maximum drainage area exceeds 1/4 acre per 100 feet of fence. Silt fencing is further restricted by slope steepness.

Land Slope	Max. Distance Above Fence
< 2%	100'
2-5%	75'
5-10%	50'
10-20%	25'
> 20%	15'

Exhibit 105b: Maximum distance above silt fence based on land slope. (Source: Indiana Erosion Control Handbook)

- Silt fence should not be used in the flow path of defined drainageways.
- Silt fence may be a high maintenance item during earth moving activities in adjacent areas, and during the rainy season.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- 2" x 2" hardwood posts or steel posts.
- 14 gauge, 6" mesh wire fence (optional).
- Woven or non-woven geotextile fabric with specified filtering efficiency and tensile strength.

Physical Property	Woven Fabric	Non-woven Fabric
Filtering efficiency	85%	85%
Tensile strength at 20% elongation:		
Standard strength	30 lbs/l.in.	50 lbs/l.in.
Extra strength	50 lbs/l.in.	70 lbs/l.in.
Slurry flow rate	0.3 gal./min./sq.ft.	4.5 gal./min./sq.ft
Water flow rate gal./min./sq.ft.	15 gal./min./sq.ft.	220
UV resistance	70%	85%

Exhibit 105c: Properties of woven versus non-woven silt fence fabric. (Source: Indiana Erosion Control Handbook)

Installation

- Dig an 8" deep, flat-bottomed or V-shaped trench along the entire intended fence line.
- Drive wood or steel support posts at least 1' into the ground, ≤ 8' apart (≤ 6' apart if not using support wire). Adjust spacing if necessary to ensure that posts are set at the low points along the fence.
- Fasten support wire to the up slope side of the posts, extending it 8" into the trench, or as recommended by the manufacturer.
- Run a continuous length of geotextile fabric on the up slope sides of the posts.

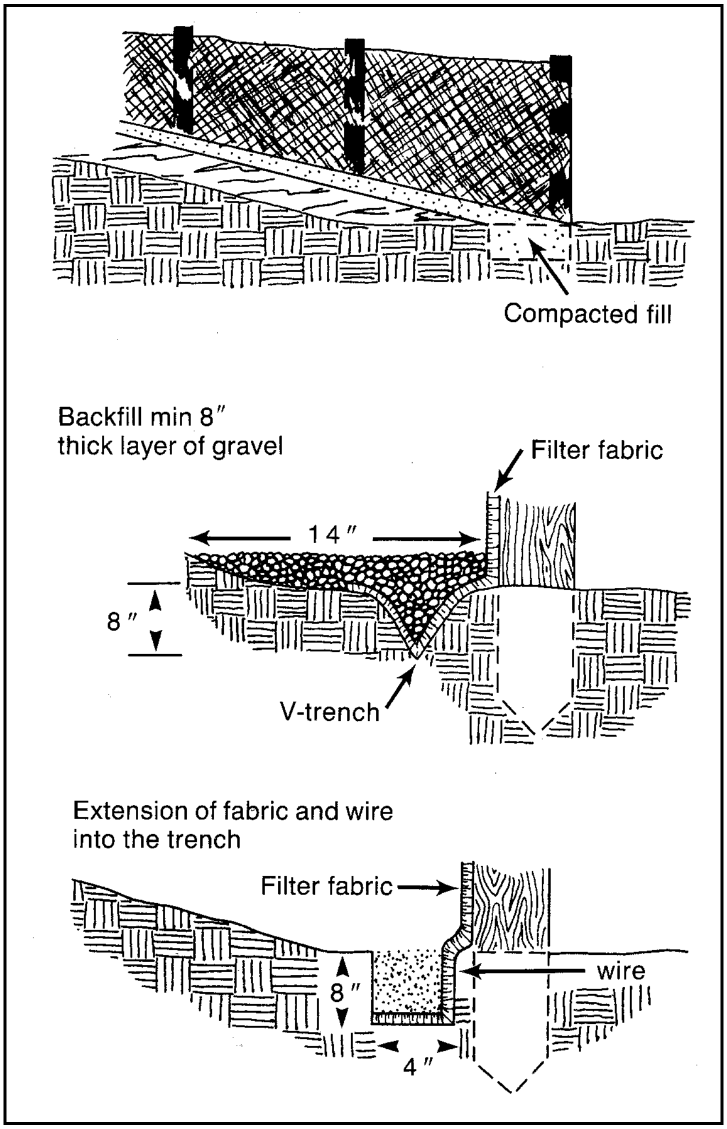


Exhibit 105d: Silt fence installation Details (Source: North Carolina Erosion Control Manual)

- If a joint is necessary, nail the overlap to the nearest post with lath.
- Place the bottom 1' of fabric in the 8" deep trench, extending the remaining 4" toward the up slope side.
- Backfill the trench with compacted earth or gravel.

Special Considerations

- Fence should be at least 10' from the toe of the slope to provide for sediment storage.
- The height of the fence should be 24"-36" above the ground surface.
- Silt fences should not be placed in areas of concentrated flows.
- Improper placement and/or installation can exacerbate and even create erosion problems.

MAINTENANCE

- Inspect fence periodically and after each storm event.
- Replace fencing as necessary.
- Remove deposited sediment when it reaches half the height of the fence at its lowest point, or if the fence begins to bulge.

REFERENCES

Related Practices

- Practice 106 Straw Bale Filter.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.
- North Carolina Erosion Control Manual

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 106
STRAW BALE FILTER

DESCRIPTION

- Temporary barrier consisting of a row of entrenched and anchored straw bales used to intercept sediment-laden runoff from small drainage areas of disturbed soil. (Note: This practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 106a: Straw Bale Filter (Source: CBBEL Files)

PURPOSE

- Cause the deposition of transported sediment load from sheet flows leaving disturbed areas.

WHERE APPLICABLE

- Erosion would occur in the form of sheet and rill erosion.
- The maximum drainage area for overland flow does not exceed 1/4 acre per 100' of barrier.
- There is no concentration of water flowing to the barrier.
- Effectiveness is required for < 3 months.

ADVANTAGES

- Straw bale filters capture and retain sediment on the construction site thus protecting waterways, streets and other areas outside of the construction limits from sedimentation.
- Straw bale filters can serve to define construction limits to equipment operators as well as bystanders.

CONSTRAINTS

- Less resilient and usually more expensive than Silt Fencing (Practice 105).

Land Slope	Max. Distance Above Fence
< 2%	100'
2-5%	75'
5-10%	50'
10-20%	25'
> 20%	15'

Exhibit 106b: Maximum distance above straw bale filter based on land slope. (Source: Indiana Erosion Control Handbook)

- Lower filter efficiency than silt fencing.
- May be a high maintenance item during earth moving activities in adjacent areas, and during the rainy season.
- Higher flow-through rate than silt fencing.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Straw bales 14" x 18" x 36" minimum.
- Two 36" long (minimum) steel rebars or 2" x 2" hardwood stakes per bale.

Installation

- Dig a $\geq$ 4" deep flat-bottomed trench along the entire intended fence line. The trench should be wide enough to accommodate a bale width, and long enough so that the end bales extend up-slope in such a way that trapped water cannot flow around the ends of the barrier.
- Place bales in the trench on edge (bindings oriented around the sides rather than top and bottom), and abut bales tightly against each other.
- Anchor the Straw Bale Filter by driving 2 rebars or hardwood stakes through each bale until nearly flush with the top. The first stake should be driven toward the previously laid bale to force the bales together.
- Tightly wedge straw into any gaps between the bales to prevent sediment-laden water from running through the cracks.
- Backfill and compact the excavated soil against the bales to ground level on the down-slope side and to 4" above ground level on the up-slope side.

T.O.C.

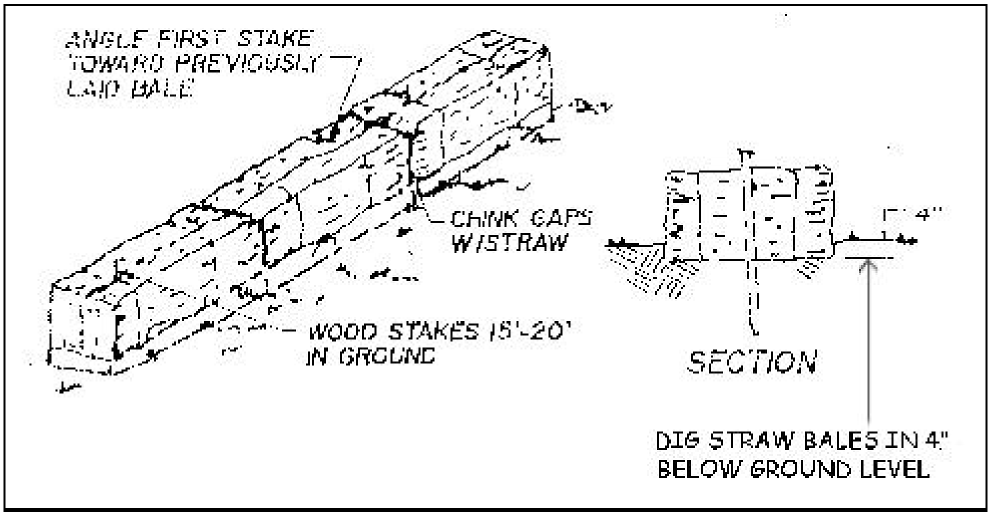


Exhibit 106c: Detail of straw bale filter installation (Source: CBBEL files)

Special Considerations

- Straw bales should not be placed in areas of concentrated flow.
- Field observations have shown that the efficacy of Straw Bale Filters is often compromised for the followings reasons:
  1. Improper use in which bales are used in waterways with high water velocities.
  2. Improper installation including no entrenchment.
  3. Inadequate maintenance.
  4. Straw bales decompose in the presence of moisture and have a very limited life span.

MAINTENANCE

- Inspect bales periodically and after each storm event.
- Replace bales as necessary.
- Remove deposited sediment when it reaches half the height of the bale filter.
- Sediment deposits remaining (after the straw bale filter is no longer required) should be dressed to the existing grade, and seeded.

REFERENCES

Related Practices

- Practice 104 Temporary Diversion.
- Practice 105 Silt Fencing.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.
- Illinois Urban Manual.

Last Print/Revision Date: October 13, 1996

PRACTICE 107
CLEARING AND GRUBBING

DESCRIPTION
- Removal and disposal of trees, snags, logs, stumps, shrubs, and rubbish.

Exhibit 107a: Clearing and Grubbing (Source: NRCS Files)

PURPOSE
- To prepare a site for construction activities.

WHERE APPLICABLE
- All situations in which vegetation, rubbish or debris must be removed prior to implementing construction activities.

ADVANTAGES
- Allows unimpeded access to construction site.
- Provides suitable substrate on which to work.
- Provides a safe environment in which to work.

CONSTRAINTS
- All areas cleared and/or grubbed must be stabilized with vegetation.
- All material cleared and/or grubbed must be properly disposed of.
- May require the use of heavy equipment.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Brushhog, chainsaw, stump grinder, bulldozer, etc.

Installation
- The limits of areas to be cleared and/or grubbed should be marked with stakes, flags, or other suitable methods.
- Trees to be left standing and uninjured should be designated by special marks placed about 6' high on the trunks. Preserved trees should be protected as described in Tree Preservation and Protection (Practice 102).
- Clearing: Removal and disposal of woody vegetation and other debris. Trees and woody vegetation should be cut off as near the ground surface as field conditions permit.

- Grubbing: Removal of all stumps, roots, and root clusters having a diameter of ≥ 1" to a depth of ≥ 2' below subgrade elevations for concrete structures, and ≥ 1' below the ground surface at embankment sites and other designated areas.

Special Considerations

- All materials cleared and/or grubbed should be disposed of as described in Debris Disposal (Practice 1301).
- Measures should be taken to prevent erosion and siltation during clearing and/or grubbing activities.
- All areas cleared and/or grubbed should be stabilized as soon as possible.

MAINTENANCE

- Areas cleared and/or grubbed should be monitored periodically until the site is stabilized.

REFERENCES

Related Practices

- Practice 102 Tree Preservation and Protection.
- Practice 105 Silt Fencing.
- Practice 106 Straw Bale Filter.
- Practice 1102 Vegetative Stabilization.
- Practice 1301 Debris Disposal.

Other Sources of Information

- NRCS Standard Specifications.
- Illinois DOT Specifications.

Last Print/Revision Date: October 13, 1996

SECTION 5.2

TILE DRAIN INSTALLATION AND REPAIR

SECTION 5.2
TILE DRAIN INSTALLATION AND REPAIR

Headwater areas for many of the streams and ditches in Indiana are in the form of closed tile drains. The upper portion of these drains is usually located within agricultural fields where water is collected through the use of perforated drains installed below the ground surface. This section concentrates on these types of drains. It should be noted that in general, these systems are installed and maintained by private landowners. These systems then discharge water to a regulated drain which may either be a larger tile or an open drain.

Stream enclosures, in the form of a long culvert or an unperforated tile drain, are often used in the headwater areas to convey drainage water without disruption to the above-ground land use. Principles provided in this section, as well as those presented in Practice 901, should be consulted when such usage of tile drains is being considered.

Subsurface tile drains consist of a conduit installed beneath the ground surface to collect and/or convey drainage water. Tiles may be constructed of corrugated plastic tubing, clay, or concrete. The choice of tile material depends on the cost, resiliency, strength, and conveyance.

Subsurface drains are often installed in agricultural fields employing one of four systems of layout: parallel, herringbone, double main, or random (Exhibit 201b). The type of system used depends on site topography, land drainage patterns, and other factors. A double main, for example, intercepts runoff on either side of a stream. A random system is useful for draining irregularly dispersed wet pockets in the landscape.

Breather pipes, or pressure relief vents, are recommended where the drain grade changes from steep to flat. The purpose of breather pipes is to allow air entry, and to relieve pressure that otherwise may cause blowouts. Breather pipes may also be replaced or modified as slotted risers which serve as inlets for areas prone to surface ponding.

Installation of surface inlets to tile systems can help remove surface water more quickly. However, surface inlets can also provide a direct conduit to receiving streams for herbicides, pesticides, and other chemicals used in agricultural fields. Buffer strips of permanent grass around inlets should be considered to reduce impact of pollutants.

Subsurface drains that are properly installed require little maintenance to keep operational. However, periodic inspections will help keep drains operating at capacity. Particular attention should be paid to outlets, water-surface inlets, traps and catch basins, and tiles located near trees. To reduce the chance of damage by various activities along roads, markers may be used to signal the location of tile crossings.

Tiles, by their nature, can dramatically alter the hydrology of areas where they are located, as well as the hydrology of adjacent properties. Care should be taken that tiles do not negatively impact valuable wildlife habitat (especially for wetland and stream dependent species), or cause detrimental water level impacts to adjacent property owners. Non-perforated or sealed joint tile should be used in these areas.

PRACTICE 201
TILE DRAIN INSTALLATION

DESCRIPTION

- A conduit, such as corrugated plastic tubing, clay tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water in headwater areas.

Exhibit 201a: Tile Drain Installation (Source: NRCS Files)

PURPOSE

- Convey watershed's headwater flow with minimal disruption to agricultural fields.
- Improve soil environment for vegetation growth.
- Collect ground water.
- Remove water from heavy use areas.
- Regulate water to control hydrophytic pests such as liver flukes, flies, or mosquitos.

WHERE APPLICABLE

- Areas with a high water table where the benefits of lowering the table would justify installing such a system.

ADVANTAGES

- Relieves artesian pressures.
- Removes surface runoff.
- May enhance crop growing potential.

CONSTRAINTS

- May be relatively expensive to install.
- May drain valuable wetland habitat.
- May negatively affect water levels of adjacent land owners.
- May transport contaminants.
- May outfall into valuable stream habitat that may be negatively impacted by potentially cool, subsurface water.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Clay, concrete, or perforated and non-perforated plastic tubing.
- Conduit should meet strength and durability requirements of the site.
- Filter material, if necessary.

T.O.C.

Installation

- Begin digging the trench at the outlet end continue upgrade.
- Trench width should at least equal the outside diameter of the drain, up to 0.5' wider than the drain.
- Round the bottom of the trench so that the drain will be embedded in undisturbed soil for the last 60 degrees of its circumference.
- For corrugated plastic tubing, installation criteria are listed in ASTM Standard F449: "Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control".
- Laying of the tile should begin at the lower end of the line and progress up-grade.
- Backfill in a manner that will not displace the conduit.

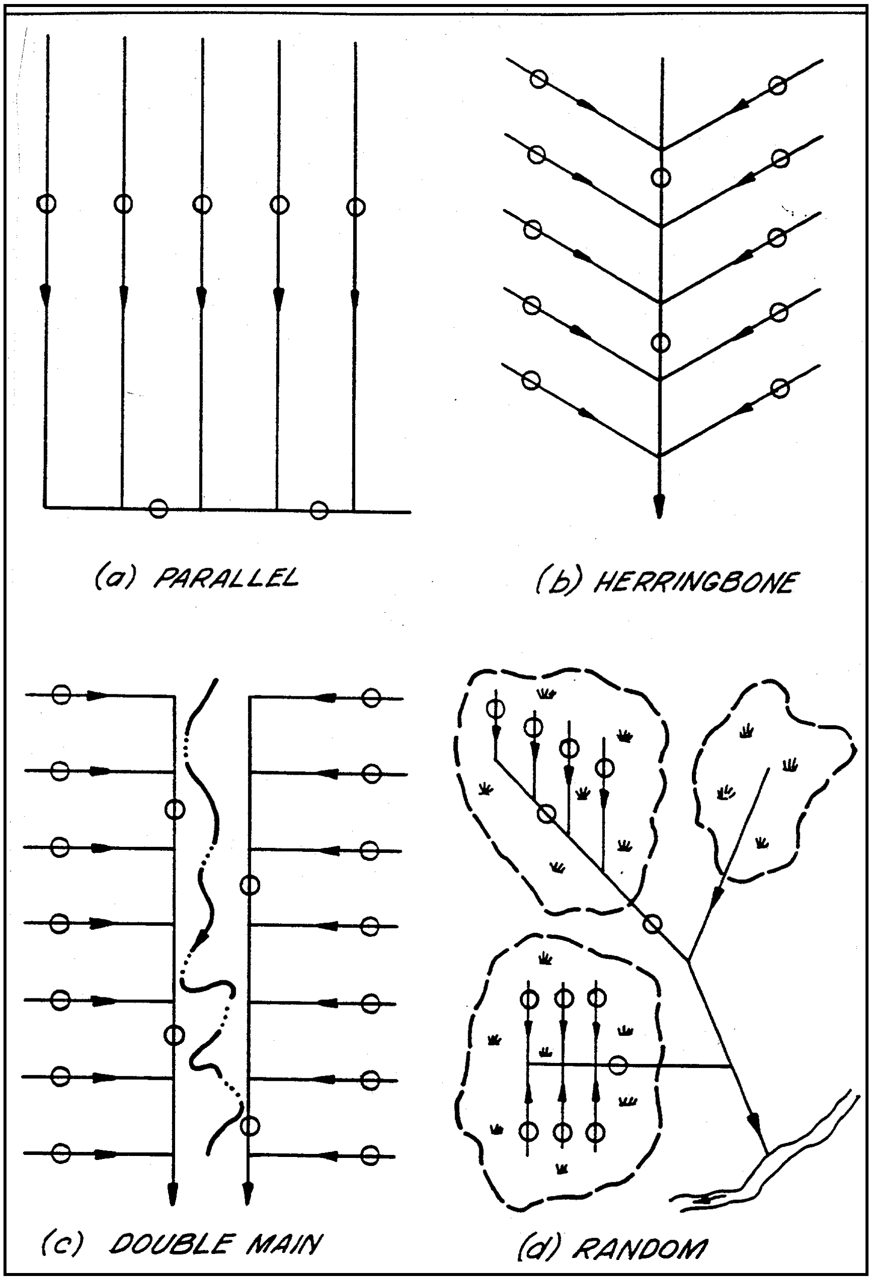


Exhibit 201b: Types of drainage collection systems (Source: NRCS National Engineering Handbook)

Special Considerations

- When the tile drain path is adjacent to or through a wetland area that is designated to be preserved, sealed or non-perforated tile/tubing must be used with sufficient distance before and after the limits of the wetland to protect it against being drained.
- Drainage easements should be considered when installing mutual drains. These easements should be recorded with the county recorder's offices.

<u>Capacity</u> - Determine by one or more of the following:

- Application of drainage coefficients as recommended by the NRCS Indiana Drainage Guide or NRCS Chapter 14, Part II of the Engineering Field Manual, to the area drained, including added capacity required to dispose of surface water entering through surface inlets.
- Comparison of the site with other similar sites where subsurface drain yields have been measured.
- yield of ground water based on the expected deep percolation of irrigated water from the overlying fields, including the leaching requirement.
- Measurement of the rate of subsurface flow at the site during a period of adverse weather and ground water conditions.
- Calculations using Darcy's law or estimation of lateral or artesian subsurface flow.

<u>Size</u>

- Compute by applying Manning's formula.
- Drain tiles should be designed in such a way that pressure flow does not occur in the tile.

<u>Depth, Spacing, and Location</u>

- Should be based on site conditions such as soils, topography, ground water conditions, crops, land use, and outlets.
- Minimum depth should be 2' in mineral soils and 2.5' in organic soils.
- Calculate equipment loads when the depth is less than 6'.

<u>Velocity and Grade</u>

- In areas where sedimentation is not a hazard, the minimum grades shall be based on site conditions and a velocity of at least 0.5' per second.

Soil Texture	**Velocity (ft/s)**
Sand and sandy loam	3.5
Silt and silt loam	5.0
Silty clay loam	6.0
Clay and clay loam	7.0
Coarse sand or gravel	9.0

Exhibit 201c: Maximum Velocity by Soil Texture

	● Filters and filter material, and envelopes and envelope material may be necessary depending on site conditions.
MAINTENANCE	● Keep inlets, trash guards, collection boxes, and structures clean and free of materials that can reduce the flow. ● Repair all broken or crushed lines to insure proper functioning of the drain. ● Repair or replace broken or damaged inlets and breathers damaged by livestock and machinery. ● Periodically inspect outlet conduit and animal guards for proper functioning.
REFERENCES	**Related Practices** ● Practice 202 Tile Drain Repair/Replacement. ● Practice 203 Breather Pipe. ● Practice 204 Tile Drain Inlet. ● Practice 1001 Tile Drain Outlet Extension. **Other Sources of Information** ● NRCS Engineering Field Handbook. ● Illinois Urban Manual. ● ASTM Standard F449. ● Davis' Handbook. ● North Carolina Erosion Control Manual.

Last Print/Revision Date: October 13, 1996

PRACTICE 202
TILE DRAIN REPAIR/REPLACEMENT

DESCRIPTION
- Maintenance, repair, and replacement of tile drains.

Exhibit 202a: Tile Drain Repair/Replacement (Source: NRCS Files)

PURPOSE
- To reestablish drain function by restoring tile segment.

WHERE APPLICABLE
- All subsurface drains.

ADVANTAGES
- Regular repairs and maintenance help avoid future costly repairs and damages.

CONSTRAINTS
- All drains should be maintained.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Varies with project.
- Properly-sized segments should match hydraulic capacity of adjoining pipes (upstream and downstream).

Installation
- Outlets should be kept free of debris. They should be protected from animals by a flap gate or a grating.
- Water surface inlets may require frequent repairs. Erosion around inlets should be repaired, and the inlet grating should be kept free of debris.
- Traps must be kept clean in order to maintain drainage capabilities. Cleanout of the trap may be less frequent as the drain ages.
- Blowouts occur when the tile is subjected to pressure flow. When the tile is subjected to pressure flow, water is forced out of the tile saturating the surrounding soil. As the flow drops, the saturated soil is sucked into the tile. To correct, replace with solid tile or correct the pressure flow problem.

- Tree roots may plug drains. To repair the line, dig it up, clean it, and re-lay it. Please note that this is only a temporary measure that may have to be repeated periodically. One way to prevent recurrence, short of killing the trees, would be to replace the part of the drain near the trees with sewer pipe.
- Drains laid under waterways may carry soil and cause holes. Drains under waterways should be inspected regularly, and the holes repaired as necessary.
- Mineral deposits can sometimes plug the perforations in drains. Indication of the presence of deposits may be seen at the outlets or at junction boxes and inspection holes. Sulphur dioxide gas injected into the upper end of the drain from tanks of compressed gas can open the drain. The gas should be held in the line for 24 hours after the air has been replaced by gas. High pressure hydraulic cleaners are also used.

Special Considerations

- Failure of drains to operate as expected may result from a variety of reasons including: insufficient capacity, drains placed too shallow, lack of auxiliary structures, insufficient drain strength, improper spacing between joints, improper bedding, poor grade and alignment, improper backfilling, and substandard materials.
- Drainage easements should be considered when installing or repairing mutual drains. These easements should be recorded at the County Recorder's Offices.

MAINTENANCE

- Periodically inspect the required area for signs of blowout at the repair site or adjacent to it.

REFERENCES

Related Practices

- Practice 201 Tile Drain Installation.
- Practice 203 Breather Pipe.
- Practice 204 Tile Drain Inlet.

Other Sources of Information

- NRCS Engineering Field Handbook.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 203
BREATHER PIPE (Pressure Relief Vent)

DESCRIPTION
- Vertical vents that relieve air pressure in subsurface drains.

Exhibit 203a: Breather Pipe (Source: NRCS Files)

PURPOSE
- Relieve pressure in the line.
- Provide air entry into the line.

WHERE APPLICABLE
- Where the drain grade changes from steep to flat.
- Where future inspection may be needed.

ADVANTAGES
- Relieves pressure that might otherwise cause blowouts.
- Provides air entry to a drain for the purposes of venting a line.
- Allows access for inspection and cleanout.
- May also act as a marker.

CONSTRAINTS
- Additional expense.
- May be minor obstacle to farm machinery when installed in agricultural fields.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Riser Pipe.
- Screen or perforated cap.
- T-joint, or other appropriate joint.

T.O.C.

Installation

- Place T-connection in line and cement riser pipe to the joint.
- Riser pipe should extend at least 3' above the ground.
- Cover the opening with a perforated cap, or heavy wire mesh.

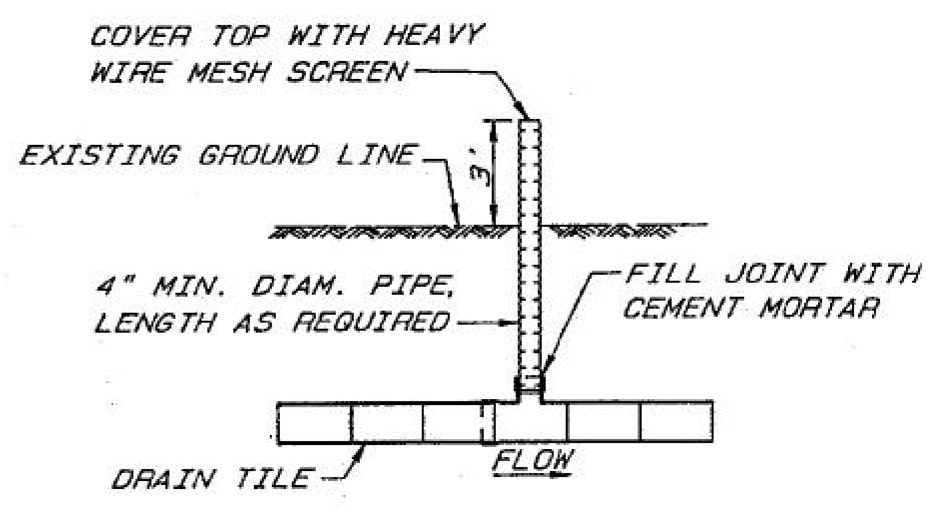


Exhibit 203b: Installation of breather pipe (Source: NRCS Files)

Special Considerations

- Vents should be located at points where the drain grade changes from a steep grade to a flat grade (where the difference in grade exceeds 0.5% or at key locations where future inspections are to occur).

MAINTENANCE

- Keep breathers free of debris.

REFERENCES

Related Practices

- Practice 201 Tile Drain Installation.
- Practice 204 Tile Drain Inlet.
- Practice 202 Tile Drain Repair/Replacement.
- Practice 1001 Tile Drain Outlet Extension.

Other Sources of Information

- NRCS Engineering Field Handbook.

Last Print/Revision Date: October 13, 1996

PRACTICE 204
TILE DRAIN INLET

DESCRIPTION
- Vertical riser with round holes or slots to provide an inlet for surface water.

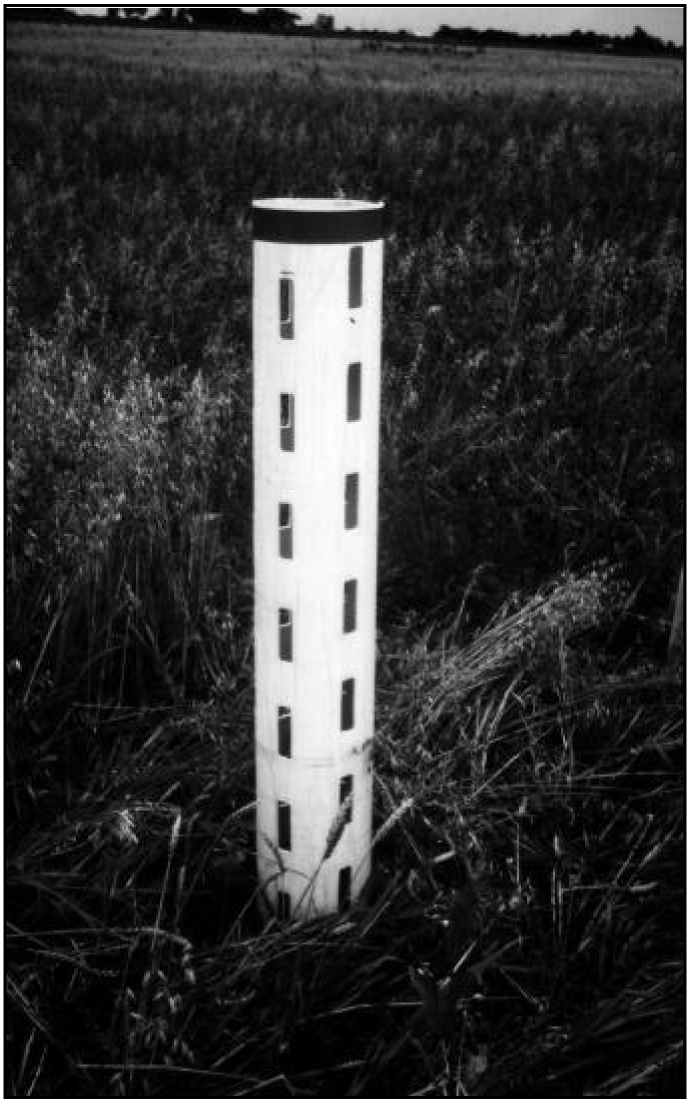


Exhibit 204a: Typical Tile Drain Inlet (Source: NRCS Files)

PURPOSE
- Provide a direct inlet for surface water in a field.
- May also provide air entry into the line or relieve pressure in the line.

WHERE APPLICABLE
- Areas prone to surface ponding.

ADVANTAGES
- Reduces surface ponding.
- Also acts as a breather pipe when no ponding is occurring next to the riser.
- Allows access for inspection and clean-out.
- Also acts as a marker for underground drain location.

CONSTRAINTS

- Additional expense.
- May be minor obstacle to farm machinery when installed in agricultural fields.
- Surface inlets can provide a direct conduit to receiving streams for herbicides, pesticides, and other chemicals used in agricultural fields.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Riser pipe made of aluminum, iron, P.V.C., smooth polyethylene, or steel. (Prefabricated slotted/round-hole intakes may also be available)
- Trash guard or prefabricated perforated cap.
- T-joint, or other appropriate joint.

Installation

- Place T-connection in line and cement riser pipe to the joint.
- Riser pipe should extend at least 3' above the ground.
- The conduit trench from the toe of the backslope to the riser, must be excavated with 1:1 (1V:1H) side slopes and backfield with compacted fill. The backfill around the riser shall be hand tamped.
- Follow installation details shown in Exhibit 204b.

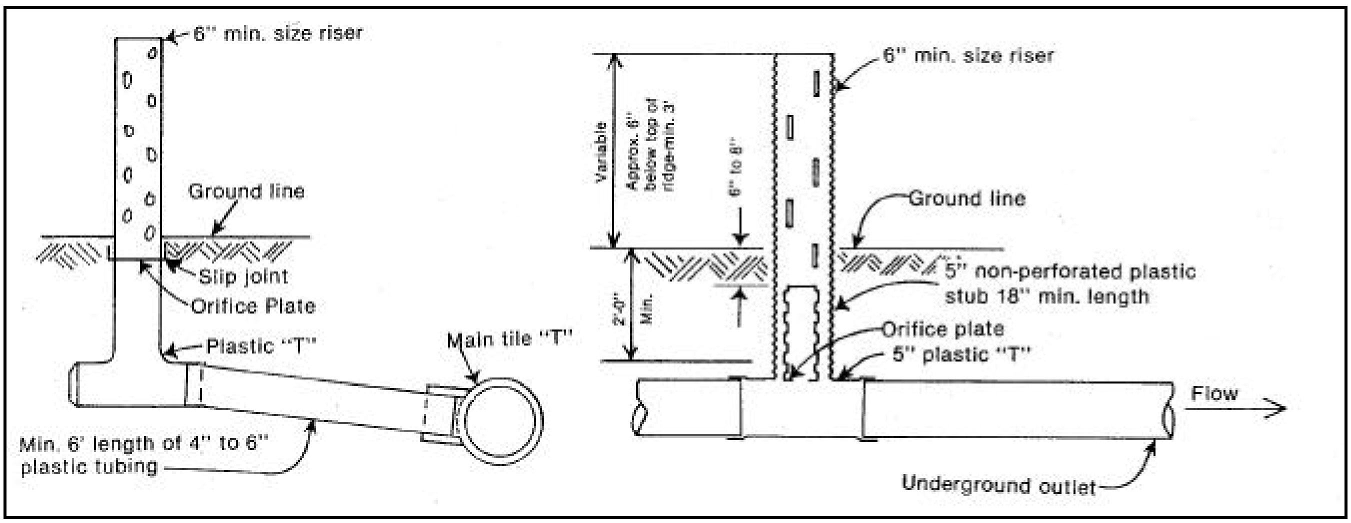


Exhibit 204b: Typical Tile Drain Inlet Installation Details (Source: NRCS Files)

- To make a Slotted Intake, cut ¾" by 4" slots in four (4) rows around the pipe (90 degree spacing). Do not space closer than 2" to the seams or end of pipe. (See Exhibit 204c for details). Slotted intake capacity is about 20 acre-inches per day.

- To make a Round-Hole Intake, Fabricate 24 holes per linear foot, ¾" diameter. Alternate fabrication approximately 12 inches per foot of 1" diameter. (See Exhibit 204c for details). Round-Hole intake capacity is about 8 acre-inches per day.

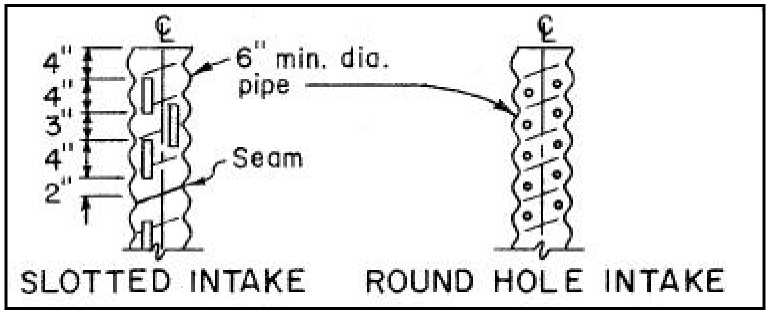


Exhibit 204c: Typical Tile Drain Riser Intake Details (Source: NRCS Files)

- Trash Guard: Top of the riser must be protected by a standard trash guard (Exhibit 204d). Prefabricated trash guards/caps may also be used.

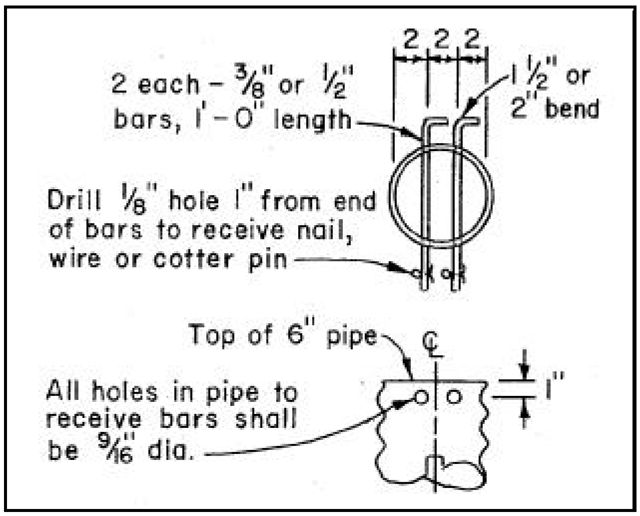


Exhibit 204d: Typical Trash Guard Details (Source: NRCS Files)

Special Considerations

- To protect the water quality and prevent chemicals used in the agricultural farms to get into the intake, a permanent grass buffer zone around the riser must be provided. The size of the buffer depends on the intake size and topography with a minimum diameter of 30 feet.

MAINTENANCE

- Inspect frequently, especially after each storm to insure that the intake remains in working conditions..

REFERENCES

Related Practices

- Practice 201 Tile Drain Installation.
- Practice 202 Tile Drain Repair/Replacement.
- Practice 203 Breather Pipe.
- Practice 1001 Tile Drain Outlet Protection.

Other Sources of Information

- NRCS Engineering Field Handbook.

SECTION 5.3

DEBRUSHING

SECTION 5.3
DEBRUSHING

Debrushing entails controlling and removing living, woody vegetation from the banks and overbanks of streams and man-made ditches. Herbicides, hand-held tools, and heavy machinery, all are useful during debrushing activities. Using a combination of herbicides and mechanical debrushing is usually the most effective approach.

Debrushing using hand-held tools is generally the least damaging to the environment, and may be the best choice for small-scale projects, and in ecologically sensitive areas. However, this approach is labor intensive, and not cost-effective for large-scale projects.

Debrushing using heavy machinery may be the most practical alternative for long stretches of banks and overbanks that require regular maintenance. Since heavy machinery is generally more damaging to the environment than hand-held tools, care must be taken to limit access to areas able to withstand the impact.

Chemical Vegetation Control can either be used alone, or in conjunction with mechanical debrushing. Foliar spray applications, in which an herbicide is sprayed so that it coats the leaves and stems of target species, can be used alone as a way to routinely control vegetation. However, depending on the project, it may be necessary to clear and dispose of the dead vegetation. Applicators also run a high risk of contaminating water, and non-target species during spraying.

Herbicides are very useful when incorporated with mechanical debrushing techniques. Painting fresh-cut stumps of woody plants will reduce or eliminate regrowth, thus reducing long-term maintenance costs. Herbicides may also be used in ecologically sensitive areas where a skilled applicator can be very selective in which plant or plant species is herbicided.

Removing stumps is generally not advised unless absolutely necessary. Stumps and intact root systems help protect banks and overbanks against erosion. Removing stumps necessitates filling in the cavities left after stump removal, regrading, and revegetating the disturbed area.

Vegetation is probably the single most important component of wildlife habitat. Deep-rooted native plants (grasses, shrubs, and trees) are usually the most economical means of bank stabilization and erosion control. Therefore, extensive use of debrushing should be reserved only where such activity is absolutely needed for maintaining access, maintaining the flow capacity and conveyance, or selectively controlling nuisance species.

PRACTICE 301
CHEMICAL VEGETATION CONTROL

DESCRIPTION

- Controlling woody vegetation by means of an herbicide.

Exhibit 301a: Chemical Vegetation Control (Source: CBBEL files)

PURPOSE

- To control growth of woody vegetation.

WHERE APPLICABLE

- Stream and ditch right-of-ways.
- Often used in conjunction with mechanical debrushing techniques (Practice 302 Debrushing Using Hand-held Tools and Practice 303 Debrushing Using Heavy Machinery).
- Areas where low impact, selective vegetation control is desirable.

ADVANTAGES

- Foliar application of herbicides may be more economical than mechanical control of woody vegetation. (However, it should not be used near the water.)
- Herbicides used in conjunction with mechanical debrushing techniques can be used to prevent resprouting.
- Often used in environmentally sensitive areas to selectively eliminate undesirable species.

CONSTRAINTS

- Herbicides can be hazardous to humans and the environment if not used properly.
- Product label should be strictly adhered to. In some cases label instructions prohibit use adjacent to water, and may prohibit use in certain areas where threatened/endangered species are known to exist.
- Applications may be done only by or under the direct supervision of a certified applicator, certified by the Office of Indiana Chemist at Purdue University.
- Application of herbicide may be limited by weather and season.
- May elicit negative public response.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Protective Clothing (minimum): shoes, long-sleeved shirt and long pants, eye protection, hat, rubber gloves.
- Foliar Application: manual or power hydraulic sprayer.
- Basal Bark Treatments: manual sprayer.
- Cut Surface Treatments: manual sprayer and or squirt bottle, tree injector.
- Herbicide.

Installation

- Foliar Spray Application: Apply to actively growing plants with fully developed foliage. Stems and leaves of target plants should be sprayed to the point of runoff.

- Injection Method: Use either a tool designed specifically for making a cut in a tree and simultaneously injecting the herbicide, or a hatchet and a squirt bottle. In both cases, tree wounds should angle downward through the bark and into the sapwood. Space cuts evenly around the trunk as recommended by the product label.

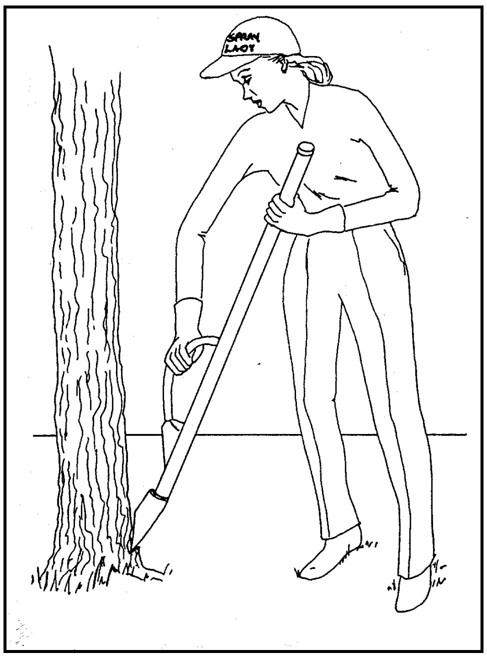
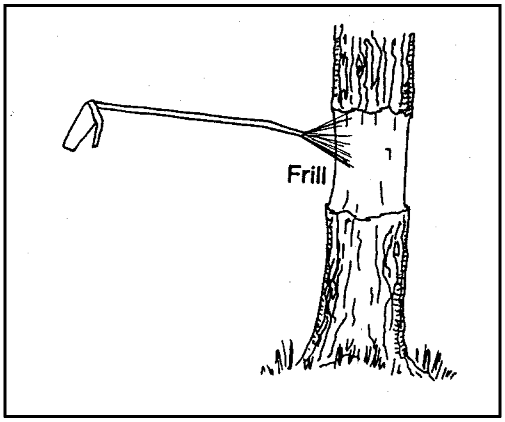


Exhibit 301b: Herbicide injection application (Source: Illinois Pesticide Manual)

- Girdling("frilling"): Make two cuts approximately 1' apart through the bark and into the sapwood, completely around the tree. Remove the bark in between and apply herbicide as recommended on the product label.

T.O.C.

Exhibit 301c: Herbicide applied following girdling (Source: Illinois Pesticide Manual)



- Stump Treatment: Cut stumps should be treated as soon as possible after cutting, preferably less than 2 hours. Stumps should be saturated, especially in the cambial area.

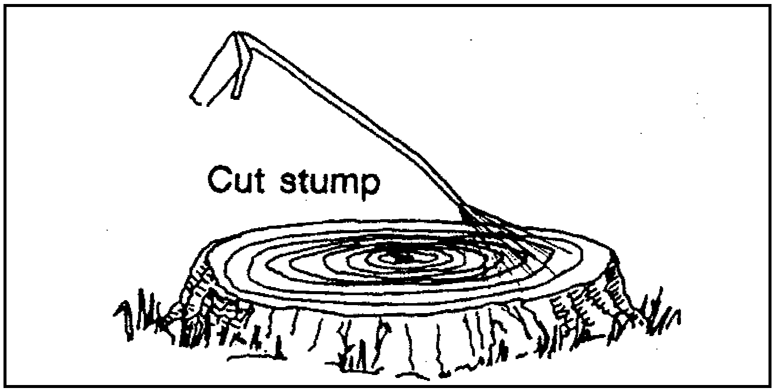


Exhibit 301d: Cut-surface application of herbicide (Source: Illinois Pesticide Manual)

Special Considerations

- Always apply herbicide in accordance with the product label.
- Take extra precautions when applying herbicide around water.
- Careless application may result in damaging non-target plants.
- Adding dyes to herbicide mixtures are useful when treating numerous cut stumps in that the applicator can keep track of stumps that have been treated, and new ones that need to be treated.
- Individual tree control may be accomplished by following methods described in the North Central Forest Experimental Station Notes (see references).

MAINTENANCE

- Repeat applications as necessary.

REFERENCES

Related Practices

- Practice 107, Clearing and Grubbing.
- Practice 302, Debrushing Using Hand-held Tools.
- Practice 303, Debrushing Using Heavy Machinery.
- Practice 304, Stump Removal.

Other Sources of Information

- Illinois Pesticide Manual.
- Illinois Vegetation Manual.
- North Central Forest Experimental Station Notes.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 302
MECHANIZED DEBRUSHING USING HAND-HELD TOOLS

DESCRIPTION
- Removing living woody vegetation by hand-held tools.

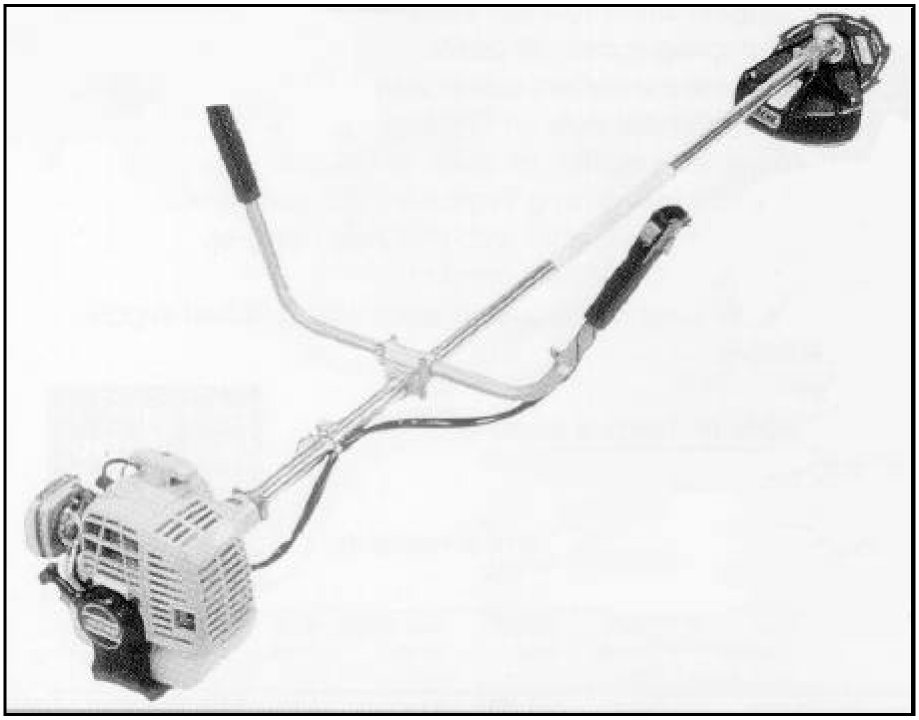


Exhibit 302a: Example of Equipment Used for Mechanized Debrushing Using Hand-held Tools (Source: CBBEL files)

PURPOSE
- To reduce or eliminate woody vegetation along stream or ditch banks and/or overbanks.

WHERE APPLICABLE
- Any drainage improvement project that specifies removing living woody vegetation.

ADVANTAGES
- Hand-held tools generally cause little to no soil displacement of banks and overbank areas.
- May be appropriate in environmentally sensitive areas.
- Lower mobilization cost than that associated with heavy machinery.
- Often requires no special training to operate hand-held tools.
- Opens up the vegetative canopy thus letting more light in for establishment of desirable plants.

CONSTRAINTS
- Time consuming.
- Labor intensive.
- Removing woody vegetation may make a bank or overbank less stable, and more prone to erosion and siltation.
- May require Vegetative Stabilization (See Practice 1102).

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Hand saws, chain saws, hand-winch, clippers, axes, machete, lopping shears, and/or weed whips.
- Herbicide.

Installation

- Cut woody vegetation above ground with appropriate implement.
- Treat stumps with an appropriate herbicide (see Practice 301 Chemical vegetation control) to prevent resprouting.

Special Considerations

- This practice does not include removing stumps or roots, or any other activity that would displace the soil.
- Cut vegetation may be removed and properly disposed of or left in place.

MAINTENANCE

- Remove resprouts as necessary.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 304 Stump Removal.
- Practice 1102 Vegetative Stabilization.
- Practice 1301 Debris Disposal.

Other Sources of Information

- Illinois DOT Specifications.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 303
MECHANIZED DEBRUSHING USING HEAVY MACHINERY

DESCRIPTION
- Removing living woody vegetation by means of heavy machinery.

Exhibit 303a: Mechanized Debrushing Using Heavy Machinery (Source: Allen County Surveyor's Office Files)

PURPOSE
- To reduce or eliminate woody vegetation along stream or ditch banks and/or overbanks.

WHERE APPLICABLE
- Any large drainage improvement project which requires removing living woody vegetation.

ADVANTAGES
- Use of heavy machinery may be more time efficient than hand-held tools.
- Opens up the vegetation canopy.

CONSTRAINTS
- May be more expensive than debrushing with hand-held tools (See Practice 302 Debrushing Using Hand-held Tools).
- Generally causes greater environmental impact than debrushing with hand-held tools.
- Generally less discriminating than hand-held tools making it more difficult to preserve select areas as necessary.
- Removing woody vegetation may make a bank or overbank less stable, and more prone to erosion and siltation.
- Generally believed to cause soil displacement.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Bush hogs, bulldozers equipped with shear blades, rakes, or discs, backhoes, etc.
- Herbicide.

Installation

- Cut woody vegetation above ground with appropriate implement.
- Treat stumps with an appropriate herbicide (see Practice 301 Chemical Vegetation Control) to prevent resprouting.

Special Considerations

- This practice does not include removing stumps or roots.
- Cut vegetation may be removed by or left in place.

MAINTENANCE

- Remove resprouts as necessary.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 304 Stump Removal
- Practice 1102 Vegetation Sterilization
- Practice 1301 Debris Disposal

Other Sources of Information

- Illinois DOT Specifications.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 304
STUMP REMOVAL

DESCRIPTION	●	Removing stumps from natural streams and man-made ditches.

Exhibit 304a: Example of Equipment Used for Stump Removal (Source: C&S Equipment Sales, Inc.)

PURPOSE	●	Prepare bank and/or channel for drainage improvement activity.
WHERE APPLICABLE	●	Any drainage improvement project that requires the removal of tree stumps.
ADVANTAGES	●	May improve access to construction site.
	●	Allows undisturbed compaction of soil, when required.
	●	Eliminates regrowth of cut trees, where appropriate.
	●	May facilitate implementation of stream stabilization practices.
CONSTRAINTS	●	Causes soil displacement.
	●	May require heavy machinery.
	●	Cavity where stump removed should be filled to grade.
	●	Site may be prone to erosion during stump-removal activities.
	●	Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Back hoe, bush hog, bulldozers, etc.
- Clean fill.
- Vegetative Restabilization (See Practice 1102).

Installation
- Cut woody vegetation above ground with appropriate implement.
- Remove stumps with appropriate implement.

Special Considerations
- Employ appropriate siltation and erosion control practices during construction.
- Stumps should be disposed of properly (See Practice 1302 Debris Disposal).
- It is often advisable to leave stumps in place to secure the banks.

MAINTENANCE
- Periodically inspect the site for signs of erosion.

REFERENCES

Related Practices
- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 1301 Debris Disposal.

Other Sources of Information
- Illinois DOT Specifications.

Last Print/Revision Date: October 13, 1996

T.O.C.

SECTION 5.4

LOGJAM REMOVAL AND RIVER RESTORATION

SECTION 5.4
LOGJAM REMOVAL AND RIVER RESTORATION

Logjams restrict the flow and conveyance of natural streams and ditches which can cause increased flooding, destruction of property and wildlife habitat, and erosion and sedimentation. However, not all in-stream structures cause problems. Submerged and overhanging logs provide important wildlife habitat. In many cases, the ripples caused by obstructions oxygenate the water to improve water quality. It is therefore useful to classify in-stream obstructions based on severity, and employ management techniques based on each category.

Localized logjam removal practices (Practices 401 and 402) are considered superior over large-scale river restoration techniques (Practice 403) because they maintain streams' natural meander geometry with long-term environmental and economical benefits. Because of their non-interference with the geometry of the stream channel and in-channel sediments, localized logjam removal practices are also institutionally more acceptable (usually no permits required) and easier to implement than large-scale river restoration works such as that described in practice 403.

Large-Scale River Restoration (Practice 403) may be accomplished in various ways. The best documented of these methods is the "Palmiter Technique". The Palmiter Technique combines clearing & snagging and inexpensive streambank protection measures to restore the stream channel to its perceived original, non-obstructed capacity. It includes removing logjams and severely leaning trees and using some of the removed material for protection of eroding streambanks. The technique also involves removing or raking of sediment bars, when needed, and revegetating the banks with trees to provide shade.

Effectiveness of large-scale river restoration or clearing & snagging projects in reducing flooding is limited only to small annual floods. **Often times, the effect of these activities on reducing flood stages of larger less frequent floods is negligible or at best limited to 2 or 3 inches of stage reduction.** In most cases, similar hydraulic benefits may be achieved by following the American Fisheries Society Stream Obstruction Removal Guide, i.e., removing only localized logjams, at a fraction of cost and time. (See "Maumee Master Plan" and "Urban Surface Water Management" references for more details.)

Regardless of their effectiveness and despite their drawbacks (in particular, a lengthy and expensive permitting process), large-scale river restoration/clearing and snagging projects are still popular and are pursued by many jurisdictions. So long as the safeguards described in Practice 403 are adhered to, the project may be implemented with minimal impact to the environment.

In all cases, access routes for stream and ditch work should be selected to minimize disturbances to wetlands, floodplains, and riparian areas. All disturbed areas should be restored or replanted with native plant species.

The obstruction classification system used in this manual is based on the "American Fisheries Society Stream Obstruction Removal Guidelines" (see Section 6, References). Five conditions are described: Condition 1 (one) is the least severe, Condition 4 (four) is the most obstructive, and Condition 5 (five) describes special cases. The following discussions are taken from the above-noted document and a document entitled: "MRBC Obstruction Removal Assistance Program".

T.O.C.

Condition 1

Minor flow impedance is present, but these obstructions are normally washed downstream or are naturally relocated during moderate flooding events. The obstructions do not pose a significant flood damage risk, and the overall conveyance is acceptable and expected to stay that way. It is recommended that obstructions in this class be left alone unless they are associated with or are within eye-sight of larger obstructions, in which case they may be removed using hand-held tools (Practice 401 Logjam Removal Using Hand-held Tools).

Exhibit 5.4a: Illustration of a Condition 1 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 2

Stream or ditch segments contain small logjams that may be inter-locked and occasionally span the entire width of the stream. Logjams are isolated, but adjacent land use is such that a major obstruction at this location may cause damaging floods in the future. It is recommended that logjams be removed with hand-held tools such as axes, chain saws, and portable winches (Practice 401), unless the logjams are associated with, or are in close proximity to, larger obstructions that require heavy machinery to remove (Practice 402). The extent of the work should be limited to cutting, relocating, removing, or, if appropriate, securing (parallel to the streambanks) any free logs or affixed logs that are crossway in the channel. Isolated or single logs that are embedded, lodged, or rooted in the channel, but do not span the channel or cause any impediment to flow, do not need to be removed. Rooted stumps that do not pose potential blockage problems should remain in place where they will continue to protect the bank against erosion.

Exhibit 5.4b: Illustration of a Condition 2 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 3

Stream or ditch segments contain large accumulations of lodged trees, root wads, and/or other debris that are inter-locked and frequently span the entire width of the stream. Large amounts of fine sediments have not yet covered or become lodged within the obstruction. Some flow can still move around the obstruction, though the flow is somewhat impeded. These obstructions pose an unacceptable flooding risk. It is recommended that stretches in this condition be restored using hand-held tools (Practice 401) if possible. Heavy machinery such as small tractors, bulldozers, log skidders, or other low ground pressure equipment may be used so long as they are not equipped for excavation (Practice 402). The extent of work shall be the same as Condition 2.

Exhibit 5.4c: Illustration of a Condition 3 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 4

Stream or ditch segments contain major blockages that have caused severe and unacceptable flow conditions. Bank erosion and upstream ponding are evident. Existing flood potential will likely increase if the obstructions are not removed. The use of heavy machinery (Practice 402) is likely the only effective way to remove obstructions in this category. The extent of work shall be the same as Condition 2.

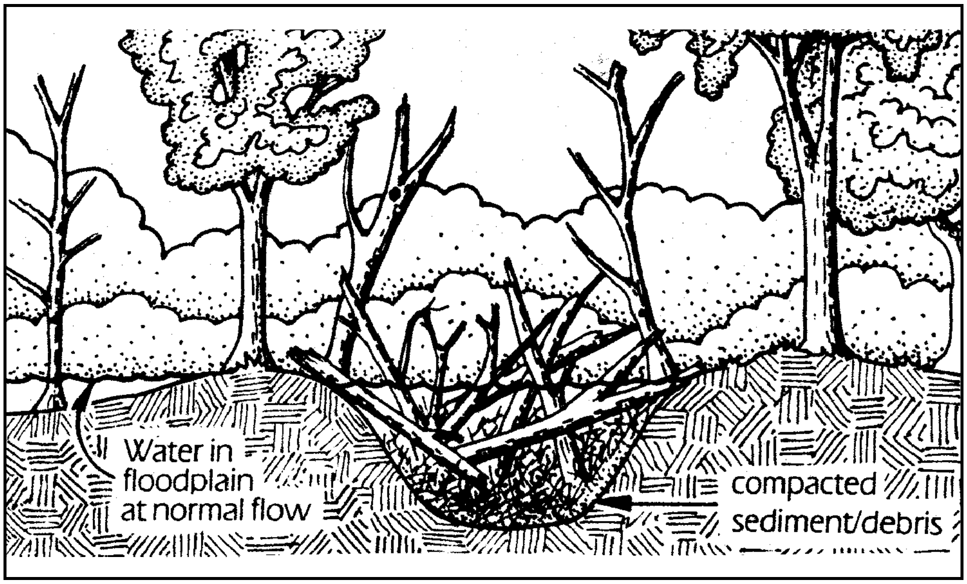


Exhibit 5.4d: Illustration of a Condition 4 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 5

Stream or ditch segments possess unique, sensitive, or valuable ecological resources including rare plants and animals, and rare habitat. These include scenic or recreational rivers. The extent of obstructions may be similar to one of the four conditions described above. Removal of logjams in these streams must be approached on a case by case basis. Generally, obstruction removal using hand-held tools (Practice 401) is more acceptable than using heavy machinery.

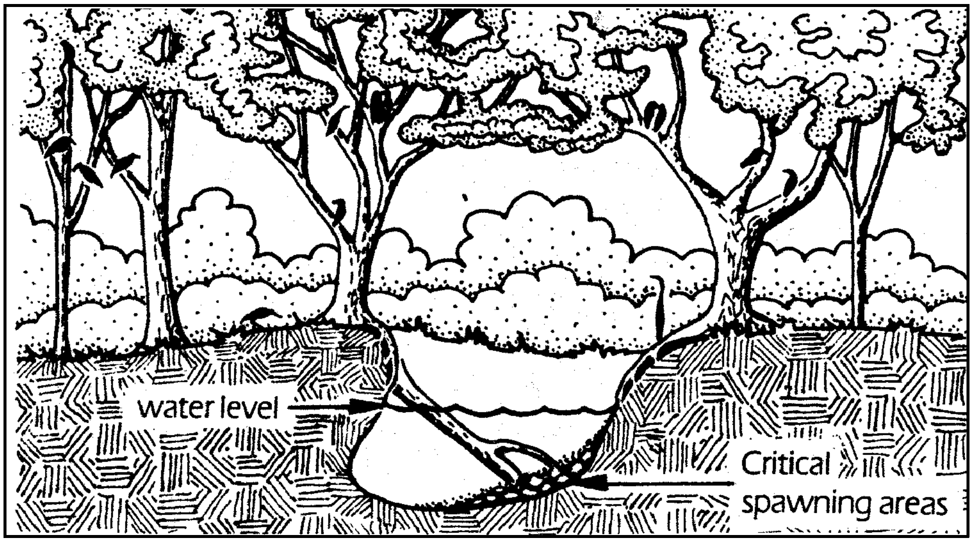


Exhibit 5.4e: Illustration of a Condition 5 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

PRACTICE 401
LOGJAM REMOVAL USING HAND-HELD TOOLS

DESCRIPTION
- Removing logjams from natural streams and man-made ditches using hand-held tools.

Exhibit 401a: Logjam Removal Using Hand-Held Tools (Source: CBBEL Files)

PURPOSE
- To remove logjams causing flooding, sedimentation, or destruction of wildlife habitat.

WHERE APPLICABLE
- Streams and man-made ditches classified as Condition 2, possibly Condition 3, and Condition 5 (See Introduction).

ADVANTAGES
- Restores natural flow and conveyance of streams and ditches.
- Reduces erosion, sedimentation, and flood potential.
- May improve wildlife habitat and water quality.

CONSTRAINTS
- May be time consuming and labor intensive.
- Restricted to logjams where use of hand-held tools are practical.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- May cause temporary sedimentation.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Hand-tools such as axes, chain saws, hand winches, floats.
- Vegetative Restabilization (See Practice 1102).

Installation
- Hand-held tools that cause the least damage to the environment shall be selected for performing the work.
- Logjams, free logs, and/or affixed logs that are crossway in the channel should be cut, relocated, removed, or, if appropriate, secured parallel to the stream bank.

- Logjams may be disposed of by removing them from the floodplain and/or wetlands, or by piling and cabling logs at secured areas, as appropriate, with minimum amount of disturbance to vegetation.
- Isolated or single logs embedded, lodged, or rooted in the channel that do not span the channel or cause any impediment to flow should not be removed unless they are associated with or are in close proximity to larger obstructions, in which case they may be removed.
- Damaged, severely leaning trees should be removed if they pose a risk of falling and causing additional obstructions.
- Stumps and root systems should be left in place.

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Logjams that do not restrict the natural flow and conveyance of streams and ditches, and are not likely to cause further blockages, should not be removed.

MAINTENANCE

- Stream conditions should be monitored on a regular basis to avoid costly logjam removal in the future.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 402 Logjam Removal Using Heavy Machinery.
- Practice 403 Large-Scale River Restoration.
- Practice 1301 Debris Disposal.

Other Sources of Information

- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 402
LOGJAM REMOVAL USING HEAVY MACHINERY

DESCRIPTION
- Removing logjams from natural streams and man-made ditches using heavy machinery.

Exhibit 402a: Logjam Removal Using Heavy Machinery (Source: NRCS Files)

PURPOSE
- To remove logjams causing flooding, sedimentation, or destruction of wildlife habitat.

WHERE APPLICABLE
- Streams and man-made ditches classified as Condition 2, Condition 3, and Condition 4 (See Introduction).

ADVANTAGES
- Restores natural flow and conveyance of streams and ditches.
- May reduce erosion, sedimentation, and flood potential.
- May improve wildlife habitat and water quality.

CONSTRAINTS
- Potentially more damaging to the environment than hand-held tools.
- May be time consuming and labor intensive.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- May cause temporary sedimentation.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Hand-tools such as axes, chain saws, hand winches, floats.
- Backhoes, bulldozers, log skidders, and other heavy, low psi machinery equipped only with brush hooks, snags, or hydraulic thumbs. <u>Machinery equipped with excavation implements may not be used.</u>
- Vegetative Restabilization (See Practice 1102).

Installation
- Machinery that causes the least damage to the environment shall be selected for performing the work.

T.O.C.

- Logjams, free logs, and/or affixed logs that are crossway in the channel should be cut, relocated, removed, or, if appropriate, secured parallel to the stream bank.
- Logjams may be disposed of by removing them from the floodplain and/or wetlands, or by piling and cabling logs at secured areas, as appropriate, with minimum amount of disturbance to vegetation.
- Isolated or single logs embedded, lodged, or rooted in the channel that do not span the channel or cause any impediment to flow should not be removed unless they are associated with or are in close proximity to larger obstructions, in which case they may be removed.
- Damaged, severely leaning trees should be removed if they pose a risk of falling and causing additional obstructions.
- Stumps and root systems should be left in place.

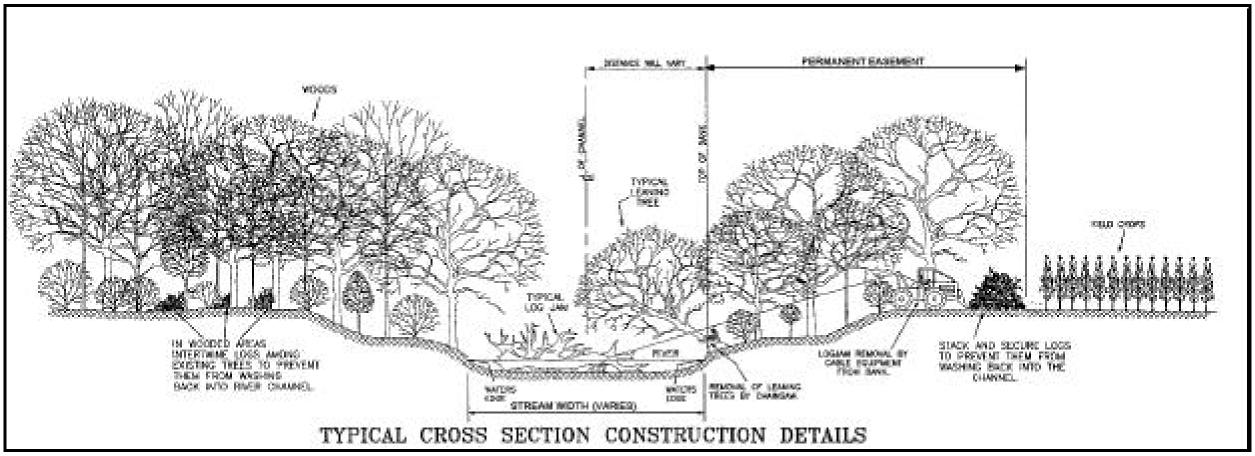


Exhibit 402b: Typical Cross-Section Construction Detail (Source: NRCS Files)

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Logjams that do not restrict the natural flow and conveyance of streams and ditches, and are not likely to cause further blockages, should not be removed.

MAINTENANCE

- Stream conditions should be monitored on a regular basis to avoid costly logjam removal in the future.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 401 Logjam Removal Using Hand-held Tools.
- Practice 403 Large-Scale River Restoration.
- Practice 1301 Debris Disposal.

Other Sources of Information

- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 403
LARGE-SCALE RIVER RESTORATION

DESCRIPTION
- A technique (Palmiter Approach) which combines clearing & snagging and inexpensive streambank protection measures to restore the stream channel to its perceived original, non-obstructed capacity.

Exhibit 403a: Although trees stabilize the banks, they may become obstructions (Source: Ohio Stream Management Guide)

PURPOSE
- To provide relief from chronic low-intensity nuisance flooding, improve drainage in agricultural areas, reduce bank erosion due to smaller floods, and provide recreation benefits to canoeists as well as to hunters and fishermen.

WHERE APPLICABLE
- Applicable to streams that are obstructed by logjams and sand bars, and have bank erosion problems, particularly where larger structural measures are not justified.

ADVANTAGES
- Maintaining a stream channel's free-flowing characteristics ensures its capability to convey the annual flood.
- May reduce bank erosion and consequently sediment accumulation.
- May improve wildlife habitat and water quality.
- Is less expensive than larger structural measures.

CONSTRAINTS
- Potentially more damaging to the environment than logjam removal alone.
- May be time consuming and labor intensive.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- Generally offer benefits similar to logjam removal but are more expensive and involve time delays due to permitting requirements.
- Not effective or appropriate for severe flood problems

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Hand-tools such as axes, chain saws, hand winches, or floats.
- Occasionally, front-end loaders, log skidders, or crawler tractors to help pull or move material.

Installation

- Palmiter approach consists of six basic techniques for restoring and maintaining normal streamflow as follows:

Step 1: Removal of Logjams and Debris

- Start from the upstream end of the stream and work your way downstream.
- Preferably use hand labor with the aid of small tools such as axes, chain saws, hand winches, and floats at time of low river stages to remove all obstacles. Some of the work may be done from boats or barges. Occasionally, tractors, horses, hoists, or front-end loaders may be used to help pull or move material.
- Material removed from the stream can be used to protect eroding banks and to direct streamflow against undesired sand bars. All woody material not used in bank stabilization should be pulled ashore and sold, piled, chipped, burned, or buried (See Practice 1301: Debris Disposal). NOTE: Original version of Palmiter approach includes allowing smaller logs to float on downstream. However, this aspect of the Palmiter's technique is discouraged in this Handbook. Allowing these logs to flow downstream may promote downstream obstructions, contribute to pile-up behind downstream bridges or culverts, or increase hazards downstream.

Exhibit 403b: Fallen trees, logjams, and other debris can partially block stream channels (Source: Ohio Stream Management Guide)

Step 2: Sediment Bar Removal

- Clear vegetation from the sediment bar surface and rake, if necessary. Where a bar is well established, it may be necessary to remove stumps and trees. (However, note that removal of sediment bars are not always necessary. Also, removal of islands with mature trees may be objectionable by agencies in certain settings.)
- Induce erosion of the bar by deflecting the stream current against

it, or by establishing a "pilot channel" through it (Exhibit 403c). Good current deflectors can be made by piling and anchoring brush at selected locations in the channel, or by cutting trees part way through and pushing them over into the channel at appropriate places (Exhibit 403d).

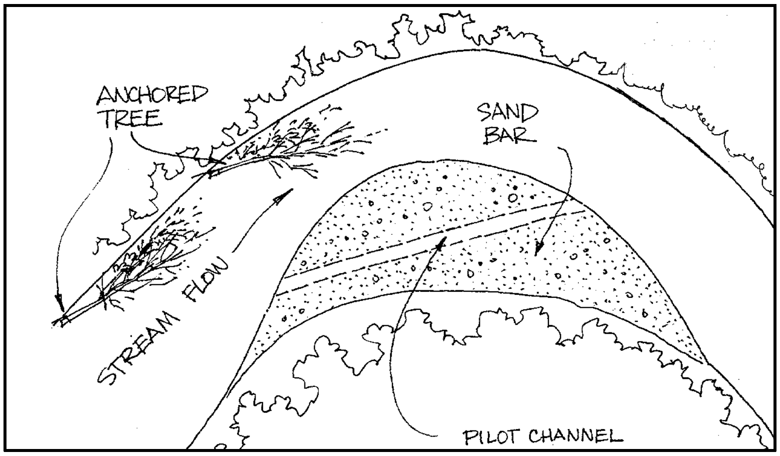


Exhibit 403c: Sand Bar Removal (Source: Ohio Stream Management Guide)

Exhibit 403d: Felled trees anchored to the streambank deflect flows away from the bank to prevent erosion (Source: Ohio Stream Management Guide)

Step 3: Removal of Potential Obstructions

- Severely leaning trees are the most common potential obstructions along a stream.
- Mark all trees or logs to be removed by spraying red, yellow, or orange paint on the upstream side of the trunks.
- Top the tree or cut off overhanging branches to reduce overhanging and to provide more sunlight for ground vegetation and faster growth of young trees. When a tree must be removed, its **stump and roots should be left in place to protect against erosion**.
- Old bridge piers, junked appliances, automobiles, and other kinds of man-made debris can also block streams and should be removed.

Exhibit 403e: Leaving the stumps and roots of severely leaning trees holds the streambank against erosion (Source: Ohio Stream Management Guide)

Step 4: Bank Erosion Protection

- Bank protection is provided in two ways:
  (1) Removing fallen trees, logjams, and other obstructions (that had been directing the currents against the eroding bank) reduces erosion.
  (2) Woody, brushy material removed from the channel is placed and secured along the side of eroding bank. These brush piles divert current away from the eroding bank and also reduce velocity of the current along the eroded bank, causing the stream to deposit sedimentation in those eroded areas most in need of fortification.

- Brush piles are placed along the eroded stream reach in a trial and error exercise to determine the most effective locations for placement. The brush is anchored to nearby stumps or trees. Where stream velocities are high, cable or wire is used to secure the brush. Where there are no existing stumps or trees to use as anchors, stakes or posts can be placed in the bank to meet the need.

Exhibit 403f: Anchored brush piles are an inexpensive but effective means of bank protection (Source: Ohio Stream Management Guide)

Step 5: Revegetation (Providing Shade)

- One of the most important steps in stream restoration is revegetation. Roots stabilize the bank and hold the soil together. Trees shade the channel and inhibit the growth of plants in the streambed which slow the flow of water. Maintaining a shade canopy over the stream, therefore, reduces sediment deposition in the main channel.
- The importance of shade is apparent if shade is removed. Within the first year after shade is removed, dense weedy growth appears in the stream channel. Annual maintenance costs increase because this growth must be removed year after year. Shade provides many benefits to a stream and its aquatic life.
- Utilize revegetation techniques described in Practice 1102: Vegetative Stabilization to provide adequate shade.

Exhibit 403g: Streams lacking shade become weed choked (Source: Ohio Stream Management Guide)

Step 6: Maintenance

- Good maintenance is both the final step and the key to success in stream restoration. Periodic examination and maintenance are essential to correct new problems as they arise, check on the success of previous work, and make adjustments where necessary. Without maintenance, the original work is only a short term solution.
- After restoration work is completed, the stream should be inspected following the next few periods of high water. In the absence of severe storms, annual or semi-annual inspections may be adequate. Late winter or early spring, before leaves develop, is an ideal time to look for problems.

Exhibit 403h: Periodic maintenance is an essential part of stream restoration (Source: Ohio Stream Management Guide)

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Effectiveness of river restoration or clearing & snagging practices in reducing flooding is limited only to small annual floods. Often times, the effect of these activities on reducing flood stages of larger less frequent floods is negligible or at best limited to 2 or 3 inches of stage reduction. Similar hydraulic benefits may be achieved by only removing isolated logjams at a fraction of the cost. (See "Maumee Master Plan" and "Urban Surface Water Management" references for more details.)

MAINTENANCE

- Noted as step 6 (above).

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 401 Logjam Removal Using Hand-held Tools.
- Practice 402 Logjam Removal Using Heavy Equipment.
- Practice 1202 Vegetative Stabilization.
- Practice 1301 Debris Disposal.

Other Sources of Information

- Ohio Stream Management Guide.
- Evaluation of River Restoration Techniques.
- Maumee Master Plan.
- Urban Surface Water Management.
- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

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SECTION 5.5

ERODED STREAMBANK REPAIR

SECTION 5.5
ERODED STREAMBANK REPAIR

Stream channel erosion can generally be corrected using either vegetative (Practices 501-506) or structural (Practices 510-515) techniques, or a combination of both (practices 507-509 and other possible combinations). Vegetation techniques are generally less expensive than structural, and are generally more compatible with stream characteristics. Structural techniques, though expensive and considered unsightly by some, may offer more permanent protection against erosion. Regardless of which technique the Handbook user decides to utilize, it is important to keep in mind that no one measure works well in all situations.

The following methods are described in terms of cost, applicability, ease of installation, and the advantage of using one technique over another. This list is not comprehensive, nor is it attempted to anticipate all circumstances in which one method might be used over another. Thus, the users must decide for themselves which method best fits the character of their particular location and problem.

Vegetative methods tend to work well along natural streams, in urban areas where a natural appearance, improved habitat, and water quality is important, and where cost may be a deciding factor as to whether a stream is restored. Visually, streams repaired using vegetative methods may take on a natural appearance after only one growing season. The network of plants critical to all vegetative techniques absorbs erosional energy during floods, provides habitat for wildlife, acts as a barrier to ice scour, conserves soil moisture, and stabilizes the soils and streambank.

Choosing a vegetative technique depends largely upon the type of problem encountered. Moderately eroded stream banks may be repaired with minimum regrading, and the installation of live stakes, a seed mix, and mulch. Live fascines, branch packings, and brush mattresses might be employed in areas with more serious erosion problems, but where there is still at least a 2:1 (1V:2H) grade to work with. However, note that the toe of slope may still require structural stabilization. Live cribwalls, lunkers, A-jacks, and vegetative geogrids work well in severely eroded areas with steep banks.

Structural techniques may be considered in highly developed areas with little to no natural overbank or where streambank pedestrian traffic is heavy. Retaining walls are generally preferred for steep to sheer, unprotected streambanks. Sheet piling may be preferred in areas where aesthetics are not important, and where space limitations prohibits the construction of a timber or concrete wall. All structural techniques should be installed in accordance with the manufacturer's specifications. Improper installation of these techniques can exacerbate erosion problems by transferring and amplifying stream velocity downstream.

Many of these techniques can and should be combined either for enhanced structural stability, improved environmental quality, or for a more aesthetically pleasing appearance. Top soil and live stakes can be placed between gabion baskets to create a more natural appearance. Riprap is sometimes advised along the eroded toe of a slope after which vegetative techniques can be used for the remainder of the slope.

Large-scale stabilization projects should be planned and designed by an experienced engineer or stream restorationist. Detailed stream studies are advised prior to tackling long, stream channel reaches. The U.S. Army Corps of Engineers' Waterways Experiment Station - Streambank Protection Guidelines for Landowners and Local Governments is one recommended reference for the engineering of major stabilization projects.

PRACTICE 501
LIVE STAKES

DESCRIPTION
- Live shrub or woody plant cuttings driven into the channel bank as stakes.

Exhibit 501a: Live Stakes (Source: NRCS Engineering Field Handbook)

PURPOSE
- To protect streambanks from the erosive forces of flowing water and to stabilize the soils along the channel bank

WHERE APPLICABLE
- Along streambanks of moderate slope, usually 4:1 or less.
- Applicable in original bank soil, not on fill.
- Useful where active erosion is light and washout is not likely.
- Often applicable in combination with other vegetative or structural stabilization methods.
- Applicable on all sizes of channels and all character types.

ADVANTAGES
- Economical, especially when cuttings are available locally.
- Can be done quickly with minimum labor.
- Results in a permanent, natural installation.
- Improved riparian habitat

CONSTRAINTS
- Should be combined with other techniques such as vegetative stabilization (Practice 1102) or mulching (Practice 1101).
- Does not provide initial surface protection until top growth has occurred.
- Will be ineffective in areas of active erosion or on channels with high fluctuation of flows.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Cuttings should be 24 - 30 inches long and ½ - 1½ inches in diameter.
- Live cuttings with side branches cleanly removed and bark intact.

- The larger of thicker butt-ends should be cleanly cut at a 45 degree angle for easy insertion into the soil and the top should be cut square or blunt.
- Cuttings should have at least 2 bud scars near the top to facilitate development of branches.
- Cuttings must be fresh and kept moist. After they have been prepared into appropriate lengths, they should not be stored for more than 1 day before driving into the soil. To increase their rate of survival they should be placed the same day.

Installation

- Starting at the lower level, drive the cuttings into the bank at right angles to the slope. (A live fascine incorporated at the low water level will add stability to the toe of the slope. See Practice 502.)
- 4/5 of the length of the cutting should be driven into the ground and the soil should be firmly packed around the cutting.

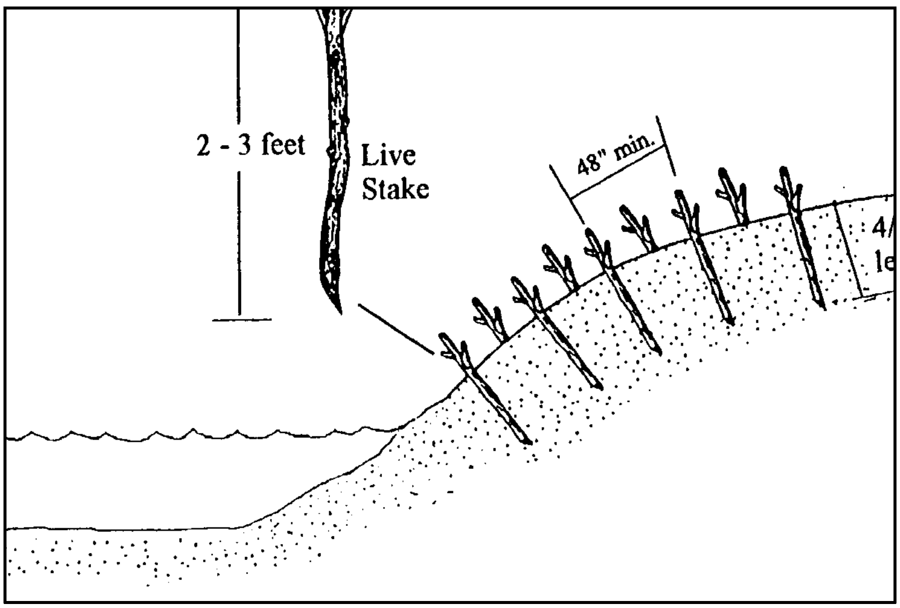

Exhibit 501b: Installation of live stakes (Source: DuPage County Streambank Stabilization Program)

- Do not split the cuttings during insertion.
  - An iron bar can be used to make the hole.
  - The density of the installation depends on the site conditions, ranging from 2 - 6 cuttings per square yard. A spacing of 2 feet or greater is recommended.
  - The stakes should be placed in off center rows.

Special Considerations

- Harvest live stakes during dormant season.
- Store live stakes under cold water (lake, stream, pond) for up to 3 days before installation.
- May need to fortify toe of slope (eg. fiber roll).
- Bank grading may be required to achieve moderate slopes before installation.

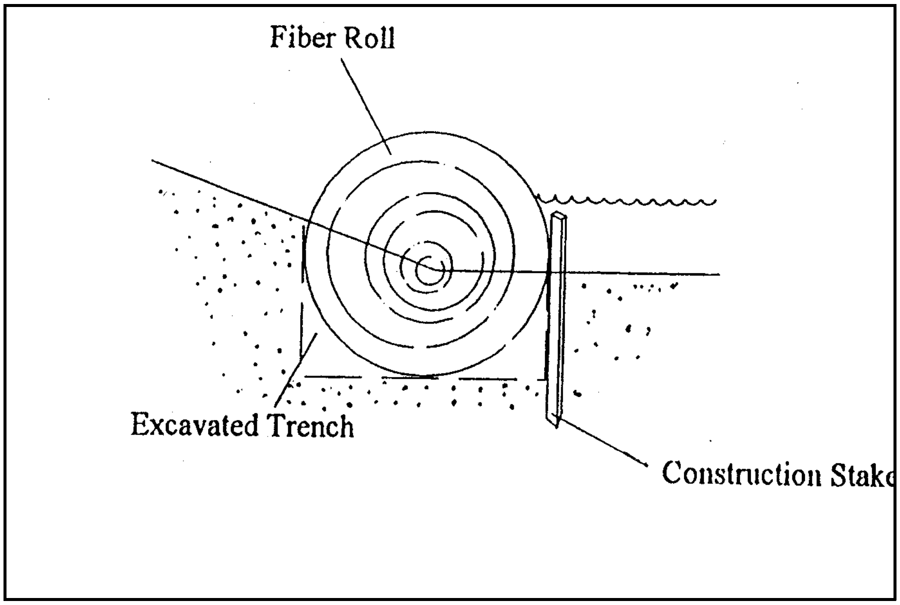

Exhibit 501c: Toe protection is often recommended when using live stakes (Source: DuPage County Streambank Stabilization Program)

MAINTENANCE

- Vegetated channel banks are vulnerable to new damage, especially right after installation. Inspect after highwater events for gaps in cover and repair with new plants. Mulch/seed exposed areas if necessary.

REFERENCES

Related Practices

- Practice 502 Live Fascines.
- Practice 503 Branch Packings.
- Practice 505 Brush Mattress.

Other Sources of Information

- Pennsylvania Streambank Stabilization Guide.
- North Carolina Erosion Control Manual.
- Tennessee Riparian Restoration Handbook.
- Iowa Streambank Erosion Control.
- DuPage County Streambank Erosion Control Handbook

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T.O.C.

PRACTICE 502
LIVE FASCINES

DESCRIPTION
- Sausage-shaped bundles of brush tied together, and placed in trenches cut into the bank, parallel to the stream.

Exhibit 502a: Preparation of Live Fascines (Source: NRCS Engineering Field Handbook)

PURPOSE
- To protect banks from washout and seepage, particularly at the edge of a stream, and where water levels fluctuate moderately.

WHERE APPLICABLE
- Effective with any stream type or size.
- Approximately 1:1 (1V:1H) slopes or flatter.
- Toe of bank and up slope area.
- Straight or curved sections.

ADVANTAGES
- Immediate erosion protection.
- Traps sediment.
- Reduces gullying.
- Slows surface water flows and increases infiltration on draughty sites.
- Provides surface stability for the establishment of vegetation.
- Improves riparian habitat

CONSTRAINTS
- Labor intensive.
- Vegetative stabilization needed between fascines.
- Construction must occur during dormant season.
- Not recommended in areas with high surface drainage over bank.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Cuttings should be > 4' long and < 1" in diameter from a variety of species that root easily, and have long, straight branches, such as willows (See Practice 501 Live Stakes).

- Jute rope.
- 3' oak construction stakes or live stakes.
- Vegetative Stabilization (Practice 1102).

Installation

- Drive stakes in a row across the slope beginning at the base of the bank at mean low water level. Stakes should be 12"-18" on center so 6" remain above the grade.
- Assemble bundles in 8"-10" diameter rolls in lengths of 1- 1½" longer than the maximum stem length by alternating stems, tapering ends, and securing with a jute rope.
- Dig a shallow trench as deep as the diameter of the fascine. Trenching should not precede placement of the bundles by more than one hour to minimize drying of soils.
- Lay bundles in trench, overlapping tapered ends.
- Drive live stakes or construction stakes through bundle, 12" on center, with additional stakes at joints.

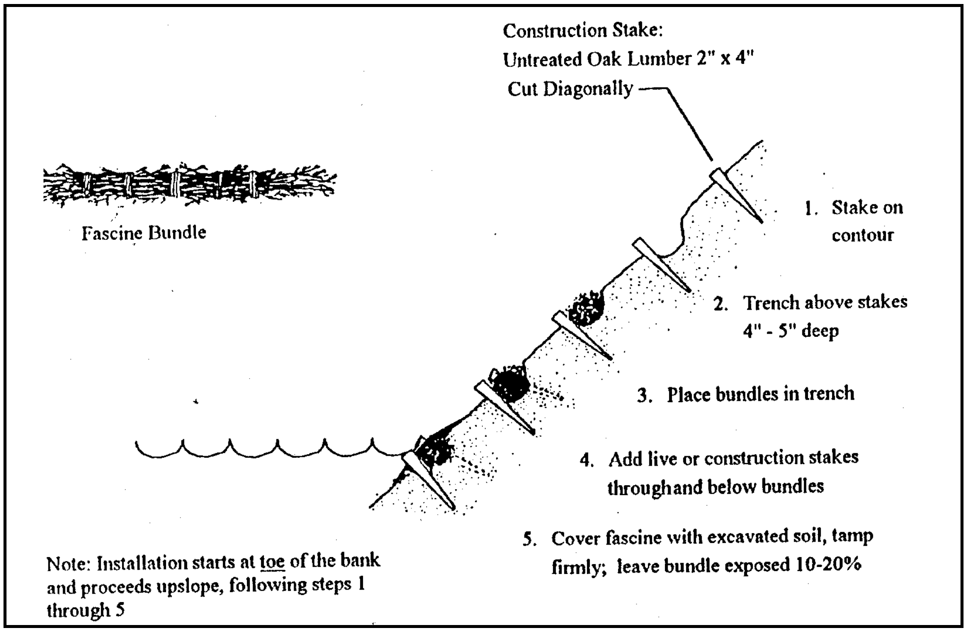

Exhibit 502b: Installation of live fascines (Source: DuPage County Streambank Stabilization Program)

- Cover fascines with excavated soil, tamping to fill voids, but leaving 10-20% of the bundles exposed.
- Eliminate air by walking on bundles.
- Continue rows to top of bank, spacing fascines according to table below (Exhibit 502c).

T.O.C.

Slope	Slope distance between trenches (ft)	Maximum slope length (ft)
1:1 (1V:1H) to 1.5:1 (1V:1.5H)	3 - 4	15
1.5:1 (1V:1.5H) to 2:1 (1V:2H)	4 - 5	20
2:1 (1V:2H) to 2.5:1 (1V:2.5H)	5 - 6	30
2.5:1 (1V:2.5H) to 3:1 (1V:3H)	6 - 8	40
3:1 (1V:3H) to 4:1 (1V:4H)	8 - 9	50
4:1 (1V:4H) to 5:1 (1V:5H)	9 - 10	60

Exhibit 502c: Distance between fascines based on bank slope length and grade.

- Revegetate disturbed area between fascines according to vegetative stabilization method.

Special Considerations
- Make sure there is sufficient contact between soil and fascines.
- Additional toe protection may be needed in high velocity areas.
- Store cut brush under cold water (lake, stream, pond) for up to three days before installation.

MAINTENANCE
- Low. Monitor for washouts. Follow maintenance for vegetative stabilization.

REFERENCES

Related Practices
- Practice 501 Live Stakes.
- Practice 503 Branch Packings.
- Practice 505 Brush Mattress.

Other Sources of Information
- Pennsylvania Streambank Stabilization Guide.
- Tennessee Riparian Restoration Handbook.
- Iowa Streambank Erosion Control.
- DuPage County Streambank Stabilization Program.
- NRCS Engineering Field Handbook.

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T.O.C.

PRACTICE 503
BRANCH PRACTICE PACKINGS

DESCRIPTION
- Alternating layers of branches and soil incorporated into a hole or slumped out area in a slope or a streambank. Branches are used both underwater and above. The branches above the water line root to form a permanent installation while those below the water line provide initial stability.

Exhibit 503a: Branch Packings (Source: NRCS Engineering Field Handbook)

PURPOSE	●	To repair washouts and scoured holes.
WHERE APPLICABLE	● ● ●	Particularly useful method for banks that have had washouts. Applicable even where water is fast and moderately deep. Washout or hole should be no more than 12' long, 5' wide, and 4' deep.
ADVANTAGES	● ● ● ● ● ●	Creates an immediate barrier, redirecting water away from the washed out area. Cuttings normally available locally. Produces immediate filter barrier. Useful in fast moving water. Permanent and natural appearance. Improved riparian habitat
CONSTRAINTS	● ●	Large amounts of branches required. Very labor intensive.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials** ●	 Live cuttings which readily root. Cuttings may be 0.5" to 3" in diameter and long enough to reach the original bank soil with 12" left exposed on the stream side.

T.O.C.

- Stakes 6' to 8' long.
- Large rocks, soil and gravel.

Installation

- Starting below the low water line, drive stakes vertically into the soil, 3' apart.
- Place a 3" - 4" layer of compressed branches in the bottom of the washout, between the vertical stakes. Cover branch mat with 8" to 12" of soil and gravel. Rocks large enough to resist the current may be placed on top of the branch mat from the stream bottom up to the average water level.
- Layers of branches are installed with the basal ends angled down into the streambank so that they are at least 12" lower than the tips of the branches.
- Follow each layer of branches with a soil and gravel mix. Compact thoroughly to insure soil contact with branch cuttings.
- Successive layers of branches and fill are alternated until the washout is completely filled.
- Branch tips must extend beyond the soil layers to grow. Basal ends must extend into undisturbed soil.

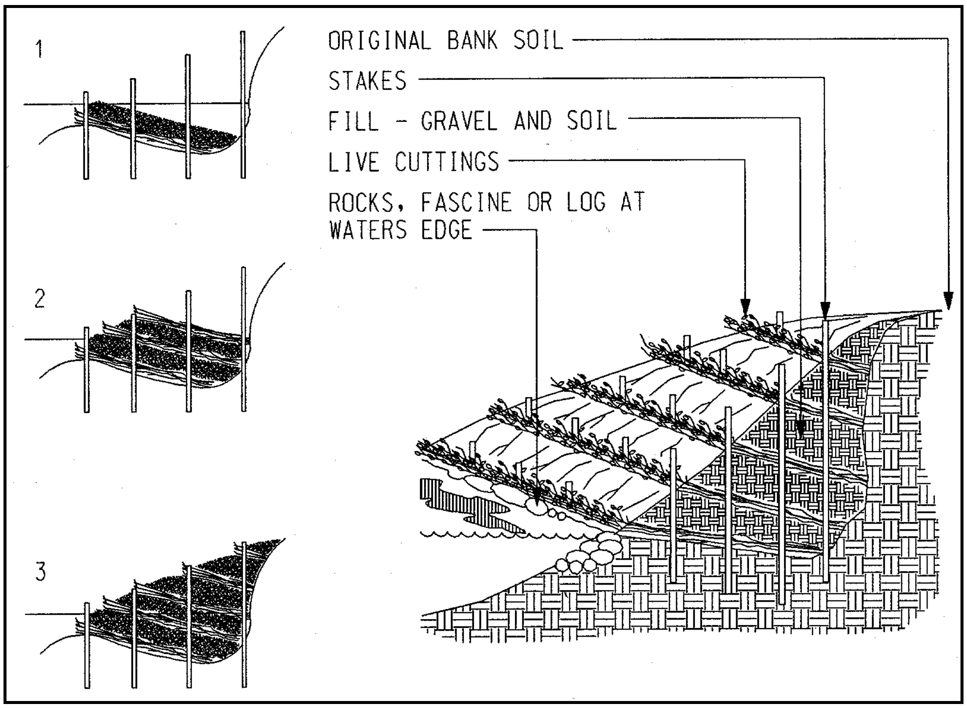

Exhibit 503b: Installation of Branch Packings (Source: CBBEL Files)

Special Considerations

- Make sure there is sufficient contact between soil and live cuttings.
- Rocks, fascine, or a log may be placed at water's edge.
- Branch packings should not be constructed over 5' in height (including the footing), and no more than 10' in length, without the assistance of a knowledgeable professional.

MAINTENANCE
- Low. Monitor and repair as necessary.

REFERENCES

Related Practices
- Practice 502 Live Fascines.
- Practice 509 A-Jacks.
- Practice 510 Stone Riprap.

Other Sources of Information
- Pennsylvania Streambank Stabilization Guide.
- Soil Bioengineering Strategies.

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PRACTICE 504
TREE REVETMENTS

DESCRIPTION

- Anchoring dead, cut trees along an eroding streambank to control erosion.

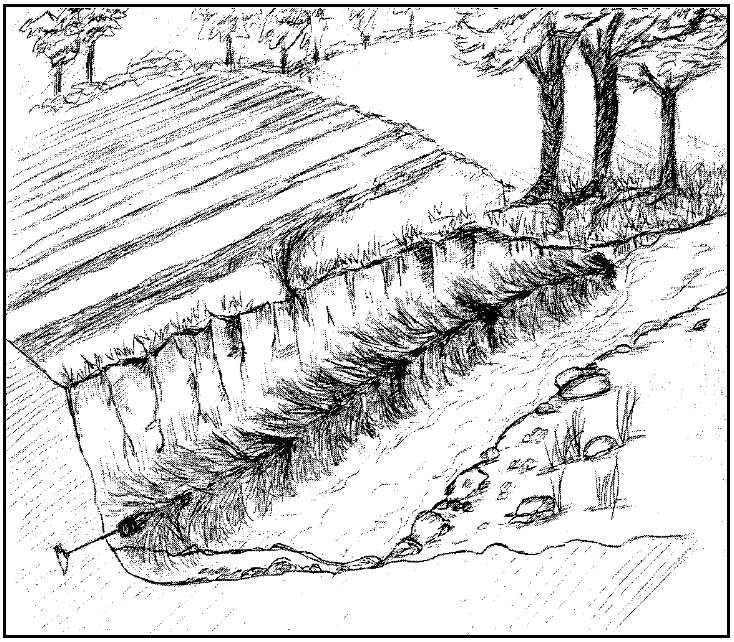

Exhibit 504a: Tree Revetments (Source: Watershed Council Shoreline Erosion Guidebook)

PURPOSE

- To slow the current along eroding banks and cause desirable deposition of silt, sand, and gravel.

WHERE APPLICABLE

- On bends of small to medium sized streams where original cover has been removed.

ADVANTAGES

- Inexpensive.
- Easy to install.
- Materials readily available.
- Provides aquatic and wildlife habitat.

CONSTRAINTS

- Only recommended for small to medium sized streams with minimal to moderate erosion problems.
- Not recommended for highly unstable streams or channels.
- Should not be used if the eroding stream bank is over 12' high.
- Not recommended if the toe is more than 2.5' below the NWL.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Large, live trees (evergreens work best).
- Driven earth anchors or steel fence posts.
- Cable (3/16" aircraft cable or larger) and cable clamps.

Installation

- The first tree revetment should be placed at the downstream end of the eroding bank, with the butt-end pointed upstream.

- Anchor both ends of each revetment tightly against the toe of the bank using earth anchors or steel fence posts, and aircraft cable.
- Each subsequent revetment should overlap the prior revetment in a fishscale pattern, and anchored as described earlier.

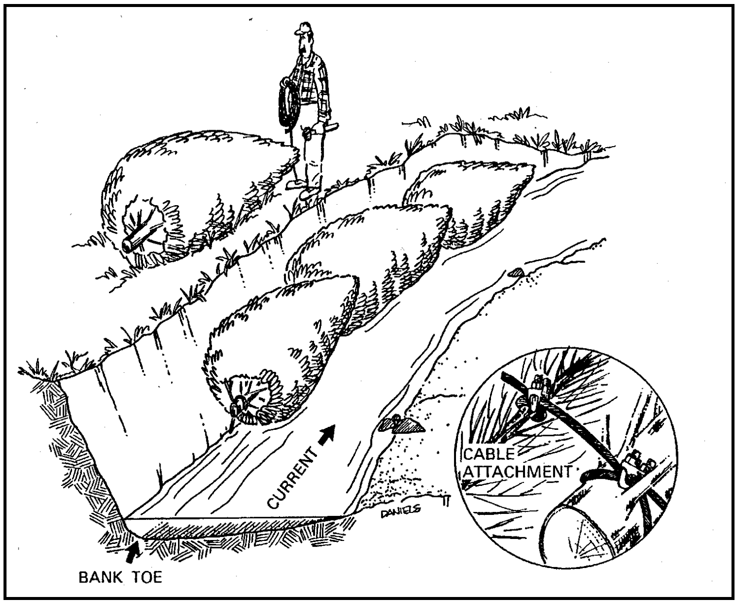

Exhibit 504b: Installation of tree revetments (Source: Missouri Tree Revetments)

Special Considerations

- Live, cut trees work better than dead trees because they are more flexible, and last longer.
- Evergreens are preferred over hardwoods because of the conical shape of evergreens, and dense branches and needles.
- Large trees are preferred over small trees.
- Cedar trees placed in early summer can dry out and lose their needles, thus reducing their ability to trap sediment and slow water flow.
- Revetments may be fortified with other vegetative techniques once enough silt has been deposited to support a seed bed or live stakes.

MAINTENANCE

- Revetments should be inspected following flood events and repaired as necessary.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 502 Live Fascines.
- Practice 503 Branch Packings.
- Practice 505 Brush Mattress.

Other Sources of Information

- Missouri Tree Revetments.
- Watershed Council Shoreline Erosion Guidebook.
- Stream Habitat Improvement Handbook.

T.O.C.

PRACTICE 505
BRUSH MATTRESS

DESCRIPTION	●	Mat of live brush fastened down over an eroded bank.

Exhibit 505a: Brush Mattress (Source: NRCS files)

PURPOSE	●	Erosion protection; rebuilds banks by capturing sediment
WHERE APPLICABLE	● ●	Approximately 2:1 (1V:2H) slopes or flatter. Low to high velocity reaches.
ADVANTAGES	● ● ●	Captures sediment during flood events which helps rebuild the bank. Produces immediate surface protection against floods. Establishes dense riparian growth.
CONSTRAINTS	● ● ●	Labor intensive. Gullies may form under mat before brush takes root. Additional toe protection often necessary.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Approximately 6' long flexible, live brush.
- Oak construction stakes (2" x 2"), at least 3' long.
- Live Fascine (Practice 502), Riprap (Practice 510), or coconut roll.
- Polyethylene net or jute rope.
- Sod staples.
- Topsoil.

Installation

- Install live fascine, riprap, or coconut fiber log at toe of slope.
- Place live brush on slope with stems tucked under toe protection structure, and stems smooth against the slope.
- Continue placing brush in a shingle pattern up the slope, at least 12" thick.
- Drive stakes perpendicular to the slope in rows, 3' on center, with only a few inches remaining above the brush.
- Place polyethylene net over brush and staple to wood stakes.
- Drive stakes deeper into the bank to tighten the net.
- Cover mattress with 1"-2" of topsoil.
- Broadcast seed a cover crop such as annual and perennial ryegrass.

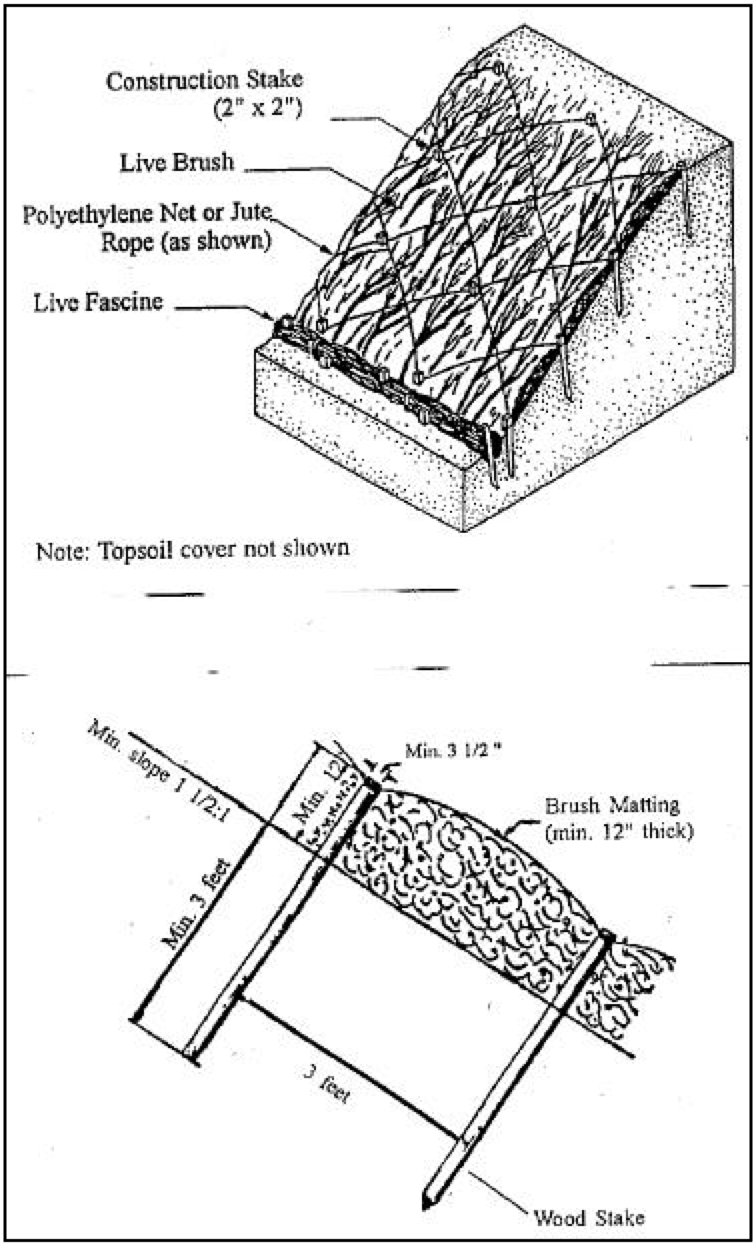

Exhibit 505b: Installation of a brush mattress (Source: DuPage County Streambank Stabilization Program)

Special Considerations

- Brush should contain a diverse assemblage of species recommended in vegetative stabilization technique (Practice 1102), and prepared according to the live stakes method (Practice 501).
- Jute rope may be laced between stakes in a diamond pattern in place of netting; the rope must be stapled to the wood stakes before final driving.
- Make sure there is good branch to soil contact so brush can root along the entire length of the branches.

MAINTENANCE

- Monitor and repair as necessary.
- Beware of gullies forming beneath the mattress before roots become established.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 502 Live Fascines.
- Practice 503 Branch Packings.
- Practice 504 Tree Revetments.

Other Sources of Information

- DuPage County Streambank Stabilization Program.
- Watershed Council Shoreline Erosion Guidebook.
- Tennessee Riparian Restoration Handbook.
- Soil Bioengineering Strategies.
- Metropolitan Washington Watershed SourceBook.

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PRACTICE 506
VEGETATIVE GEOGRID

DESCRIPTION

- Soil lifts wrapped with natural or synthetic geotextile materials between which are placed layers of live branches.

Exhibit 506a: Vegetative Geogrid (Source: Biotechnical Erosion Control Limited)

PURPOSE

- Rebuilds banks by capturing sediment; reinforces bank.

WHERE APPLICABLE

- Streams with moderate to steep slopes.
- High velocity areas.

ADVANTAGES

- Immediately reinforces bank at a steeper angle.
- Captures sediment and contributes to rebuilding the bank.
- Provides medium for revegetation.

CONSTRAINTS

- Labor intensive.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Brush of varying species and lengths (See Practice 501 Live Stakes).
- Suitable soil or soil/gravel fill.
- Vegetative stabilization (See Practice 1102).
- Natural (burlap) or synthetic geotextile fabric.
- 1" x 2" oak stakes, 1' - 2' long.

Installation

- Live cut brush is placed on the ground, perpendicular to the stream.
- Brush is covered with the geotextile.
- Fill material is placed over the geotextile and compacted.

- Geotextile is tightly wrapped around the soil layer and secured with the stakes.
- Live brush is placed between each soil lift.
- Continue the above process until the desired height is achieved. The final level should be finished with branch packings.

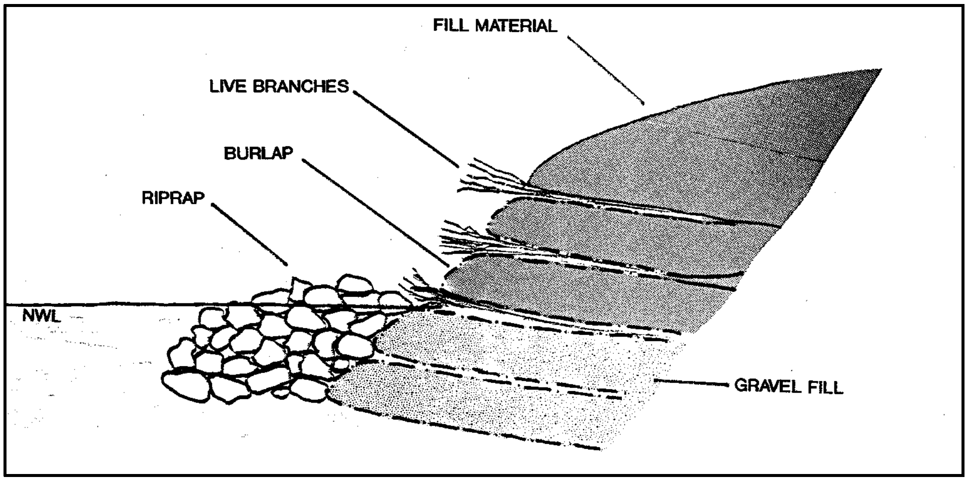

Exhibit 506b: Construction of a vegetative geogrid (Source: CBBEL Files)

Special Considerations

- Gravel fill may be used in the bottom tiers; rock may be placed at the toe of the slope for added protection.

MAINTENANCE

- Monitor and repair as necessary.
- Beware of gullies forming beneath the mattress before roots become established.

REFERENCES

Related Practices

- Practice 502 Live Fascines.
- Practice 507 Live Cribwalls.
- Practice 508 Lunkers.
- Practice 509 A-Jacks.

Other Sources of Information

- DuPage County Stream Stabilization Program.
- Soil Bioengineering Strategies.

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T.O.C.

PRACTICE 507
LIVE CRIBWALLS

DESCRIPTION	●	A rectangular framework of logs, rock, and woody cuttings used to protect an eroding streambank, especially at outside bends of main channels where strong currents are present, and at locations where an eroding bank may eventually form a split channel.

Exhibit 507a: Live Cribwalls (Source: NRCS Engineering Field Handbook)

PURPOSE	●	To protect eroding streambanks.
WHERE APPLICABLE	●	Especially useful at outside bends of main channels with strong currents, and at locations where an eroding bank may eventually form a split channel.
ADVANTAGES	● ● ●	Immediate erosion protection. Permanent and natural appearance. Improves aquatic and wildlife habitat.
CONSTRAINTS	● ● ● ● ●	Requires local availability of logs and rocks. Very labor intensive. More complex than fascines or branch packings. May require riprap at end points. Not applicable where bed is severely eroded as undercutting will occur. Not suitable for rocky terrain or for use in narrow reaches with high banks on both sides.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	Bark free logs at least 6" in diameter.
	●	Plant cuttings (See Practice 501 Live Stakes).
	●	Fill must include granular material to support plant growth.
	●	Timber spikes or rebar.

Installation

- Dig out cribwall base 2 - 3' below existing streambed.
- Place first log parallel to the water's edge, and at bottom of excavated channel.
- Place fiber roll or live fascine at toe of slope.
- Place next layer of logs on top of and perpendicular to first log, approximately 4' apart. Attach logs to each other using spikes or rebar.
- Install Branch Packings (Practice 503) and fill between the logs.
- The top layer should be compacted with fill; the top log should be parallel to the edge of the stream.
- Height of cribbing should be 50-70% of the height of the bank.
- May require riprap at endpoints.
- A double cribwall may be constructed by placing an additional log parallel and adjacent to the bank for each layer.

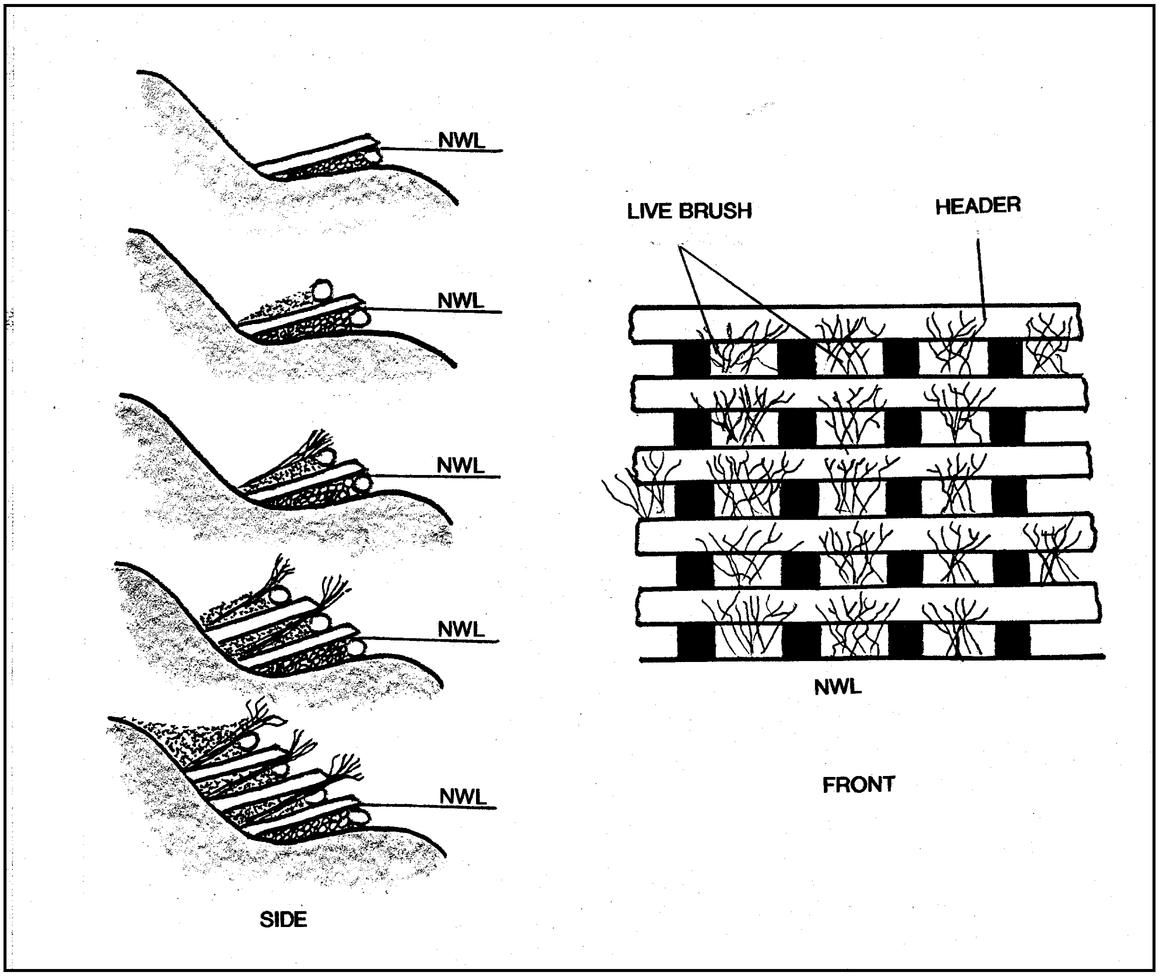


Exhibit 507b: Construction of a live cribwall (Source: CBBEL Files)

Special Considerations

- Live cribwall over 6' tall should not be constructed without the assistance of a knowledgeable professional.

MAINTENANCE

- Low. Monitor and repair as necessary, especially at ends of structure.

REFERENCES

Related Practices

- Practice 502 Live Fascines.
- Practice 508 Lunkers.
- Practice 509 A-Jacks.
- Practice 506 Vegetative Geogrid.
- Practice 510 Stone Riprap.
- Practice 512 Gabion Retaining Wall.

Other Sources of Information

- Pennsylvania Streambank Stabilization Guide.
- Soil Bioengineering Strategies.
- DuPage County Streambank Stabilization Program.
- IWL Streambank Protection Methods.

Last Print/Revision Date: October 13, 1996

PRACTICE 508
LUNKERS

DESCRIPTION
- Oak or plastic (Eco-wood) rectangular boxes built into toe of bank to eliminate scour and provide fish habitat.

Exhibit 508a: Lunkers (Source: CBBEL Files)

PURPOSE
- Protect toe of bank and provide aquatic habitat.

WHERE APPLICABLE
- Undercutting at toe of bank.
- Approximately 3:1 (1V:3H) slope.
- Straight or curved sections.

ADVANTAGES
- Immediate erosion protection at toe of slope.
- Provides habitat.

CONSTRAINTS
- Labor intensive.
- Requires equipment for excavating and backfilling.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Eco-wood or oak lunker.
- 5/8" rebar in 5' lengths (9 per lunker)
- Geotechnical fabric.
- Live Stakes (Practice 501).
- Vegetative Stabilization (Practice 1102).

Installation

- Follow procedures for vegetative stabilization.
- Excavate trench in channel at toe of bank so extending end of stringer lies flat across undistributed soil.
- Lay lunkers in trench end to end.
- Drive 9 rebars through each lunker, into streambed.
- Place riprap on top of lunkers, and backfill with excavated material.
- Slope stream bank back at 3:1 (1V:3H) slope and tamp.
- Revegetate disturbed area according to vegetative stabilization method.

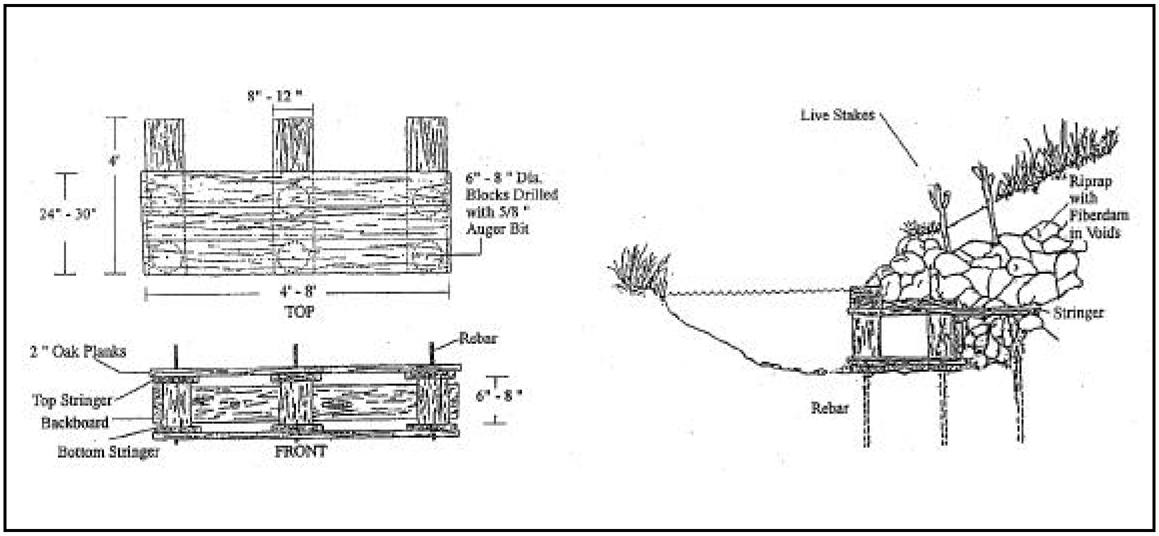


Exhibit 508b: Construction of a lunker structure (Source: DuPage County Streambank Stabilization Program)

Special Considerations

- Only use oak lunkers where baseflow is high enough to completely submerge lunker.

MAINTENANCE

- Low. Monitor and repair as necessary, especially at ends of structure.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 502 Live Fascines.
- Practice 503 Branch Packings.
- Practice 506 Vegetative Geogrid.
- Practice 510 Stone Riprap.
- Practice 512 Gabion Retaining Wall.

Other Sources of Information

- DuPage County Streambank Stabilization Program.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 509
A-JACKS

DESCRIPTION	●	Concrete, jack-like structures set at toe of bank. Often integrated with live stakes and other vegetative stabilization techniques.

Exhibit 509a: A-Jacks Installation (Source: Illinois State Water Survey Publication)

PURPOSE	●	To protect streambanks from the erosive forces of flowing water and to stabilize the soils along the channel bank.
WHERE APPLICABLE	●	Along eroded toe.
	●	Low to high velocity areas.
	●	Scour holes.
ADVANTAGES	●	Protects soil from scour during plant propagation.
	●	Provides erosion control protection even if vegetation does not become established.
	●	Immediate erosion protection at toe of slope.
	●	Improves aquatic and wildlife habitat.
CONSTRAINTS	●	Labor intensive.
	●	Must be used in conjunction with vegetative stabilization.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	2' A-Jacks.
	●	Live Stakes (Practice 501).
	●	Fiberdam - geotechnical material.
	●	Vegetative Stabilization (Practice 1102).
	●	Suitable backfill.

Installation

- Follow preparation procedures for vegetative stabilization.
- Excavate 1' deep trench in channel at toe of bank.
- Lay an interlocking row of A-Jacks in trench.
- Place live stakes according to live stakes method, and fiberdam in voids between A-Jacks.
- Backfill until A-Jacks are completely buried.
- Slope streambank back at 3:1 (1V:3H) slope, if possible, and tamp.
- Revegetate disturbed area according to vegetative stabilization methods.

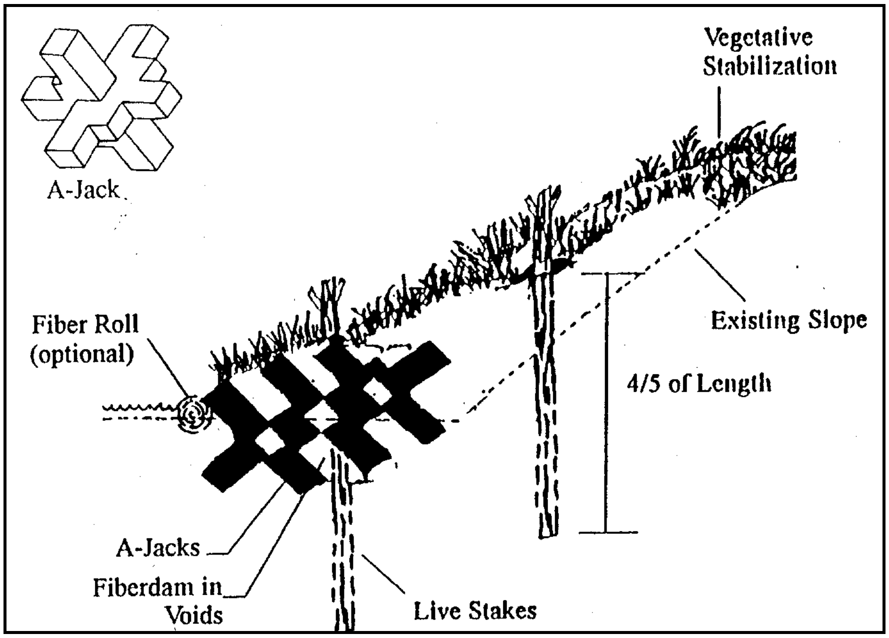


Exhibit 509b: Installation of A-jacks in conjunction with live stakes and vegetative stabilization (Source: DuPage County Streambank Stabilization Program)

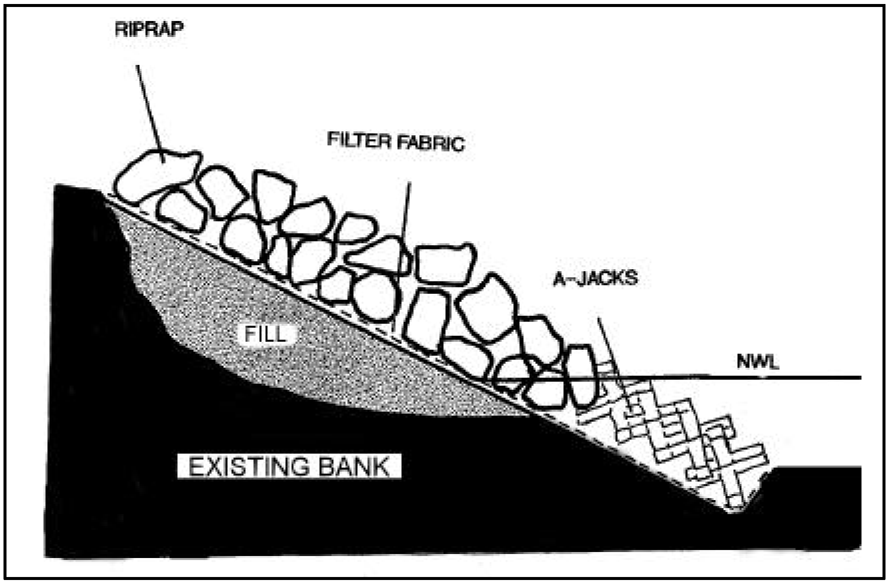


Exhibit 509c: A-jacks used in conjunction with riprap (Source: CBBEL Files)

Special Considerations

- A-Jacks should be stacked above the 5-year high flow elevation and trenched in 2' deep.
- Combine fiber roll with A-Jacks when wave action is evident or immediate natural appearance is desired.
- May be combined with riprap.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 502 Live Fascines.
- Practice 503 Branch Packing.
- Practice 506 Vegetative Geogrids.
- Practice 507 Live Cribwalls.
- Practice 508 Lunkers.

Other Sources of Information

- DuPage County Streambank Stabilization Program.
- Illinois State Water Survey Publication.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 510
STONE RIPRAP

DESCRIPTION	●	Covering of a portion of a channel bank with a layer of stone that approximates the natural slope of the channel bank. (Note: This practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 510a: Stone Riprap (Source: North Carolina Erosion Control Manual)

PURPOSE	●	To protect streambanks from the erosive forces of flowing water.
WHERE APPLICABLE	●	On small to medium sized channels and on all character types.
	●	Generally applicable where flow velocities exceed 6 ft/sec or where vegetative streambank protection is inappropriate.
	●	Shaded areas.
	●	Streams where water levels fluctuate.
	●	Actively eroding banks usually along channel curves or wherever it is desirable to reduce the energy of the water.
ADVANTAGES	●	Relatively inexpensive, especially compared to other structural methods such as walls.
	●	Flexible and resistant to scour.
	●	Allows for water percolation.
CONSTRAINTS	●	Available stone must be able to resist the force of high velocity water flows.
	●	Not recommended on steep slopes or areas where slope cannot be regraded to 2:1 (1V:2H) or flatter.
	●	Hand-placed riprap is labor intensive.
	●	Flooding may wash riprap into stream.

T.O.C.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Hard, angular and weather-resistant stone having specific gravity of at least 2.5.
- Where available, use local stone. Local stone can often be obtained at lower cost and it also blends better into the existing streambank environment.
- 50% of stone (by weight) must be larger than specified d_{50} and no more than 15% of the pieces (by weight) should be less than 3 inches.
- Geotextile fabric or sand/gravel layer should be used for stabilization under all permanent riprap installations.

Installation

- Remove brush, trees, stumps and other debris.
- Excavate only deep enough for filter and riprap.
- Compact any fill material to density of surrounding natural soil.

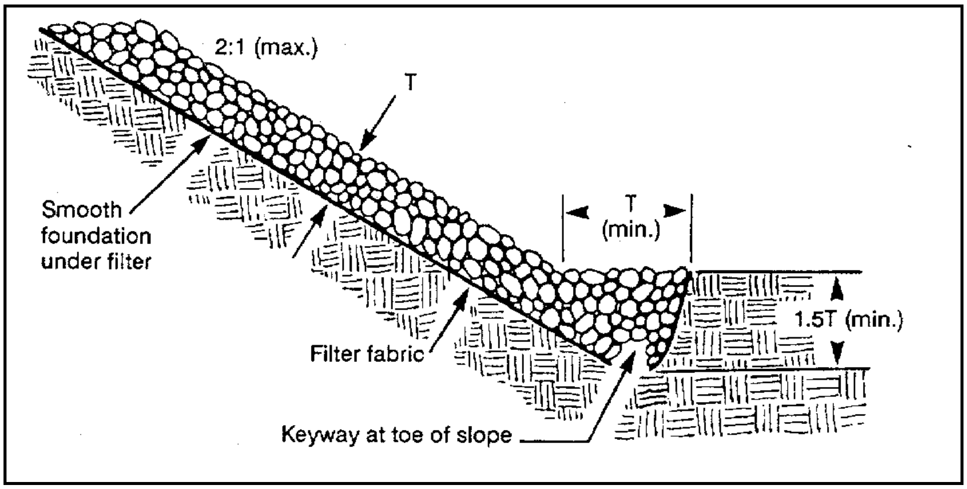


Exhibit 510b: Construction of a riprap bank with toe protection (Source: Indiana Erosion Control Handbook)

- Cut keyway at base of slope to reinforce the toe; keyway depth should be 1½ times the design thickness of the riprap and extend a horizontal distance equal to the design thickness.
- Place geotextile fabric. If using sand/gravel filter, spread the well-graded aggregate in a uniform layer at least 6 inches thick; if 2 or more layers are required, place the layer of smaller gradation first and avoid mixing the layers.
- Add riprap to full thickness in 1 operation.
- Place smaller rock in voids to form a dense, uniform, well-graded mass. Some hand placement of material will most likely be necessary.
- Blend the riprap surface smoothly with the surrounding area to eliminate protrusions or overfalls.
- Riprap may be either hand-placed or dumped.

Special Considerations

- Use the peak 10-year storm discharge for computing the minimum expected (design) velocity.
- Foundation toe must be properly reinforced to prevent undercutting or slumping.
- Slopes steeper than 2:1 (1V:2H) should be flattened so stone material will not become displaced.
- Riprap must be properly graded to prevent stone movement and erosion of the foundation.
- Compact the slopes before placing riprap or stone settlement and displacement may occur.
- Extend riprap sections the entire length between well-stabilized points of the stream channel.
- Riprap used must be of large enough size and extend at least 12 inches below normal water level to provide habitat for aquatic organisms in the voids
- May secure toe using A-Jacks (See Practice 509)

MAINTENANCE

- Inspect periodically for displaced stone material, slumping and erosion at edges (especially downstream or downslope). Properly designed and installed riprap usually requires very little maintenance if promptly repaired.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 507 Live Cribwalls.
- Practice 508 Lunkers.
- Practice 512 Gabion Retaining Wall.
- Other Combined Practices.

Other Sources of Information

- Indiana Erosion Control Handbook.
- North Carolina Erosion Control Manual.
- Pennsylvania Streambank Stabilization Guide.
- COE Streambank Guidelines.

Last Print/Revision Date: October 13, 1996

PRACTICE 511
CONCRETE RETAINING WALL

DESCRIPTION ● A permanent concrete wall which retains a stream bank.

Exhibit 511a: Concrete Retaining Wall (Source: Land and Water Magazine)

PURPOSE	● Create permanent wall that retains soils, usually along highly eroded and steep to sheer stream channels.
WHERE APPLICABLE	● Stream channels of all types and sizes. ● Stream channels with widely fluctuating water levels, and with high velocities.
ADVANTAGES	● Low maintenance. ● Provides permanent stability. ● Prevents erosion and scouring.
CONSTRAINTS	● Expensive compared to other types of walls. ● Requires heavy equipment. ● Lacks ecological value. ● May exacerbate downstream erosion problems if not installed properly. ● Limited to areas with sufficient room for installation. ● May be objectionable aesthetically. ● Must be designed by an engineer to fit conditions to the site.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials** ● Concrete. ● Support structures. ● Reinforcing steel (some types). ● Forms and formwork.

Installation

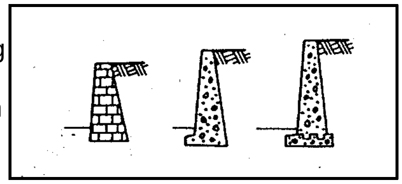
- Assemble general information: topographical and physical surveys, controlling dimensions.
- Analyze subsoil conditions.
- Select type and tentative wall proportions.
- Compute each pressure and surcharge pressure.
- Analyze structural stability.
- Analyze foundation stability.
- Design structural elements.
- Select drainage in backfill.
- Predict settlement and movement of walls.

Special Considerations

- There are five principle types of concrete retaining walls:

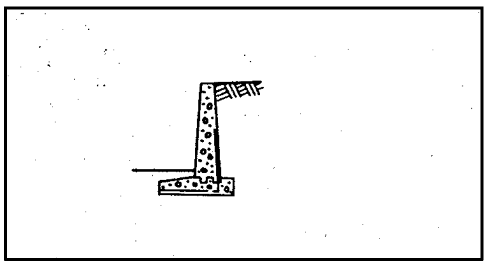
- Gravity Walls: No tensile stress. Heavy construction provides plenty of relative strength, but may not be economical for high walls.

Exhibit 511b: Gravity Retaining Wall (Source: Teng Foundation Design)



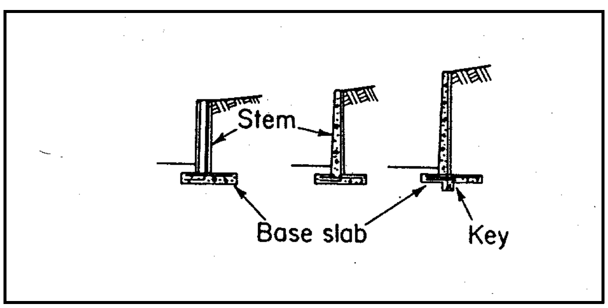
- Semi-Gravity Walls: Some reinforcing steel necessary to reduce the mass of concrete.

Exhibit 511c: Semi-Gravity Retaining Wall (Source: Teng Foundation Design)



- Cantilever Walls: Inverted T forms base and acts as cantilever. Usually made of reinforced concrete, but concrete blocks may be used. Economical for walls ≤ 25'.

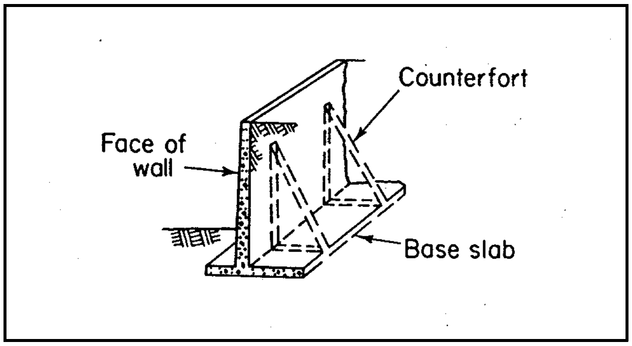
Exhibit 511d: Cantilever Retaining Wall (Source: Teng Foundation Design)



T.O.C.

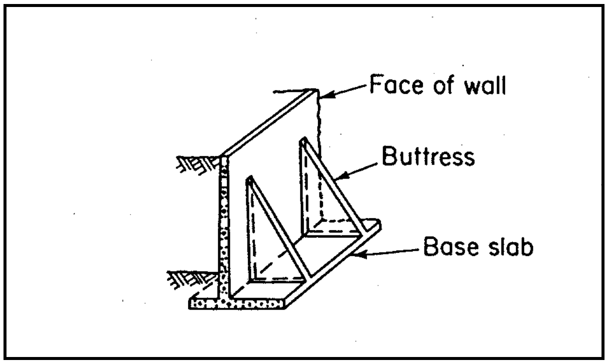
- Counterfort Walls: Like cantilever walls but with vertical brackets called counterforts on the bank side of the wall.

Exhibit 511e: Counterfort Retaining Wall (Source: Teng Foundation Design)



- Butressed Walls: Like counterfort walls but brackets (butresses) are on stream side of wall.

Exhibit 511f: Butressed Retaining Wall (Source: Teng Foundation Design)



MAINTENANCE

- Low.
- Wall settlement can jeopardize the overall integrity of the wall. The potential for settlement can be reduced by overbuilding the wall in excess of the settlement prediction.

REFERENCES

Related Practices

- Practice 507 Live Cribwalls.
- Practice 510 Stone Riprap.
- Practice 511 Concrete Retaining Walls.
- Practice 512 Gabion Retaining Wall.
- Practice 513 Timber Retaining Walls.
- Practice 514 Sheetpile Retaining Walls

Other Sources of Information

- Teng Foundation Design.
- Bulkheads and Seawalls.

T.O.C.

PRACTICE 512
GABION RETAINING WALL

DESCRIPTION	●	Rock-filled baskets of wire or plastic. Baskets are wired together to form a wall or mattress for erosion control along a bank or channel.

Exhibit 512a: Gabion Retaining Wall (Source: North Carolina Erosion Control Manual)

PURPOSE	●	Protect steep banks where scouring or undercutting are problems.
WHERE APPLICABLE	●	Lining confined channels.
	●	Medium to large size streams and on all character types.
ADVANTAGES	●	Relatively economical when rock fill is available.
	●	Flexible, especially when combined with live plant material.
	●	Very effective in immediately securing unstable streambanks.
CONSTRAINTS	●	Labor intensive.
	●	Skill is required to install correctly.
	●	Expensive to correct if not installed correctly.
	●	Lacks ecological value
	●	May exacerbate downstream erosion problems if not installed properly.
	●	Requires more space than retaining walls.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Gabion baskets.
- 4" - 8" rocks for gabions, and 2.5" - 4" for mattresses.
- Filter fabric in highly erodible areas.

Installation

- Gabions and gabion mattresses must be keyed into the streambed to prevent undermining and slumping.

T.O.C.

- Empty baskets are wired together and anchored to the streambed.
- Baskets are filled by hand or machine in one foot layers. Two connecting wires are installed with each layer until the gabions are filled.
- Adjoining gabions are wired together by their vertical edges; empty gabions, stacked on filled gabions, are wired to the filled gabions at front and back.
- Baskets are closed and securely laced once filled.
- Gabions may be built as mass gravity structures with wide bases and narrow tops.

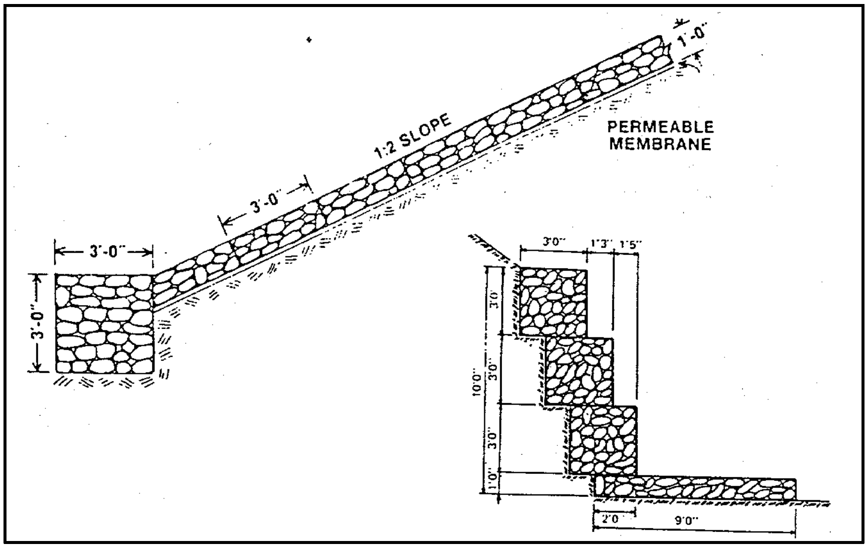


Exhibit 512b: Construction of a gabion retaining wall and mattress (Source: North Carolina Erosion Control Manual)

Special Considerations

- Live Stakes (Practice 501) may be placed between baskets and secured into the soil when used on slopes.

MAINTENANCE

- Low. Monitor and repair as necessary.

REFERENCES

Related Practices

- Practice 501 Live Stakes.
- Practice 511 Concrete Retaining Walls.
- Practice 513 Timber Retaining Walls.
- Practice 514 Sheetpile Retaining Walls.

Other Sources of Information

- Pennsylvania Streambank Stabilization Guide.
- Maccaferri Gabions, Inc. Technical Handbooks.

PRACTICE 513
TIMBER RETAINING WALL

DESCRIPTION	●	A permanent timber wall which retains a streambank.

Exhibit 513a: Timber Retaining Wall (Source: NRCS Engineering Field Handbook)

PURPOSE	●	Create permanent wall that retains soils, usually along highly eroded and steep to sheer stream channels.
WHERE APPLICABLE	●	Stream channels of all types and sizes.
	●	Stream channels with widely fluctuating water levels, and with high velocities.
	●	Wall heights up to 4' differential.
ADVANTAGES	●	May use less skilled labor and lighter material than other walls.
	●	Can be adapted to a range of stream bank configurations.
	●	Low maintenance.
	●	Prevents erosion and scouring.
CONSTRAINTS	●	Expensive.
	●	Limited to areas with sufficient room for installation.
	●	May be objectionable aesthetically.
	●	Lacks ecological value and may be discouraged by agencies due to concerns about potential negative impacts of treated lumber or plastic especially where constant or considerable contact exists with water.
	●	May exacerbate downstream erosion problems if not installed properly.
	●	Must be tied back at heights above 3' which may require excavation.
	●	Less permanent than stone or concrete walls.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	Wood timbers treated with a preservative.
	●	Steel bins.
	●	Open graded granular backfill.

Design

- Assemble general information: topographical and physical surveys, controlling dimensions.
- Analyze subsoil conditions (visual; requires geotechnical report if over 3' high).
- Select type and tentative wall proportions.
- Compute earth pressure and surcharge pressure (over 3' high).
- Analyze structural stability (over 3' high).
- Analyze foundation stability (over 3' high).
- Design structural elements (over 3' high).
- Select drainage in backfill.

Installation

- Establish firm foundation soil. Put in at least 6". Open graded gravel as bedding.
- Lay successive courses of timbers with offset joints.
- Every fourth course, turn a timber at least as long as the height of the wall perpendicular and embedded in the soil behind the wall with a steel pin.
- Backfill with open graded aggregate and compact with each horizontal course.

Special Considerations

- The space behind the wall must be free draining so that the water pressure differentials caused by stream fluctuations are minimized.
- Wall heights over 3' should be reviewed by a structural engineer prior to installation.

MAINTENANCE

- Check for rotting timbers and replace as necessary.
- Wall settlement can jeopardize the overall integrity of the wall. The potential for settlement can be reduced by overbuilding the wall in excess of the settlement prediction.
- Watch for erosion at the wall base as undermining is often the cause of wall failure.

REFERENCES

Related Practices

- Practice 507 Live Cribwalls.
- Practice 510 Stone Riprap.
- Practice 511 Concrete retaining Walls.
- Practice 512 Gabion Retaining Wall.
- Practice 513 Timber Retaining Walls.
- Practice 514 Sheetpile Retaining Walls.

Other Sources of Information

- Teng Foundation Design.
- Bulkheads and Seawalls.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 514
SHEETPILE RETAINING WALL

DESCRIPTION

- Steel, concrete, wood, or plastic sheet piles that interlock to form a continuous wall along a stream channel. The wall may be partially supported by anchors imbedded in the soil behind the wall, called tie-backs.

Exhibit 514a: Sheetpile Retaining Wall
(Source: NRCS Files)

PURPOSE

- Create a temporary or permanent wall that retains soils, usually along highly eroded and steep to sheer stream channels.
- Where land ownership or rights prohibit flattening a slope or other types of armor.

WHERE APPLICABLE

- Stream channels of all types and sizes.
- Stream channels with widely fluctuating water levels, and with high velocities.
- Where permanent channel obstructions such as bridge abutments cause significant erosion.

ADVANTAGES

- Low maintenance.
- Provide permanent stability if necessary.
- Prevents erosion and scouring in immediate area of sheet piling.
- May be used along channels where space prohibits the construction of other structures that require more space to work.

CONSTRAINTS

- Expensive.
- Requires heavy equipment.
- Should not be used in areas where boulders or bedrock would

prevent driving piles to the appropriate depth.

- Should not be used to create very high walls in which the flexural strength of the wall might be compromised.
- May be objectionable aesthetically.
- Lacks ecological value and may be discouraged by agencies due to concerns about potential negative impacts of treated lumber or plastic especially where constant or considerable contact exists with water.
- May exacerbate downstream erosion problems if not installed properly.
- Must be reviewed by a structural engineer for stability.
- May transfer erosion downstream from sheeting if not properly transitioned.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Rolled steel, precast concrete, wood or plastic piles.
- May require anchoring structures such as cantilevers or tie rods.

- Steel: Interlocking, rolled steel sheet piles of varying weights driven into the ground. Steel is the most widely used pile material.

- Wood: Independent or tongue-and-groove interlocking planks driven edge to edge into the ground. May be permanent if permanently inundated, though generally used as a temporary structure for short to moderately high walls.

- Concrete: Precast, concrete piles driven side by side into the ground. Long service life but high initial costs. Concrete piles are more difficult to handle and drive than steel piles. May be useful in streams with high abrasion, and where the wall must support an axial load. Can induce settlement in soft foundations.

- Plastic: High density, interlocking plastic sheets. Usually vibrated into the ground. Plastic has lower structural capacities than other materials and is generally used in tie-back situations.

Installation

- The most common methods for installing sheetpiling include driving, jetting and trenching. The type of sheetpiling used usually governs the method of installation.
- Driving: Sheetpiling is typically driven with traditional pile driving equipment.
- Jetting: Water jets are sometimes necessary when driving piles into dense, cohesionless soils. Jetting should be performed on both sides of piling simultaneously but must be discontinued during the last 5'-10' of penetration.
- Trenching: Usually necessary when pile penetration is shallow and driving is impossible.
- Sheetpile retaining walls should be designed by a qualified engineer and installed in accordance with the manufacturer's specifications.

Special Considerations

- Anchored walls are required when the height of the wall exceeds heights recommended for cantilever walls, or when lateral deflections are a consideration. Proximity of an anchored wall to an existing structure is governed by the horizontal distance required for the installation of an anchor.

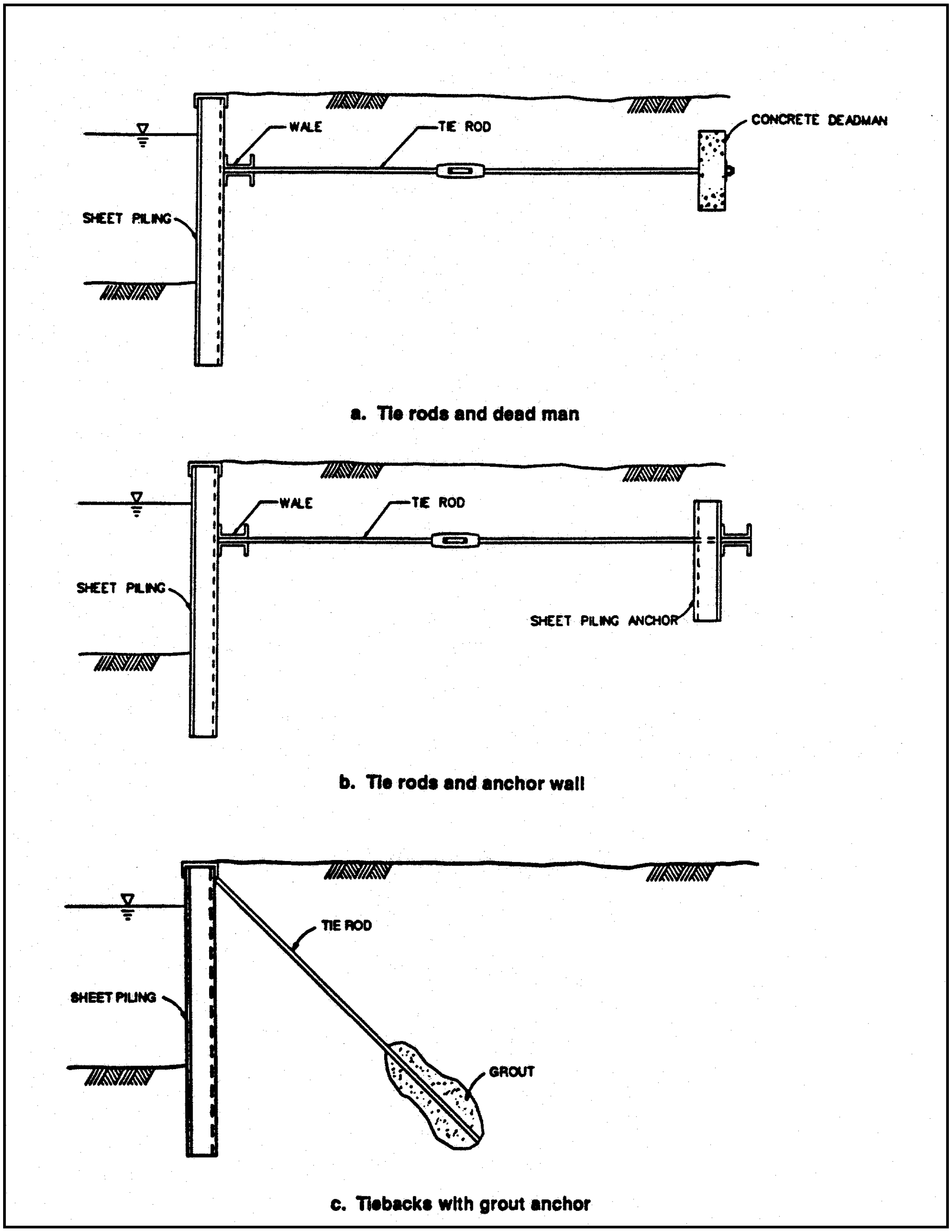


Exhibit 514b: Anchored walls (Source: COE Engineering Manual)

- Cantilever walls are usually used as floodwalls or earth retaining walls < 10' - 15' high. Cantilever walls derive their support solely from foundation soils so they may be installed relatively close ($\geq$ 1.5

times the length of the piling) to an existing structure.

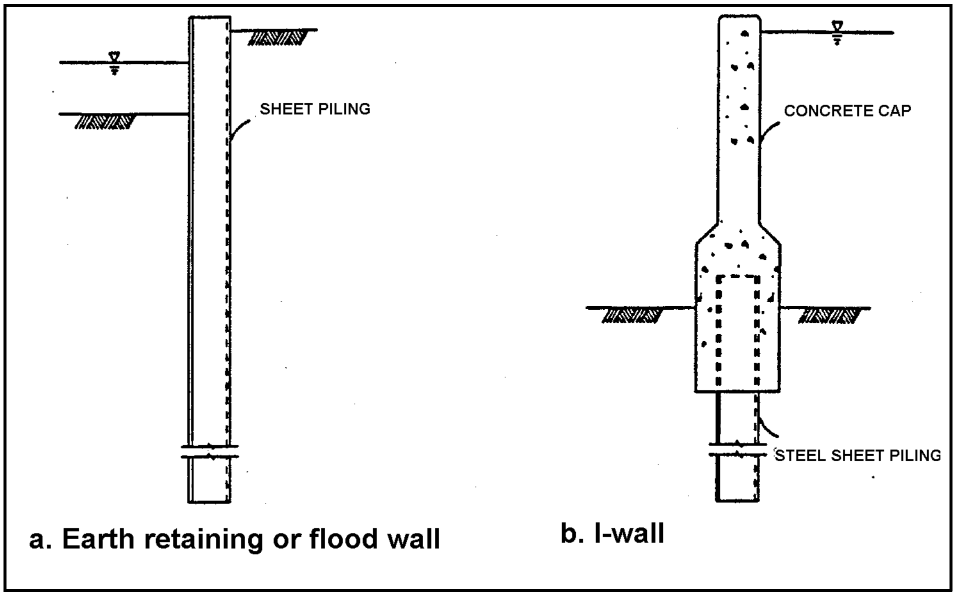


Exhibit 514c: Cantilever walls (Source: COE Engineering Manual)

- A geotechnical investigation should be conducted to identify foundation conditions, and to assist in the choice of pile material and design.
- An evaluation of system loads applied to the piling should be conducted prior to designing a wall. Loads governing the design arise primarily from the soil and water surrounding the wall, and other influences such as surface surcharges, and external loads applied directly to the piling.

MAINTENANCE

- Low.
- Uncapped, exposed sheet piling corrodes at varying rates averaging 2 - 10 mils per year, depending on surrounding atmospheric conditions. Sheetpiling driven into natural, undisturbed soils has a negligible corrosion rate. Increased erosion occurs with piles installed in organic or fresh fills.
- Wall settlement can jeopardize the overall integrity of the wall. The potential for settlement can be reduced by overbuilding the wall in excess of the settlement prediction.

REFERENCES

Related Practices

- Practice 507 Live Cribwalls.
- Practice 508 Stone Riprap.
- Practice 511 Concrete Retaining Walls.
- Practice 512 Gabion Retaining Walls.
- Practice 513 Timber Retaining Walls.
- Practice 515 Composite Retaining Walls.

Other Sources of Information

- COE Engineering Manual.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 515
COMPOSITE RETAINING WALL (Soldier Pile with Sheeting)

DESCRIPTION
- A permanent retaining wall in which timber or pre-cast concrete are installed horizontally between steel I-beam piles.

Exhibit 515a: Composite Retaining Wall (Source: CBBEL Files)

PURPOSE
- Create a temporary or permanent wall that retains soils, usually along highly eroded and steep to sheer stream channels.

WHERE APPLICABLE
- Stream channels of all types and sizes.
- Stream channels with widely fluctuating water levels, and with high velocities.

ADVANTAGES
- Low maintenance.
- Provide permanent stability if necessary.
- Prevents erosion and scouring.
- May be used along channels where space prohibits the construction of other structures that require more space to work.
- May be more aesthetically acceptable than sheetpiling.

DISADVANTAGES
- Expensive.
- Requires heavy equipment.
- Should not be used in areas where boulders or bedrock would prevent driving piles to the appropriate depth.
- Should not be used to create very high walls in which the flexural strength of the wall might be compromised.
- Lacks ecological value and may be discouraged by agencies due to concerns about potential negative impacts of treated lumber or plastic especially where constant or considerable contact exists with water.
- May exacerbate downstream erosion problems if not installed properly.

- Requires professional design and geotechnical review.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Steel I-beam piles.
- Pre-cast concrete sheets, tongue and groove wood planks, or railroad ties.

Installation

- Assemble general information: topographical and physical surveys, controlling dimensions.
- Analyze subsoil conditions.
- Analyze structural stability.
- Analyze foundation stability.
- Design structural elements.
- Predict settlement and movement of walls.

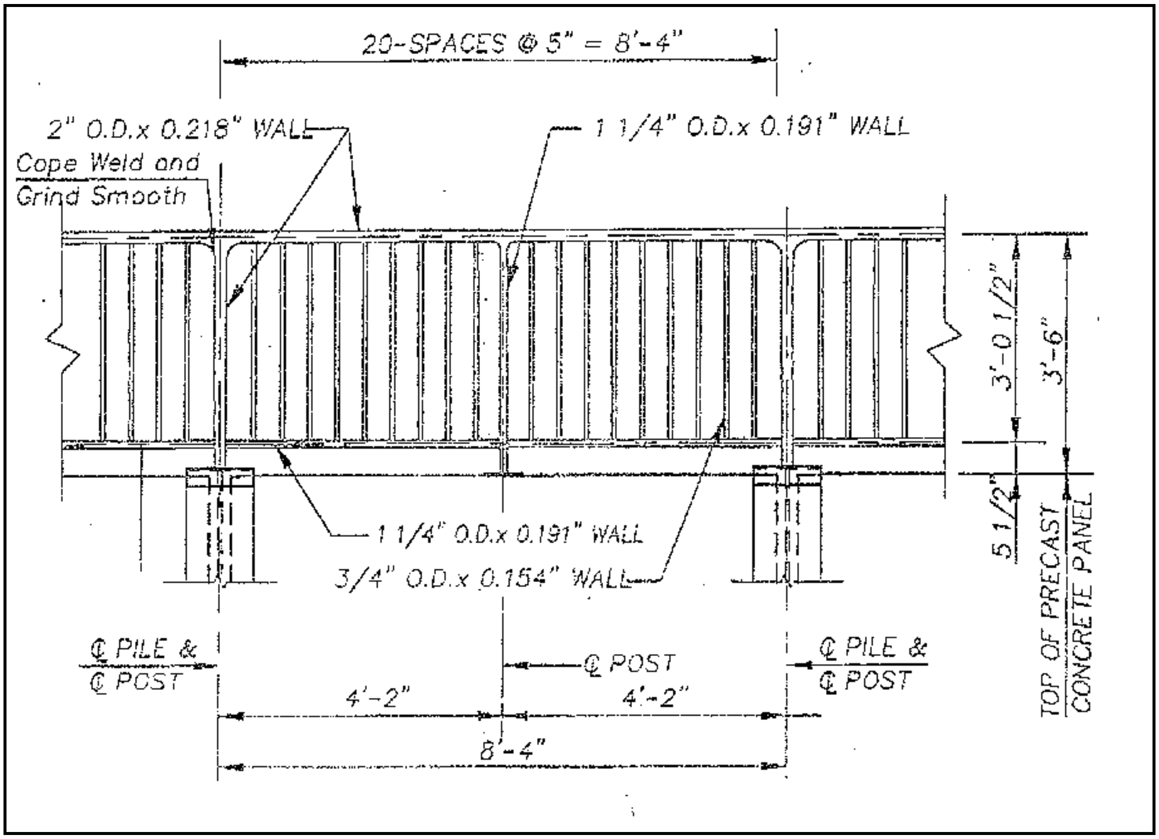


Exhibit 515b: Typical Example of a Composite Wall Design (Source: CBBEL Files)

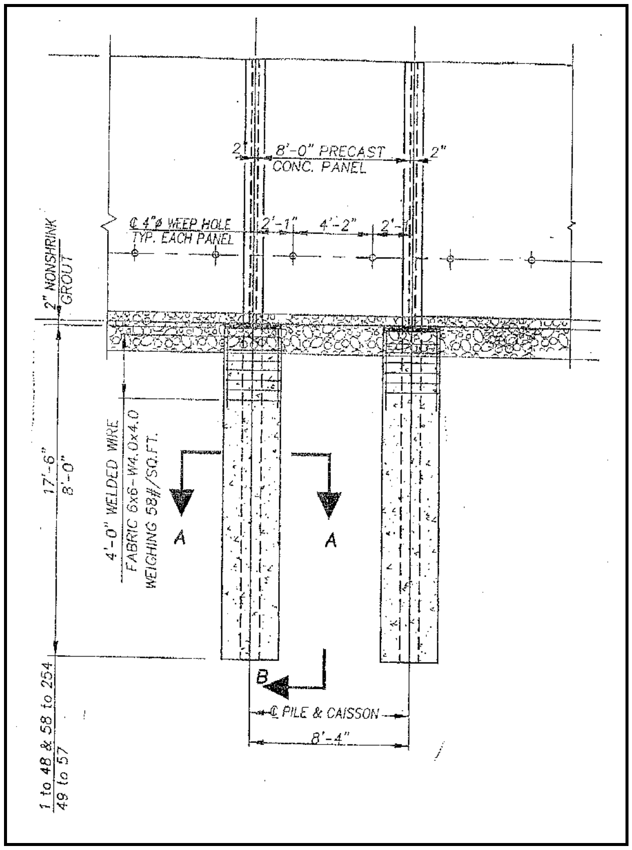


Exhibit 515c: Typical Example of a Composite Wall's Pile and Post Design Details (Source: CBBEL Files)

Special Considerations

- A geotechnical investigation should be conducted to identify foundation conditions, and to assist in the choice of pile material and design.
- An evaluation of system loads applied to the piling should be conducted prior to designing a wall. Loads governing the design arise primarily from the soil and water surround the wall, and other influences such as surface surcharges, and external loads applied directly to the piling.

MAINTENANCE

- Low.
- Wall settlement can jeopardize the overall integrity of the wall. The potential for settlement can be reduced by overbuilding the wall in excess of the settlement prediction.

REFERENCES

Related Practices

- Practice 510 Stone Riprap.
- Practice 511 Concrete Retaining Walls.
- Practice 512 Gabion Retaining Walls.
- Practice 513 Timber Retaining Walls.

Other Sources of Information

- COE Engineering Manual.

T.O.C.

SECTION 5.6

CHANNEL EXCAVATION/DREDGING

SECTION 5.6
CHANNEL EXCAVATION/DREDGING

This section consists of three common excavation/dredging practices. The first two practices, Channel Bottom Dipping (Practice 601) and Channel Bank Excavation (Practice 602), pertain to situations where the channel portion of a stream or ditch needs to be modified. The effectiveness of these two practices is normally limited to low flows or smaller floods. The third practice, Channel Overbank Excavation (Practice 603), is normally performed to increase the floodway conveyance either as a compensatory measure for floodway encroachment or as a means of lowering the flood stages. Because a large portion of floodflows associated with larger, less frequent floods is conveyed by channel overbanks, the overbank excavation has the largest effect on flood stages.

Bottom Dipping is normally performed in man-made ditches or those regulated drains that are subject to periodic maintenance. When channel excavation/dredging is required to increase the capacity of a natural stream or to reshape the channel to a more stable configuration, negative impacts on the aquatic habitat and the riparian corridor are inevitable. The one-sided construction technique (explained below) as well as erosion control measures prescribed for these practices would minimize some of this impact. However, in many instances it may be necessary to mitigate for unavoidable negative impacts resulting from this type of project. The overbank excavation involves the least amount of disturbance to the channel and the natural habitat associated with it. However, it sometimes impacts the riparian habitat where excavation is occurring and will also normally require some degree of mitigation.

In certain conditions, especially in regularly maintained, man-made drainage ditches where <u>no</u> trees or shading vegetation currently exist along the banks (Exhibit 3.3a), working on both sides of the ditch could be considered. However, even under these circumstances, it is recommended that the work be limited to only one side of the stream so that permanent, shade-producing trees have a chance to be established on the non-worked side. Aside from water quality and habitat benefits, maintaining a shade canopy over the stream inhibits the growth of weeds in the streambed. Growth of dense weeds in the stream channel slow the flow of water and promote sediment deposition in the main channel, increasing the annual maintenance costs.

Where channel or overbank modifications are taking place along natural streams or shaded drainageways, part of the natural aquatic and streamside habitat should be preserved, and some shade retained, by limiting construction to one side of the stream (Exhibit 5.6a). When conditions allow, limiting work to north and east sides would be environmentally more beneficial, as leaving trees on south and west sides will provide shading to the stream. When feasible, vegetative filter strips (Practice 804) should be installed along the work-side of the bank, both to reduce sedimentation and to provide maintenance access for any future work.

When compared with two-sided modification, single-bank modification has fewer adverse impacts on terrestrial wildlife habitat, though aquatic habitat is still affected. In some instances, single-bank modification also costs less to construct and revegetate. Therefore, all the practices provided in this section assume that the entire work will be done from one side of the channel with spoil deposited along the work-side. However, when the two-sided modification is considered, despite its drawbacks noted earlier, work may be done and spoil deposited on both sides of the ditch.

Exhibit 5.6a: One-sided construction lessens the environmental impact on the stream (Source: Ohio Stream Management Guide)

PRACTICE 601
CHANNEL BOTTOM DIPPING

DESCRIPTION
- Dipping, dredging and/or removing sediment from the channel bottom with a bucket from one side of the channel without disturbing the ditch banks.

Exhibit 601a: Channel Bottom Dipping (Source: NRCS files)

PURPOSE
- To lower the grade of the ditch bottom to match the upstream or downstream reaches by means of excavating or dredging the sediments accumulated at the ditch bottom over time.

WHERE APPLICABLE
- Where in-channel obstruction such as sediment or vegetative debris have eliminated a positive hydraulic grade.
- Where stream banks and adjacent overbanks are well defined and stable while in-channel alignment and condition are not conducive for effective low flow.

ADVANTAGES
- Improve low flow conveyance capacity of stream.
- Provides hydraulic benefit to low flow conditions.
- Prevents stagnation or sedimentation pools by providing positive flow conditions.
- Eliminates impact to inflow structures such as tile drains or surface flow systems.

CONSTRAINTS
- Need for extensive in-channel erosion control measures.
- May temporarily impact well established aquatic habitat.
- Has minimal hydraulic benefit for flood flow conditions.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- In-channel sediment basin.

Installation
- Install In-channel Sediment Basin (Practice 801) if necessary.

- Remove all in-channel obstructions (Practice 401 or 402).
- Excavate low flow channel below existing flow line to grades shown in design plans or specifications. Cross section geometry should, in general, be trapezoidal with positive grade. Side slopes of excavated low flow area should be cut away from edge of water so as not to compromise channel bank stability.
- Spoil material should be disposed of adjacent to excavated area unless required differently in design plans or specifications. Spoil shall be placed landward of channel bank by a distance of five feet or more (outside of the floodway) and leveled to a slope of 5:1 (1V:5H) or flatter so as not to severely impact stream system and applied erosion control measures. From the maximum height, the soil should have an 8:1 (1V:8H) back slope to field level. Grading of spoil material should coincide with adjacent stream overbank topography.
- All spoil deposition areas shall be same-day seeded or mulched immediately after final grading if not in agricultural production.

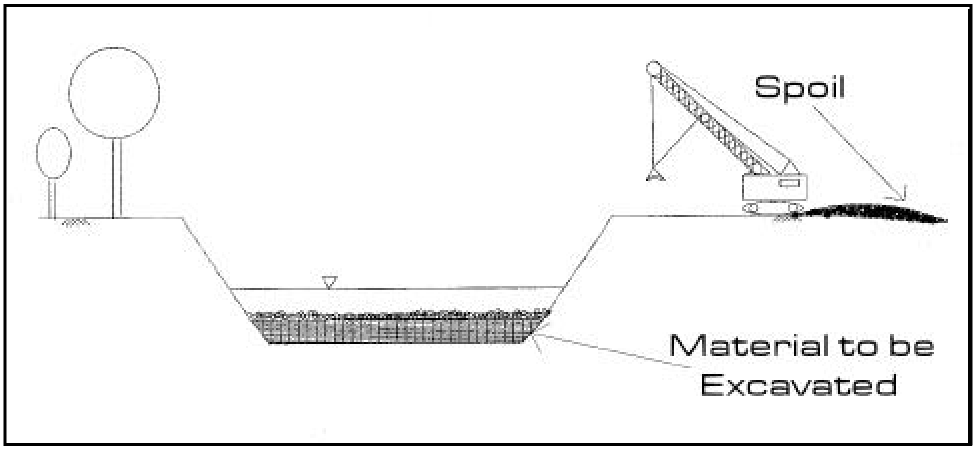


Exhibit 601b: Illustration of Bottom Dipping practice (Source: CBBEL Files)

Special Considerations

- Transitions in size or dimension of excavated area should be gradual to prevent unstable flow conditions and to avoid sedimentation problems.
- Disposal of spoil material should consider additional factors of land ownership or right-of-way, land use (particularly agricultural or crop production), environmentally sensitive areas, or related impacts due to placement of the material.
- Spoil material should not be placed in floodway or in wetlands. Additional permits are required for placement of fill in floodway or wetlands. (See Practice 1301 Debris Disposal.)
- When feasible, consider installing vegetative filter strip (Practice 804) along the work-side of the bank. Channel excavation practices create a unique opportunity to install filter strips with minimal costs.

MAINTENANCE

- Inspect excavated area after major flow events to remove collected debris, as necessary.
- Inspect excavated reach to confirm stability in channel cross section, particularly the channel banks for location of excessive erosion or

streambank failure.

- Remove sediment and debris from excavated area as necessary to maintain cross section and grade to prevent additional sedimentation or erosion.
- Reduce sediment delivery to the ditch by regrading eroded ditch banks and by installing erosion control practices in the contributing watershed.

REFERENCES

Related Practices

- Practice 401 Logjam Removal Using Hand-held Tools .
- Practice 402 Logjam Removal Using Heavy equipment.
- Practice 704 Channel Transitions (Tie-Ins).
- Practice 801 In-channel Sediment Basin .
- Practice 1001 Tile Drain Outlet Extension.
- Practice 1301 Debris Disposal.
- Practice 1303 Permanent Maintenance Access.

Other Sources of Information

- Illinois Urban Manual.
- NRCS Standard Specifications.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 602
CHANNEL EXCAVATION/DREDGING

DESCRIPTION
- Excavating the banks (side slopes) and bottom of a channel through one-sided construction methods.

Exhibit 602a: Channel Excavation/Dredging (Source: NRCS Files)

PURPOSE
- To increase the cross section of a ditch or reshape the channel to a more stable configuration by means of channel excavation/ dredging from one side of channel.

WHERE APPLICABLE
- Where flood flow conditions warrant additional conveyance capacity in the channel area itself.
- Where channel, soil or site conditions allow for extensive excavation of material for entire stream cross section.

ADVANTAGES
- Maximizes available flow conveyance capacity of stream system.
- Provides hydraulic benefit to adjacent lands.
- Can provide a stable stream cross section for entire channel width.
- Can provide for larger in-channel and overbank habitat.

CONSTRAINTS
- May require reconstruction of all side outlets to main stream.
- May require extensive erosion control measures.
- May need extensive overbank area to perform construction.
- May negatively impact well established riparian corridor.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Vegetative stabilization material.
- Erosion control blankets or matting.

Installation

- Work should be performed from one side of channel only. When conditions allow, limiting work to north and east sides would be environmentally more beneficial as leaving trees on south and west sides provides shading to the stream. Cross section excavation should start from top of the bank of work side, continue to the ditch bottom, and then proceed to the top of the other bank.
- Install In-channel Sediment Basin (Practice 801), if necessary.
- Remove all in-channel obstructions (Practice 401 or 402).
- Remove brush and vegetative matter to be disposed of by appropriate means (Activity 5.3)
- Clear and Grub channel bank (Practice 107). Brush and debris to be disposed of by appropriate means (Practice 1301)
- Note all points of concentrated inflow to channel for special excavation/protection of these outlets.
- Excavate cross section to grades shown in design plans or specifications. Cross section geometry should in general be trapezoidal with consideration for geotechnical stability of side slopes and adjacent topography. Side slopes of excavated area should be preferably 3:1 (1V:3H) or flatter but never greater than 2:1 (1V:2H).
- Apply applicable excavated area lining as required by design plans or specifications. These linings should conform to guidelines noted for the specific requirements stated in rip-rap, vegetative, or concrete linings noted in Practices 701, 702 and 703.
- Remove piped or surface outflow structures to a point equal to the excavation limits. Re-establish outlet and applicable outfall structures while applying appropriate energy dissipators or erosion resistant linings to allow positive grade and free flow to main channel (Practices 704, 705, 1001, and 1002).
- Spoil material should be disposed of adjacent to excavated area unless required differently in design plans or specifications. Spoil shall be placed away from newly excavated bank by a distance of five feet or more (outside of the floodway) and leveled to a slope of 5:1 (1V:5H) or flatter so as not to severely impact erosion control measures and to coincide with adjacent stream overbank topography. From the maximum height, the spoil should have an 8:1 (1V:8H) slope to field level.
- All spoil deposition areas shall be same-day seeded or mulched immediately after final grading if not in agricultural production.

- All excavated areas shall be revegetated immediately after final grading using erosion control matting (Practice 1104) to the extent feasible. Same-day seeding or mulching may be considered where conditions allow rapid establishment of vegetation.

T.O.C.

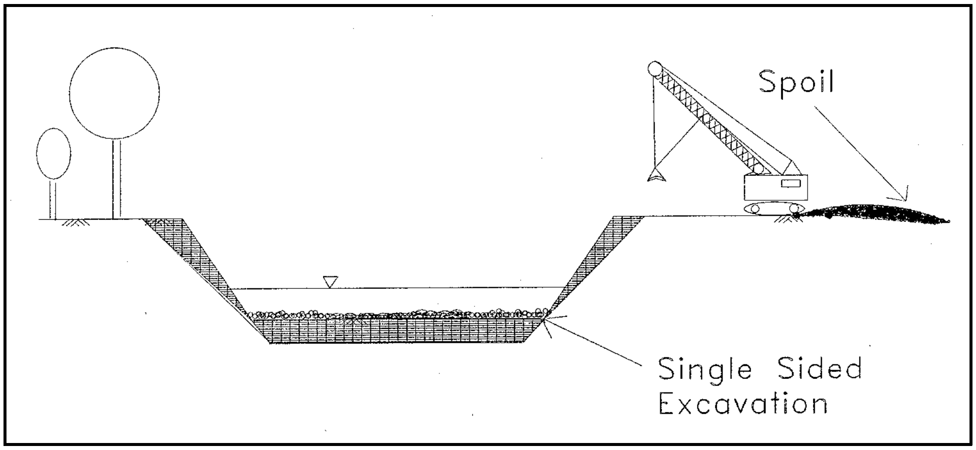


Exhibit 602b: Illustration of one-side channel excavation practice (Source: CBBEL Files)

Special Considerations

- Transitions in size or dimension of excavated area should be gradual to prevent unstable flow conditions and to avoid sedimentation problems.
- Disposal of spoil material should consider additional factors of land ownership or right-of-way, land use (particularly agricultural or crop production), environmentally sensitive areas, or related impacts due to placement of the material.
- Spoil material should not be placed in floodway or in wetlands. Additional permits are required for placement of fill in floodway or wetlands. (See Practice 1301 Debris Disposal.)
- When feasible, consider installing vegetative filter strip (Practice 804) along the work-side of the bank. Channel excavation practices create a unique opportunity to install filter strips with minimal costs.

MAINTENANCE

- Inspect excavated reach after major flow events to repair damaged areas, as necessary.
- Inspect transition areas to confirm stability in channel cross section and for points of erosion.
- Remove sediment and debris from excavated area as necessary to maintain cross section and grade to prevent additional sedimentation or erosion.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 701 Channel with Grass Lining.
- Practice 702 Channel with Riprap Lining.
- Practice 703 Channel with Concrete Lining.
- Practice 704 Channel Transitions (Tie-Ins).
- Practice 705 Grade Transitions.
- Practice 801 In-channel Sediment Basin.
- Practice 1001 Tile Drain Outlet Extension.
- Practice 1002 Riprap-Lined Apron.
- Practice 1102 Vegetative Stabilization.
- Practice 1103 Bonded Fiber Matrix.

- Practice 1104 Erosion Control Blankets and Matting.
- Practice 1301 Debris Disposal.
- Practice 1303 Permanent Maintenance Access.
- Activity 5.3 Debrushing.
- Activity 5.4 Logjam Removal and River Restoration.

Other Sources of Information

- Illinois Urban Manual.
- NRCS Standard Specifications.

Last Print/Revision Date: October 13, 1996

PRACTICE 603
CHANNEL OVERBANK EXCAVATION

DESCRIPTION	●	Excavating channel overbank areas only (this practice may also include excavation of a portion of the bank that is above the ordinary high water line).

Exhibit 603a: Overbank excavation on one side of channel increases the flood carrying capacity of the stream (Source: CBBEL Files)

PURPOSE	●	To increase the conveyance capacity of a stream or ditch by means of excavating a portion of the channel's overbank area without disturbing the channel itself.
WHERE APPLICABLE	●	Where flood flow conditions warrant additional conveyance capacity in the stream or ditch or where compensatory floodplain storage has been required to maintain floodway conveyance or floodplain storage.
	●	Where channel, soil, or site conditions limit ability to excavate material for entire stream cross section.
ADVANTAGES	●	Improve flow conveyance capacity of stream system.
	●	Provides hydraulic benefit without impacting aquatic environment.
	●	Disposal of relatively dry dredged material is easier.
	●	Channel cross section and flow less likely to be impacted by stream sediment loads.
	●	Provides for larger, improved overbank habitat.
CONSTRAINTS	●	May require reconstruction of all side outlets to main stream.
	●	May require extensive erosion control measures.
	●	May need extensive overbank area to perform construction.
	●	May negatively impact well established riparian corridor.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Vegetative stabilization material.
- Erosion control blankets/matting or another suitable method to stabilize the bank.

Installation

- Install in-channel sediment basin (Practice 801), if necessary.
- Clear and Grub channel bank areas (Practice 107). Brush to be disposed of by appropriate means (Practice 1301)
- Note all points of concentrated inflow to channel for special excavation/protection of these outlets.
- Excavate cross section above normal flow line to grades shown in design plans or specifications. Cross section geometry should in general be trapezoidal with slight grade sloping to channel centerline. Side slopes of excavated area should be preferably 3:1 (1V:3H) or flatter but never greater than 2:1 (1V:2H).
- Apply applicable excavated area lining as required by design plans or specifications. These linings should conform to guidelines noted for the specific requirements stated in rip-rap, vegetative, or concrete linings noted in Practices 701, 702 and 703.
- Remove piped or surface outflow structures to a point equal to the excavation limits. Reestablish outlet and applicable outfall structures while applying appropriate energy dissipators or erosion resistant linings to allow positive grade and free flow to main channel (Practices 704, 705, 1001, and 1002).
- Spoil material should be disposed of adjacent to excavated area unless required differently in design plans or specifications. Spoil shall be placed away from newly excavated bank by a distance of five feet or more (outside of the floodway) and leveled to a slope of 5:1 (1V:5H) or flatter so as not to severely impact erosion control measures and to coincide with adjacent stream overbank topography. From the maximum height, the spoil should have an 8:1 (1V:8H) slope to field level.
- All spoil deposition areas shall be same-day seeded or mulched immediately after final grading if not in agricultural production.
- All excavated areas shall be revegetated immediately after final grading using erosion control matting (Practice 1104) to the extent feasible. Same-day seeding or mulching may be considered where conditions allow rapid establishment of vegetation.

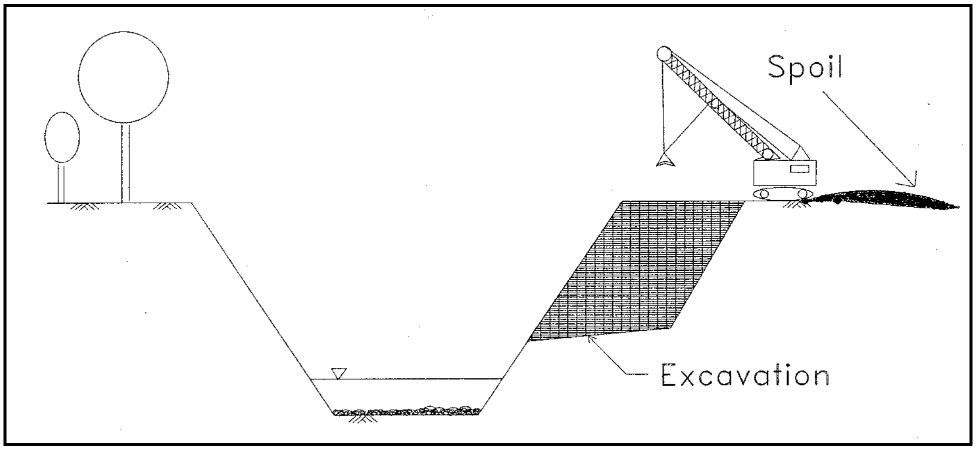


Exhibit 603b: Typical cross section of stream showing overbank area subject to excavation (Source: CBBEL Files)

Special Considerations

- Maximum permissible velocities for vegetative linings should not exceed those noted in Practice 701.
- Transitions in size or dimension of excavated area should be gradual to prevent unstable flow conditions and to avoid sedimentation problems.
- Disposal of spoil material should consider additional factors of land ownership or right-of-way, land use (particularly agricultural or crop production), environmentally sensitive areas, or related impacts due to placement of the material.
- Spoil material should <u>not</u> be placed in floodway or in wetlands. Additional permits are required for placement of fill in floodway or wetlands. (See Practice 1301 Debris Disposal.)
- When feasible, consider installing vegetative filter strip (Practice 804) along the work-side of the bank. Channel excavation practices create a unique opportunity to install filter strips with minimal costs.

MAINTENANCE

- Inspect excavated area after major flow events to repair damaged reaches as necessary.
- Inspect transition areas to confirm stability in channel cross section and for points of erosion.
- Remove sediment and debris from excavated area as necessary to maintain cross section and grade to prevent additional sedimentation or erosion.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 701 Channel with Grass.
- Practice 702 Channel with Riprap Lining.
- Practice 703 Channel with Concrete Lining.
- Practice 704 Channel Transitions (Tie-Ins).
- Practice 705 Grade Transitions.
- Practice 801 In-channel Sediment Basin.
- Practice 1001 Tile Drain Outlet Extension.
- Practice 1002 Riprap-Lined Apron.

- Practice 1102 Vegetative Stabilization.
- Practice 1103 Bonded Fiber Matrix.
- Practice 1104 Erosion Control Blankets and Matting.
- Practice 1301 Debris Disposal.
- Practice 1303 Permanent Maintenance Access.
- Activity 5.3 Debrushing.
- Activity 5.4 Logjam Removal and River Restoration.

Other Sources of Information

- Illinois Urban Manual.
- NRCS Standard Specifications.

SECTION 5.7

DITCH RELOCATION/CONSTRUCTION AND TRANSITIONS

SECTION 5.7
DITCH RELOCATION/CONSTRUCTION AND TRANSITIONS

Relocated or recently constructed ditches are often lined with grass, riprap, or concrete to control erosion resulting from concentrated runoff. Channels with grass lining may be used where the slope does not exceed 5%, and the design velocity will not exceed 5 feet per second. These type of channels are often preferred over riprap and concrete channels because they are less expensive to install, and provide the added benefit of improved water quality and water retention.

Channels with riprap lining are recommended where flow is too high for grass channels; where steep grades, wetness, prolonged base flow, and seeping and/or piping would cause erosion; where highly erosive soils or climatic conditions would preclude the establishment of vegetation; and where runoff must be conveyed in a limited space.

Channels with concrete lining are much more expensive to install than either grass or riprap channels. They are most often used in very flat areas where maintaining sufficient flows would be difficult to achieve with riprap or grass. Care must be taken when constructing concrete-lined channels to achieve the correct grade or in-channel ponding will result.

Ground water in the immediate proximity of concrete and riprap channels will not likely be impacted. However, it should be noted that neither of these channels appreciably filter out runoff-born contaminants; rather, contaminants are transported to a downstream location.

Special handling may be required when a new ditch has to be located adjacent to a wetland or has to cross a wetland. These circumstances may require that the channel be enclosed either as a long culvert or as a non-perforated tile or tubing. Other design innovations may also be possible and have to be addressed on a case-by-case basis.

Channel transitions are used to provide a gradual tie-in between the existing stream or ditch, and on-line channel improvements such as retention basins or channel relocations. They are also used at the junction of two channels. Transitions should be designed to maintain the existing flow regime, and avoid hydraulic jumps.

If the ditch is being relocated, the existing channel should be kept undisturbed until the relocated channel is complete and fully stabilized. Once the new channel is established, the water may be diverted to the new channel by means of a channel tie-in/transition section.

Grade transitions (chutes) are open channels (usually paved) used to convey high-velocity water down a steep slope without erosion. They are widely used where concentrated runoff from an upland area needs to be directed to a receiving stream or ditch that is located at a significantly lower grade. Chutes are also sometimes used to safely convey the high-velocity current exiting culvert outlets to the receiving waterbody. Rock chutes may also be modified for in-channel use for grade stabilization purposes.

In-channel grade stabilization structure help control sedimentation by reducing bank erosion caused by excessive channel grades. Reducing the grade slows water velocities, thereby reducing the erosive action of the water. These structures are also sometimes used outside the main channel for grade transition purposes. Grade stabilization structures can be complex, and should only be designed by a qualified engineer.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 701
CHANNEL WITH GRASS LINING

DESCRIPTION

- A natural or constructed channel that is shaped or graded to required dimensions and established with vegetation for stable conveyance and runoff. (Note: a variation of this practice may also be found as "Grass-Lined Channel" in the Indiana Erosion Control Handbook.)

Exhibit 701a: Channel with Grass Lining (Source: North Carolina Erosion Control Manual)

PURPOSE

- To carry runoff as a new ditch, a relocated section of an existing watercourse, a by-pass channel, or to carry concentrated runoff from a small watershed area to a stable outlet without damage from erosion or flooding.

WHERE APPLICABLE

- New ditches, ditch relocations, by-pass channels, roadside ditches, channels at property boundaries, outlets for diversions, and other channels draining low areas where slopes are $\leq$ 5%.
- Sometimes used in place of curb and gutter for conveyance of storm water.

ADVANTAGES

- Carries concentrated runoff without damage from erosion or flooding.
- Enhance water quality by filtering out pollutants.
- Provide some water retention benefits.

CONSTRAINTS

- Not suitable for high-velocity flow or where channel slope must be more than 5%.
- Need room for a relatively large cross section.
- Requires establishment of a dense, erosion resistant vegetative cover (Practice 1102 Vegetative Stabilization).
- Requires erosion control blankets or matting while vegetation becomes established (Practice 1104 Erosion Control Blankets).

- May require drainage tile (Practice 201 Tile Drain Installation) if areas have high water table or if there are seepage problems.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Vegetative stabilization.
- Erosion control blankets or matting.

Installation
- Install Sediment Basin (Practice 801) or Temporary Diversion (Practice 104), if necessary.

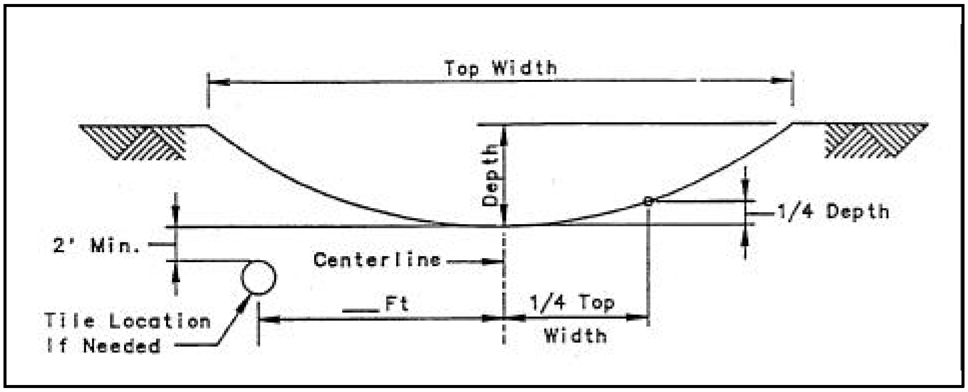


Exhibit 701b: Parabolic Cross Section (Source: NRCS Standard Specifications)

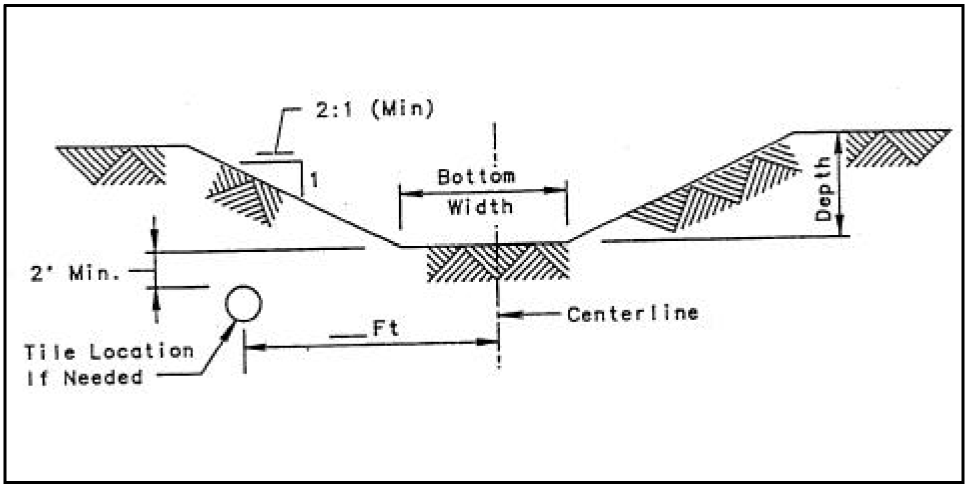


Exhibit 701c: Trapezoidal Cross Section (Source: NRCS Standard Specifications)

- Clear and Grub (Practice 107) construction area.
- If drainage tile is needed, it should be located ± 1/3 of the distance away from the center of the top width of the waterway. The top of the tile should be 2'-4' below the bottom of the waterway, except when impractical due to soil or outlet conditions.
- Channel cross section should be parabolic or trapezoidal. The parabolic shape is preferred.
- Protect all concentrated inflow points along the channel with erosion resistant linings, riprap (Practice 702) or other appropriate measures.

T.O.C.

- Seed and mulch the channel immediately after grading (Exhibit 701d or Exhibit 1102b), and protect with erosion control blankets and/or matting.
- Stabilize outlets during channel installation (Practices 1001 and 1002).

Special Considerations

- Optimum seeding dates are March 1 to May 10 and August 1 to September 30. Permanent seeding done between May 10 and August 10 may need irrigation.
- Maximum permissible velocities of flow shall not exceed the values shown in Exhibit 701d.

Channel Slope	Lining	Velocity (ft/sec)[1]
0-5%	Tall Fescue (endophyte-free)[2] Kentucky Bluegrass Smooth Bromegrass	5
	Grass-legume Mixture	4
	Red Fescue Red Top	3
	Small Grains[3]	2.5
5-10%	Tall Fescue (endophyte-free)[2]	5
	Kentucky Bluegrass Smooth Bromegrass	4
	Grass-legume Mixture	3
> 10%	Tall Fescue (endophyte-free)[2] Kentucky Bluegrass Smooth Bromegrass	3

1 Permissible velocities should be decreased 25% for highly erodible soils.
2 Tall fescue provides little cover for, and may be toxic to, some species of wildlife. The use of endophyte-free tall fescue in this Handbook has only been recommended in high velocity areas that are subject to frequent inundation or flow. The IDNR recognizes the need for additional research on alternatives to tall fescue, such as buffalo grass, orchard grass, smooth Bromegrass, and switchgrass. When feasible, alternative vegetative lining such as those presented in Exhibit 1102b should be considered.
3 For temporary seeding and its optimum dates, see Practice 1102 Vegetative Stabilization.

Exhibit 701d: Permissible Velocities for Channels Lined with Vegetation

MAINTENANCE

- Inspect channel following storm events and repair as necessary.
- Check channel outlet and road crossings for blockage, sediment, bank instability, and piping or scour holes. Repair as necessary.
- Remove sediment and debris from channel as necessary to maintain design cross section and grade and to prevent spot erosion.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 201 Tile Drain Installation.
- Practice 702 Channel with Riprap Lining .
- Practice 703 Channel with Concrete Lining.
- Practice 704 Channel Transitions (Tie-ins).
- Practice 705 Channel Transitions (Chutes).
- Practice 706 In-Channel Grade Stabilization Structure.
- Practice 1001 Tile Drain Outlet Extension.
- Practice 1002 Riprap-Lined Apron.
- Practice 1102 Vegetative Stabilization.
- Practice 1104 Erosion Control Blankets and Matting.

Other Sources of Information

- Illinois Urban Manual.
- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.

Last Print/Revision Date: October 13, 1996

PRACTICE 702
CHANNEL WITH RIPRAP LINING

DESCRIPTION

- A constructed channel that is shaped or graded to required dimensions and lined with riprap for stable conveyance and runoff. (Note: a variation of this practice may also be found as "Riprap-Lined Channel" in the Indiana Erosion Control Handbook.)

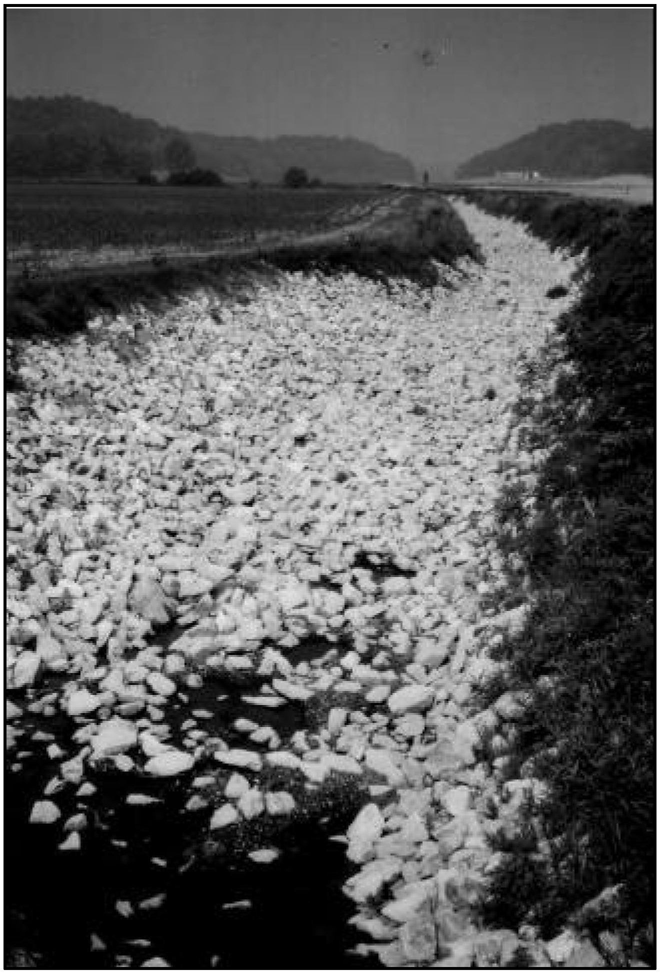


Exhibit 702a: Channel with Riprap Lining (Source: NRCS Files)

PURPOSE

- To carry runoff as a new ditch, a relocated section of an existing watercourse, a by-pass channel, or to carry concentrated runoff from a small watershed area to a stable outlet without damage from erosion or flooding.

WHERE APPLICABLE

- New ditches, ditch relocations, by-pass channels, roadside ditches, channels at property boundaries, outlets for diversions, and other channels draining low areas.
- Concentrated runoff is such that a lining is needed to control erosion.
- Steep grades, wetness, prolonged base flow, seepage, or piping would cause erosion.
- Use by people or domestic animals precludes use of vegetated waterways.

- Soils are highly erosive or other soil or climatic conditions preclude using vegetation.

ADVANTAGES

- Carries concentrated runoff without damage from erosion or flooding.
- More resilient than channel with vegetative lining.
- Lower maintenance than channel with vegetative lining.
- Controls seepage, piping, and sloughing or slides.

CONSTRAINTS

- More expensive than channel with vegetated lining.
- May increase likelihood of dissolved and suspended substances being transported to surface waters due to high flow velocities.
- Does not provide wildlife habitat.
- Side slopes must be 2:1 (1V:2H) or flatter.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Rock (size and gradation according to specifications).
- Geotextile fabric for filtering or aggregate (INDOT CA No. 5) filter layer under the riprap.

Installation

- Clear and Grub (Practice 107) channel and spoil areas.
- Excavate cross section to the lines and grades shown in design specifications, overcutting for thickness of riprap and filter material.

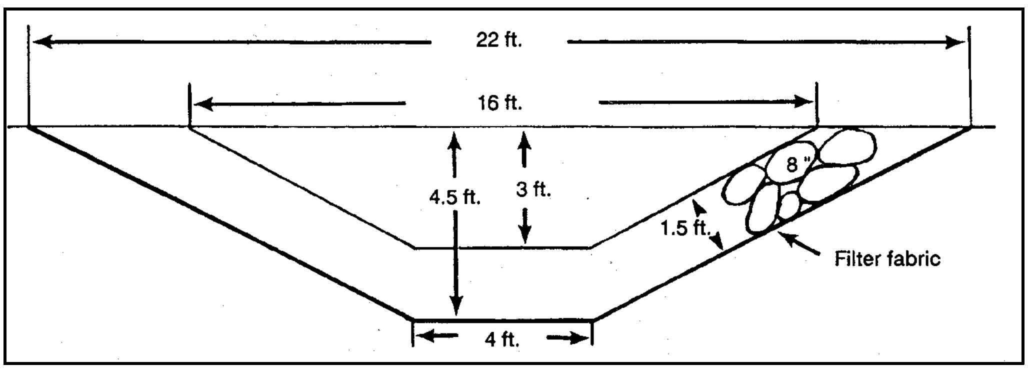


Exhibit 702b: Typical dimensions and installation details of a channel with riprap lining (Source: Indiana Erosion Control Handbook)

- Install geotextile fabric in the excavated channel as a foundation for the riprap.
- Place riprap over the foundation to the depth and thickness and elevation shown in the design plans. It should form a dense, uniform, and well-graded mass with few voids.
- Blend the finished rock surface with the surrounding landing surface so there is no overfall or channel construction.
- Stabilize channel inlet points, and install needed outlet protection during channel installation.
- Stabilize disturbed areas after construction is completed.

Special Considerations

- Piping and bank instability may result if geotextile is omitted or damaged during installation.
- Undercutting may result if riprap is not extended far enough downstream.
- Gullying along the edge of the riprap may occur if riprap is not blended to the ground surface.
- Poorly graded riprap or stones not placed to form a dense, stable channel lining may result in rock material displacement and erosion of the foundation.

MAINTENANCE

- Inspect channel following storm events and repair as necessary.
- Check channel outlet and road crossings for blockage, sediment, bank instability, and piping or scour holes. Repair as necessary.
- Remove sediment and debris from channel as necessary to maintain design cross section and grade and to prevent spot erosion.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 701 Channel with Grass Lining .
- Practice 703 Channel with Concrete Lining.
- Practice 704 Channel Transitions (Tie-Ins).

Other Sources of Information

- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.
- North Carolina Erosion Control Manual.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 703
CHANNEL WITH CONCRETE LINING

DESCRIPTION

- A constructed channel that is shaped or graded to required dimensions and lined with concrete for stable conveyance and runoff.

Exhibit 703a: Channel with Concrete Lining (Source: ASCE Urban Stormwater Manual)

PURPOSE

- To carry runoff as a new ditch, a relocated section of an existing watercourse, a by-pass channel, or to carry concentrated runoff from a small watershed area to a stable outlet without damage from erosion or flooding.

WHERE APPLICABLE

- New ditches, ditch relocations, by-pass channels, roadside ditches, channels at property boundaries, outlets for diversions, and other channels draining low areas.
- Concentrated runoff is such that a lining is needed to control erosion.
- Steep grades, wetness, prolonged base flow, seepage, or piping would cause erosion.
- Use by people or domestic animals precludes use of vegetated waterways.
- Soils are highly erosive or other soil or climatic conditions preclude using vegetation.

ADVANTAGES

- Carries concentrated runoff without damage from erosion or flooding.
- More resilient than channel with vegetative lining.
- Lower maintenance than channel with vegetative lining.
- Controls seepage, piping, and sloughing or slides.

CONSTRAINTS

- More expensive than Practices 701 or 702.
- May increase likelihood of dissolved and suspended substances being transported to surface waters due to high flow velocities.
- Does not provide wildlife habitat and should be avoided in situations where wildlife habitat is an intended use.

- Sideslopes must be 2:1 (1V:2H) or flatter.
- Requires tile drain unless installed on low shrink-swell soils that are well-drained.
- Special care should be utilized during design and installation as freeze-thaw tends to break up the lining.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Concrete should be plastic enough for thorough consolidation and stiff enough to stay in place on side slopes. Minimum strength should be 3,000 lb/in^2.
- Types I, II, or (if necessary) Types IV or V Portland cement should be used.
- Aggregate should be $\leq$ 1.5".

Installation

- Clear and Grub (Practice 107) channel and spoil areas.
- Excavate cross section to the lines and grades shown in design specifications. Cross sections may be triangular, parabolic, trapezoidal, or rectangular. No spoil should be deposited adjacent to the lined waterway unless such spoil and the adjacent area have a positive grade toward the lined waterway or inlets.
- Concrete lining should be 4" in most areas, and 6"-8" with welded wire fabric reinforcing in problem areas.
- Stabilize channel inlet points, and install needed outlet protection during channel installation.
- Stabilize disturbed areas after construction is completed.

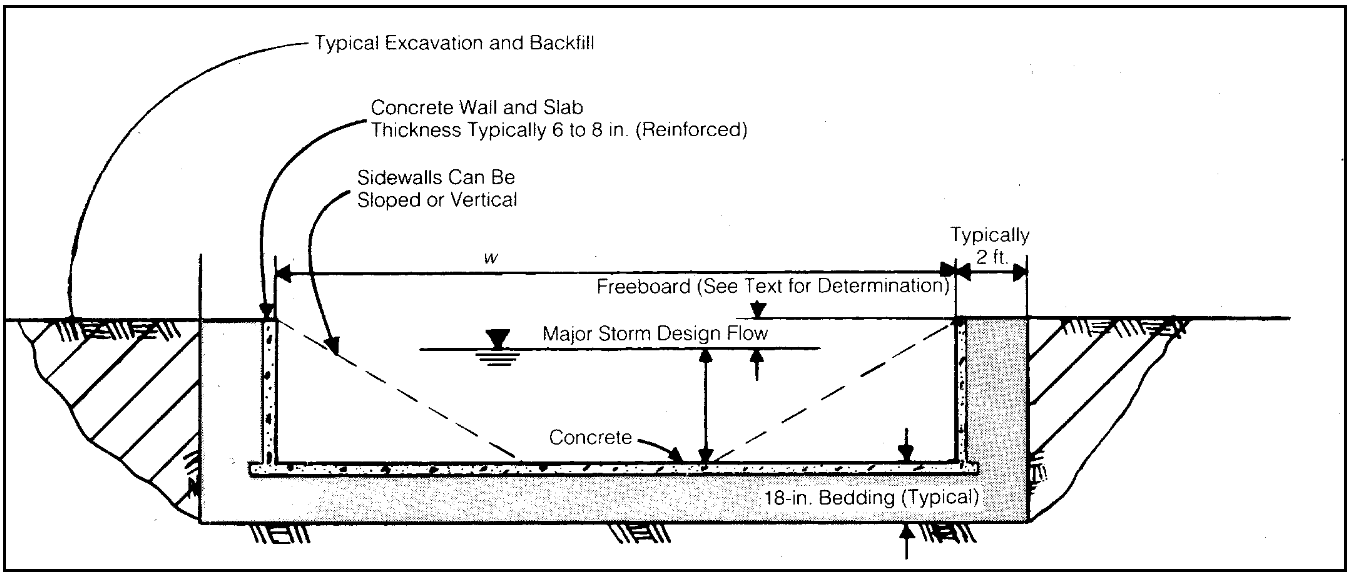


Exhibit 703b: Schematic of channel with concrete lining (Source: ASCE Urban Stormwater Manual)

Special Considerations

- The minimum freeboard for channels with concrete lining should be 0.25' above design in high water areas where erosion-resistant vegetation cannot be grown adjacent to the paved side slopes.
- The maximum capacity of the waterway flowing at designed depth shall not exceed 200 ft^3/sec.

- Contraction joints in concrete linings, if required, should be formed transversely to a depth of about 1/3 of the thickness of the lining at a uniform spacing in the range of 10'-15'.

MAINTENANCE

- Protect lined channel from damage by farm equipment and vehicles. Do not use lined channel as a roadway, and practice care when crossing.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 701 Channel with Grass Lining.
- Practice 702 Channel with Riprap Lining.
- Practice 704 Channel Transitions (Tie-Ins).

Other Sources of Information

- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.
- ASCE Urban Stormwater Manual.

Last Print/Revision Date: October 13, 1996

PRACTICE 704
CHANNEL TRANSITIONS (TIE-INS)

DESCRIPTION
- Gradual transition of channel cross-section to match changing cross-section shape (geometry) or direction.

Exhibit 704a: Channel Transition (Source: Noble County Surveyor's Office Files)

PURPOSE
- To create a stable, transitional segment where a stream or ditch joins with another stream or ditch, on-line detention basin, or other on-line improvements.

WHERE APPLICABLE
- On-line channel improvements.
- Junctions of streams and ditches.

ADVANTAGES
- Avoid abrupt changes in channel velocity and conveyance (hydraulic jumps).
- Maintain existing flow regime.
- Reduce erosive forces.

CONSTRAINTS
- Difficult to achieve within short reaches.
- May require water diversions during construction.
- May require special cover treatment.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Suitable fill for smooth transition.
- Riprap, erosion control matting, or similar material are needed to protect transition zone.

- Seed or sod for well established vegetative cover where necessary.

Installation
- Horizontal angles at point of contraction should be no sharper than 1:1 (1W:1L).
- Horizontal angles at point of expansion should be no sharper than 4:1 (1W:4L).
- Vertical expansion and contraction should be no steeper than 10:1 (1V:10H).
- Establish non-erosive grade prior to junction with water feature.

Special Considerations
- Stream or ditch bank may need to be armored against erosion at throttle points.
- Delta formation (sediment deposition) may be a problem where channel velocity drops out of a transition zone
- If a considerable difference in grades exists between the two channels, chutes or grade stabilization structure may be necessary.
- Avoid additional runoff inflow at a point of transition within a channel reach.

MAINTENANCE
- Periodically check throttle points for signs of erosion. Armor bank as necessary.
- Dredging sediment depositions may be necessary.

REFERENCES

Related Practices
- Practice 601 Channel Bottom Dipping.
- Practice 602 Channel Bank Excavation.
- Practice 701 Channel with Grass Lining.
- Practice 702 Channel with Riprap Lining .
- Practice 703 Channel with Concrete Lining.
- Practice 705 Grade Transitions (Chutes).
- Practice 706 In-Channel Grade Stabilization Structure.
- Practice 801 In-channel Sediment Basin.
- Practice 802 In-channel Floodwater Retention Basin.
- Activity 5.5 Eroded Streambank Repair.

Other Sources of Information
- Davis Handbook.
- ASCE Urban Stormwater Manual.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 705
GRADE TRANSITIONS (CHUTES)

DESCRIPTION

- Open channels (usually paved with rock, concrete block, or reinforced vegetation) which act as a grade treansition to convey high-velocity water down a steep slope without erosion. (Note: these practices are also included in the Indiana Erosion Control Handbook as outlet protection structures.)

Exhibit 705a: Typical Grade Transition (Rock Chute). (Source: CBBEL Files)

PURPOSE

- To convey high-velocity water down a steep slope without erosion.

WHERE APPLICABLE

- Where runoff has to be conveyed down a steep slope.
- New channels constructed as outlets for culverts and conduits.
- High velocity sections of streams or ditches.

ADVANTAGES

- Minimizes the potential for downstream erosion by reducing the velocity and energy of concentrated Stormwater flows.
- Reduces the effects of turbidity and sedimentation downstream.

CONSTRAINTS

- May require heavy machinary to install.
- Generally not appropriate on slopes steeper than 10% (grade stabilization or drop structures must be considered for extremely steep slopes.)
- Contributing drainage area should not be more than 100 acres for Rock and Concrete Block Chutes, and no more than 20 acres for Reinforced Vegetated Chutes.
- Peak runoff from a 10-year frequency, 24 hour duration storm event must be accommodated in most cases.
- Rock Chutes may be aesthetically objectionable when dry.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

Rock Chute

- Crushed Stone Riprap.

- Geotextile Fabric.

Concrete Block Chute
- Concrete block.
- Geotextile fabric.
- Plastic sheeting.
- Sand.

Reinforced Vegetated Chute
- Erosion control blankets and turf reinforcement mat (Practice 1104)
- Gravel or crushed stone riprap.
- Drain tile.

Installation

Rock Chute
- Excavate the apron area subgrade below design elevation to allow for the thickness of filter and riprap.
- Compact fill used in the subgrade to the density of the surrounding undisturbed material, and smooth enough to protect fabric from tearing.
- Place geotextile fabric on the foundation. If more than one piece of fabric is needed, then upstream piece should overlap the downstream piece by at least one foot.
- Install riprap to the lines and elevations shown in the design.
- Make sure the top of the apron is level with or slightly below the receiving stream.
- Blend the riprap smoothly to the surrounding grade.
- Stabilize all disturbed areas immediately following installation.

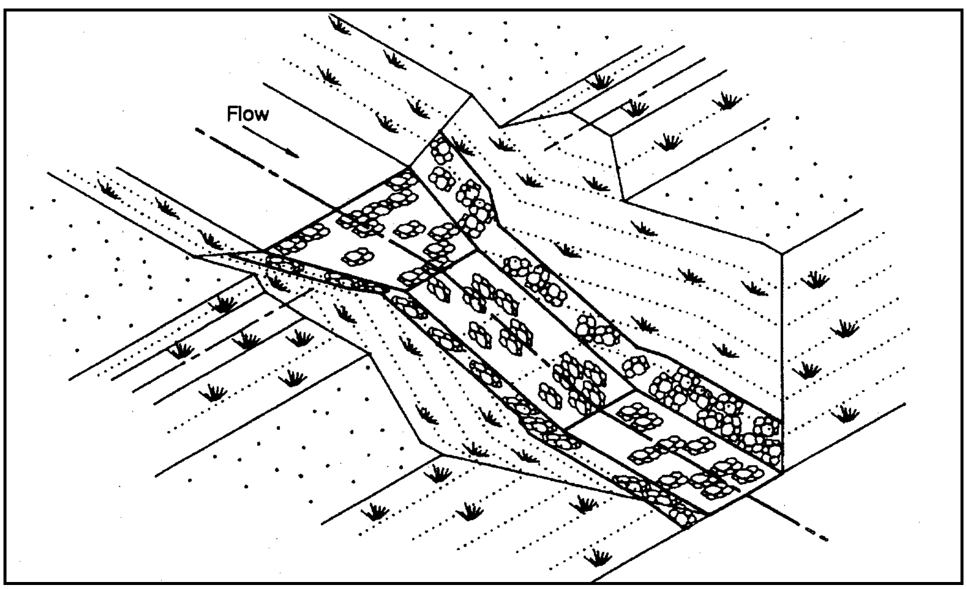


Exhibit 705b: Oblique view of a Rock chute (Source: Indiana Erosion Control Handbook)

Concrete Block Chute

- Construct a ridge on either side of chute.
- Excavate chute, inlet, and outlet apron to about 10" below the design plan finished grade to allow for thickness of foundation materials and concrete blocks. (The aprons, when installed, should be on a zero grade).
- Compact any fill used in the subgrade to the density of the surrounding undisturbed material.
- Smooth subgrade enough to protect plastic sheeting and geotextile fabric from tearing.
- Make a small trench around the perimeter of the structure (i.e. edges of inlet and outlet aprons and top of the chute side slopes) to secure the sheeting and fabric.
- On the smoothed subgrade, install first the plastic sheeting, then 2" of sand, and finally the geotextile fabric.
- Press the plastic sheeting and geotextile fabric into the trench and fill with soil to anchor.
- Lay the concrete block (holes facing up) on the geotextile fabric taking care not to damage the fabric.
- Fill holes in blocks with soil.
- Stabilize all disturbed areas immediately following installation.

Exhibit 705c: Concrete Block Chute (Source: CBBEL Files)

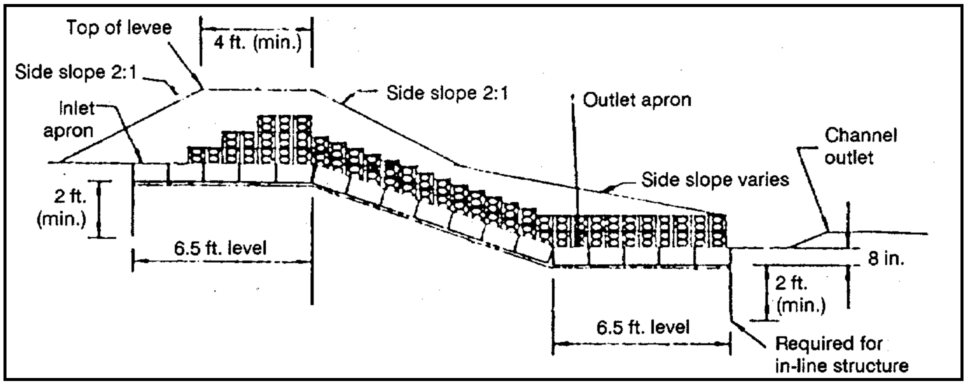


Exhibit 705d: Detailed cross-sectional view of a concrete block chute (Source: Indiana Erosion Control Handbook)

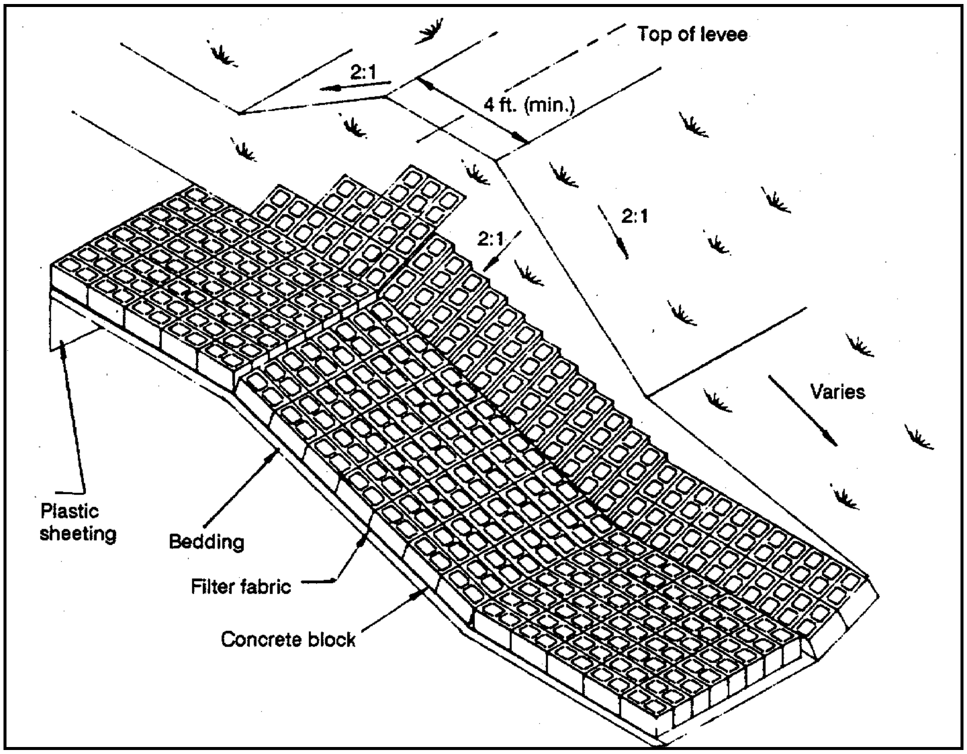


Exhibit 705e: Oblique view of a concrete block chute (Source: Indiana Erosion Control Handbook)

<u>Reinforced Vegetated Chute</u>

- Construct a ridge on each side of the chute to contain runoff, according to designed capacity.
- Excavate and/or fill and compact the required section and slope to finished grade as specified in the erosion and sediment control plan.
- Construct the inlet and outlet aprons so they are straight, aligned with the receiving channel, and at zero grade.
- Lay drain tile outside the chute area, including outlet pipe section and animal guard.
- Install and anchor the turf reinforcement mat according to manufacturers directions, and cover with soil.
- Immediately following mat installation, permanently seed (Practice

1102), fertilize, and install erosion control blankets according to manufacturers directions.

Exhibit 705f: Reinforced Vegetated Chute (Source: Indiana Erosion Control Handbook)

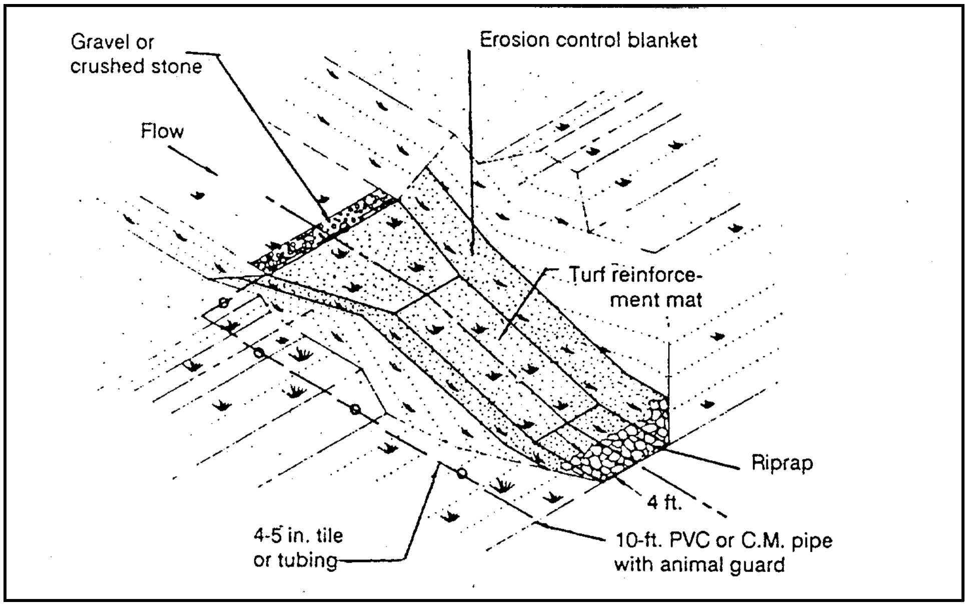


Exhibit 705g: Oblique view of a reinforced vegetated chute (Source: Indiana Erosion Control Handbook)

Special Considerations

- Downstream erosion may occur if the downstream apron area is not flat.
- It may be necessary to install a subsurface drain to intercept seepage from and drain it away from the structure.
- Scouring around inlet apron, or overtopping and bypassing of chute, may occur if the chute is not constructed to designed capacity.

MAINTENANCE	• Inspect inlet and outlet after storm events for scouring, and repair as needed. • Keep inlets and outlets free of debris and other obstructions. • Do not drive equipment or vehicles on the structure. • Vegetated Chute: during establishment of vegetation, inspect after each storm event, checking especially for blockage, sediment and scour holes. • Remove accumulated sediment and make other repairs as necessary.
REFERENCES	**Related Practices** • Practice 1102 Vegetative Stabilization. **Other Sources of Information** • Indiana Erosion Control Handbook. • Illinois Urban Manual. • North Carolina Erosion Control Manual.

Last Print/Revision Date: October 13, 1996

PRACTICE 706
IN-CHANNEL GRADE STABILIZATION STRUCTURE

DESCRIPTION
- Structure designed to reduce channel grade in streams and ditches.

Exhibit 706a: In-Channel Grade Stabilization Structure (Source: North Carolina Erosion Control Manual)

PURPOSE
- To prevent erosion of a channel that results from excessive grade in the channel bed. This practice allows the designer to adjust channel grade to fit soil conditions.

WHERE APPLICABLE
- Where head cutting or gully erosion is active.
- Where beds of intersecting channels are at different elevations.
- Where a flatter grade is needed for stability in a proposed channel or water disposal system.

ADVANTAGES
- Stabilizes progressive head cutting in existing streams and ditches.
- Stabilizes erosion gullying.

CONSTRAINTS
- Expensive to install.
- May require emergency bypass where surface water enters the structure.
- Usually requires extensive engineering.
- May impact fish migration at normal and low flows.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Grade stabilization structures may be constructed of concrete, riprap, gabions, or pipe drop structures.

Installation
- Grade stabilization structures can be complex and should be designed by a qualified engineer.

- The structure should be located on a straight section of the channel with no upstream or downstream curves within 100'.
- The foundation material should be stable, homogenous, mineral soils with sufficient strength to support the structure.
- Flood bypass should be available. Protect the area where bypass flow enters the channel downstream.
- The structure should be designed to control the peak runoff from a 10 year storm, or to meet the bankfull capacity of the channel, whichever is greater.
- Set the crest of the structure's inlet at an elevation that will stabilize the grade of the upstream channel. Set the outlet section at an elevation that will provide a stable grade downstream to assure stability.
- Foundation drainage should be provided for to reduce hydrostatic loads on drop spillway structures.
- Velocity flow at the outlet should be kept within the allowable limits for the receiving stream. Place a transition section consisting of properly-sized riprap at the toe of the structure to prevent erosion of the channel bed.

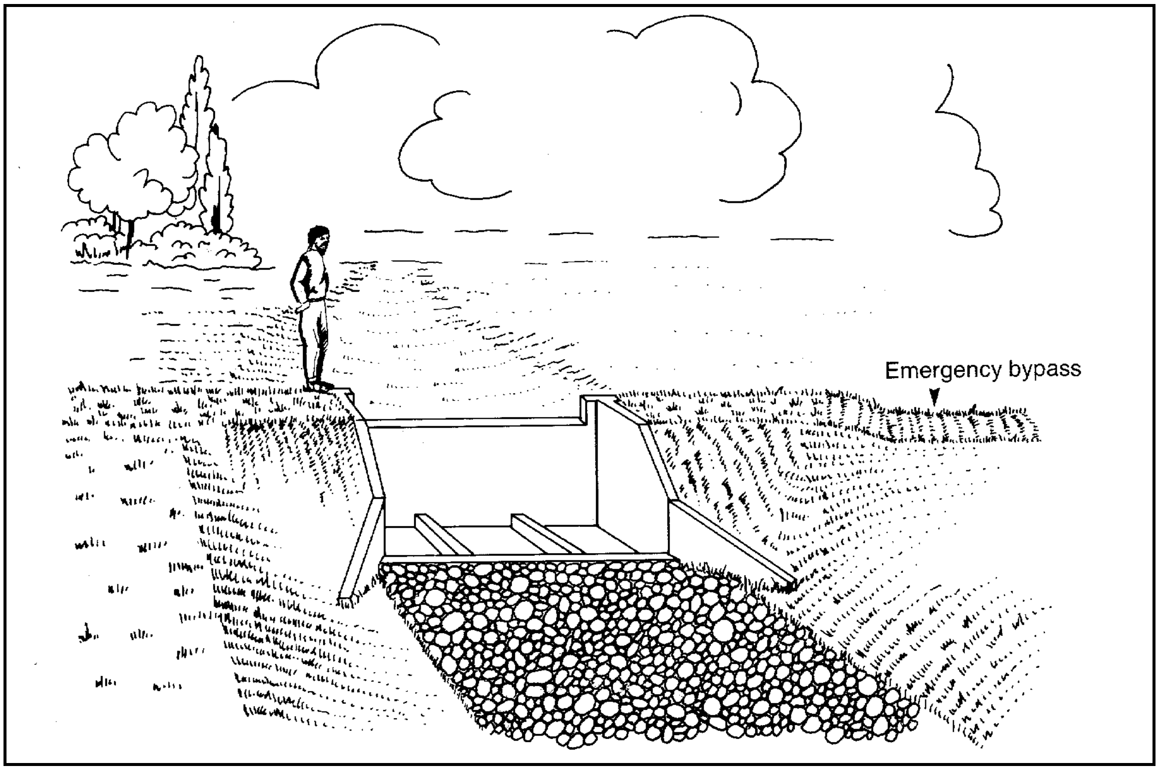


Exhibit 706b: Reinforced concrete drop spillway for grade stabilization with emergency bypass and downstream protection (Source: North Carolina Erosion Control Manual)

Special Considerations

- Surface runoff should be diverted around the structure during construction.
- Make the end of the riprap section as wide as the receiving channel, and make sure the transition section of riprap between the structure

end sill and the channel is smooth.
- Make sure there is no overfall from the end sill along the surface of the riprap to the existing channel bottom.
- Stabilize disturbed areas as soon as possible (Activity 5.11 Revegetation and Site Stabilization).
- If conditions allow, rock chute (Practice 703) modified for in-channel use may be used instead of a grade stabilization structure as a transition section.

MAINTENANCE
- Inspect periodically after storm events throughout the life the structure.
- Check fill around the structure for signs of piping, erosion, and settlement and to ensure that good protective vegetation is maintained.
- Check inlet and outlet for signs of scour or erosion.
- Check emergency bypass for signs of erosion.
- All deficiencies should be repaired immediately.

REFERENCES

Related Practices
- Practice 705 Grade Transitions (Chutes).
- Practice 1102 Vegetative Stabilization.
- Activity 5.11 Revegetation and Site Stabilization.

Other Sources of Information
- Indiana Erosion Control Handbook.
- North Carolina Erosion Control Manual.
- NRCS National Engineering Handbook.

Last Print/Revision Date: October 13, 1996

SECTION 5.8

SEDIMENT CONTROL AND IN-CHANNEL FLOODWATER RETENTION

T.O.C.

SECTION 5.8
SEDIMENT CONTROL AND IN-CHANNEL FLOODWATER RETENTION

Controlling in-channel sedimentation is best accomplished by employing good soil conservation practices in upland areas adjacent to streams and ditches. Installation of erosion control practices is the most effective. However, such effectiveness can significantly increase through utilization of vegetative buffer or filter strips. Vegetative filter strips are very effective in trapping sediment before it reaches the channel. Generally, the width of a filter strip should increase with the slope of the ground.

In-channel floodwater retention basins and in-channel sediment basins essentially employ the same concepts but at a different scale: the cross-sectional area of a channel is increased to reduce velocities, thereby allowing sediment deposition and increasing storage capacity. Sediment basins are generally smaller than retention basins, and place more emphasis on trapping sediment than providing additional storage. Floodwater retention basins are usually constructed to improve flood water storage capacity with the added benefit of some sediment control. However, it should be noted that off-line retention basins, when possible, are usually a more practical and economical choice than on-line retention basins.

The installation of in-channel floodwater retention and sedimentation basins (Practices 801 and 802) would often times involve excavation on both sides of a natural stream or a man-made ditch. While this is sometimes inevitable, it may be possible to limit the excavation activities to one side of a channel only. As indicated earlier in Section 5.6, one-sided modification of natural streams is always preferable to two-sided modification. The one-sided channel modification would involve fewer adverse impacts on terrestrial wildlife habitat and is, therefore, less likely to require extensive compensatory mitigation measures by the regulatory agencies.

Hydraulic dredging is used to remove in-channel sediment. This practice is most useful in channels large enough to accommodate dredging equipment, and with large-scale projects that justify such expensive measures.

T.O.C.

PRACTICE 801
IN-CHANNEL SEDIMENT BASIN

DESCRIPTION	●	Area within a channel designed to reduce flow velocities (thus allowing sediment deposition) by increasing the cross sectional area (width and depth) of a channel.

Exhibit 801a: In-Channel Sediment Basin (Source: NRCS Files)

PURPOSE	●	To create a basin to trap and store sediment conveyed in stream flow or storm runoff.
WHERE APPLICABLE	●	Where watercourse and gully erosion are a problem.
	●	Where the downstream environment may be significantly impacted by a large sediment influx.
	●	Where a stream or ditch is transporting heavy sediment loads.
ADVANTAGES	●	Preserves the capacity of ditches and streams.
	●	Traps and stores sediment before it is borne downstream.
	●	Often provides additional runoff storage capacity which may reduce peak flows.
	●	May contribute to ground water recharge.
	●	Convenient access site for removing deposition in stream.
CONSTRAINTS	●	Sediment basins do not trap all water-borne sediments.
	●	Should not be used in areas such as riffles where the creation of a basin would destroy valuable wildlife or aquatic habitat.
	●	May capture very little of water-borne sediments during major runoff events.
	●	Not as effective in preventing in-channel sediment loads as upland erosion control methods or watershed-based best management practices.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Excavation equipment.
- Seed for revegetation.
- Topsoil if necessary.

Installation
- Clear and grub (Practice 107) area to be improved.
- Basins should be placed at terraced intervals. The spacing should be set to prevent watercourse gully erosion.
- The basin should be large enough to control the runoff from a 10-year, 24-hour frequency storm without overtopping.
- The basin should have the capacity to store sediment accumulation for a period of 10 years.
- The basin should transition properly to existing or proposed channel and have the ends closed to the elevation needed for the design capacity.
- Seed as describe in Vegetative Stabilization (Practice 1102).
- Transition channel as described in Channel Tie-Ins (Practice 704).

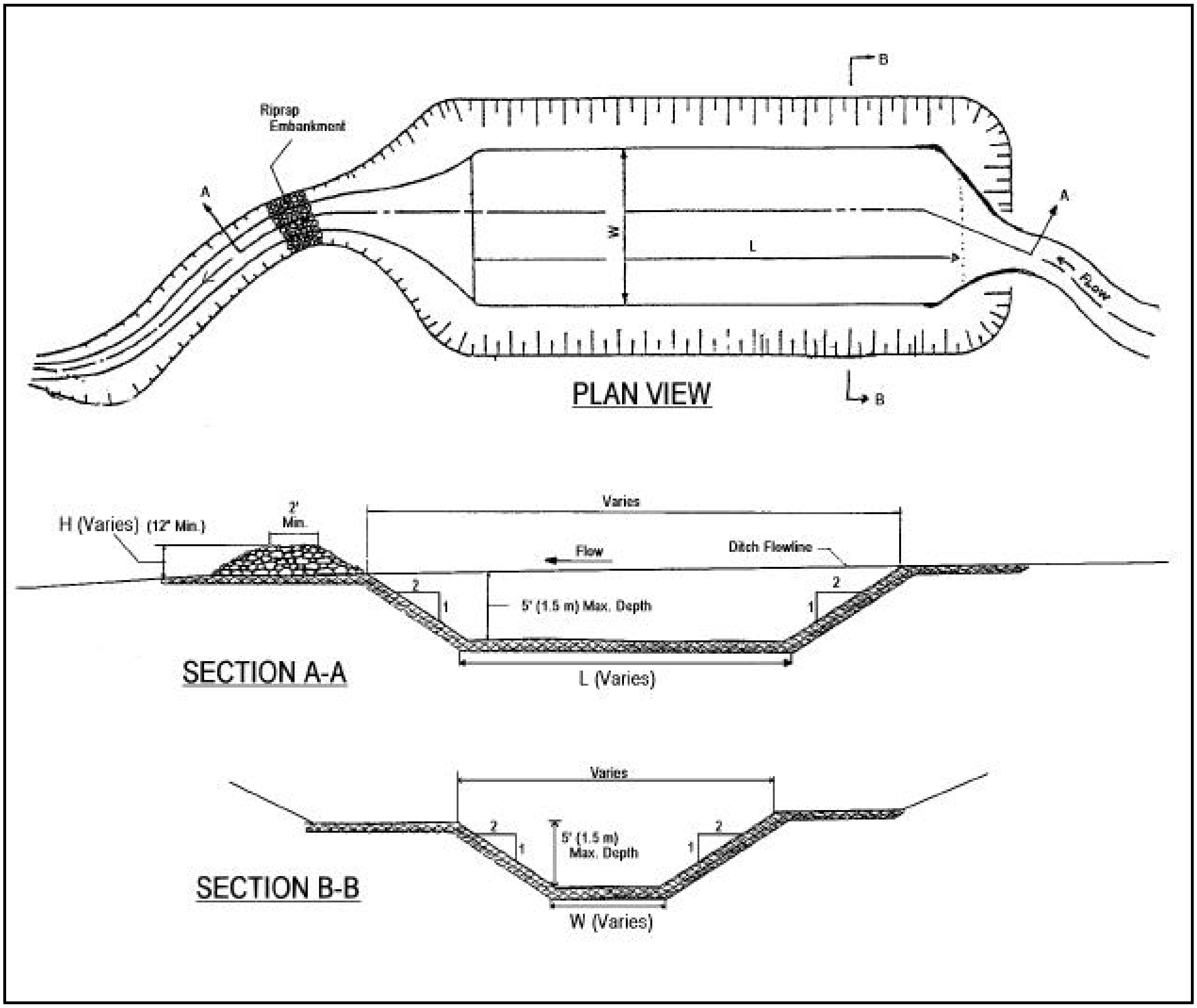


Exhibit 801b: Typical schematic of in-channel sediment basin (Source: CBBEL Files)

	Special Considerations	
	●	Channel cut-off or stabilization structures may be necessary at entrance and exit sections of basin to prevent unstable gully and channel erosion.
MAINTENANCE	●	Inspect transition segments for erosion of banks or channel in order to maintain.
	●	Maintain sediment design capacity by routinely excavating the basin.
	●	Keep side slopes and transition areas free from brush in those areas needed for maintenance and sediment removal.
	●	Maintain transition areas in and out of sediment basin.
	●	Use soil conservation practices in surrounding watershed.
REFERENCES	**Related Practices**	
	●	Practice 104 Temporary Diversion.
	●	Practice 107 Clearing and Grubbing.
	●	Practice 803 Hydraulic Dredge.
	●	Practice 1102 Vegetative Stabilization.
	●	Activity 5.3 Debrushing.
	●	Activity 5.11 Revegetation and Site Stabilization.
	Other Sources of Information	
	●	NRCS Standard Specifications.
	●	Indiana Erosion Control Manual.
	●	Illinois Stormwater Management BMPs

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 802
IN-CHANNEL FLOODWATER RETENTION BASIN

DESCRIPTION

- On-line retention area designed to decrease peak flow rates downstream from the retention facility.

Exhibit 802a: In-Channel Floodwater Retention Basin (Source: CBBEL Files)

PURPOSE

- Flood control.

WHERE APPLICABLE

- When off-site areas were developed without adequate detention controls.
- When off-site to on-site drainage area ratios are less than 5:1.

ADVANTAGES

- Reduces peak flow rates downstream.
- May improve water quality.
- Provides moderate flood control in certain situations.

CONSTRAINTS

- The larger the ratio of off-site to on-site runoff, the less effective on-line detention will be in achieving flood control and pollution removal.
- May negatively impact fish and wildlife if the existing stream or ditch provides good habitat.
- Regional detention (developed outside the main channel) is a better choice than in-channel detention in most situations.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Suitable fill.
- Seed for revegetation if necessary.
- Appropriate outlet.

Installation

- Select an outlet configuration that will maximize flood control as well as remove pollutants. The optimum configuration is also dependent upon the off-site area in terms of size, impervious percentage, and level of existing stormwater control.

- Regional Detention: The detention basin should be sized as if the entire area were on site. Land cover based on local zoning should be used for undeveloped off site areas. Release rates should be equal to the specified release rate (In most jurisdictions, the release rate is equivalent to 5 or 10-year undeveloped conditions. Staged (2-10-100) release rates are also becoming popular.) If there is some existing detention in the off site areas, it may be useful to model that detention (under both normal and overflow conditions) to reduce the storage needed in the regional basin.

- Off Site Area Developed with Inadequate Best Management Practices: A 2-year or 5-year (or the release rate designated in local ordinances or standards) should achieve reasonable pollutant removal. The overflow spillway should accommodate 100-year release rates for flood control benefits. The relatively low 2-year or 5-year release rate will improve capture of the first flush of larger storm events. The relatively high 100-year release rate will minimize the amount of detention storage that is filled prior to the peak of the event, reserving the storage to attenuate the peak flow.

- Off Site Area Developed with Detention and Other Best Management Practices: A 2-year or 5-year outlet (or the release rate designated in local ordinances or standards) should be sized. The high flow outlet should be sized based on the total drainage area (i.e. the 100-year release rate in developed condition).

- Off Site Area Undeveloped: On site detention should be based on the assumption that the area will be developed, and as described above.

Special Considerations

- See Exhibit 802b, for deciding whether an on-line detention (In-stream Floodwater Retention Basin) is appropriate for the specific site conditions.
- Locate In-Channel Flood Retention Basin where pool area can be contained within floodplain limits, when possible. Exhibit 802c shows plan view of an appropriately-designed retention pond.

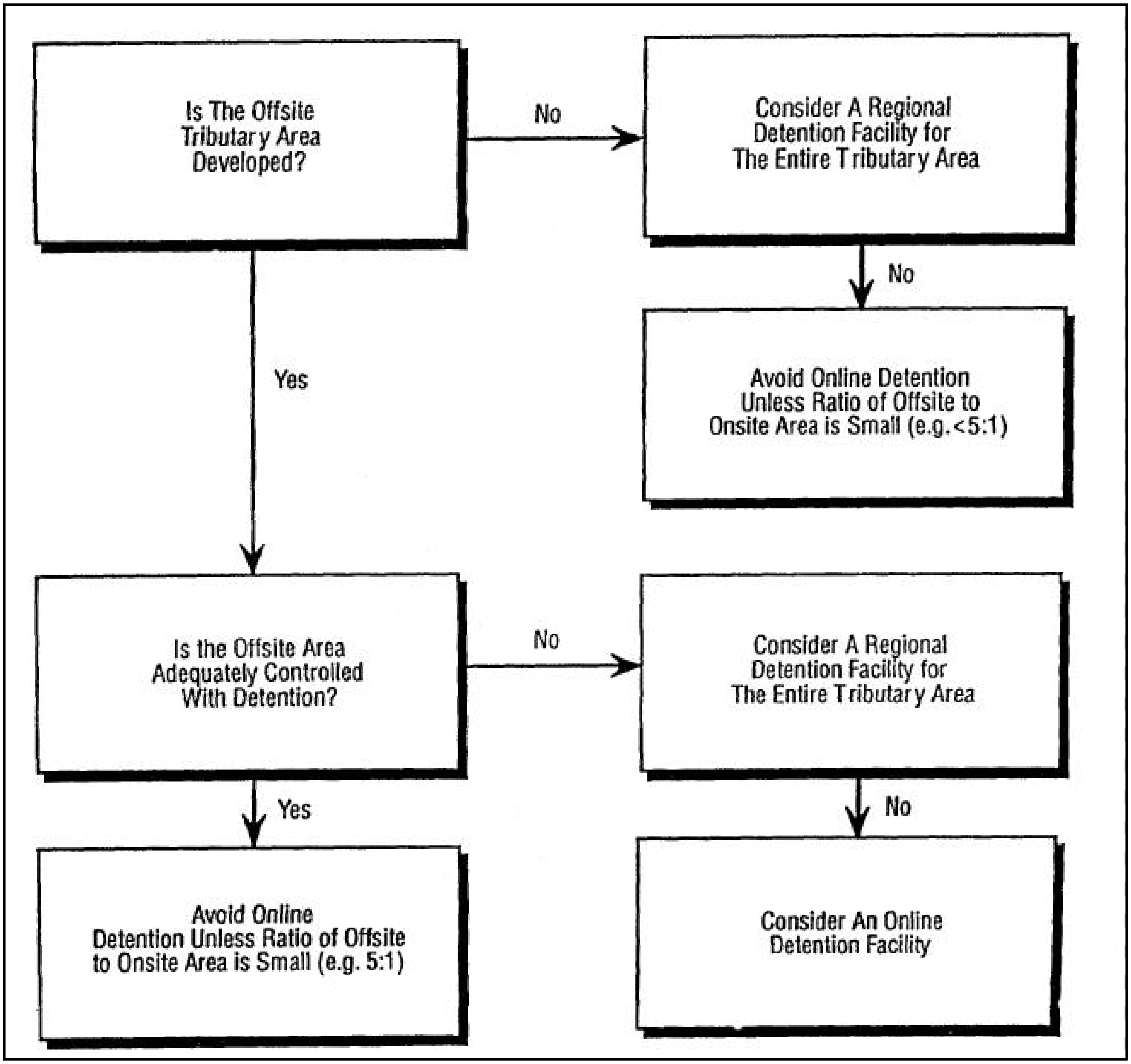


Exhibit 802b: Decision Process (Source: Illinois Stormwater Management BMPs)

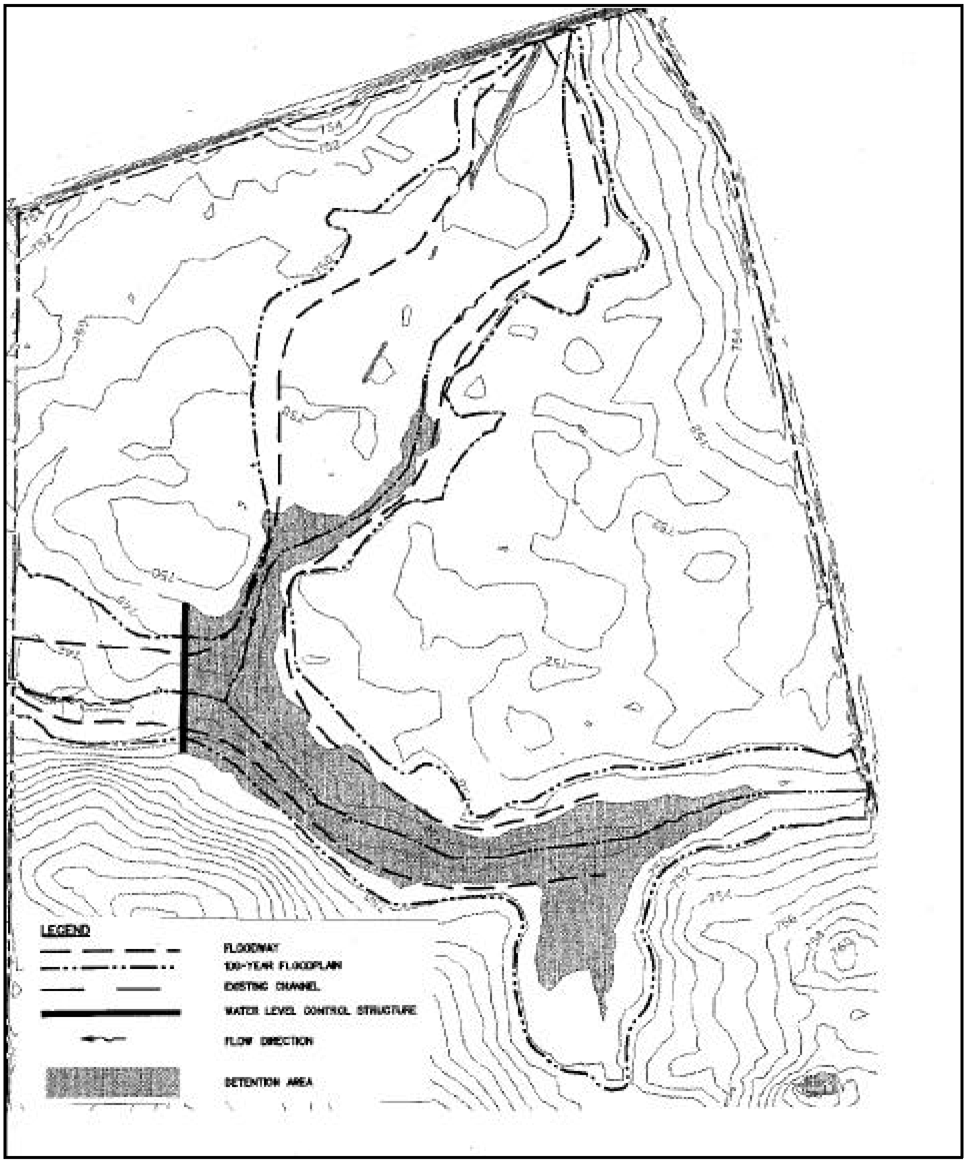


Exhibit 802c: Plan view of a properly-located In-Channel Retention Basin (Source: CBBEL Files)

MAINTENANCE

- Inspect inlets for blockages.
- Maintain sediment design capacity by clearing the basin or raising the embankment.
- Keep embankment area debrushed (Practices 301, 302, 303, 304).
- Use soil conservation practices in surrounding watershed.

REFERENCES

Related Practices

- Practice 706 In-Channel Sediment Basin.
- Practice 804 Grade Stabilization Structure.
- Practice 1102 Vegetative Stabilization.
- Activity 5.11 Revegetation and Site Stabilization.

Other Sources of Information

- Illinois Stormwater Management BMPs.

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PRACTICE 803
HYDRAULIC DREDGING

DESCRIPTION
- Removing in-channel sediment using a hydraulic pump.

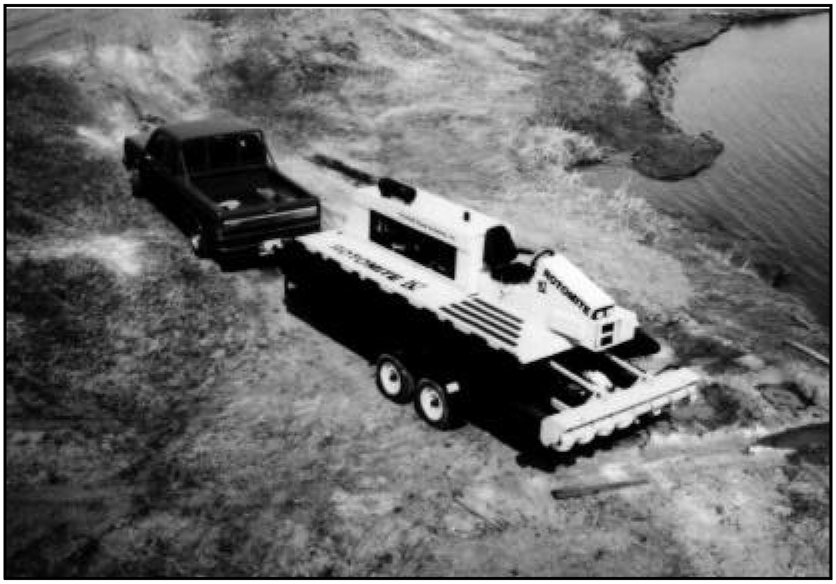

Exhibit 803a: Hydraulic Dredger being taken to the dredging site: (Source: Crisafulli Pump Company)

PURPOSE
- Removal of sediment from stream, lake, sediment basin, or similar facility.

WHERE APPLICABLE
- Wide channels or bodies of water capable of accommodating a hydraulic dredge.
- Removing accumulated sediments from In-Channel Sediment Basins/Traps
- In channels where sediment removal using standard earth moving equipment would cause an unacceptable amount of sediment resuspension.
- In streams or ponds where access by land is limited for removing the accumulated sediment.

ADVANTAGES
- Removes sediment with minimal resuspension of sediment.
- Restores channel conveyance and capacity.
- Allows sediment disposal to occur away from channel area.
- Allows vegetation to remain on banks.

CONSTRAINTS
- Usually requires wide, deep channels or larger bodies of water.
- Proximity to piers, docks or other structures may preclude the use of hydraulic dredges.
- Require appropriate disposal site to pump dredged material and allow it to dewater.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Cutterhead, dustpan, or hopper dredge.

Installation

- For most streams in Indiana, the hydraulic dredge will be utilized in association with an In-Channel Sediment Basin/Trap. The construction of the In-Channel Sediment Basin/Trap is explained in Practice 801. Exhibit 803b shows the typical section of a sediment trap within the area subject to hydraulic dredging highlighted.

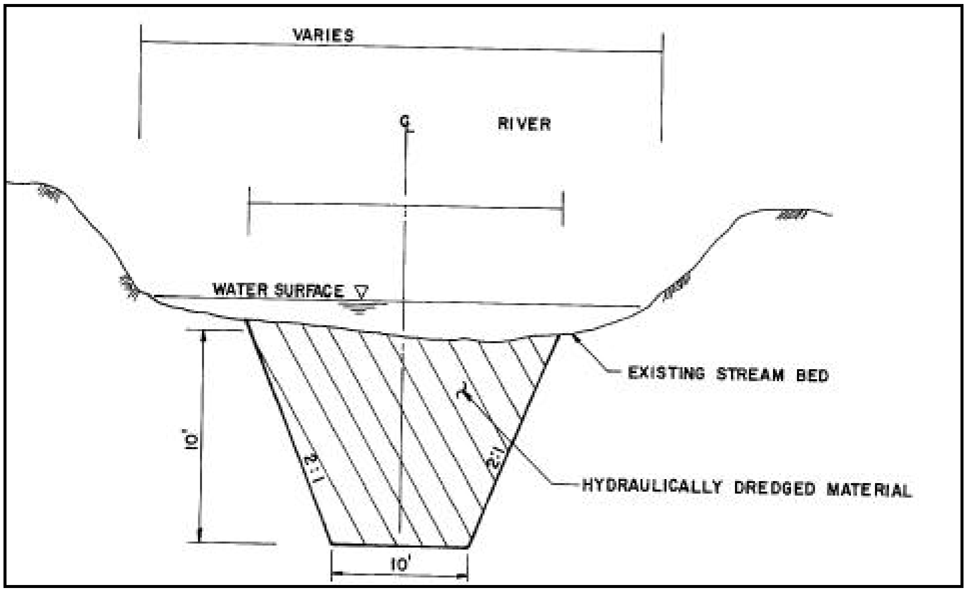

Exhibit 803b: A sediment trap typical section showing areas subject to hydraulic dredging (Source: CBBEL Files)

- Cutterhead Dredges: This type of dredge employs a suction device with high-energy cutting and sweeping action. Turbidity can be kept to a minimal through proper selection of cutter rotation speed, ladder swing speeds, and depth of cut. Generally, the optimum selection of these parameters correspond to the selection for attaining the highest production. Cutterhead dredges are not recommended for the removal of more than 10' of material.

- Dustpan Dredges: The dustpan dredge is a hydraulic suction dredge that uses a widely flared dredgehead along which water jets are mounted. The jets loosen and agitate sediment particles which are then captured in the dustpan. This type of dredge works best in free-flowing granular material, and is not recommended to dredge fine-grained (clay) sediment.

- Hopper Dredges: These dredges remove sediment by dragging a large, flat draghead and using a hydraulic suction to remove the disturbed material. Resuspension of sediment using hopper dredges may be less than or comparable to that for cutterhead dredges.

- Disposal Site: A disposal site needs to be prepared in order to contain the dredged material while allowing proper dewatering of removed sediment. This basin may require extensive sediment control measures and runoff control structures.

Special Considerations

- In most cases, maneuverability requirements, hydrodynamic conditions, location of the disposal site, and other factors dictate the type of dredge to be used.
- Special purpose dredges may be necessary if conventional dredges are deemed inappropriate.
- Limited number of contractors with necessary equipment are located in Indiana. This may increase costs associated with this practice.
- Concerns for use of this practice near permanent structures such as bridges, road embankments, etc., must be addressed.
- Channel cutoff or stabilization structures may be necessary at entrance and exit sections to prevent unstable channel erosion.

MAINTENANCE

- Redredge as necessary to maintain acceptable flow conveyance and capacity.

REFERENCES

Related Practices

- Practice 801 In-Channel Sediment Basin.
- Practice 802 In-Channel Floodwater Retention Basin.

Other Sources of Information

- COE Dredging Technical note

Last Print/Revision Date: October 13, 1996

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PRACTICE 804
VEGETATIVE FILTER STRIP

DESCRIPTION
- Vegetated buffer strip between a sediment-producing site and a watercourse that should be protected from sedimentation. (Note: a variation of this practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 804a: Vegetative Filter Strip (Source: NRCS Files)

PURPOSE
- To remove sediment and other pollutants from runoff water by filtration, deposition, infiltration, absorption, and vegetative uptake.

WHERE APPLICABLE
- Along construction sites to reduce sediment born in sheetflow.
- Above or adjacent to wetlands, streams or ditches when conditions allow and a buffer is required.

ADVANTAGES
- Slows the flow of and removes sediment from surface runoff.
- Reduces damage associated with sedimentation.
- Improve water quality.

CONSTRAINTS
- Sometimes requires regular maintenance such as mowing, debrushing, burning, etc.
- Maximum concentrated flow depth should not exceed 2.5".
- May impact fish migration at normal and low flows.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Appropriate seed mix. (Exhibit 1102b, Buffer Zones/Filter Strips)

Installation
- Clear and grub area (Practice 107).
- Slope should be $\leq$ 15%.
- Maximum contributing area should be 5 acres.
- Minimum filter strip width should be determined using Table 804b. Larger widths, beyond those shown in the table, may improve sediment removal efficiency, especially for a larger than average

contributing area.

Ground Slope	Minimum Width (feet)
Less than 1%	10
1 - 5%	20
5 - 6%	30
6 - 9%	40
9 - 13%	50
13 - 18%	60

Exhibit 804b: Minimum filter strip width for various percent slopes.

- Filter strip length should be at least 50'-75' long.
- Seed according to Vegetative Stabilization (Practice 1102, Exhibit 1102b - Buffer Zone/Filter Strips). Vegetation should be planted during optimum seeding times on firm, moist seed beds. Lime and fertilize as necessary.
- Multi-species Riparian Buffer Strips may also be utilized, when appropriate. A model taken from an Ecological Restoration Symposium (see reference) is shown as Exhibit 804c.

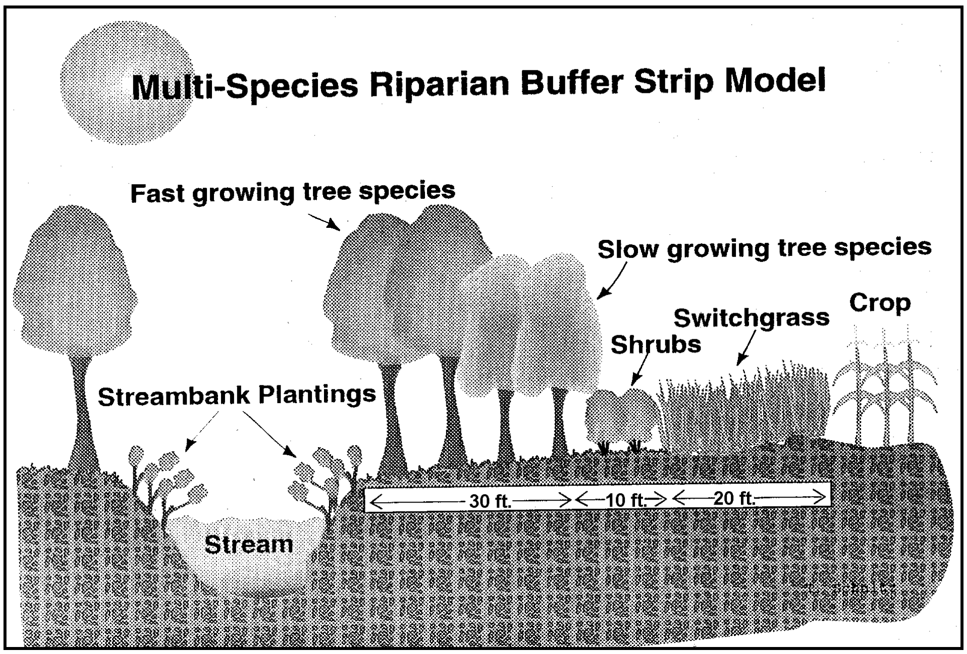

Exhibit 804c: Multi-Species Riparian Buffer Strip Model (Source: Ecological Restoration Symposium)

Special Considerations

- Avoid compacting soils underlying the filter strip during construction.
- Uniform sheet flow is necessary throughout.
- Establish filter strip as early as possible.
- Maintain vegetation at the most dense stand possible, especially at ground level.
- Flow depth should not exceed the height of the grass.

- Shrubs do not appreciably improve water quality in filter strips.
- Filter strip limits should be marked in order to keep farming activities off.

MAINTENANCE

- Mow as necessary (preferably after August), or utilize an appropriate management technique for species used. Burning is also possible with proper permits, if required.
- Use caution if using herbicide.
- Vegetated filter strips should not be used as roadways.
- Inspect regularly for erosion and repair as necessary.
- Filter strips that have accumulated so much sediment that they are above design grade should be disked, graded and replanted as necessary to reestablish sheet flow conditions.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 1101 Mulching.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- NRCS Engineering Field Handbook.
- Indiana Erosion Control Handbook.

Last Print/Revision Date: October 1999

SECTION 5.9

STREAM ENCLOSURE/CROSSING CONSTRUCTION AND REPAIR

SECTION 5.9
STREAM CROSSING CONSTRUCTION AND REPAIR

Culverts, bridges, and fords/low water crossings are three common ways to span streams and ditches. While the scope of this manual does not provide actual construction guidelines or design specifications, it does provide a broad overview of factors to consider when contemplating one of the three practices.

Bridges are the most expensive structure to install, and are most often used for longer stretches over water too deep to accommodate culverts or fords/low water crossings. Bridges can be designed so that conveyance beneath the bridge is virtually unchanged. Culverts are much less expensive than bridges, and are more often used when conditions permit. Fords/low water crossings are usually used as temporary measures during construction. However, permanent fords/low water crossings may be appropriate in low traffic, rural areas.

The potential introduction of pollution into a channel is low for bridges and channels. There is a much higher potential at fords/low water crossings, as vehicles actually enter the channel.

Maintenance of properly-installed bridges and culverts is low. These structures are often protected with riprap to reduce scouring. Fords/low water crossings are much higher maintenance than bridges and culverts, and should be checked following major storm events for washouts and rock displacement.

Stream enclosures, also known as "long culverts", are often used in the headwater areas of many streams and ditches to convey runoff without disturbing the above ground land use. Guidelines provided in this section (Practice 901) as well as those presented in Section 5.2 should be consulted when such enclosures are being considered.

PRACTICE 901
CULVERTS

DESCRIPTION
- Hydraulically short conduit which conveys flow through a roadway embankment, or through some other type of obstruction.

Exhibit 901a: Permanent Road Culvert (Source: CBBEL Files)

PURPOSE
- Provide a channel crossing with minimal impact to conveyance.

WHERE APPLICABLE
- When it is necessary to convey water under a roadway embankment or some other obstruction.

ADVANTAGES
- May allow for channel crossing with minimal impact to the environment or conveyance.
- Less expensive than a bridge.

CONSTRAINTS
- Improper design can cause upstream flooding.
- May increase velocity and cause downstream erosion problems.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Concrete or corrugated metal pipe.
- Selection of materials should be based on structural strength, hydraulic roughness, durability, and corrosion and abrasion resistance.

Installation
- Varies with each project.
- Design permanent stream crossings in accordance with Indiana DOT standards and specifications, considering maximum loadings anticipated, safety, flow capacities, and other requirements for DOT installation approval. The local DOT can provide necessary guidance.
- Keep clearing and excavation of the streambanks and bed and approach sections to a minimum.
- Divert all surface water from the construction site onto undisturbed

areas adjoining the stream. Line unstable stream banks with riprap or otherwise appropriately stabilize them.
- Keep stream crossing at right angles to the stream flow.
- Align road approaches with the center line of the crossing for a minimum distance of 30 feet. Raise culvert fill a minimum of l ft above the adjoining approach sections to prevent erosion from surface runoff and to allow flood flows to pass around the structure.
- Ensure that bypass channels necessary to dewater the crossing site are stable before diverting the stream. Upon completion of the crossing, fill, compact, and stabilize the bypass channel appropriately.
- Install protective ground covers to provide permanent erosion protection and improve visual quality but not interfere with driver site distance from roadway.
- Ensure that permanent measures needed to control erosion from road water runoff (such as riprap and paved channels, paved flumes, or riprap outlet protection) meet all construction requirements for those practices.

Special Considerations
- Culvert capacities may be calculated using "Hydraulic Charts for the Selection of Highway Culverts" (Hydraulic Engineering Circular No. 5, 1965), and "Capacity Charts for the Design of Highway Culverts" (Hydraulic Engineering Circular No. 10, 1965). The appropriate charts are dictated by the parameters of roughness, slope, headwater depth, tailwater depth, length, and either inlet or outlet control.
- When replacing a culvert and/or changing its size, it is important to consider both upstream and downstream ramifications. Choosing a culvert that is too small may cause upstream flooding. Choosing a culvert that is much larger than an existing under-sized culvert, will reduce the storage caused by the existing, under-sized culvert and therefore may cause increased discharges downstream.

MAINTENANCE
- Inspect periodically and after major storms to check for channel blockage, erosion of abutments, channel degradation, riprap displacement, slope failure, and piping. Make all needed repairs immediately to prevent further damage to the installation.
- Most culvert maintenance problems occur at the outfall. See Activity 5.10 for Outlet Protection measures.

REFERENCES

Related Practices
- Practice 902 Bridges.
- Practice 903 Fords/Low Water Crossings.
- Activity 5.10 Outlet Protection.

Other Sources of Information
- HERPICC Stormwater Drainage Manual.
- BPR Hydraulic Engineering Circular 5.
- North Carolina Erosion Control Manual

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PRACTICE 902
BRIDGES

DESCRIPTION
- Structure carrying a path or road over a channel.

Exhibit 902a: A typical bridge (Source: NRCS Files)

PURPOSE
- To provide cross channel access.

WHERE APPLICABLE
- Any stream or ditch.

ADVANTAGES
- Allows channel crossing with minimal environmental impact.

CONSTRAINTS
- Expensive.
- Requires professional engineering.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Varies with the type of project.

Installation
- Varies dramatically with each project.

Special Considerations

Practicality
- It is usually cheaper to install a culvert, pipe, or detour rather than a bridge. A bridge should be absolutely necessary.

Aesthetics
- Generally, bridges with long spans, shallow structure depth, and high columns are aesthetically pleasing. However, they are also expensive. Therefore: make spans as long as they need to be, use minimum vertical clearance, use open abutments, make structures as shallow as practical, and use single column supports if possible.

Preliminary Design

- Normal, skewed, or curved crossings will be dictated by the connections to other facilities. Normal crossings are cheapest and easiest to install.
- Approximate spans will be determined by the terrain, obstructions, required clearances, and assumed width of support.
- Wingwalls optimize bridge length.
- Vertical alignment will be determined on the basis of required clearance, depth for falsework, depth for structure and maximum allowable grades on approaches.
- Type selection is usually based upon required spans, available depth, permissibility of falsework use, length of construction season, and economy.
- Bridge opening size should be calculated based on appropriate hydraulic analysis to avoid upstream floodwater surcharge.

Economy

- In selecting for economy, consider short spans, low columns, liberal allowance for depth, open abutments, continuous spans, reinforced concrete, as well as simplicity of layout, structural concept and execution.

MAINTENANCE

- Erosion and scouring may occur around bridge abutments. See Exhibit 902b for plans for bridge scour protection.

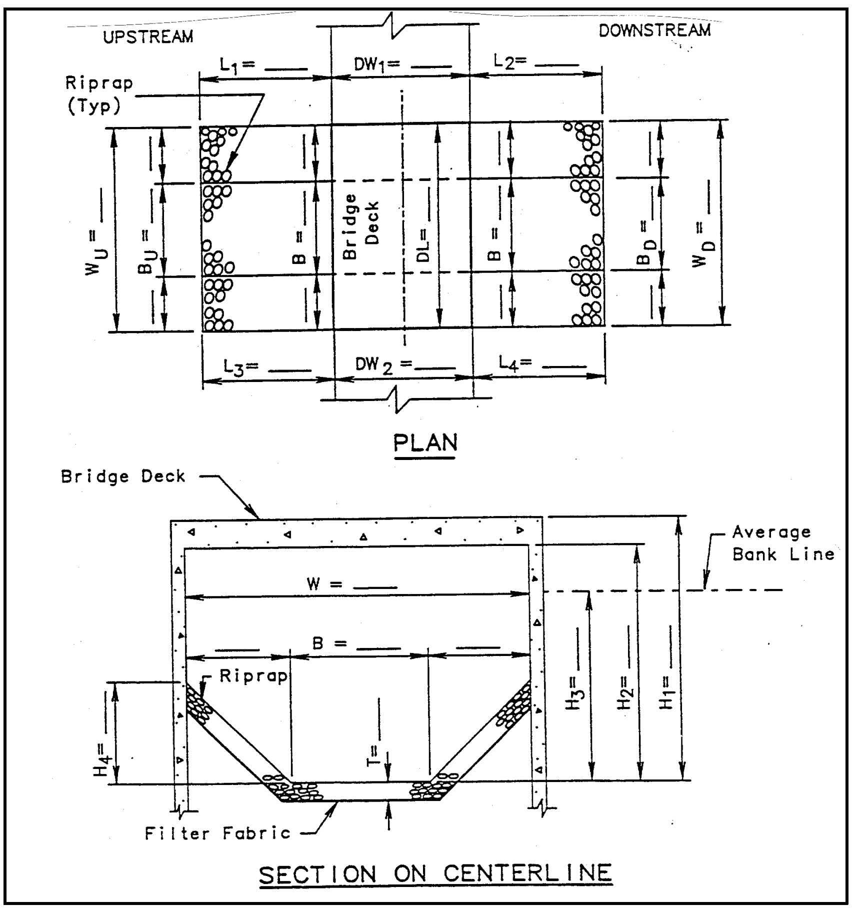

Exhibit 902b: Bridge scour protection plan (Source: NRCS Standard Specifications)

REFERENCES

Related Practices

- Practice 103 Temporary Wetland Crossing.
- Practice 104 Temporary Diversion.
- Practice 801 In-Channel Sediment Basin.

Other Sources of Information

- Indiana Erosion Control Handbook.
- Aesthetics of Bridges.
- Manual of Bridge Design.
- NRCS Standard Specifications.

Last Print/Revision Date: October 13, 1996

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PRACTICE 903
FORDS/LOW WATER CROSSINGS

DESCRIPTION
- A ford or temporary structure installed across a stream or watercourse for short-term use by construction vehicles or heavy equipment (Note: this practice is also included in the Indiana Erosion Control Handbook).

Exhibit 903a: Fords/Low Water Crossings (Source: NRCS Files)

PURPOSE
- To provide a simple means for construction vehicles to cross channels.

WHERE APPLICABLE
- Where heavy equipment must be moved across a channel.

ADVANTAGES
- Allows channel crossing with minimal environmental impact.

CONSTRAINTS
- Drainage area should be less than 1 square mile.
- Anticipated life of crossing usually 1 year or less.
- Temporary diversions may be needed during construction.
- May temporarily increase erosion and flooding, if not installed properly.
- May be expensive to install.

- Source of a continuous downstream sediment movement.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Riprap and geotextile fabric, culvert, or bridge abutments.

Installation

- Preconstruction
  1. Construct crossing when stream is low.
  2. Install crossing at right angle to the stream.
  3. Limit surface runoff by installing temporary diversion (Practice 104).
- Installing a Ford
  1. If necessary, install an in-channel sediment basin (practice 801) before preparing the approaches to the ford.
  2. Install temporary diversions in the road approach sections to divert surface runoff (Practice 104).
  3. Excavate and grade the approaches.
  4. Lay geotextile fabric for stabilization.
  5. Apply weather resistant stone over the fabric to a minimum depth of twice the specified D_{50}.

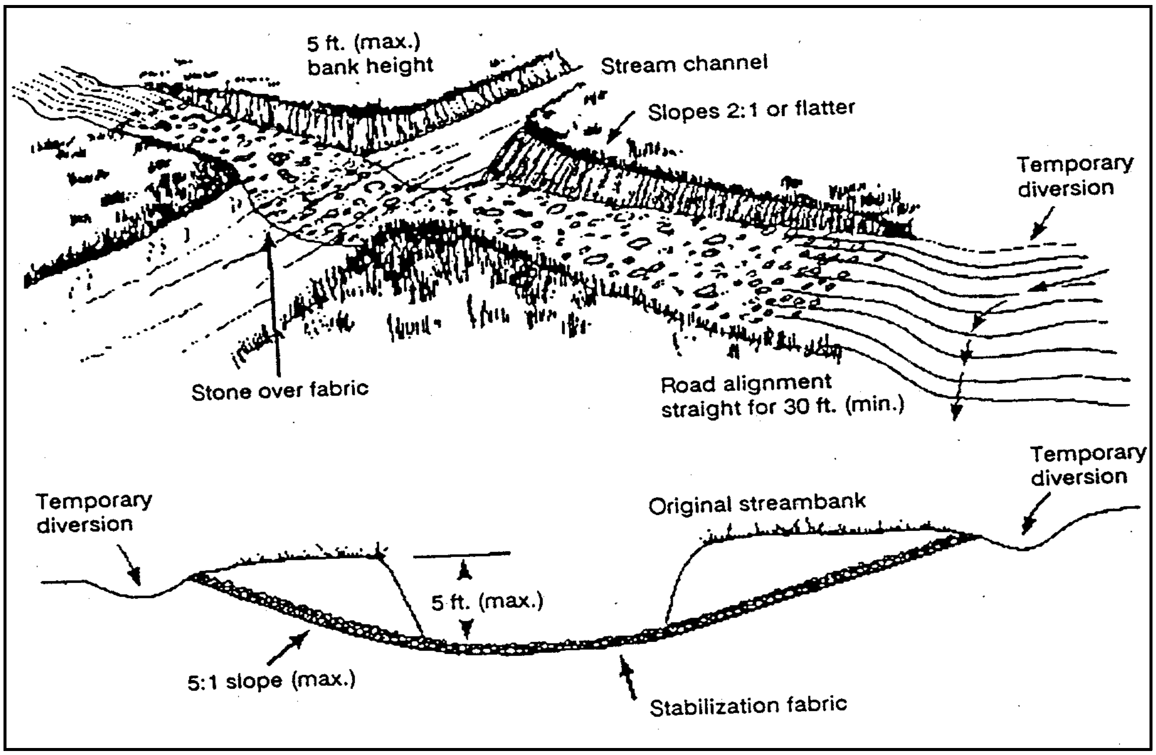

Exhibit 903b: A temporary ford of stone over geotextile fabric (Source: Indiana Erosion Control Handbook)

- Installing a Temporary Bridge or Culvert
  1. Elevate bridge abutments or culvert at least 1' above the adjoining streambank to allow storm overflow to bypass the structure without damage.
  2. Extend the culvert pipe beyond fill side slopes.
  3. Stabilize disturbed streambanks, fill slopes, and overflow and other disturbed areas.

Special Considerations
- Try to avoid stream crossings whenever possible.
- Bridges usually cause the least disturbance.
- Culverts may be the least expensive crossing to install.
- Fords are well suited for wide, shallow crossings.

MAINTENANCE
- Inspect periodically after storm events throughout the life the structure.
- All deficiencies should be repaired immediately.

REFERENCES

Related Practices
- Practice 103 Temporary Wetland Crossing.
- Practice 104 Temporary Diversion.
- Practice 801 In-Channel Sediment Basin.

Other Sources of Information
- Indiana Erosion Control Handbook.
- North Carolina Erosion Control Manual.
- NRCS Standard Specifications.

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SECTION 5.10

OUTLET PROTECTION

SECTION 5.10
OUTLET PROTECTION

Small (less than 8 inches in diameter) tile drain outfalls that outlet to a relatively large ditch or stream may be accommodated simply by projecting the tile from the channel slope. This is normally accomplished by use of a metal extension pipe as described in practice 1001: Tile Drain Outlet Extension.

Outlet protection for a pipe or an open drain tributary is required where the flow velocity of an outlet will exceed the permissible velocity of the receiving channel. Protection is usually achieved with a structurally lined apron downstream from the outlet where discharge changes from pipe flow to channel flow or from one open drain to another (Practice 1002). The purpose of the structure is to prevent scour at the discharge point, and to minimize the potential for downstream erosion by reducing the velocity of concentrated storm water flows.

For pipe, the depth of the tailwater immediately below the pipe outlet must be determined to calculate the design capacity of the pipe, as well as the design discharge velocity. Fluctuations in the assumed tailwater depth must be considered. The design of the outlet protection must determine the apron length and width, considering the bottom grade, sideslopes, alignment and materials.

PRACTICE 1001
TILE DRAIN OUTLET EXTENSION

DESCRIPTION
- A section of rigid pipe, metal preferred, without perforation or open joints that is attached to the end of small size tile drains to provide a stable outfall.

Exhibit 1001a: A Tile Drain Outlet Extension (Source: Tipton County Files)

PURPOSE
- To provide an economical stable outlet for a closed tile drain

WHERE APPLICABLE
- Where small tile drains (less than 8 inches in diameter) outlet into an open ditch.

ADVANTAGES
- Very practical.
- Economical.
- Easy to install.

CONSTRAINTS
- May cause erosion in the receiving ditch, if the receiving drain is not wide and deep enough.
- May require additional structures if surface water also enters the ditch at the same location. (see "Special Considerations".)
- May require bank excavation if cover is not adequate.
- Not suitable where velocity of water exiting tile drain is too high.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Corrugated steel or aluminum pipe in adequate length.
- Swinging gate or some type of grating or coarse screen to exclude rodents or other small animals.

Installation
- Excavate a trench with sufficient width at least equal to the outside diameter of drain, up to 0.5 foot wider than the drain.
- Round the bottom of the trench so that the drain will be embedded in undisturbed soil at least 60 degrees of its circumference.
- The pipe should be sufficiently long to insure that there will be no

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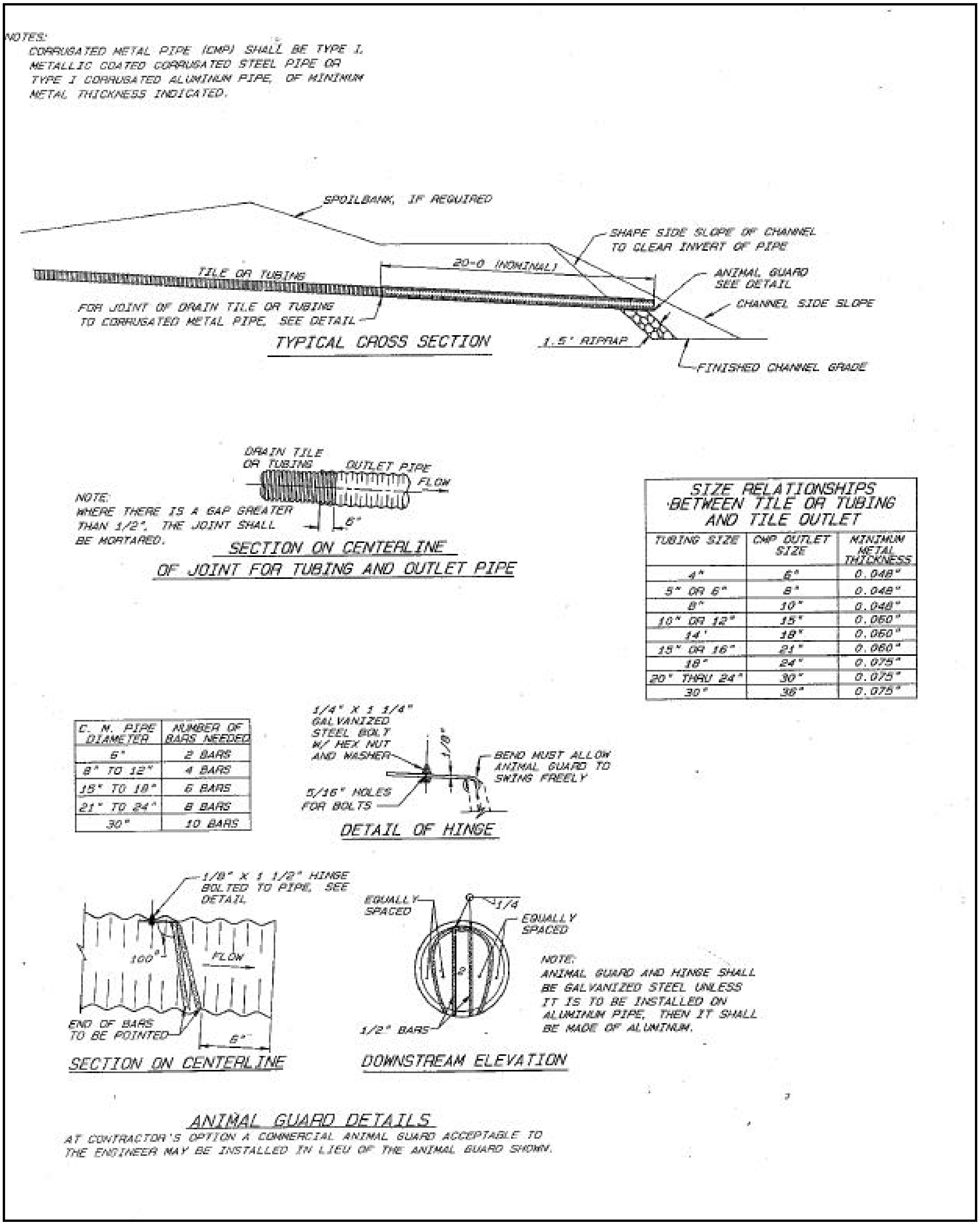
seepage around the drain which may cause erosion at the outlet.

- At least two-thirds of the pipe should be embedded in the bank to provide the required cantilever support (Exhibit 1001b).
- When sufficient depth of drain is not obtainable at the drain outlet, several methods may be used to protect the drain (Exhibit 1001c).



SIZE RELATIONSHIPS BETWEEN TILE OR TUBING AND TILE OUTLET

TUBING SIZE	CMP OUTLET SIZE	MINIMUM METAL THICKNESS
4"	6"	0.048"
5" OR 6"	8"	0.048"
8"	10"	0.048"
10" OR 12"	15"	0.060"
14"	18"	0.060"
15" OR 16"	21"	0.060"
18"	24"	0.075"
20" THRU 24"	30"	0.075"
30"	36"	0.075"

C. M. PIPE DIAMETER	NUMBER OF BARS NEEDED
6"	2 BARS
8" TO 12"	4 BARS
15" TO 18"	6 BARS
21" TO 24"	8 BARS
30"	10 BARS

Exhibit 1001b: Typical Specifications for Pipe Outlet Extension (Source: NRCS Files)

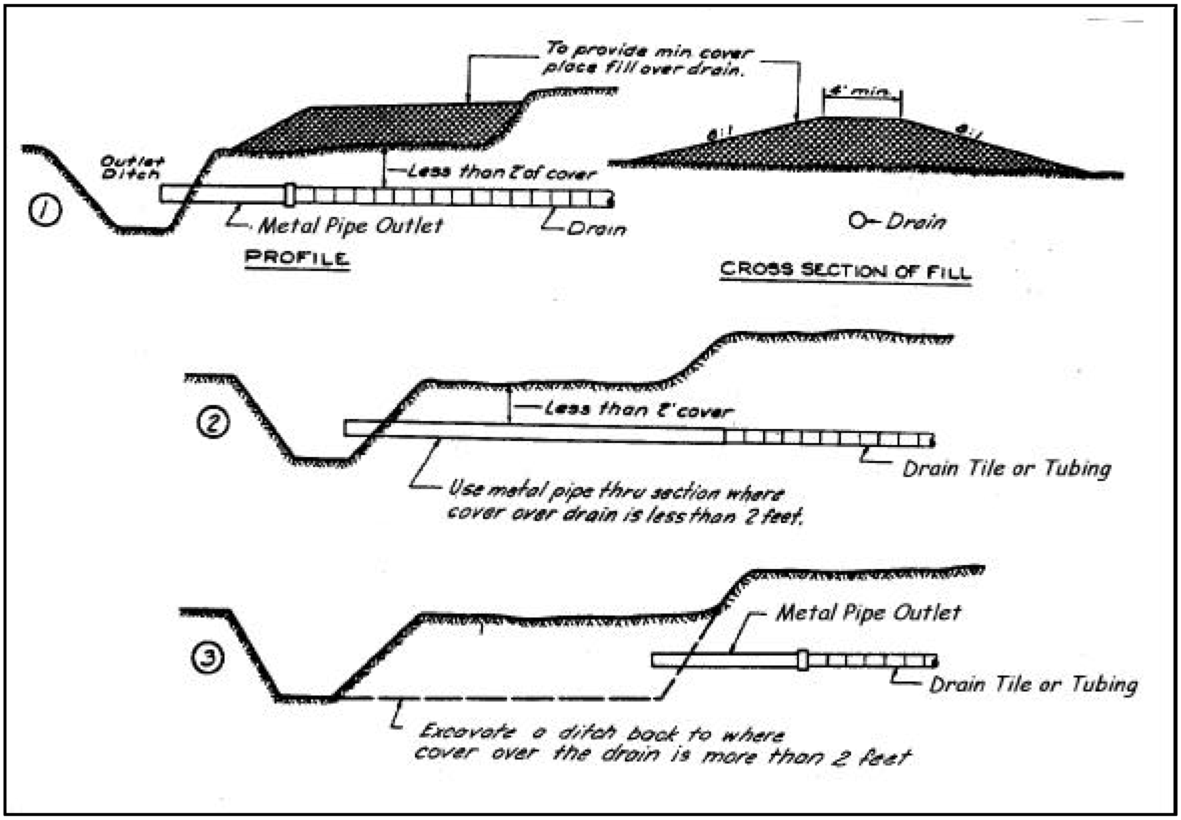


Exhibit 1001c: Methods for handling shallow depths at drain outlet (Source: NRCS Engineering Field Handbook)

Special Considerations

- If surface water enters the outlet at the same location as the drain, some type of structure is needed to discharge the surface water into the ditch without erosion and to provide protection for the outlet of the drain (Exhibit 1001d).

- A Tile Drain Outlet into a recessed area off the ditch minimizes the turbulence and provides protection from bank erosion, floating ice, and debris.

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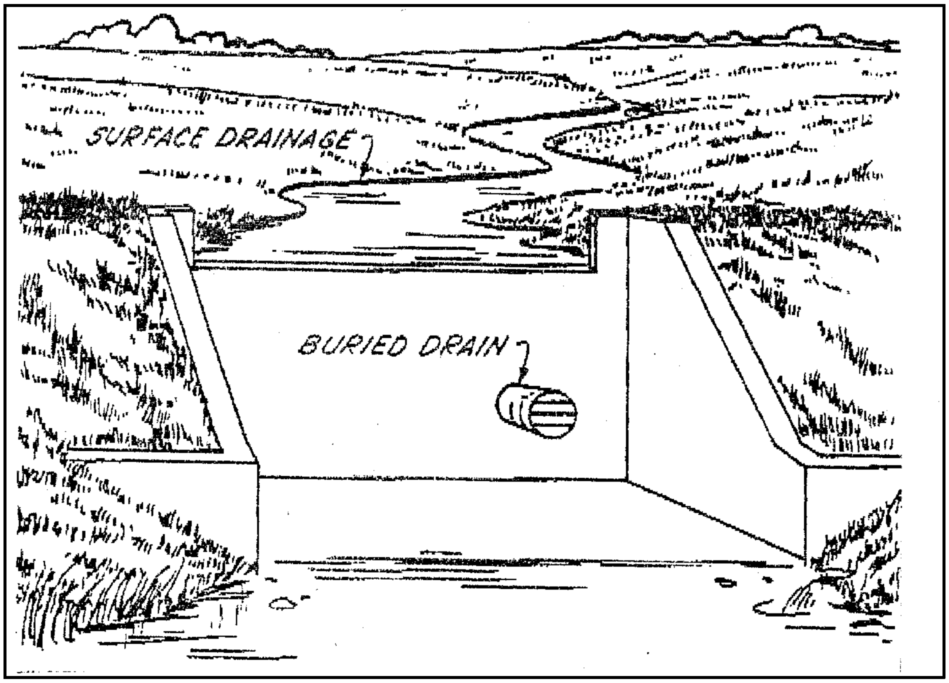

Exhibit 1001d: Drain outlet protection when surface water is present (Source: NRCS National Engineering Handbook)

MAINTENANCE

- Inspect the outlet often and repair or replace the pipe, as necessary.
- Inspect the swinging gate or screens for proper operation.

REFERENCES

Related Practices

- Practice 201 Tile Drain Installation.
- Practice 202 Tile Drain Repair/Replacement.
- Practice 705 Grade Transitions (Chutes).
- Practice 1002 Riprap-Lined Apron

Other Sources of Information

- NRCS Engineering Field Handbook.
- NRCS National Engineering Handbook.
- NRCS Files.

Last Print/Revision Date: October 13, 1996

PRACTICE 1002
RIPRAP-LINED APRON

DESCRIPTION	●	Riprap apron placed at outlet end of culverts, conduits, or channels. (Note: this practice is also included as "Rock Chute" in the Indiana Erosion Control Handbook.)

Exhibit 1002a: Riprap-Lined Apron (Source: North Carolina Erosion Control Manual)

PURPOSE	●	To reduce runoff velocity and prevent erosion at the outlet of a channel or culvert.
WHERE APPLICABLE	●	Culvert outlets.
	●	Pipe conduits from all sediment basins, and dry as well as wet basin detention stormwater ponds.
	●	New channels constructed as outlets for culverts and conduits.
	●	Where outflows from conduits or channels do not exceed 10 feet per second.
ADVANTAGES	●	Prevent scour erosion at stormwater outlets.
	●	Protects outlet structure.
	●	Minimizes the potential for downstream erosion by reducing the velocity or energy of concentrated stormwater flows.
	●	Reduces the effects of turbidity and sedimentation downstream.
CONSTRAINTS	●	May require heavy machinery to install riprap.
	●	Not recommended for pipe outlets at the top of cuts, or on slopes steeper than 10%.
	●	Contributing drainage area should be $\leq$ 100 acres.
	●	Peak runoff from a 10-year frequency, 24 hour storm event should be accommodated.
	●	Length and width of apron are calculated based on pipe diameter, design flow rate, and the absence or presence of downstream tailwater.

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DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Riprap.
- Geotextile fabric.

Installation
- Excavate the apron area subgrade below design elevation to allow for the thickness of filter and riprap.
- Compact fill used in the subgrade to the density of the surrounding undisturbed material, and smooth enough to protect fabric from tearing.
- Place geotextile fabric on the foundation. If more than one piece of fabric is needed, then upstream piece should overlap the downstream piece by at least one foot.
- Install riprap to the lines and elevations shown in the design.
- Make sure the top of the apron is level with or slightly below the receiving stream.
- A portion of the apron below the outlet may be shaped into a bowl or a plunge pool to act as a stilling basin.
- Blend the riprap smoothly to the surrounding grade.
- Stabilize all disturbed areas immediately following installation.

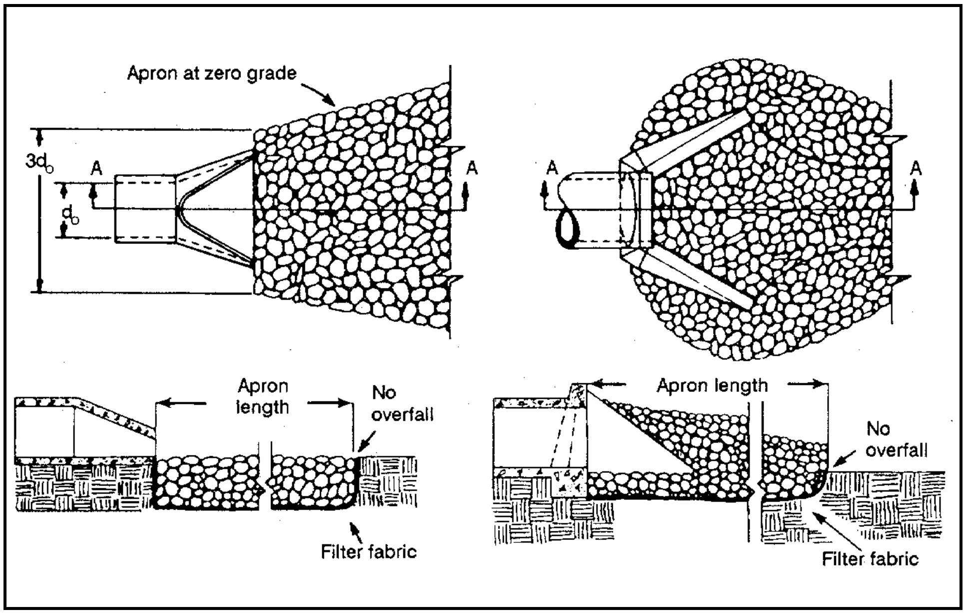

Exhibit 1002b: Pipe outlet aprons for a channel (left) that is not well defined and (right) that is well defined. (Source: Indiana Erosion Control Handbook)

Special Considerations
- Choice of materials should be based on the type of soil to be protected, season, and economics.
- Organic mulch materials such as straw, wood chips, bark, and wood fiber have been found to be the most effective.
- Chemical soil stabilizers and binders work best when used in conjunction with organic mulches.

MAINTENANCE
- Inspect and reapply mulch as necessary after storm events.

- Continue inspections until vegetation becomes established.

REFERENCES

Related Practices
- Practice 105 Silt Fencing.
- Practice 106 Straw Bale Filter.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information
- Indiana Erosion Control Handbook.
- Illinois Urban Manual.
- North Carolina Erosion Control Manual.

SECTION 5.11

REVEGETATION AND SITE STABILIZATION

SECTION 5.11
REVEGETATION AND SITE STABILIZATION

Stabilizing a site with vegetation following any drainage improvement project is a critical component in reducing sedimentation and armoring the site against future erosion. This section addresses revegetation techniques as well as practices to protect exposed soil while vegetation is becoming established.

Techniques discussed in Vegetative Stabilization (Practice 1102) are most often used in conjunction with other drainage improvement activities, or alone when conditions permit. Vegetative Stabilization complements the practices listed in Section 5.5 (Eroded Streambank Repair). Temporary, dormant, or permanent seedings should follow any soil-displacing activity. Wheat, rye, and oats are often used as temporary cover crops. Native plant species are recommended for permanent seedings. Native plants have extensive root systems well-suited for bank stabilization, and provide better habitat for wildlife than introduced species. Native plants also tend to be hardier than introduced species, and require less maintenance.

Using vegetation alone to stabilize the banks of streams and ditches should only take place in areas with moderate sideslopes and where the scouring forces of high velocity flows will not preclude the establishment of plants. A good rule of thumb is as follows: If the sideslopes support rigorous vegetation prior to implementing improvement activities, then that stretch is a good candidate for armoring with vegetation. Sideslopes with scoured banks supporting little or no vegetation likely contain water with flows too high and fast to support vegetation.

The installation of mulch, erosion control blankets and matting, and/or a bonded fiber matrix is often necessary in conjunction with seeding. Mulch is the least expensive, but is not appropriate in areas subject to high concentrated flows. Erosion control blankets and matting work well in areas with high concentrated flows, but are expensive to install and are prone to erosion beneath the mat if not installed properly. Bonded fiber matrices are a good choice along very steep banks and in areas with low to moderate concentrated flows.

Regular maintenance is critical in achieving final site stabilization. Recently planted or sodded areas usually require watering. Fertilizer should only be used if a soil test indicates it is necessary. Care should be taken that the fertilizer does not leach into a stream or ditch. To enhance the establishment of native grasses, the newly planted areas need to be mowed, burned, or weeded periodically. When burning is impractical and mowing is necessary, it should be done after August 1 to protect ground-nesting wildlife. Erosion control blankets, mats, mulch, and fiber bonded matrices should be monitored and repaired as necessary following storm events until vegetation has a chance to become established.

PRACTICE 1101
MULCHING

DESCRIPTION
- Application of plant residues or other suitable materials to the soil surface. (Note: this practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 1101a: Mulching (Source: North Carolina Erosion Control Manual)

PURPOSE
- To prevent erosion.
- To reduce the velocity of overland water flow.
- To foster growth of vegetation by preserving soil moisture and insulating soil from extreme heat or cold.
- To reduce rain drop impact (splash erosion).

WHERE APPLICABLE
- Areas that recently have been seeded.
- Areas that require soil protection but cannot be seeded because of the time of year or other reasons.
- Areas that require mud and dust control.

ADVANTAGES
- Controls erosion in recently seeded areas.
- Conserves soil moisture thereby promoting seed germination and seedling growth.
- Reduces soil surface compaction or crusting by protecting the soil surface from raindrop impact.
- Moderates temperature and moisture extremes.

CONSTRAINTS
- Added cost to seeding.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Straw, hay, wood fiber, cellulose, or excelsior.

Installation

- Prior to Application
  1. Shape and grade as required.
  2. Remove all rocks, clods, or debris larger than 2" in diameter that will prevent contact between the mulch and soil surface.
  3. When using erosion control blankets, lime, fertilizer, and seed may be applied either before or after laying the blanket. The preferred method is to seed and add amendments before installing the blanket.

- Time of Application
  1. Immediately after seeding, or planting by conventional methods or by hydroseeding. May be applied with seeding as hydromulching.
  2. Immediately after seedbed preparation when dormant seedings are to be made by seeding over the mulch.

- Application and Anchoring
  1. Apply mulch at recommended rate.
  2. Spread uniformly by hand, hay fork, mulch blower, or hydromulcher. No more than 25% of ground surface should be visible following application.
  3. If straw or hay is used, anchor immediately (See Exhibit 1101b).

Anchoring Method	How to Apply
Mulch anchoring tool OR Farm disk (dull serrated, and set straight)	Crimp or punch straw or hay into soil 2-4". Operate machinery on the contour of slope.
Cleating with dozer tracks	Operate dozer up and down slope
Wood hydromulch fibers	Apply 0.5 ton/acre using a hydromulcher at a rate of 750 lbs/acre with a tacking agent. Do not use in areas of concentrated flow.
Asphalt emulsion	Should conform to ASTM Spec. #977. Apply at rate of 0.05 gal./sq.yd. Do not use in areas of concentrated flow.
Synthetic tackifier, binder or soil stabilizer	Apply according to manufacturers recommendations.
Biodegradable netting	Apply over mulch and staple with 6-8" wire staples. Follow manufacturers recommendations.

Exhibit 1101b: Mulch anchoring methods. (Source: Indiana Erosion Control Handbook)

T.O.C.

- Rate
  See Exhibit 1101c.

Material	Rate	Comments
Straw or hay	1.5-2 tons/acre	Should be dry and unchopped Should be free of undesirable seeds Spread by hand or machine Must be crimped or anchored
Wood fiber cellulose	1 ton/acre	Apply with hydromulcher and use tacking agent
Long fiber wood	0.5-0.75 tons/acre	Anchor in areas subject to wind

Exhibit 1101c: Mulch Materials Rates (Source: Indiana Erosion Control Handbook)

Special Considerations

- Choice of materials should be based on the type of soil to be protected, season, and economics.
- Organic mulch materials such as straw and hay have been found to be the most effective.
- Chemical soil stabilizers and binders work best when used in conjunction with organic mulches.

MAINTENANCE

- Inspect and reapply mulch as necessary after storm events.
- Continue inspections until vegetation becomes established.

REFERENCES

Related Practices

- Practice 104 Temporary Diversion.
- Practice 105 Silt Fencing.
- Practice 106 Straw Bale Filter.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- Indiana Erosion Control Handbook.
- Illinois Urban Manual.
- North Carolina Erosion Control Manual.

T.O.C.

PRACTICE 1102
VEGETATIVE STABILIZATION AND SEEDING

DESCRIPTION
- Stabilization and protection of streambanks with selected vegetation.

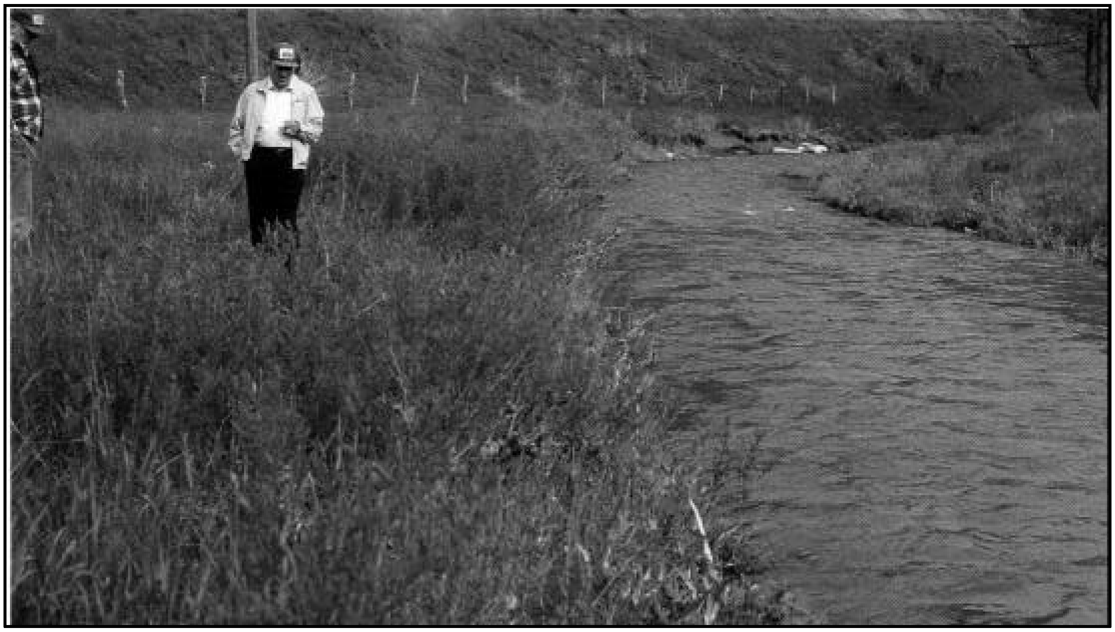

Exhibit 1102a: Vegetative Stabilization (Source: North Carolina Erosion Control Manual)

PURPOSE
- To protect streambanks from the erosive forces of flowing water and provide a natural, pleasing appearance.
- To restabilize areas disturbed during construction.
- Shade provided by woody vegetation maintains lower water temperatures and provides wildlife habitat.

WHERE APPLICABLE
- Generally applicable along streams and ditches where bankfull flow velocity does not exceed 5 ft/sec., and soils are erosion resistant.
- Vegetative techniques usually should be incorporated with structural techniques if the bankflow velocity exceeds 5 ft/sec. (See referenced sources.)

ADVANTAGES
- Often less expensive than structural techniques.
- Natural appearance.
- May create or enhance wildlife habitat.
- Self repairing in many cases.

CONSTRAINTS
- May not be applicable in high flow ditches and streams.
- Full stabilization may not be achieved until plants become established.
- Often requires limited but regular maintenance such as burning, and in some situations, herbiciding or even mowing.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- Appropriate plant species selected from following Exhibit 1102b or other referenced sources. Note that not all species listed are suitable for every region or soil.
- Mulch, erosion control blankets, and/or bonded fiber matrix.

Partial Sunlight (Half Day) to Full Sunlight

Common Name	**Botanic Name**	**Plugging Rate On Center**	**Seeding Rate**
Banks and Slopes (Stabilizing Matrix Species)			
Big Bluestem	Andropogon gerardii	18-24"	5 lb/ac
Brown Fox Sedge	Carex vulpinoidea	18-24"	0.25 lb/ac
Canada Wild Rye	Elymus canadensis	18-24"	5 lb/ac
Streambank Rye	Elymus riparius	18-24"	1 lb/ac
Silky Wild Rye	Elymus villosus	18-24"	1 lb/ac
Virginia Wild Rye	Elymus virginicus	18-24"	3 lb/ac
Torrey's Rush	Juncus torreyi	18-24"	0.01 lb/ac
Evening Primrose	Oenothera biennis	18-24"	0.25 lb/ac
Switch Grass	Panicum virgatum	18-24"	1 lb/ac
Indian Grass	Sorghastrum nutans	18-24"	5 lb/ac
Prairie Cord Grass	Spartina pectinata	18-24"	N/A
Blue Vervain	Verbena hastata	18-24"	1 lb/ac
Toe, Lower Banks (Stabilizing Species)			
Sweet Flag	Acorus calamus	18-24"	N/A
Water Plaintain	Alisma subcordatum	18-24"	N/A
Bluejoint Grass	Calamagrostis canadensis	18-24"	N/A
Creeping Spike Rush	Eleocharis acicularis	18-24"	N/A
Blue Flag Iris	Iris virginica	18-24"	N/A
Torrey's Rush	Juncus torreyi	18-24"	N/A
Switch Grass	Panicum virgatum	18-24"	N/A
Arrowhead	Sagittaria latifolia	18-24"	N/A
Hardstem Bulrush	Scripus acutus	18-24"	N/A
Chairmaker's Rush	Scirpus americanus	18-24"	N/A
Dark Green Rush	Scirpus atrovirens	18-24"	N/A
River Bulrush	Scirpus fluviatilis	18-24"	N/A
Prairie Cord Grass	Spartina pectinata	18-24"	N/A
Blue Vervain	Verbena hastata	18-24"	N/A
Cover Crops (Hydroseeding, Hand or Machine Planted Species			
Annual Ryegrass	Lolium multiflorum	N/A	60 lb/ac
Perennial Ryegrass	Lolium perenne	N/A	24 lb/ac
Smartweed	Polygonum punctatum	N/A	5 lb/ac
Yellow Coneflower	Ratibida pinnata	18-24"	0.25 lb/ac
Black-Eyed Susan	Rudbeckia hirta	18-24"	0.25 lb/ac
Brush for live stakes, brush mattress, live fascine, branch packings, live cribwall and vegetated geogrid. (North bank may have to be planted by shade-tolerant species.)			
Buttonbush	Cephalanthus occidentalis		
Silky Dogwood	Cornus amonum		
Red-Osier Dogwood	Cornus stolonifera		

Exhibit 1102b : Plant species for Vegetative Stabilization (Source: DuPage County Streambank Stabilization Program)

Partial Sunlight (Half Day) to Full Sunlight (continued)

Common Name	**Botanic Name**	**Plugging Rate On Center**	**Seeding Rate**
Brush ... (continued from last page)			
White Willow	Salix alba		
Peach-Leaved Willow	Salix amygdaloides		
Pussy Willow	Salix discolor		
Sandbar Willow	Salix interior		
Black Willow	Salix nigra		
Elderberry	Sambucus canadensis		
Non-Stabilizing Decorative and Screening Plants			
Swamp Milkweed	Asclepias incarnata		
Joe-Pye Weed	Eupatorium maculatum		
Spiderwort	Tradescantia ohiensis		
Culver's Root	Veronicastrum virginicum		
Golden Alexanders	Zizia aurea		
Shrubs (Plant sparsely to prevent overshading banks)			
Eastern Ninebark	Physocarpus opulifolius		
Arrowwood Viburnum	Viburnum dentaum		
Nanneyberry Viburnum	Viburnum lentago		
Trees (Plant lightly to prevent overshading banks)			
White Ash	Fraxinus americana		
Green Ash	Fraxinus pennsylvanica		
Quaking Aspen	Populus tremuloides		
Swamp White Oak	Quercus bicolor		
White Cedar	Thuja occidentalis		
Basswood	Tilia americana		
Buffer Zone/Filter Strips			
Big Bluestem	Andropogon gerardii	N/A	5 lb/ac
New England Aster	Aster novae-angliae	N/A	2 oz/ac
Oats*	Avena sativa	N/A	25 lb/ac
Daisy*	Chrysantheumum leucanthemum	N/A	0.25 lb/ac
Chicory*	Cichorium intybus	N/A	0.1 lb/ac
Barley*	Hordeum vulgare	N/A	25 lb/ac
Annual Ryegrass*	Lolium multiflorum	N/A	25 lb/ac
Wild Bergemont	Monarda fistulosa	N/A	0.5 oz/ac
Switch Grass	Panicum virgatum	N/A	1 lb/ac
Yellow Coneflower*	Ratibida pinnata	N/A	0.25 lb/ac

Exhibit 1102b (continued): Plant species for vegetative Stabilization (Source: DuPage County Streambank Stabilization Program)

Partial Sunlight (Half Day) to Full Sunlight (continued)

Common Name	Botanic Name	Plugging Rate On Center	Seeding Rate
Buffer Zone/Filter Strips (continued)			
Black-Eyed Susan*	Rudbeckia hirta	N/A	0.25 lb/ac
Indian Grass	Sorghastrum nutans	N/A	5 lb/ac
Alsike Clover*	Trifolium hybridum	N/A	0.1 lb/ac
Red Clover*	Trifolium pratense	N/A	0.1 lb/ac
Hoary Vervain	Verbena stricta	N/A	0.5 oz/ac

* Transition species to be planted in the outer 5 feet of buffer to blend into existing landscape.

Full Shade

Common Name	Botanic Name	Plugging Rate On Center	Seeding Rate
Bank and Slopes			
Sideflowering Aster	Aster lateriflorus	18-24"	0.25 lb/ac
Gray Sedge	Carex amphibola	18-24"	N/A
Common Wood Sedge	Carex blanda	18-24"	N/A
Fowl Manna Grass	Glyceria striata	18-24"	0.25 lb/ac
Non-Stabilizing Decorative Plants			
Jack-in-the-Pulpit	Arisaema triphyllum	10'	N/A
Green Dragon	Arisaema dracontium	10'	N/A
Turtlehead	Chelone glabra	10'	N/A
Shooting Star	Dodecatheon meadia	10'	N/A
Spotted Jewelweed	Impatiens capensis	10'	N/A
Cardinal Flower	Lobelia cardinalis	10'	N/A
Virginia Bluebells	Mertensia virginica	10'	N/A
Solomon's Seal	Polygonatum Canaliculatum	10'	N/A
Ostrich Fern	Pteretis pennsylvanica	10'	N/A
Swamp Buttercup	Ranunculus septentrionalis	10'	N/A

Not Recommended

Common Name	Botanic Name
Box Elder	Acer negundo
Garlic Mustard	Allilaria officinalis
Tartarian Honeysuckle	Loicera tatarica
Reed Canary Grass	Phalaris arundinacea
Common Buckthorn	Rhamnus cathartica
Glossy Buckthorn	Rhamnus frangula
Multiflora Rose	Rosa multiflora

Exhibit 1102b (continued): Plant species for vegetative Stabilization (Source: DuPage County Streambank Stabilization Program)

Installation

- Site Preparation
  1. Selected vegetative stabilization measure should be compatible with improvements planned or carried out by others.
  2. Protective measures should be started at a stabilized or controlled point on the stream and extended to a stabilized or controlled point downstream.
  3. The grade of the channel must be controlled, either by natural or artificial means, before any vegetative measure can be used, unless live stakes can be installed below the anticipated depth of the bottom scour.
  4. The substrate should have enough silt and clay material to maintain adequate moisture and nutrient supply, and sufficient pore space to permit root penetration. The bulk density should be 1.2-5 grams per cubic centimeter. Clay content should not exceed 35%.
  5. Soil depth appropriate for plant growth should be at least 12", except where adding soil material is not feasible because of steep grades.
  6. pH should be in a range between 5.5 and 6.5.
  7. Substrate should be free of toxins harmful to plant growth.

- Seedbed Preparation
  1. Apply fertilizer or other required amendments prior to final seedbed preparation.
  2. Prepare seedbed to a minimum depth of 3" by disking or other means. All tillage should follow the contour of the land.

- Seeding/Plugs (Exhibit 1102b)
  1. All permanent seed mixes should be installed with a rangeland drill seeder. Temporary mixes may be applied with a drill seeder, cultipacker, or a hydraulic sprayer. Hydro seeders are also good for larger areas.
  2. All seed, if possible, should be certified for viability.

- Timing
  1. Dormant seedings should take place between Dec. 1-Feb. 28 (north of U.S. 40), Dec. 10-Jan 15 (south of U.S. 40).
  2. Permanent seedings should take place between March 1 and September 30. Permanent seeding done between May 10 and August 10 may need irrigation.
  3. Temporary seeding should take place between March 1 and April 15 (oats), September 15 to October 30 (cereal rye and wheat), and March 1 to May 1 or August 1 to September 1 (perennial ryegrass).
  4. Plugs should be installed during spring.

Special Considerations

- Use of native species is always preferable to invasive introduced species such as Tall Fescue. However, the use of such species is sometimes inevitable where immediate and effective erosion control is essential. Indiana Erosion Control Handbook includes the listing of more traditional permanent seeding species applicable to many of these situations.
- All seedings should be protected with stabilization methods during the period of establishment (Practices 1101, 1103, and 1104).
- A listing of vendors who regularly carry native species noted in Exhibit 1102b may be obtained from the U.S. Fish and Wildlife Service.

MAINTENANCE

- Areas of inadequate cover after dormant seedings should be reseeded with a temporary or permanent matrix after mid- to late-April.
- Areas seeded with a permanent or temporary matrix should be fertilized as necessary. Damaged, eroded, bare, or sparsely covered areas should be repaired and reseeded.

REFERENCES

Related Practices

- Practice 1101 Mulching.
- Practice 1103 Bonded Fiber Matrix.
- Practice 1104 Erosion Control Blankets and Matting.
- Practice 1201 Wetland Replacement.
- Practice 1202 Stream Environment Enhancement.
- Practice 1204 Tree Replacement.

Other Sources of Information

- Indiana Erosion Control Handbook.
- DuPage County Streambank Stabilization Program.
- NRCS Standard Specifications.
- COE Engineering Manual.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 1103
BONDED FIBER MATRIX

DESCRIPTION	●	Continuous matrix of elongated wood strands held together by a water-resistant bonding agent.

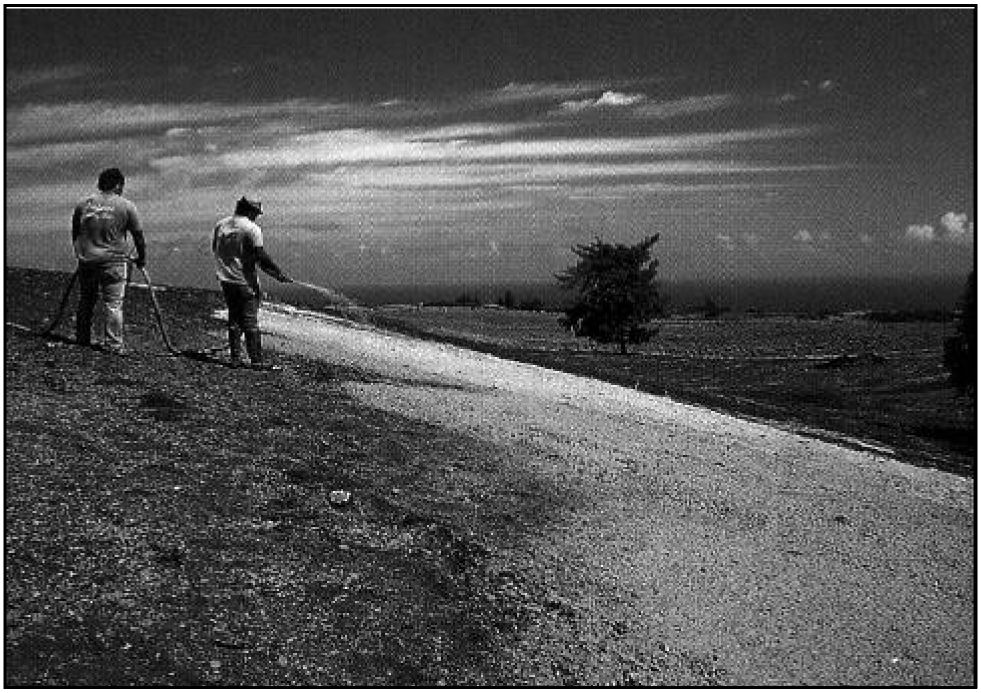

Exhibit 1103a: Bonded Fiber Matrix (Source: Weyerhaeuser Products Brochure)

PURPOSE	●	To prevent erosion and enhance germination.
WHERE APPLICABLE	●	Usually on very steep slopes.
	●	Areas where access prohibits installation of more traditional erosion control methods.
ADVANTAGES	●	Holds on near-vertical surfaces.
	●	Reduces labor requirements.
	●	Provides immediate, temporary surface stabilization.
	●	Provides immediate erosion and water quality benefits.
	●	Reduces soil crusting.
	●	Conserves moisture and increases seed germination and seedling growth.
	●	Usually incorporated with fertilizer and a seed mix.
CONSTRAINTS	●	Not recommended on sandy soils.
	●	Not recommended for areas of high concentrated flows.
	●	Requires special training and a hydraulic applicator.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	3,000-4,000 pounds of bonded fiber matrix per acre.
	●	Approved hydraulic applicator.

Installation
- Should be installed according to manufacturers recommendations by a certified contractor.
- Spray apply at a minimum of 3,000-4,000 pounds per acre using standard hydraulic seeding equipment. Material should be sprayed in successive layers to achieve 100% coverage of all exposed soil.

Special Considerations
- Should not be applied immediately before, during, or after rainfall.
- Material should have 24 hours to dry prior to any rain event.

MAINTENANCE
- Inspect for erosion after each storm event during vegetation establishment. Reapply as necessary.

REFERENCES

Related Practices
- Practice 1101 Mulching.
- Practice 1102 Vegetative Stabilization.
- Practice 1104 Erosion Control Blankets and Matting.

Other Sources of Information
- Weyerhaeuser Products Brochure.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 1104
EROSION CONTROL BLANKET

DESCRIPTION

- Biodegradable organic or synthetic mulch incorporated into a polypropylene or similarly netting material. (Note: this practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 1104a: Erosion Control Blanket (Source: CBBEL Files)

PURPOSE

- To prevent erosion.

WHERE APPLICABLE

- Usually on slopes or in areas of concentrated flow.
- Area with high potential for erosion.

ADVANTAGES

- Provides temporary surface stabilization.
- Provides immediate erosion and water quality benefits.
- Reduces soil crusting.
- Conserves moisture and increases seed germination and seedling growth.
- Applicable in areas of concentrated flow and steep slopes (where mulch alone often fails).

CONSTRAINTS

- Expensive.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Organic (straw, excelsior, coconut fiber, etc.) or synthetic mulch material incorporated into a polypropylene or similar netting. Material may be biodegradable, photodegradable, or permanent.

Installation

- Select type and weight of blanket to fit site conditions (e.g. slope, channel, flow velocity).
- Install necessary erosion control devices.
- Grade site as specified on plans.
- Add topsoil where appropriate.

- Prepare seedbed, fertilize, and seed immediately after grading.
- Lay blankets on seeded areas following manufacturers directions. Blankets should be laid so they are in continuous contact with the soil, and upslope or upstream ones should overlap the lower ones by at least 8".
- Tuck the uppermost edge of the upper blankets into a check slot (slit trench) and backfill with soil. Tamp down.
- Anchor blankets as specified by the manufacturer. This usually involves driving 6"-8" wood or metal staples into the ground in a pattern determined by site conditions. Wood staples are preferable to metal staples. Wood staples will swell and hold better.

Exhibit 1104b: Proper installation of erosion control blankets in a drainageway (Source: Indiana Erosion Control Handbook)

Special Considerations

- Maximum life varies with material.
- Poor contact between the soil and the blanket resulting from improper stapling, or not using check slots, may cause water to flow under the blanket.

MAINTENANCE

- Inspect for erosion after each storm event during vegetation establishment.
- If any areas show erosion, pull back that portion of the blanket, add soil, re-seed, and re-lay and staple the blanket.
- Check area periodically after vegetation establishment.

REFERENCES

Related Practices

- Practice 1101 Mulching.
- Practice 1102 Vegetative Stabilization.
- Practice 1105 Bonded Fiber Matrix.

Other Sources of Information

- Indiana Erosion Control Handbook.
- NRCS Standard Specifications.

T.O.C.

SECTION 5.12

MITIGATION MEASURES

SECTION 5.12
MITIGATION MEASURES

Some stream and ditch improvement activities may inevitably cause unreasonably detrimental environmental impacts, even if best management practices are used. This section addresses practices that create or enhance wetlands and stream/ditch corridor habitat. Several of the practices contained in Section 5.1 (Common Practices for Site Assessment and Preparation) are utilized to avoid or minimize unreasonably detrimental impacts on the environment. However these latter practices are normally called for as part of construction plans and are not generally regarded as compensatory mitigation measures.

Wetland replacement usually entails enhancing the functional value of an existing, degraded wetland or creating a new wetland. Wetland replacement is relatively expensive and requires extensive planning by a qualified wetland consultant. IDNR District wildlife biologists can often help in planning, when needed. Generally, wetlands created on hydric soils in naturally low-lying areas of the landscape have a better chance of survival. Once established, created wetlands are relatively low-maintenance, requiring minimum management such as exotic plant control and prescribed burns. However, construction monitoring and aggressive management during at least the first five years of establishment are critical to creating a successful wetland.

Stream environment enhancement and the creation of check dams both involve creating aquatic habitat with in-channel structures. The primary objectives of all described structures are to improve water quality and habitat through aeration, the creation of deep water pockets, sediment removal, providing cover for fish, and substrate and food for other aquatic organisms. This is accomplished by providing conditions that create varying degrees of upstream ponding, and downstream scour action. When considering in-channel structures for stream enhancement, special care should be taken that structures do not create excessive upstream flooding or downstream erosion.

Drainage Code (IC 36-9-27) prohibits the IDNR from requiring tree planting or tree retention within the easement of a regulated drain if certain conditions are adhered to. However, tree planting or replacement when it does not create a conflict with maintenance activity may be considered in streams not considered "regulated drain" as an enhancement measure or to compensate for trees lost as a result of a drainage improvement activity.

An extensive body of literature is available on the subject of stream environment enhancement that provides details of various techniques in this category. Several of these publications are referenced in the "Forest Service Habitat Improvement Handbook". Further references and information may also be obtained from local environmental groups and agencies.

T.O.C.

PRACTICE 1201
WETLAND REPLACEMENT

DESCRIPTION
- Restoring or creating wetlands as an enhancement measure or to replace wetlands disturbed during construction.

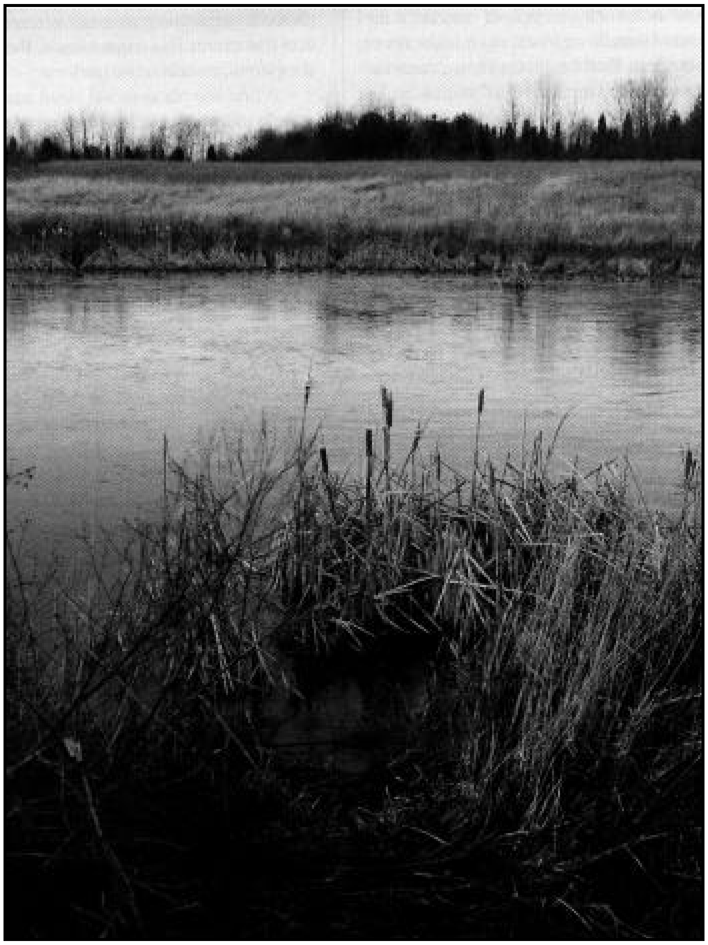

Exhibit 1201a: Wetland Replacement (Source: Land and Water Magazine)

PURPOSE
- To replace the functions and values of wetlands disturbed during development activities.
- To enhance water quality and stormwater storage capabilities of a watershed.

WHERE APPLICABLE
- Projects with wetlands impacts.
- Where wetland restoration is considered as part of a watershed management scheme.

ADVANTAGES
- Replaces ecological values lost due to impacts.
- Improves water quality, wildlife habitat, flood water retention, and ground water recharge.

CONSTRAINTS
- Expensive (However, financial assistance is usually available through contacting the IDNR Fish and Wildlife Division).
- It may not be possible to create wetlands of the same functional values as high quality, naturally occurring wetlands.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Top soil.
- Local wetland plants and seeds.

Installation

- Wetlands should be located on hydric soils.
- Excavation: The basin should be graded to 1' below the final grade unless the material found at the grade level is acceptable wetland topsoil.
- Topsoil: At least 12" of wetland topsoil is necessary for plantings. Topsoil should be finished to +0.25 to -0.20 feet of the grade lines and dimensions shown on the plans, prior to scarification. Average grades should meet the grade lines. Topsoil should be applied in a manner that minimizes compaction. Upon completion of scarifying, a 150-200 pound person should sink 1" - 2" in the material while walking.
- Wetland Seeding: The area to be seeded should be worked to a minimum depth of 3" using a disk tiller or similar equipment. The prepared surface should be relatively free of weeds, clods, stones, rivulets, gullies, crusting and caking. Seed should be planted using a rangeland, no-till drill attachment. Hydraulic seeding or hand broadcasting is not recommended other than in inaccessible areas.
- Wetland Planting: Wetland plugs, tubers, and rootstock should be installed during May and June, and within one week of seeding. One day prior to planting, the water levels should be at normal water level so that soils are saturated to 1' in the locations to be planted. Plugs should be planted 50 plants to a 10' x 10' goose grid.

Zone	Water Depth
Mesic Prairie	6" to 12" above NWL*
Sedge Meadow	NWL - to 6" above NWL
Shallow Emergent	3" below NWL to NWL
Deep Emergent	12" below NWL to 3" below NWL
Submergent	> 12" below NWL

* NWL = Normal Water Line

Exhibit 1201b: Wetland planting zones (Source: CBBEL Files)

Special Considerations

- Installing water control structures to induce drawdowns may enhance the viability of the wetland; however, water control structures are subject to vandalism and require periodic maintenance and/or adjustment.
- Wetlands require little maintenance once they are established. However, aggressive management especially during the first 5 years

is critical to their success.

MAINTENANCE	●	Watering, if necessary, during plant establishment.
	●	Herbiciding purple loosestrife and other exotics.
	●	Prescribed burning and/or mowing when burning is not appropriate.
	●	Inlet and outlet structures should be kept free of debris.
REFERENCES	**Related Practices**	
	●	Practice 1102 Vegetative Stabilization.
	●	Practice 1202 Stream Environment Enhancement.
	Other Sources of Information	
	●	NRCS Engineering Field Handbook.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 1202
STREAM ENVIRONMENT ENHANCEMENT

DESCRIPTION	●	Instream structures designed to improve aquatic wildlife habitat.

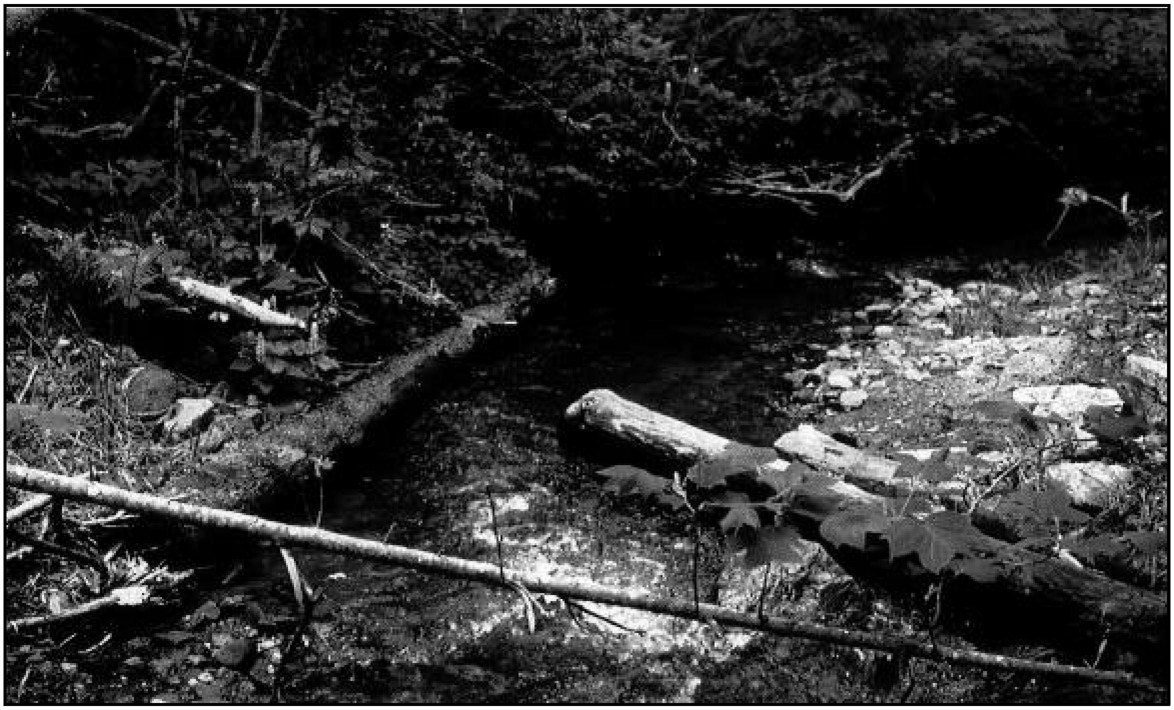

Exhibit 1202a: Stream Environment Enhancement (Source: Forest Service Habitat Improvement Handbook)

PURPOSE	●	To improve wildlife habitat.
WHERE APPLICABLE	●	Any stream improvement project in which one of the objectives is to improve wildlife habitat.
ADVANTAGES	●	May create deeper water.
	●	May flush sediment thereby improving water quality.
	●	Provides cover for fish.
	●	Provides substrates and food for aquatic organisms.
	●	Most structures can be installed with hand tools.
CONSTRAINTS	●	May be an added expense.
	●	May cause upstream flooding and downstream erosion if not properly installed.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	Hand tools or heavy equipment, when needed..
	●	Natural structures (boulders, logs, stumps, etc.).
	●	Cable for securing some structures.
	●	Rebar.

Installation

- <u>Channel Block:</u> Log or log and crib structures installed across stream meanders and oxbows to consolidate braided channels. Channel blocks create deeper channels conducive for larger fish. Blocks should be placed at the lower end of the flood channel as well as the upper end to prevent head cutting.

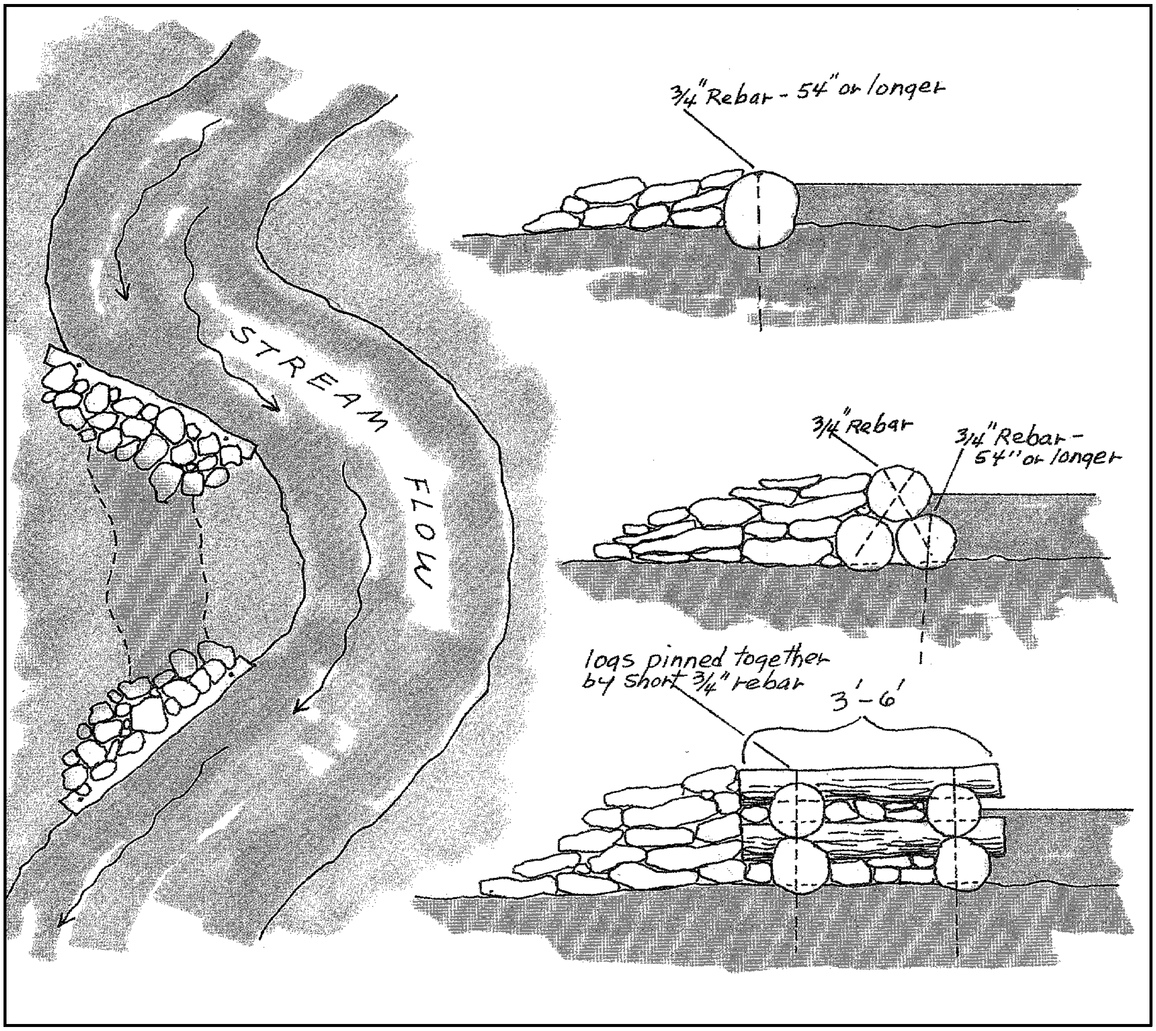

Exhibit 1202b: Channel blocks (Source: Forest Service Habitat Improvement Handbook)

- Boulder Placement: Boulders can be placed in most stream locations including riffles, runs, flats, glides, and open pools. Greatest benefits are likely to be achieved in currents > 2 ft/sec. Boulders provide overhead cover and resting pockets.

Exhibit 1202c: Boulder placement (Source: Forest Service Habitat Improvement Handbook)

- Cover Logs and Rootwads: These structures provide overhead cover where water depth may be adequate, but cover is lacking. Logs may be pinned into gravel channels with rebar. Rootwads (tree stumps with roots intact) are usually anchored to the bank so that the root mass is mostly submerged.

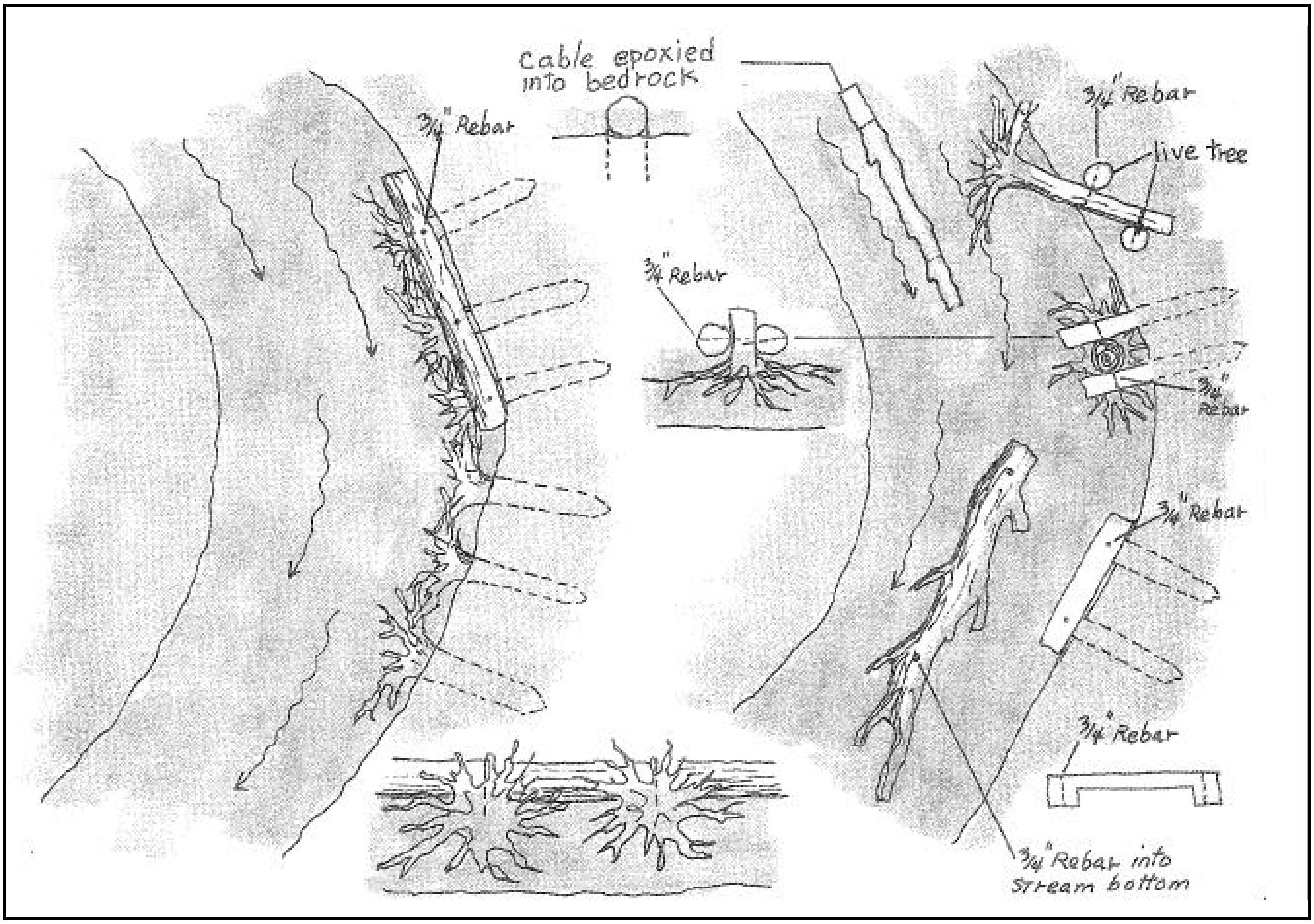

Exhibit 1202d: Cover logs and rootwads (Source: Forest Service Habitat Improvement Handbook)

- Tree Cover: Trees felled so that the tops of the trees are in the channel provide cover and structure for fish and other aquatic organisms. Trees can also be placed along the banks and serve as revetments (Practice 504). Felled trees should be sufficiently anchored to avoid creating flow-impeding obstructions downstream.

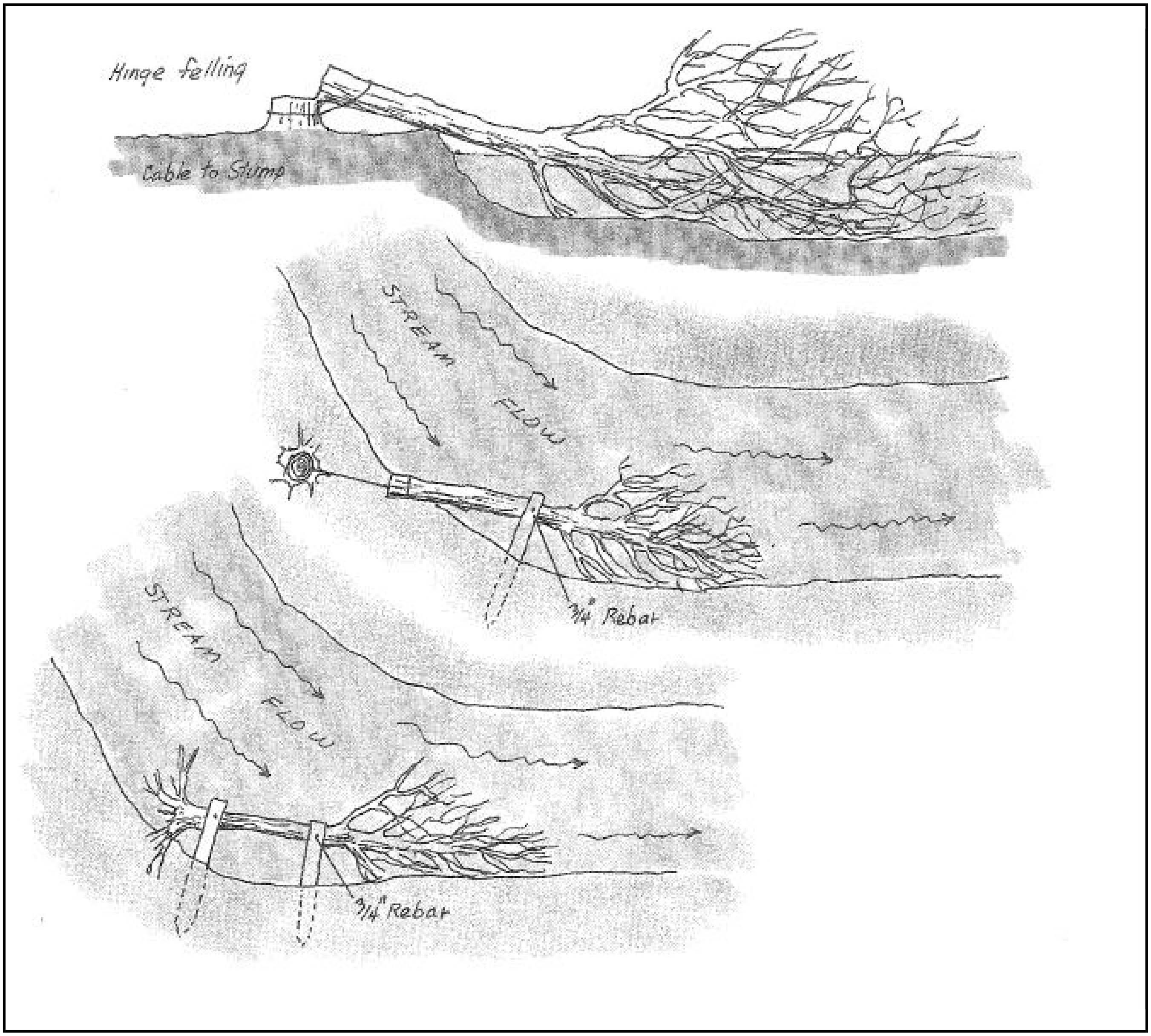

Exhibit 1202e: Tree Cover (Source: Forest Service Habitat Improvement Handbook)

- Wing Deflectors: Log and stone structures that constrict and divert water flow so that stream meanders and pools are formed by scouring and relocation of fine sediment. Wing deflectors should be placed so that water is diverted toward a stable section of the streambank. The main deflector log should be placed at a 35 degree angle from the streambank, and supported with a downstream brace log.

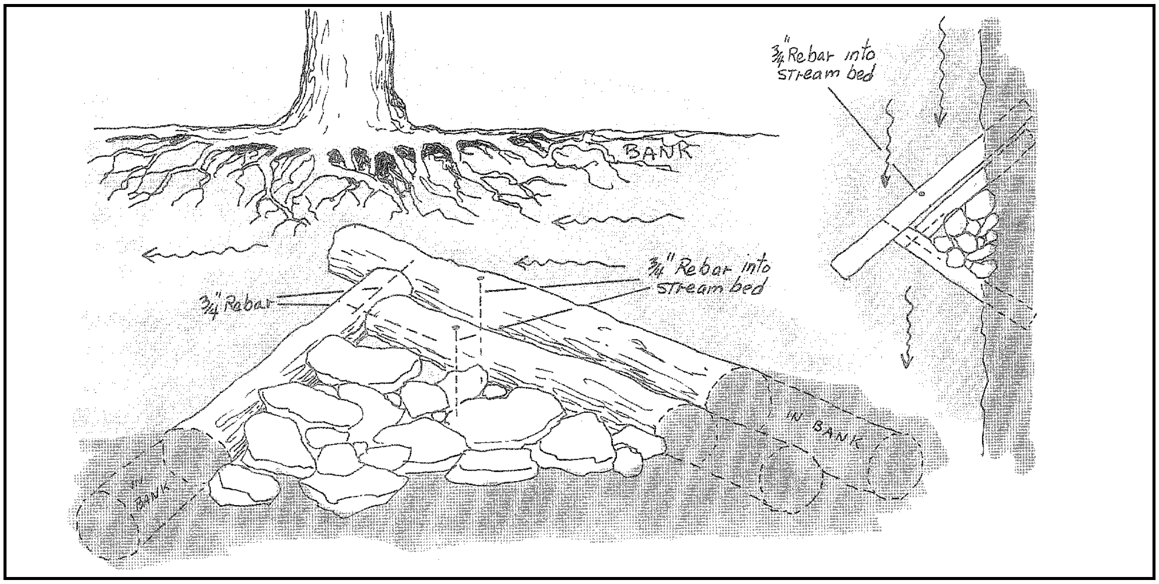

Exhibit 1202f: Single-wing deflector (Source: Forest Service Habitat Improvement Handbook)

- Rock Current Deflectors: Rock current deflectors constrict flow to create artificial pool-riffle sequences. Riprap is dumped or hand-placed as two facing triangles with their bases at each channel bank. To be effective, several sets of rock deflectors should be placed along a stream reach far enough apart, usually five to seven stream widths, to allow a pool-riffle sequence to develop. The structures should not be so high as to block flood flows.

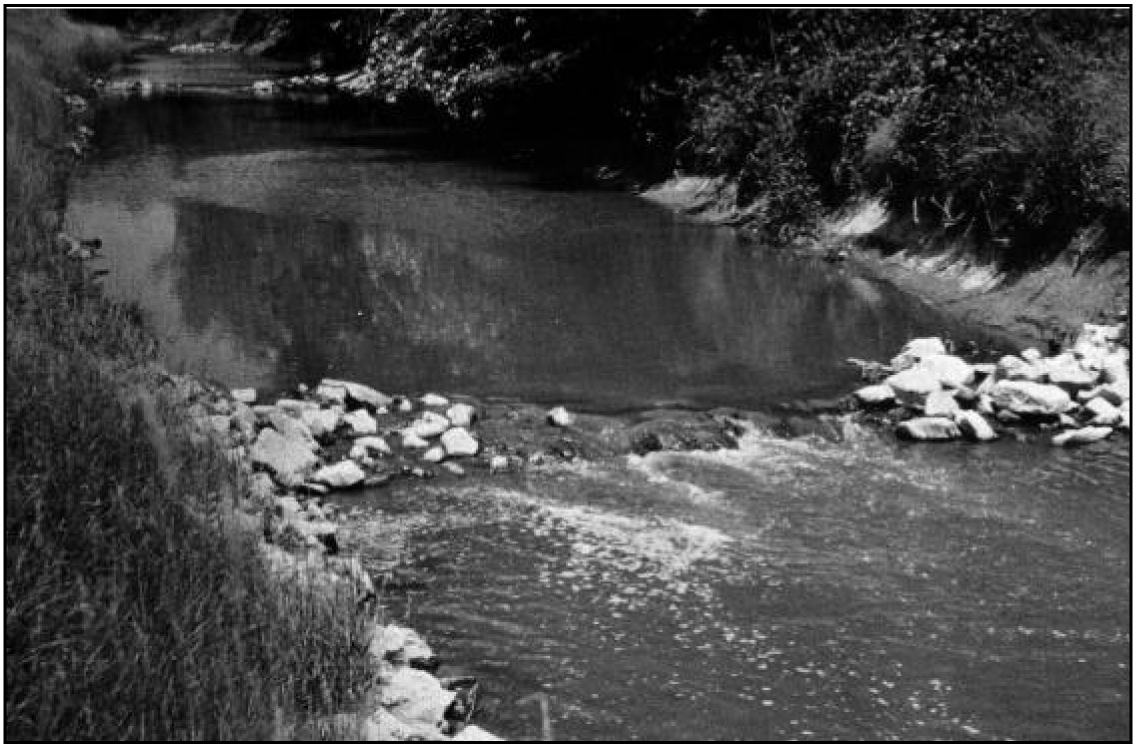

Exhibit 1202g: Rock current deflector (Source: Ohio Stream Management Guide)

Special Considerations

- Care should be taken that in-stream structures do not cause upstream flooding or downstream erosion.
- Instream structures may not be appropriate in channels with unstable banks.
- Placing obstructions in channel may not be appropriate for single-purpose, man-made drainage ditches.
- Many of these structures may be incorporated with bioengineering techniques for eroded streambank repair (Practices 501, 502, 503 504, 505, 506, 507 , 508, 509, 510).

MAINTENANCE

- Inspect periodically, and especially after flood events.
- Repair as necessary.

REFERENCES

Related Practices

- Activity 5.5 Eroded Streambank Repair.
- Practice 1203 Log Check Dams.

Other Sources of Information

- Forest Service Habitat Improvement Handbook.
- Ohio Stream Management Guide.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 1203
LOG CHECK DAMS

DESCRIPTION ● Log and/or rock structures placed across channels to create pools.

Exhibit 1203a: Log Check Dams (Source: Forest Service Habitat Improvement Handbook)

PURPOSE	●	To create pool habitat for fish.
	●	To trap organic debris used for food by aquatic invertebrates.
	●	To slow water thereby reducing erosional forces.
WHERE APPLICABLE	●	Steep gradient channels less than 30' wide.
	●	Channels with well defined banks.
ADVANTAGES	●	Create deep, downstream pools through scouring.
	●	Create quiet water upstream of the dam.
	●	Dams produce more dramatic changes than other stream enhancement techniques (Practice 1202).
CONSTRAINTS	●	Log Check dams are more expensive to install than other enhancement techniques.
	●	Log Check dams are higher maintenance than other techniques.
DESIGN AND CONSTRUCTION GUIDELINES	**Materials**	
	●	Logs > 10" in diameter (the larger the better).
	●	Rebar.

T.O.C.

- Hogwire.

Installation

Wedge Dam

- Wedge dams are best suited in channels where there is a break in gradient with a steeper section immediately upstream.
- The two main logs in the dam should face upstream at a 45-degree angle to stream flow with the two brace logs pinned to the main logs at about a 90 degree angle. The butts of the two main logs should extend into the streambank 3'-6'. There should be a 6"-12" drop from the top of the check dam to the water. Once the logs are in place, attach the howgwire to the upperside of the log so that it extends upstream. Put a layer of gravel or flat stones on top of the wire.

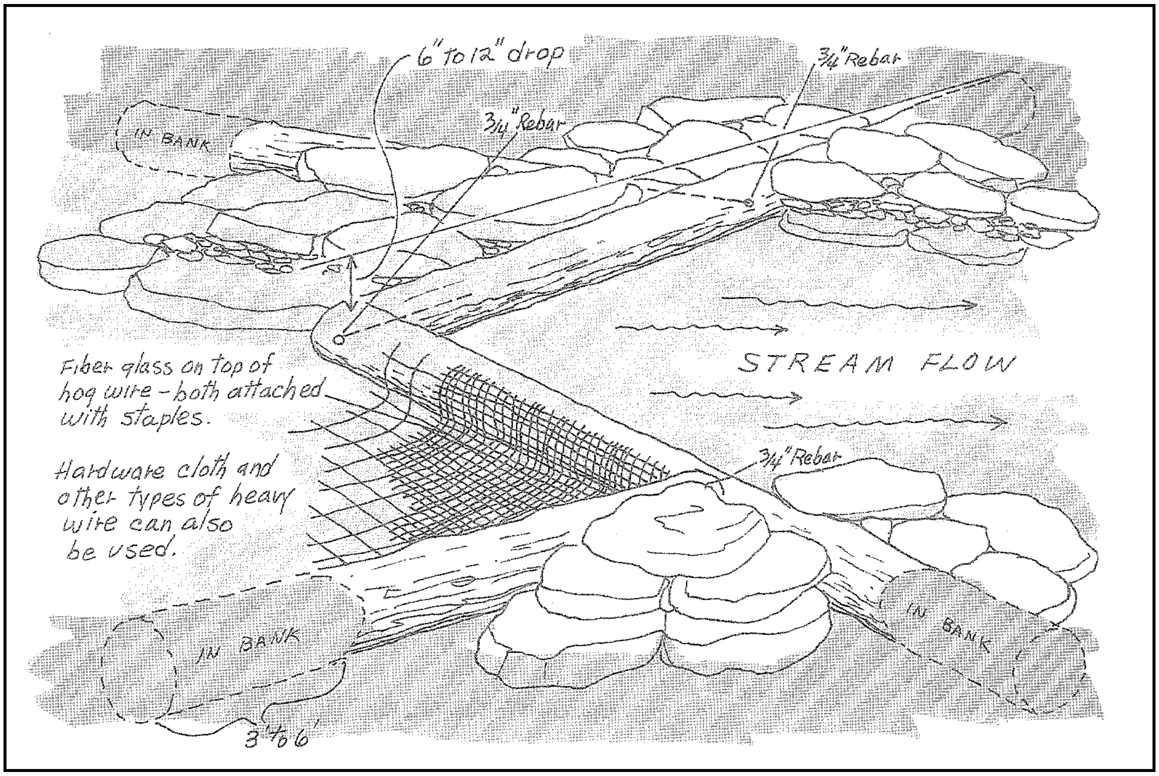

Exhibit 1203b: Wedge dam (Source: Forest Service Habitat Improvement Handbook)

K Dam

- K Dams are best suited for streams < 15' wide. Use one log (≥ 16") to span the entire length of the stream. Attach braces to the main log at about an 45 degree angle. Cut a spillway into the main log to concentrate flow to the center of the stream. Attach hardware cloth to the main log as described above.

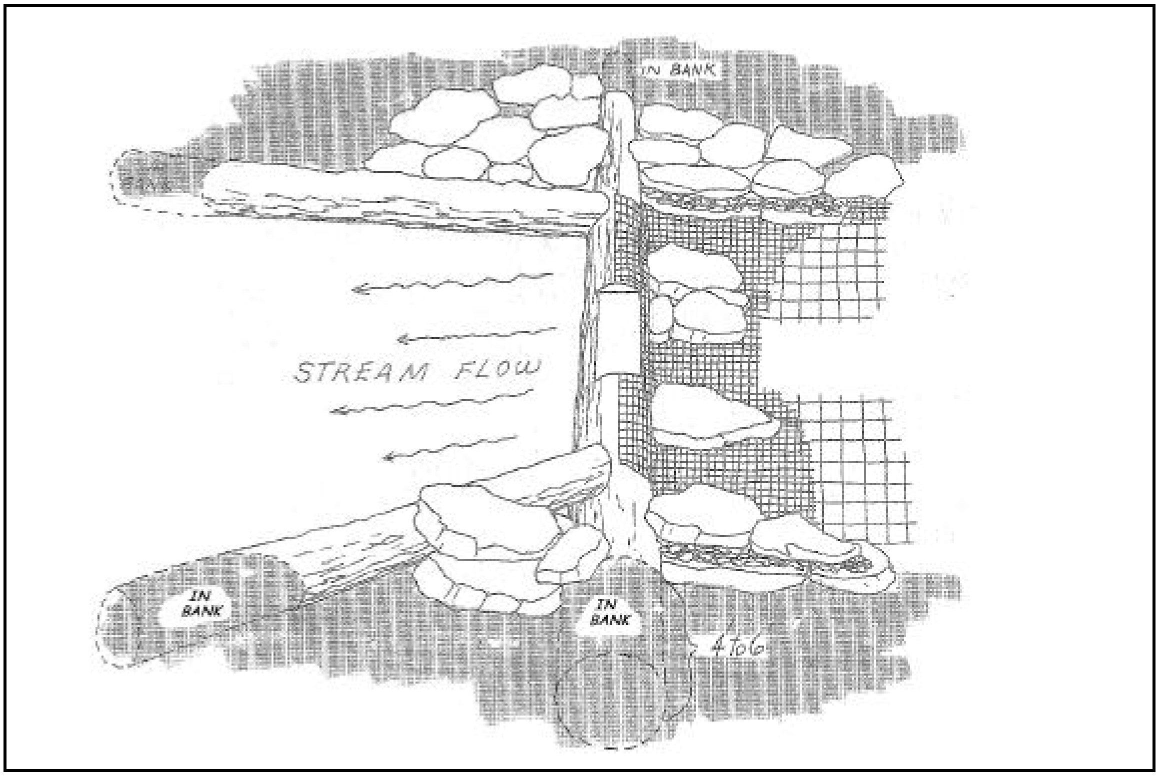

Exhibit 1203c: K-dam (Source: Forest Service Habitat Improvement Handbook)

Special Considerations

- Washing underneath check dams is the most common failure.
- Wedge dams are suitable for streams less than 30' wide. K dams should be used on streams less than 15' wide.
- K dams create larger and deeper pools than wedge dams; however, maintenance is higher with K dams.
- K dams are more difficult to install than wedge dams because greater excavation is needed to anchor the main log.

MAINTENANCE

- Monitor for under washing and repair as necessary.

REFERENCES

Related Practices

- Practice 1202 Stream Environment Enhancement.

Other Sources of Information

- Forest Service Habitat Improvement Handbook.

Last Print/Revision Date: October 13, 1996

T.O.C.

PRACTICE 1204
TREE REPLACEMENT

DESCRIPTION	●	Planting trees as an enhancement measure or to compensate for trees lost as a result of a drainage improvement activity.

Exhibit 1204a: Tree Replacement/Planting (Source: North Carolina Erosion Control Manual)

PURPOSE	●	Compensating for trees lost during a drainage improvement activity.
	●	To stabilize the soil, to provide food and shelter for wildlife, and to provide windbreaks or screens.
WHERE APPLICABLE	●	Where tree planting or woodland corridors are called for as a part of a watershed management scheme.
	●	Projects with tree impacts, where trees do not interfere with regular maintenance activities. (Indiana Drainage Code prohibits the IDNR from requiring tree planting or retention within the easement of a regulated drain if certain conditions apply.)
ADVANTAGES	●	Stabilize the soil and prevent erosion.
	●	Reduce stormwater runoff by intercepting rainfall, promoting infiltration, and lowering the water table through transpiration.
	●	Provide wildlife habitat.
	●	Provide shade.
	●	Increase property values and improve site aesthetics.
CONSTRAINTS	●	May interfere with ditch maintenance activities.
	●	Is an added expense.
	●	Trees take years to establish.
	●	Until the trees become established, soil needs to be protected and stabilized in the area between immature trees by means of shrubs, vines, and other types of shade-tolerant ground covers.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Bare-root tree seedlings (small trees).
- Balled-and Burlapped or Container-Grown trees (large trees), with minimum soil ball size being 12 inches in diameter for each inch of trunk diameter..
- Ground cover species (Practice 1102).
- Mulch (Practice 1101).

Installation

Bare-root tree seedlings

- Bare-root seedlings should be handled only while dormant in late winter, early spring, or after leaf fall in autumn. Availability of stock usually limits planting to winter or spring.
- Store packages of seedlings in a shaded location out of the wind.
- If it is necessary to store moss-packed seedlings for more than two weeks, add one pint of water per package. Do not add water to clay-treated seedlings.
- Do not allow roots to dry out during planting by carrying seedlings exposed to air and sun. Keep moss-packed seedlings in a container packed with wet moss or filled with thick muddy water. Cover clay-treated seedlings with wet burlap.
- With a tree planting bar or spade, make a notch deep enough to accommodate the roots. Place the roots in the notch to the same depth as in the nursery, then firm soil around roots by pressing the notch closed (Exhibit 1204b).

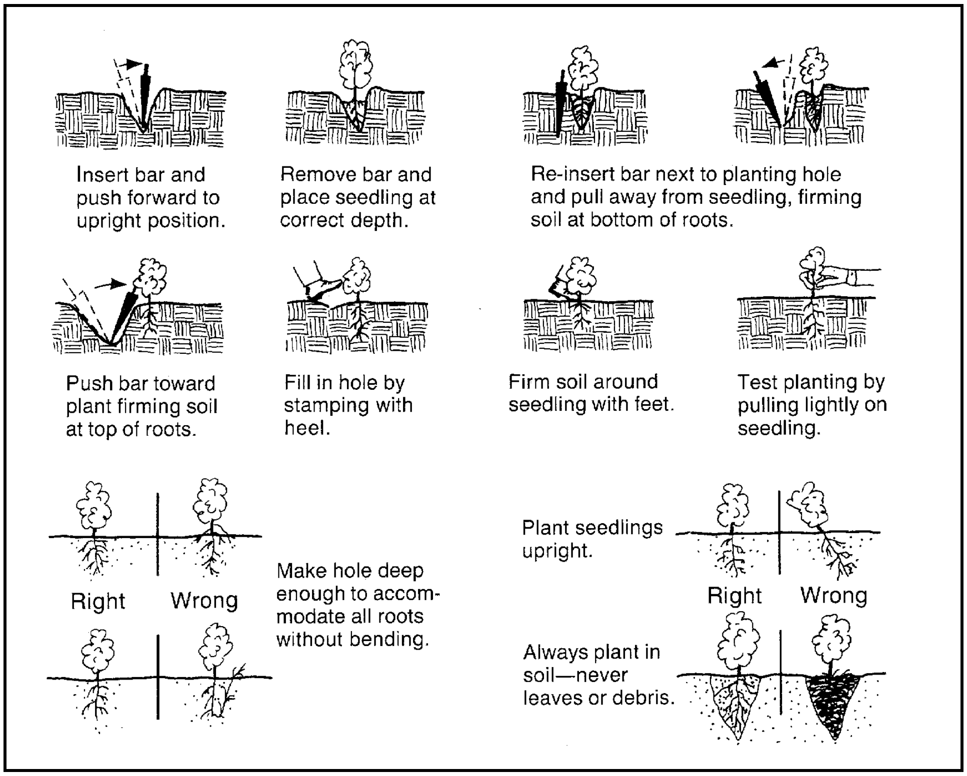

Exhibit 1204b: Planting bare-root seedlings (Source: North Carolina Erosion Control Manual)

- Water immediately and mulch the area within 2 ft of the plant.
- Several weeks after planting, broadcast a handful of 10-10-10 fertilizer around each plant, at least 1 ft from the base.
- On large sites where slopes are not prohibitive, bare-root seedlings can be efficiently planted in furrows using a tractor-drawn vegetable transplanter.

Balled-and Burlapped or Container-Grown trees

- Late fall (Nov. - Dec.) is the preferred planting time for deciduous trees and evergreens, although they may be planted year-round. Avoid summer planting.
- Keep the soil around the roots moist until planting.
- Branches should be bound with soft rope to prevent damage during transport.
- Each planting hole must be deep and wide enough to allow proper placement of the root ball. Ideally, the hole should be twice the size of the root ball. When digging the hole, keep topsoil separate from subsoil. If the subsoil is high in clay, allow extra room (one-half the height of the root ball). Backfill the hole with enough topsoil or peat moss to position the base of the tree at the same level as in the nursery (Exhibit 1204c).
- If the plant is in a container, carefully remove it, taking the soil surrounding the roots with it. This may require cutting the container. Loosen the twine and burlap at the top of balled-and-burlapped plants and check to make sure that no other wrapping is present before planting.
- Before replacing subsoil, mix it with one-third peat moss or well-rotted manure. Backfill the hole, firming the soil as it is replaced, and leave a depression around the trunk within the excavated area to hold water. Cover the base of the trunk to the same level as before it was removed.
- Water thoroughly and re-water as necessary to keep the roots moist.
- Stake small trees with vertical stakes driven into the ground, just beyond the root ball (Exhibit 1204c). Secure large trees with guy wires. Cushion wire, where it contacts the tree, with rubber hose. Wrap the trunks of young trees to protect them from sunburn and pests.

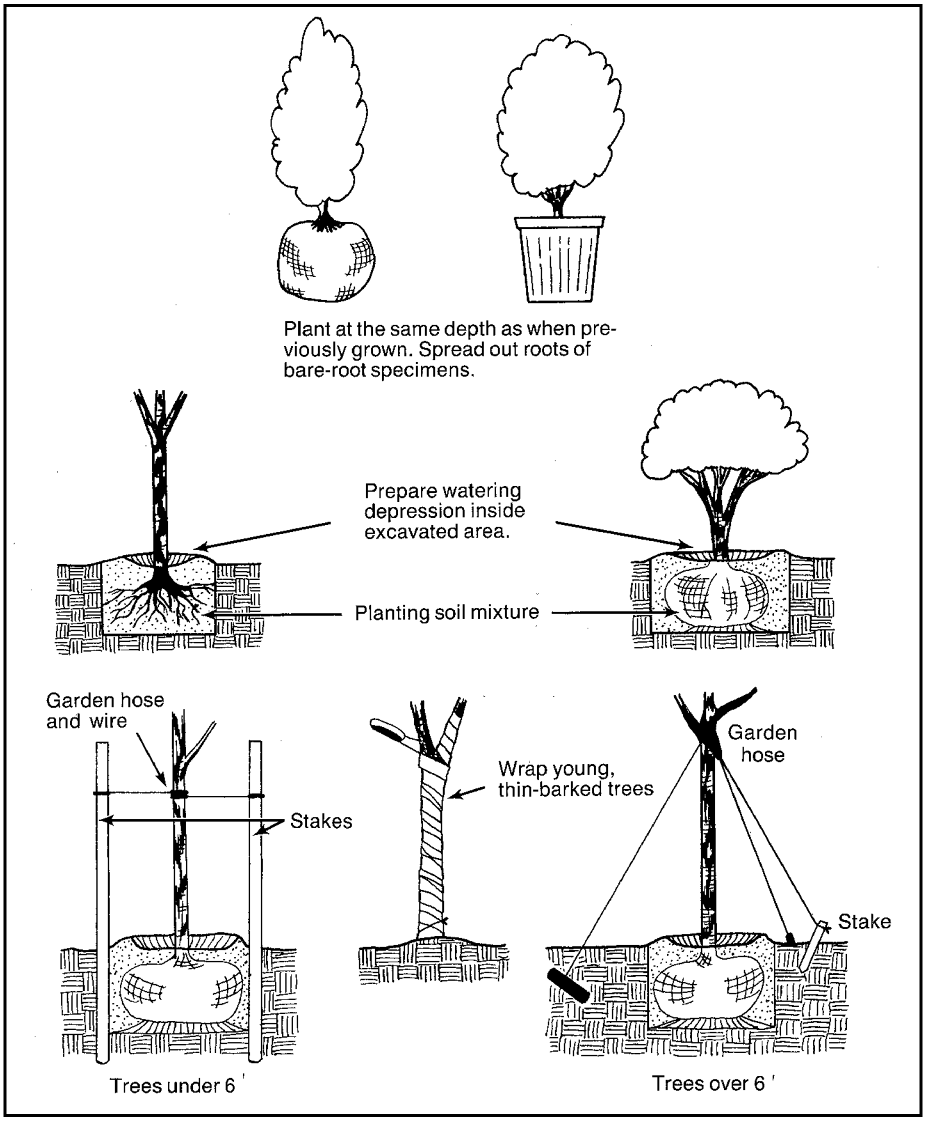

Exhibit 1204c: Planting balled and burlapped and container-grown trees (Source: North Carolina Erosion Control Manual)

Special Considerations

- Although trees are among the best soil stabilizers, years are required for the development of forest cover adequate to meet sedimentation control objectives. Efforts must first focus on establishing densely-growing species to stabilize the site and protect area between immature trees.

MAINTENANCE

- Fertilize trees in late fall or early spring (**before leaves emerge**). Using a punchbar, crowbar, or auger, make holes 18 inches deep and about 2 ft apart around the drip line of each tree. Distribute the fertilizer evenly among the holes to bring it in contact with tree roots, and close.
- Repair damaged roots by cutting off the damaged areas and painting with tree paint. Spread peat moss, wood chips or moist topsoil over exposed roots.
- Repair damage to bark by trimming around damaged areas. Taper the cut to provide drainage, and paint with tree paint.

- Cut all damaged limbs above the tree collar at the trunk or main branch. Use three separate cuts for each branch to avoid peeling bark from healthy areas of the tree.

REFERENCES

Related Practices

- Practice 102 Tree Preservation and Protection.
- Practice 1102 Vegetative Stabilization.
- Practice 1202 Stream Environment Enhancement.

Other Sources of Information

- North Carolina Erosion Control Manual.

Last Print/Revision Date: October 13, 1996

SECTION 5.13

OTHER RELATED PRACTICES

SECTION 5.13
OTHER RELATED PRACTICES

This section addresses debris disposal, permanent limited livestock access, and permanent maintenance access to streams and ditches.

Debris disposal involves the proper disposal and/or removal of debris and spoil from channels and overbank areas. All garbage and miscellaneous rubbish should be removed from the site and landfilled. Other debris may be dealt with on site as appropriate. Brush and small woody debris may be burned; logs and stumps should be removed from the floodplain, or cabled in a secure location; non-toxic debris such as broken concrete may be buried on site a minimum depth of 2'.

Free and unconfined access to streams/ditches by livestock cause erosion/siltation and degrade water quality and stream habitat. Permanent limited livestock access allows livestock to obtain water at streams or ditches, but only in very localized areas. Generally, the entire channel is fenced off except for a 12'-16' wide ramp which extends 2'-3' into the channel. The ramp is protected with riprap and gravel, and is fenced to keep livestock out of the main channel.

Permanent maintenance access deals with the construction and maintenance of grassed access roads along streams and ditches. Although it is regarded as an added expense, permanent maintenance access should be considered for sites and activities where regular maintenance is anticipated.

Last Print/Revision Date: October 13, 1996

PRACTICE 1301
DEBRIS DISPOSAL

DESCRIPTION
- Proper disposal of debris and spoil removed from channels and overbank areas.

Exhibit 1301a: Debris/Spoil Disposal(Source: Ohio Stream Management Guide)

PURPOSE
- To safely dispose of debris.
- To safely dispose of spoil material.
- To improve site aesthetics.

WHERE APPLICABLE
- Any drainage improvement project where debris is removed.
- Channel Excavation spoil disposal.

ADVANTAGES
- Prevents removed debris from becoming a problem in the future.
- Improves site aesthetics.
- After planting, the piled spoil provides a greater variety of wildlife habitat while also serving as a place of safety for animals during floods.

CONSTRAINTS
- May be expensive.
- May be difficult to find an appropriate disposal site.

DESIGN AND CONSTRUCTION GUIDELINES

Materials
- May need equipment to haul debris.
- May need cables to securely anchor woody debris.
- For spoil piles: Vegetative Stabilization (Practice 1102).

Installation
- Garbage and miscellaneous rubbish should be removed from the site and landfilled.
- Brush and small woody debris may be burned on site.
- Logs and stumps should be removed from the floodplain, or cabled in a secure location.

- Non-toxic debris such as broken concrete may be buried a minimum of 2' deep.
- Spoil material from channel excavation (Activity 5.6) may be piled in the floodplain but out of the floodway. When spread in wooded areas, care must be taken so that the spoil does not suffocate tree roots. Spoil piles should be planted to combinations of woody cover and wildlife meadow mixture vegetation (Practice 1102).

Special Considerations

- Logs and woody debris that have been removed from channel may be cabled in a secure location outside the floodway so that they do not impede flow even under flooded conditions.

MAINTENANCE

- Logs and woody debris cabled on site should be checked periodically.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Activity 5.3 Debrushing.
- Activity 5.4 Obstruction Removal/River Restoration.
- Activity 5.6 Channel Excavation/Dredging.

Other Sources of Information

- Illinois DOT Specifications.
- MRBC Obstruction Removal Program.
- Ohio Stream Management Guide.

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T.O.C.

PRACTICE 1302
PERMANENT LIMITED LIVESTOCK ACCESS

DESCRIPTION

- Creation of limited permanent access areas to streams and ditches for purposes of livestock watering.

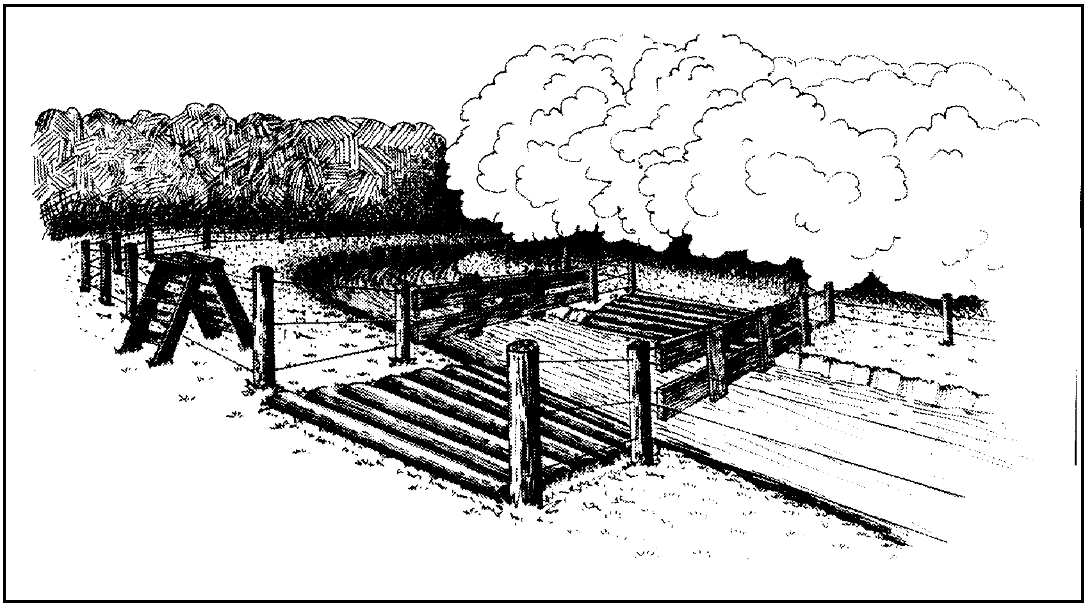

Exhibit 1302a: Permanent Limited Livestock Access (Source: Virginia Landowner's Guide)

PURPOSE

- To provide livestock with a watering area.
- To limit livestock access to streams and ditches to a confined area in order to minimize bank erosion.

WHERE APPLICABLE

- Any stream or ditch which is used for livestock watering or livestock crossing.

ADVANTAGES

- Reduces erosion along channel caused by livestock.
- Provides watering area for livestock while minimizing erosion.
- Improves water quality and habitat by allowing vegetation to become established along the shore, thus creating a buffer to filter runoff.

CONSTRAINTS

- Added expense.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Barbed wire and fence posts.
- Geotextile fabric.
- Riprap.
- Road gravel.
- Screenings.
- Seed mix.

Installation

<u>Recessed Limited Access</u> (Exhibit 1302b, Exhibit 1302d)

- Excavate 12'-16' of the stream or ditch bank back $\pm$ 6'.

- Grade the watering ramp so that the ramp slope does not exceed 4:1(1V:4H). Ramp and channel sideslopes should not exceed 2:1(1V:2H).
- Install geotextile fabric from the top of the ramp to 2'-3' (or as far as necessary for livestock to get to the water) into the recessed area. Install a 6"-8" layer of riprap over the fabric. Place 6" of road gravel over the riprap. Cap the road gravel with 2" of screenings.
- Re-seed (Practice 1102) all areas disturbed during construction that are not protected with riprap and gravel. Use erosion control blankets when slopes are steeper than 3:1 (1V:3H).
- Install barbed wire fence along both sides of the watering ramp, and across the bottom of the ramp. The fence should only go as far down into the recessed area as necessary for livestock to obtain water.

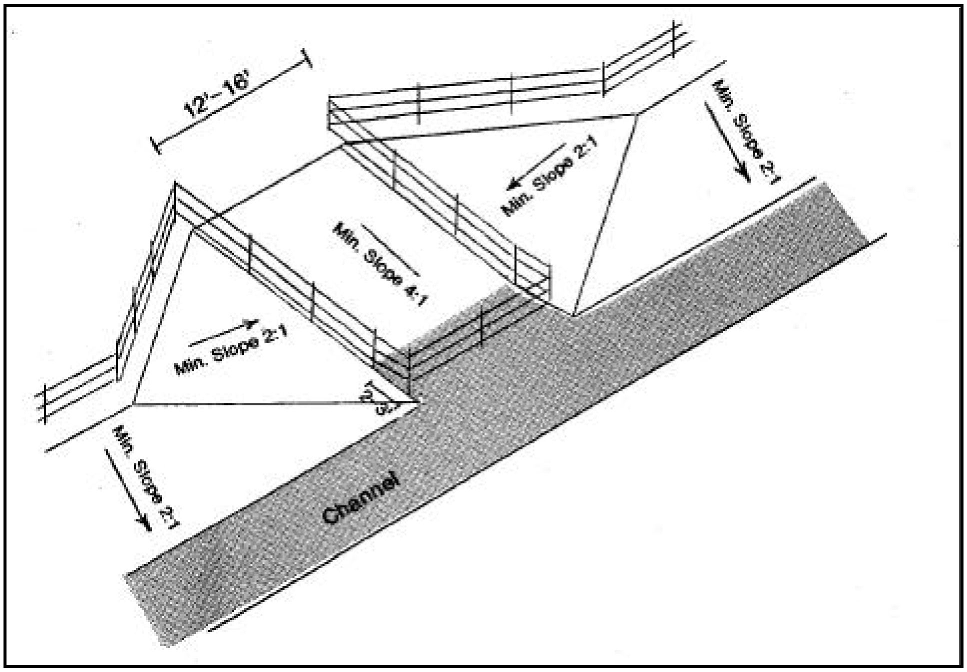

Exhibit 1302b: Recessed, permanent limited livestock access (Source: CBBEL Files)

Non-recessed Limited Access (1302c, Exhibit 1302d)

- Grade and armor the watering ramp as described above.
- Re-seed (Practice 1102) all areas disturbed during construction that are not protected with riprap and gravel. Use erosion control blankets when slopes are steeper than 3:1 (1V:3H).
- Install barbed wire fence along both sides of the watering ramp, and across the bottom of the ramp. The fence should only go as far into the channel as necessary for livestock to obtain water.

T.O.C.

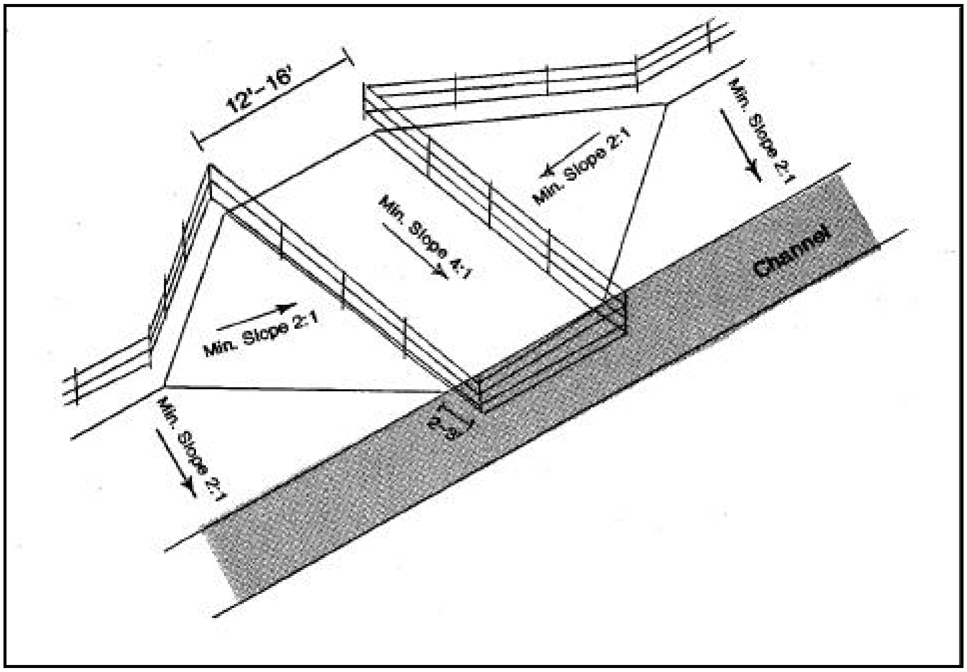

Exhibit 1302c: Non-recessed, permanent limited livestock access (Source: CBBEL Files)

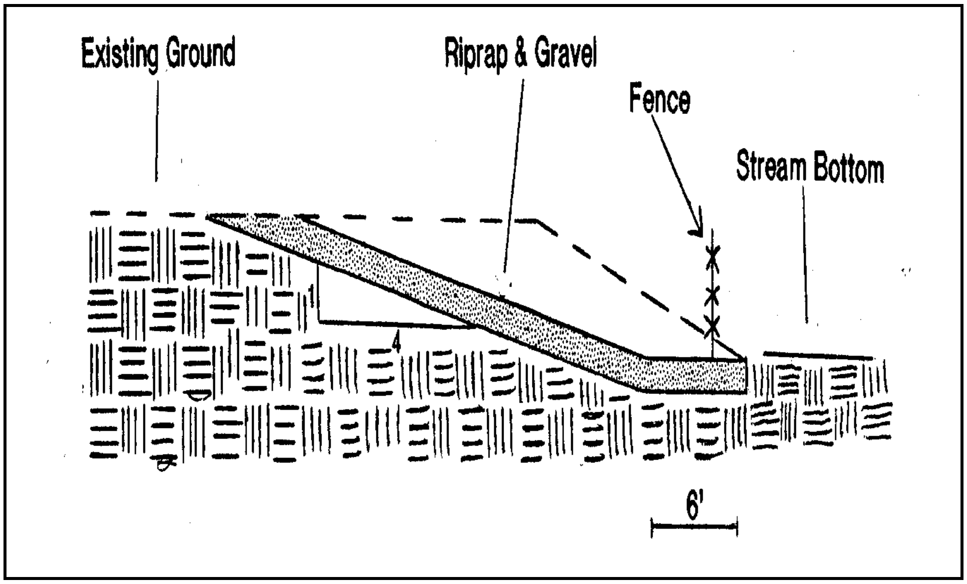

Exhibit 1302d: Typical cross section of permanent, limited livestock access (Source: CBBEL Files)

Special Considerations

- Recessed access is recommended over direct stream or ditch access in most cases.

MAINTENANCE

- Monitor water ramp and sideslopes for erosion, especially after flood events, and repair as necessary.
- Apply additional riprap and gravel as necessary.

REFERENCES

Related Practices

- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- NRCS Files
- Virginia Landowner's Guide

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T.O.C.

PRACTICE 1303
PERMANENT MAINTENANCE ACCESS

DESCRIPTION

- Creation of a permanent, passable maintenance access road adjacent to a channel which is designed to minimize erosion, and has positive drainage.

Exhibit 1303a: Permanent Maintenance Access (Source: Allen County Surveyor's Office Files)

PURPOSE

- Reduce erosion along streams and ditches caused by vehicles.
- Provide permanent vehicular access for routine maintenance activities.

WHERE APPLICABLE

- Applicable for projects where long term maintenance access is required along a channel.

ADVANTAGES

- Allows permanent vehicular access without causing erosion.
- Provides for drainage under access road while minimizing erosion.

CONSTRAINTS

- Wooded easements must be cleared and grubbed (Practice 107).
- Added expense.
- Erosion must be kept in check during plant establishment.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Fill material may be necessary.
- Corrugated, 24' long, 12" diameter PVC or PE pipe with watertight joints.
- Riprap.
- Granular fill (gravel $\leq$ 1" in diameter).
- Seed mix.

Installation

Wooded Easements

- Verify that no wetlands will be impacted.
- Clear and grub (practice 107) access area at least 15' wide, plus area needed for piling spoil.
- Grade a 15' easement along the channel. The finished grade elevation should be no more than 0.5' above pre-construction ground elevation. The easement should slope toward the channel at a 6% grade (Exhibit 1303b, 1303c).
- Spoil should be graded into a berm between the easement and the woods.
- A berm drain should be installed between any breaks in the berm (Exhibit 1303d).
- Seed disturbed area (Practice 1102).

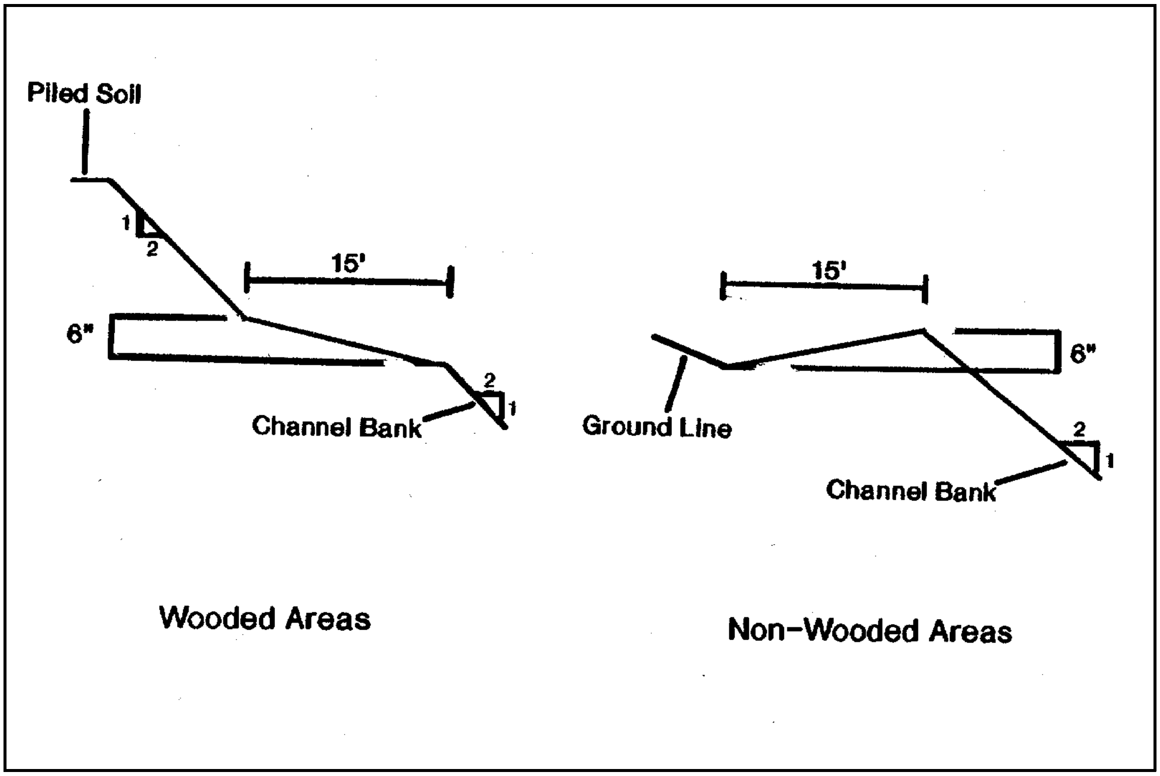

Exhibit 1303b: Berm grading details (Source: CBBEL Files)

T.O.C.

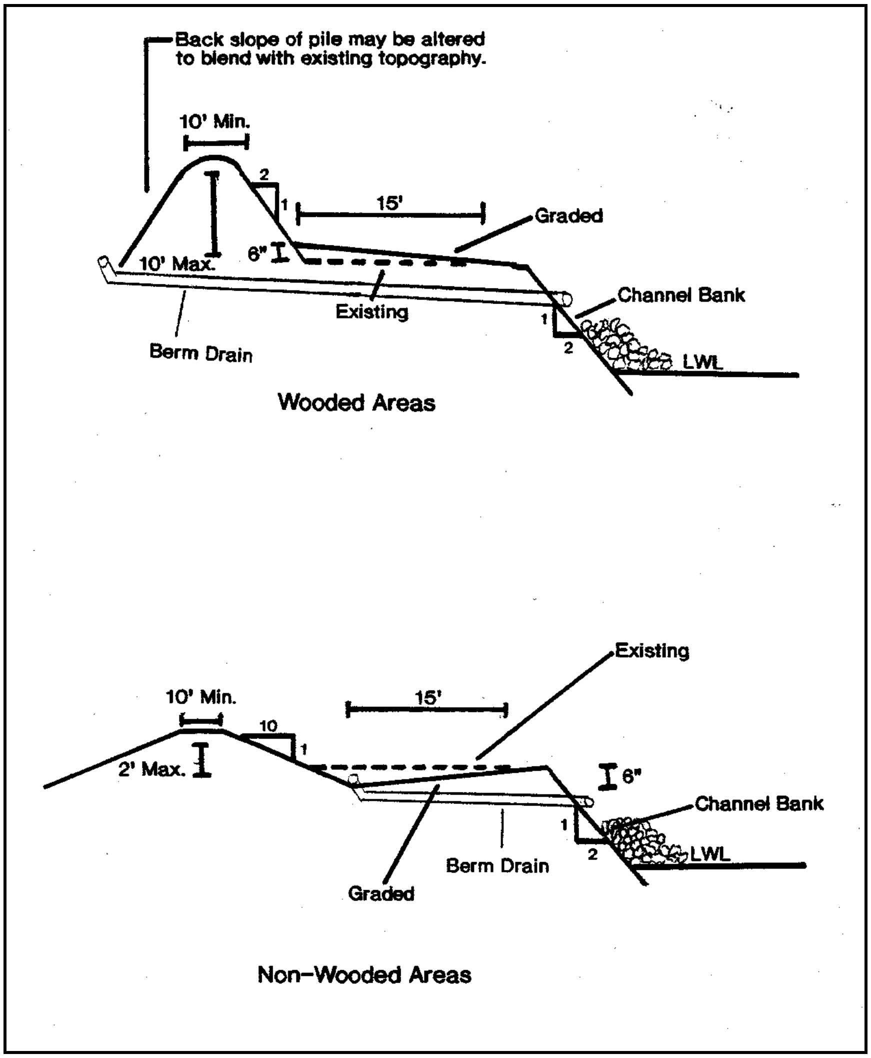

Exhibit 1303c: Grading and access road details (Source: CBBEL Files)

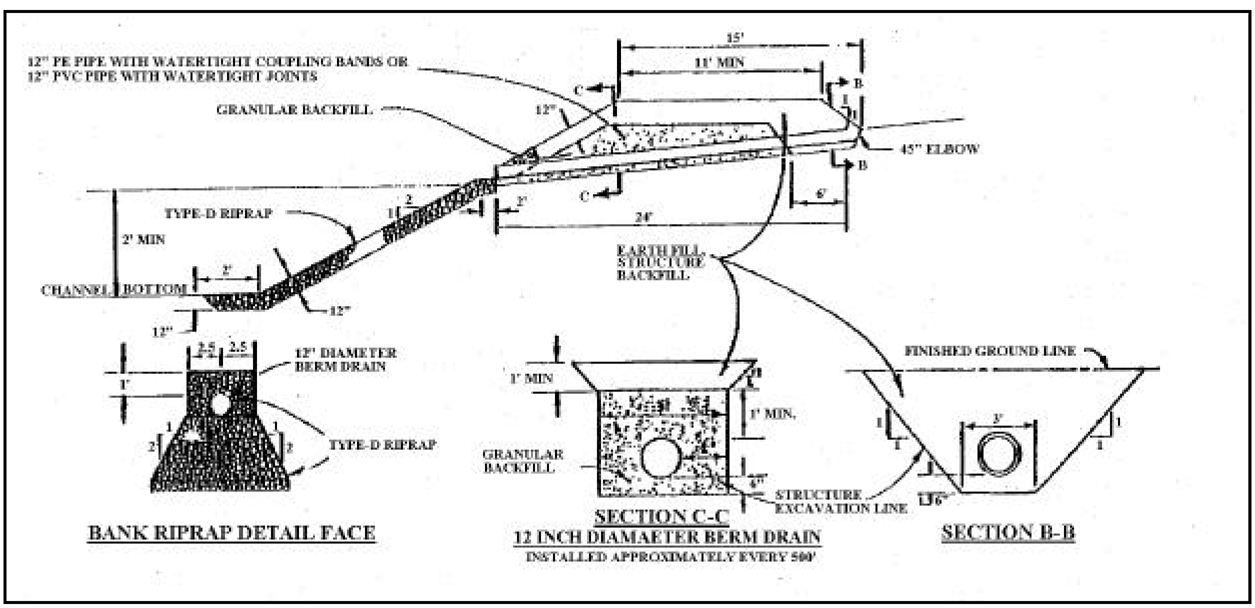

Exhibit 1303d: Berm drain details (Source: NRCS Files)

Non-Wooded Easements

- Verify that no wetlands will be impacted.
- Grade at least a 15' wide access area along the channel. The finished grade should be no more than 0.5' above pre-construction ground elevation. The easement should slope away from the channel at a 6% grade (Exhibit 1303b, Exhibit 1303c).
- Spoil may be graded into the adjacent field creating a low berm for positive drainage.
- Berm drains should be installed at least every 500' (Exhibit 1303d).
- Seed disturbed area (Practice 1102).

Installing Berm Drains

- 12" diameter berm drains should be installed at least every 500' (Exhibit 1303d).
- Drains should be trenched beneath the easement and filled with granular backfill.
- Inlet elevations should be established by providing 0.2% minimum grade from the low ground behind the spoil to the berm drain inlet.
- A 45 degree elbow should be attached to the inlet of the drain.
- Outfall area should be protected with riprap.

Special Considerations

- Where possible, access roads should be located on non-wooded sides of a channel.

MAINTENANCE

- Periodically check access road, and berm drain inlets and outlets for erosion, especially during plant establishment.

REFERENCES

Related Practices

- Practice 102 Tree Preservation and Protection.
- Practice 103 Temporary Wetland Crossing.
- Practice 107 Clearing and Grubbing.
- Practice 1102 Vegetative Stabilization.
- Activity 5.10 Outlet Protection.

Other Sources of Information

- NRCS Files.

Last Print/Revision Date: October 13, 1996

SECTION 6

REFERENCES

SECTION 6
REFERENCES

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  Maryland Department of Transportation
  State Highway Administration
  P.O.Box 719
  Baltimore, Maryland 21203-0717
  Telephone: (410) 333-1331

- **American Fisheries Society Obstruction Removal Guideline**

  Stream Obstruction Removal Guidelines, 1983.
  American Fisheries Society
  5410 Grosvenor Lane
  Bethesda, MD 20814
  Telephone: (301) 897-8616

- **ASCE Urban Stormwater Manual**

  Design and Construction of Urban Stormwater Management Systems, 1992.
  American Society of Civil Engineers
  345 East 47th Street
  New York, NY 10017-2398

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  Telephone: (301) 322 -4961

- **Bulkheads and Seawalls**

  Breachwaters, Jetties, Bulkheads and Seawalls. 1992
  Pile Buck, Inc.
  P. O. Box 1056
  Jupiter, Florida 33468-1056
  Telephone: (407) 744-8780

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  Christopher B. Burke Engineering, Ltd.
  National City Center, Suite 1368 South
  115 West Washington Street
  Indianapolis, IN 46204
  Telephone: (317) 266-8000

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  DuPage County Stormwater Management Division
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  DuPage County Center
  421 North County Farm Road
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  Institute for Water Resources, Casey Building
  Ft. Belvoir, VA 22060

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  Sheehorn, E. Monty.
  USDA Forest Service
  Southern Region
  1720 Peachtree Road, N.W.
  Atlanta, Georgia 30367-9102
  (Technical Publication R8-TP 16)
  Telephone: (404) 347-2384

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  Purdue University
  1284 Civil Engineering Building
  West Lafayette, IN 47907-1284
  Telephone: (317) 496-1176

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  2300 S. Dirksen
  Springfield, IL 62701
  Telephone: (217) 782-7820

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  P.O.Box 19281
  Springfield, IL 62794
  Telephone: (217) 785-2427

- **Illinois State Water Survey Publication**

  Illinois State Water Survey Miscellaneous Publication 149.
  Illinois State Water Survey
  2204 Griffith Drive
  Champaign, IL 61820
  Telephone: (708) 682-7130

- **Illinois Stormwater Management BMPs**

  Urban Stormwater Best Management Practices for Northeastern Illinois, 1993.
  Northeastern Illinois Planning Commission, Chicago, IL.
  222 South Riverside Plaza, Suite 1800
  Chicago, IL 60606
  Telephone: (312) 454-0400

- **Illinois Urban Manual**

  Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement. 1995
  United States Department of Agriculture
  Natural Resources Conservation Service
  1902 Fox Drive
  Champaign, IL 61820
  Telephone: (217) 398-5265

- **Illinois Vegetation Manual**

  Illinois Nature Preserves Commission Vegetation Manual.
  Illinois Nature Preserve Commission
  524 South 2nd
  Springfield, IL 62701-1787
  Telephone (217) 785-8686

- **Indiana Erosion Control Handbook**

  Indiana Handbook for Erosion Control on Developing Areas: Guidelines for Protecting Water Quality Through the Control of Soil Erosion and Sedimentation on Construction Sites.
  Urban Conservation Program
  Division of Soil Conservation
  Indiana Department of Natural Resources
  402 West Washington Street, Room S-265
  Indianapolis, IN 46204-2748
  Telephone: (317) 233-3870

- **Iowa Streambank Erosion Control**

  How to Control Streambank Erosion. 1987.
  Iowa Department of Natural Resources
  Soil Conservation Service
  U.S. Department of Agriculture
  Wallace, State Building
  900 East Grand
  Des Moines, Iowa 50319-0034
  Telephone: (515) 281-8693

- **IWL Streambank Protection Methods**

  Save Our Streambanks: A Survey of Methods. 1989.
  The Isaak Walton League of America
  1401 Wilson Blvd, Level B
  Arlington, VA 22209
  Telephone: (703) 715-6644

- **Land and Water Magazine**

  Land and Water, July/August 1995
  Land and Water Inc
  900 Central Ave, Suite 21
  P.O.Box 1197
  Fort Dodge, Iowa 50500-9925
  Telephone: (515) 576-3191

- **Maccaferri Gabions, Inc. Technical Handbooks**

  Maccaferri Gabions, Inc. Technical Handbooks.
  Maccaferri Gabions, Inc.
  111 South Bemiston Ave., Suite 517
  St. Louis, MO 63105
  Telephone: (314) 725-2477

- **Manual of Bridge Design**

  Manual of Bridge Design, 3rd Ed., 1971
  California Department of Transportation
  Office of Procurement, Document Section
  P.O.Box 20191
  Sacramento, CA 95820
  Telephone: (916) 574-2200

- **Maumee Master Plan**

  Maumee River Basin Flood Control Master Plan. 1995
  Christopher B. Burke Engineering, Ltd. for Maumee River Basin Commission
  Maumee River Basin Commission
  Room B-80
  City-County Building
  Fort Wayne, IN 46802
  Telephone: (219) 449-7226

- **Metropolitan Washington Council Site Planning**

  Site Planning for Urban Stream Protection, 1995.
  Metropolitan Washington Council of Governments
  777 N. Capitol Street, N.E., Suite 300
  Washington, D.C. 20002-4201
  Telephone: (202) 962-3200

- **Metropolitan Washington Council Watershed Sourcebook**

  Watershed Restoration Source Book.
  Anacosta Restoration Team, Department of Environmental Programs, Metropolitan Washington Council of Governments Collected Papers
  Metropolitan Information Center
  Metropolitan Washington Council of Governments
  777 N. Capitol Street, N.E., Suite 300
  Washington, D.C. 20002-4201
  Telephone: (202) 962-3200

- **Missouri Tree Revetments**

  Tree Revetments for Streambank Stabilization
  Missouri Department of Conservation
  Division of Fisheries
  P.O. Box 180
  Jefferson City, MO 65102
  Telephone: (314) 751-8115

- **MRBC Obstruction Removal Program**

  Stream Obstruction Removal Assistance Program. 1996
  Christopher B. Burke Engineering, Ltd. for Maumee River Basin Commission
  Maumee River Basin Commission
  Room B-80
  City-County Building
  Fort Wayne, IN 46802
  Telephone: (219) 449-7226

- **North Carolina Erosion Control Manual**

  Erosion and Sediment Control Planning/Design Manual and Field Manual.
  Land Quality Section
  North Carolina Department of Environmental Health and Natural Resources
  P.O. Box 27687
  Raleigh, NC 27611
  Telephone: (303) 879-3010

- **North Central Forest Experimental Station Notes**

  North Central Forest Experimental Station Central Hardwood Notes 6.10: Individual Tree Control.
  Department of Forestry and Natural Resources
  Purdue University
  West Lafayette, Indiana 46360
  Telephone: (317) 494-3586

- **NRCS Engineering Field Handbook**

  Natural Resources Conservation Service, Engineering Field Handbook, Rev. June, 1993
  United States Department of Agriculture
  Natural Resources Conservation Service
  6013 Lakeside Boulevard
  Indianapolis, IN 46278
  Telephone: (317) 290-3217

- **NRCS Files**

  Articles, writings, pictures, slides, and other data obtained from various Natural Resource Conservation Service offices, but not necessarily part of a handbook or manual.
  U.S. Department of Agriculture
  Natural Resources Conservation Service
  6013 Lakeside Boulevard
  Indianapolis, IN 46278
  Telephone: (317) 290-3217

- **NRCS National Engineering Handbook**

  Natural Resources Conservation Service, National Engineering Handbook
  United States Department of Agriculture
  Natural Resources Conservation Service
  6013 Lakeside Boulevard
  Indianapolis, IN 46278
  Telephone: (317) 290-3217

- **NRCS Standard Specifications**

  Natural Resources Conservation Service Technical Guide, Section 4: Standard Specifications.
  United States Department of Agriculture
  National Resource Conservation Service
  6013 Lakeside Boulevard
  Indianapolis, IN 46278
  Telephone: (317) 290-3217

- **Ohio Stream Management Guide**

  Ohio Stream Management Guide, 1986.
  Ohio Department of Natural Resources
  1939 Fountain Square Ct.
  Columbus, Ohio 43224
  (614) 265 - 6610

- **Pennsylvania Streambank Stabilization Guide**

  Streambank Stabilization and Management Guide for Pennsylvania Landowners, 1986.
  Commonwealth of Pennsylvania
  State Bookstore
  P.O. Box 1365
  Harrisburg, PA 17105
  Telephone: (717) 787-2121

- **Soil Bioengineering Strategies**

  Soil Bioengineering Streambank Strategies. 1991
  Robbin B. Sotir and Associates
  627 Cherokee Street, Suite 111
  Marietta, Georgia 30060
  Telephone: (770) 424-0719

- **South Carolina Developer's Handbook**

  South Carolina's Developer's Handbook for Freshwater Wetlands, 1995
  South Carolina Department of Health and Environmental Control & U.S. Army Corps of Engineers
  South Carolina Department of Health and Environmental Control
  Office of Ocean and Coastal Resource Management
  4130 Faber Place, Suite 300
  Charleston, SC 29201
  Telephone: (803) 744-5638

- **Teng Foundation Design**

  Foundation Design. 1962.
  Teng, C. Wayne.
  Prentice-Hall, Inc.
  Englewood Cliffs, New Jersey

- **Tennessee Riparian Restoration Handbook**

  Riparian Restoration and Streamside and Erosion Control Handbook, 1994.
  Tennessee Department of Environment and Conservation
  EEO/AA/ADA Coordinator
  401 Church Street, 21st Floor
  Nashville, TN 37243
  Telephone: (615) 532-0103

- **Urban Development Planning Guide**

  Urban Development Planning Guide, Third Edition.
  The Hoosier Heartland Resource Conservation and Development Council, Inc.
  5995 Lakeside Blvd., Suite B
  Indianapolis, Indiana 46278
  Telephone: (317) 290-3250

- **Urban Surface Water Management**

  Urban Surface Water Management, 1989
  Stuart G. Walesh, Valporaiso University
  John Wiley & Sons, Inc.
  New York

- **Watershed Council Shoreline Erosion Guidebook**

  Understanding, Living With and Controlling Shoreline Erosion: A Guidebook for Shoreline Property Owners, 1995.
  Tip of the Mitt Watershed Council
  P.O. Box 300
  Conway, MI 49722
  Telephone: (616) 347-1181

- **Weyerhaeuser Products Brochure**

  Weyerhaeuser Engineered Fiber Products Brochure
  Weyerhaeuser
  7001 396th SE
  Snoqualmie, Washington 98065
  Telephone: (800) 443-9179

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APPENDIX A

Glossary of Terms

GLOSSARY OF TERMS

For the purpose of this Handbook, the following definitions and abbreviations shall apply. Although all of the definitions and abbreviations listed below may have not been used in this Handbook, the additional terminology is provided to assist the user of Handbook in understanding technical terminology associated with Drainage Improvement Projects and the associated regulations. Program-specific terms have been defined separately for each program and are contained in pertinent sub-sections of Section 2 of this handbook.

ACRONYMS

ASTM	American Society for Testing Materials
CBBEL	Christopher B. Burke Engineering, Ltd.
COE	United States Army Corps of Engineers
EPA	Environmental Protection Agency
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
NRCS	USDA-Natural Resources Conservation Service
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

DEFINITIONS

AASHTO Classification. The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway and Transportation Officials.

Abutment. The sloping sides of a valley that supports the ends of a dam.

Acre-Foot. The volume of water that will cover 1 acre to a depth of 1 ft.

Aggregate. (1) The sand and gravel portion of concrete (65 to 75% by volume), the rest being cement and water. Fine aggregate contains particles ranging from 1/4 in. down to that retained on a 200-mesh screen. Coarse aggregate ranges from 1/4 in. up to l½ in. (2) That which is installed for the purpose of changing drainage characteristics.

Alluvial Soils. Soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.

Alluvium. A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay, and all variations and mixtures of these. Unless otherwise noted, alluvium is unconsolidated.

Anti-Seep Collar. A device constructed around a pipe or other conduit placed through a dam, levee, or dike for the purpose of preventing soil movement and piping failures.

Anti-Vortex Device. A facility placed at the entrance to a pipe conduit structure, such as a drop inlet spillway or hood inlet spillway, to prevent air from entering the structure when the pipe is flowing full.

Apron. A pad of non-erosive material designed to prevent scour holes developing at the outlet ends of culverts, outlet pipes, grade stabilization structures, and other water control devices.

Aquifer. An underground porous, water-bearing geological formation. The term is generally restricted to materials capable of yielding an appreciable supply of water.

ASTM. American Society for Testing Materials, an association that publishes standards and requirements for materials used in the construction industry.

Backwater. The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water shall flow.

Barrel. A conduit placed through a dam, levee, or dike to control the release of water.

Base Flood. See "Regulatory Flood".

Base Flood Elevation (BFE). The water surface elevation corresponding to a flood having a one percent probability of being equalled or exceeded in a given year.

Base Flow. Stream discharge derived from groundwater sources as differentiated from surface runoff. Sometimes considered to include flows from regulated lakes or reservoirs.

Bearing Capacity. The maximum load that a material can support before failing.

Bedrock The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium, or hard and have' a smooth or irregular surface.

Benchmark. A marked point of known elevation from which other elevations may be established.

Bentonite. A highly plastic clay consisting of the minerals, montmorillonite, and beidellite that swell extensively wet. Often used to seal soil to reduce seepage losses.

Berm. A narrow shelf or flat area that breaks the contiguity of a slope.

Best Management Practices. Design, construction, and maintenance practices and criteria for stormwater facilities that minimize the impact of stormwater runoff rates and volumes, prevent erosion, and capture pollutants.

Borrow Area. A source of earth fill material used in the construction of embankments or other earth fill structures.

Capacity of a Storm Drainage Facility. The maximum flow that can be conveyed or stored by a storm drainage facility without causing damage to public or private property.

Capillary Action. The tendency of drier soil particles to attract moisture from wetter portions of soil.

Catch Basin. A chamber usually built at the curb line of a street for the admission of surface water to a storm sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

Centerline of Channel. The middle point or baseline of a channel.

Channel. A portion of a natural or artificial watercourse which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. It has a defined bed and banks which serve to confine the water.

Channel Improvement. Alteration, maintenance, or reconstruction of the channel area for the purpose of improving the channel capacity or overall drainage efficiency. The noted "improvement" does not necessarily imply water quality or habitat improvement within the channel or its adjacent area.

Channel Stabilization. Protecting the sides and bed of a channel from erosion by controlling flow velocities and flow directions using jetties, drops, or other structures and/or by fining the channel with vegetation, riprap, concrete, or other suitable lining material.

Channelization. Alteration of a stream channel by widening, deepening, straightening, or paving certain areas to improve flow characteristics.

Chicken Wire. A woven wire fabric with an opening size of about 1½ in.

Chute. A high-velocity, open channel (usually paved) for conveying water down a steep slope without erosion.

Classified Filter Strip. A parcel of land that has been or will be classified as filter strip for the purpose of property assessment and taxation. The details of the associated procedures and criteria are contained in IC 6-1.1-6.7 . See also Filter Strip.

Clay. (1) Soil fraction consisting of particles less than 0.002 mm in diameter. (2) A soil texture class that is dominated by clay or at least has a larger proportion of clay than either silt or sand.

Cohesion. The capacity of a soil to resist shearing stress, exclusive of functional resistance.

Cohesive Soil. A soil that, when unconfined, has considerable strength when air-dried and significant strength when saturated.

Companion (nurse) Crop. A crop sown with another crop that will germinate quickly and provide a protective vegetative cover until the preferred species can become established. The crop, usually small grain, is sown with a legume or perennial grass species.

Compost. Organic residue (or a mixture of organic residue and soil) that has undergone biological decomposition until it has become relatively stable humus.

Contour. An imaginary line on the surface of the earth connecting points of the same elevation.

Contour Line. Line on a map which represents a contour or points of equal elevation.

Control Structure. A structure designed to control the rate of flow that passes through the structure, given a specific upstream and downstream water surface elevation.

County Surveyor. A constitutional officer of the county, elected to a 4-year term from the county at large. Primary duties of the surveyor includes maintaining annexation descriptions, legal survey book, and section corner record book. Surveyor is also an ex-officio member of the County Drainage Board and the technical authority on the construction, reconstruction, and maintenance of all regulated drains or proposed regulated drains in the county. Other major responsibilities of the surveyor includes administering filter strip programs, membership in the County Plan Commission, and certification to the Indiana Alcoholic Beverage Commission.

Crown of Pipe. The elevation of the top of pipe.

Cross-Section. A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

Cultipacker Seeder. A seeder equipped with an attachment that will firm the seedbed to increase seed-to-soil contact.

Culvert. A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal or other impediment.

Cut. (1) A portion of land surface or area from which earth has been removed or will be removed by excavating. (2) The depth below the original ground surface to the excavated surface.

Cutoff Trench. A long, narrow excavation (keyway) constructed along the center line of a dam, dike, levee, or embankment and filled with relatively impervious material intended to reduce seepage of water through porous strata.

Cutting. A detached leaf stem or piece of root that is encouraged to form roots. A greenwood cutting is made during the period of active growth. A hardwood cutting is made during the dormant season.

Cut-and-Fill. The process of earth grading by excavating part of a higher area and using the excavated material for fill to raise the surface of an adjacent lower area.

Dam. A barrier to confine or impound water for storage or diversion, to prevent gully erosion, or to retain soil, sediment, or other debris.

Datum. Any level surface to which elevations are referred, usually using Mean Sea Level.

Design Life. The period of time for which a facility is expected to perform its intended function.

Design Storm. A selected storm event, described in terms of the probability of occurring once within a given number of years, for which drainage or flood control improvements are designed and built.

Desilting Area. An area of grass, shrubs, or other vegetation used for inducing deposition of silt and other debris from flowing water. Located above a stock tank, pond, field, or other area needing protection from sediment accumulation.

Detention. Managing stormwater runoff by temporary holding and controlled release.

Detention Storage. The temporary detaining of storage of stormwater in storage facilities, on rooftops, in streets, parking lots, school yards, parks, open spaces or other areas under predetermined and controlled conditions, with the rate of release regulated by appropriately installed devices.

Detention Time. The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).

Dewatering. The removal of water temporarily impounded in a holding basin.

d_{50} . A term used to define rock gradations. In a representative sample, 50% of the rock fragments will have a diameter larger than the d_{50} size and 50% will be smaller.

Dibble Bar. A heavy metal tool with a blade and foot pedal used to open holes for planting seeds, sprigs, cuttings or seedlings.

Dike. An embankment to confine or control water. Often built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge. Usually the rate of water flow. A volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.

Ditch. A man-made, open drainageway in or into which excess surface water or groundwater drained from land, stormwater runoff, or floodwaters flow either continuously or intermittently.

Diversion. A channel with a supporting ridge on the lower side constructed at the top, across, or bottom of a slope for the purpose of controlling surface runoff.

Diversion Dike. A barrier built to divert surface runoff.

Divide (drainage). The boundary between watersheds.

Drain. A buried slotted or perforated pipe or other conduit (subsurface drain) or a ditch (open drain) for carrying off surplus groundwater or surface water.

Drainage. The removal of excess surface water or groundwater from land by means of ditches or subsurface drains. Also see Natural drainage.

Drainage (soil). As a natural condition of the soil, drainage refers to both the frequency and duration of periods when the soil is free of saturation. Soil drainage conditions are defined as:

- *Well-drained*--Excess water drains away rapidly, and no mottling occurs within 36 in. of the surface.

- *Moderately well drained*--Water is removed from the soil somewhat slowly resulting in small but significant periods of wetness, and mottling occurs between 18 and 36 in.

- *Somewhat poorly drained*--Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time, and mottling occurs between 8 to 18 in.

- *Poorly drained*--Water is removed so slowly that it is wet for a large part of the time, and mottling occurs between 0 and 8 in.

- *Very poorly drained*--Water is removed so slowly that the water table remains at or near the surface for the greater part of the time; there may also be periods of surface ponding; the soil has a black to gray surface layer with mottles up to the surface.

Drainage Area. The area draining into a stream at a given point. It may be of different sizes for surface runoff, subsurface flow and base flow, but generally the surface runoff area is considered as the drainage area.

Drainage Board. A board consisting of three to five persons including the county executive (commissioners) or members appointed by the executive body (at least one of the Board member must be a county executive). The County Surveyor serves on the Board as an ex-officio, non-voting member. In a county having a consolidated city, the department of public works of the consolidated city comprises the drainage board. The Board is responsible for adopting drain classifications and a long-range plan, and for making decisions regarding the design, construction, reconstruction, and/or maintenance of regulated drains in the county.

Drainage Improvement. An activity within or adjacent to a natural stream or a man-made drain primarily intended to improve the flow capacity, drainage, erosion and sedimentation control, or stability of the drainageway.

Drainage Shed. See Drainage Area.

Drainageway. A natural or artificial stream, closed conduit, or depression that carries surface water. This term has been used throughout the Handbook as a neutral term applying to all types of drains and watercourses, whether man-made or natural.

Drawdown. Lowering of the water surface in an open channel or lake or groundwater.

Drop Inlet. A structure in which water drops through a vertical riser connected to a discharge conduit or storm sewer.

Drop Spillway. A structure in which the water drops over a vertical wall onto an apron at a lower elevation.

Drop Structure. A structure for dropping water to a lower level and dissipating its surplus energy without erosion.

Duration. The time period of a rainfall event.

Earth Dam. A dam constructed of compacted suitable soil materials.

Earth Embankment. A man-made deposit of soil, rock, or other material often used to form an impoundment.

Emergency Spillway. Usually a vegetated earth channel used to safely convey flood discharges around an impoundment structure.

Energy Dissipater. A device used to reduce the energy of flowing water to prevent erosion.

Environment. The sum total of all the external conditions that may act upon a living organism or community to influence its development or existence.

Erodibility. Susceptibility to erosion.

Erosion. The wearing away of the land surface by water, wind, ice, gravity, or other geological agents. The following terms are used to describe different types of water erosion:

- *Accelerated erosion*--Erosion much more rapid than normal or geologic erosion, primarily as a result of the activities of man.

- *Channel erosion* --An erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.

- *Gully erosion* --An erosion process whereby runoff water accumulates in narrow channels and, over relatively short periods, removes the soil to considerable depths, ranging from 1-2 ft. to as much as 75-100 ft.

- *Rill erosion*--An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils (see Rill).

- *Splash erosion*--The spattering of small soil particles caused by the impact of raindrops on wet soils; the loosened and spattered particles may or may not be subsequently removed by surface runoff.

- *Sheet erosion*--The gradual removal of a fairly uniform layer of soil from the land surface by runoff water.

Excess Rainfall. The amount of rainfall that runs directly off an area.

Farm or Field Tile. A small diameter clay pipe installed in an agricultural area to allow drainage of farmland.

Filter Blanket. A layer of sand and/or gravel designed to prevent the movement of fine-grained soils.

Filter Fabric. See Geotextile Fabric.

Filter Strip. Usually a long, relatively narrow area (usually, 20-75 feet wide) of undisturbed or planted vegetation used to retard or collect sediment for the protection of watercourses, reservoirs, or adjacent properties. See also Classified Filter Strip.

Flapgate. A device that allows liquids to flow in only one direction in a pipe. Backflow preventers are used on outlet pipes to prevent a reverse flow during flooding situations.

Flood or Flood Waters. A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow, the unusual and rapid accumulation, or the runoff of surface waters from any source.

Flood Frequency. A statistical expression of the average time period between floods equaling or exceeding a given magnitude. For example, a 100-year flood has a magnitude expected to be equaled or exceeded on the average of once every hundred years; such a flood has a one-percent chance of being equaled or exceeded in any given year. Often used interchangeably with "recurrence interval".

Flood Peak. The highest stage or greatest discharge attained by a flood event, thus peak stage or peak discharge.

Flood Stage. The stage at which overflow of the natural banks of a stream begins.

Floodplain. The channel proper and the areas adjoining the channel which have been or hereafter may be covered by the regulatory or 100-year flood. Any normally dry land area that is susceptible to being inundated by water from any natural source. The floodplain includes both the floodway and the floodway fringe districts.

Floodway. The channel of a river or stream and those portions of the flood plains adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood of any river or stream.

Flume. A constructed channel lined with erosion-resistant materials used to convey water on steep grades without erosion.

Foundation Drain. A pipe or series of pipes that collects groundwater from the foundation or footing of structures to improve stability.

Freeboard. A vertical distance between the elevation of the design high-water and the top of a dam, diversion ridge, or other water control device.

French Drain. A drainage trench backfilled with a coarse, water-transmitting material; may contain a perforated pipe.

Gabion. A wire mesh cage, usually rectangular, filled with rock and used to protect channel banks and other sloping areas from erosion.

Gauge. (1) A device for measuring precipitation, water level, discharge, velocity, pressure, temperature, etc. (2) A measure of the thickness of metal.

Gauging Station. A selected section of a stream channel equipped with a gauge, stage recorder, or other facilities for determining stream stage and discharge.

Geotextile Fabric. A woven or non-woven, water-permeable synthetic material used to trap sediment particles, prevent the clogging of aggregates with fine grained soil particles, or as a separator under road aggregate..

Geotextile Liner. A synthetic, impermeable fabric used to seal impoundments against leaks.

Grab Strength. A measure of the tensile strength for geotextiles, in elongation, as defined in ASTM-4632.

Gradation. The distribution of the various sized particles that constitute a sediment, soil, or other material, such as riprap.

Grade. (1) The slope of a road, a channel, or natural ground. (2) The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction, such as paving or the laying of a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment, or bottom of excavation, or other land area to a smooth, even condition.

Grade Stabilization Structure. A structure for the purpose of stabilizing the grade of a gully or other watercourse, thereby preventing further head-cutting or lowering of the channel bottom.

Gradient. (1) A change of elevation, velocity, pressure, or other characteristics per unit length. (2) Slope.

Grading. The cutting/or filling of the land surface to a desired slope or elevation.

Grass. A member of the botanical family Graminae, characterized by blade-like leaves that originate as a sheath wrapped around the stem.

Grassed Waterway. A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses and used to safely conduct surface water from an area.

Ground Cover (horticulture). Low-growing, spreading plants useful for low-maintenance landscape areas.

Habitat. The environment in which ,he life needs of a plant or animal are supplied.

Hardware Cloth. A welded wire fabric, typically with square openings of 1 in. or less.

Head. (1) The height of water above any plane of reference. (2) The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit would have to fall to release the average energy possessed. Used in various compound terms, such as pressure head or velocity head.

Head Loss. Energy loss due to friction, eddies, changes in velocity, elevation, or direction of flow.

Headwater. (1) The source of a stream. (2) The water upstream from a structure or point on a stream.

Hydrograph. A graph showing for a given point on a stream the discharge, stage (depth), velocity, or other property of water with respect to time.

Hydrologic Cycle. The circuit of water movement from atmosphere to earth back to the atmosphere through various stages or processes, such as precipitation, runoff, infiltration, percolation, storage, evaporation, and transpiration.

Hydrology. The science of the behavior of water in the atmosphere, on the surface of the earth, and underground. A typical hydrologic study is undertaken to compute flowrates associated with specified flood events.

Hydromulching. The process of applying mulch hydraulically in a water medium.

Hydroseeder. The machine/equipment used to disseminate seed hydraulically in a water medium. Mulch, lime, and fertilizer can be incorporated into the sprayed mixture.

Impervious. Not allowing infiltration.

Impoundment. Generally, an artificial water storage area, such as a reservoir, pit, dugout, sump, etc.

INDOT. Indiana Department of Transportation. Generally used here to refer to specifications contained in the publication "INDOT Standard Specifications."

Infiltration. Passage or movement of water into the soil.

Inoculum. A culture of microorganisms intentionally introduced into a medium, such as seed, soil, or compost.

Invert. The inside bottom of a culvert or other conduit.

Keyway. A cutoff trench dug beneath the entire length of a dam to cut through soil layers that may cause seepage and possible dam failure.

Lag Time. The interval between the center of mass of the storm precipitation and peak flow of the resultant run-off.

Laminar Flow. Flow at relatively slow velocity in which fluid particles slide smoothly along straight lines everywhere parallel to the axis of a channel or pipe.

Land Capability. The suitability of land for use. Land capability classification involves consideration of: (1) the risks of damage from erosion and other causes and. (2) the difficulties in land use owing to physical land characteristics, including climate.

Land Surveyor. A person licensed under the laws of the State of Indiana to practice land surveying.

Land Use Controls. Methods for regulating the uses to which a given land area maybe put, including such things as zoning, subdivision regulation, and floodplain regulation.

Legume. Any member of the pea or pulse family, which includes peas, beans, peanuts, clover, alfalfa, sweet clover, lespedeza, etch, black locust, and kudzu. Practically all legumes are nitrogen-fixing plants.

Liquid Limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. A soil textural classification in which the proportions of sand, silt, and clay are well balanced. Loams have the best properties for cultivation of plants.

Mean Depth. (1) Average depth. (2) Cross-sectional area of a stream or channel divided by its surface or top width.

Mean Velocity. Average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the reach.

Mulch. A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Mullen Burst Test. A standardized test used to test the strength of geotextile fabrics to bursting pressures.

Mutual Drain. A drain that: (1) Is located on two or more tracts of land that are under different ownership; (2) Was established by the mutual consent of all the owners; and (3) Was not established under or made subject to any drainage statute.

National Geodetic Vertical Datum of 1929 (NGVD 1929). The nationwide, Federal Elevation datum used to reference topographic elevations to a known value.

Natural Drainage. The flow patterns of stormwater run-off over the land in its pre-development state.

Nitrogen Fixation. The conversion of atmospheric nitrogen into stable compounds usable by plants. Carried out by bacteria that colonize the roots of most legumes.

Node (botany). The point on a plant stem at which a leaf or leaves arise. Creeping stems (i.e., rhizomes and stolons), and in some plants the upright stems, produce roots at the nodes.

Nonpoint Source Pollution. Pollution that enters a water body from diffuse origins on the watershed and does not result from discernable, confined, or discrete conveyances.

Normal Depth. Depth of flow in an open conduit during uniform flow for the given conditions.

Nutrient(s). (1) A substance necessary for the growth and reproduction of organisms. (2) In water, those substances (chiefly nitrates and phosphates) that promote growth of algae and bacteria.

One-Sided (or Single-Sided) Construction. a project involving construction on only one (1) side of a channel limiting the work to the entire area below the top of the banks and within the drainage easement on one (1) side of the stream or open drain.

Open Drain. A natural watercourse or constructed open channel that conveys drainage water.

Outfall. The point, location, or structure where wastewater or drainage discharges from a pipe or open drain to a receiving body of water.

Outlet. The point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Outlet Channel. A waterway constructed or altered primarily to carry water from man-made structures, such as smaller channels, tile lines, and diversions.

Outside Valley. The spacing or width of corrugations for corrugated metal pipe.

Overland Flow. Consists of sheet flow, shallow concentrated flow and open channel flow.

Peak Discharge. The maximum instantaneous flow from a given storm condition at a specific location.

Percolation. The movement of water through soil.

Percolation Rate. The rate, usually expressed as inches per hour or inches per day, at which water moves through the soil profile.

Perennial Stream. A stream that maintains water in its channel throughout the year.

Permeability (soil). The quality of a soil that enables water or air to move through it. Usually expressed in 'inches per hour or inches per day.

Permeability Rate. The rate at which water will move through a saturated soil. Permeability rates are classified as:

- *Very slow*--Less than 0.06 in./hr.
- *Slow*--O.06 to 0.20 in./hr.
- *Moderately slow*--O.20 to 0.63 in./hr.
- *Moderate*--O.63 to 2.0 in./hr.

- *Moderately rapid*--2.0 to 6.3 in./hr.
- *Rapid*--6.3 to 20.0 in./hr.
- *Very rapid*--More than 20.0 in./hr.

Permittivity. The volumetric flow rate of water per unit cross-sectional area per unit head under laminar flow conditions, in the normal direction generally through a geotextile.

Pervious. Allowing movement of water.

Pesticides. Chemical compounds used for the control of undesirable plants, animals, or insects. The term includes insecticides, herbicides, algicides, rodenticides, nematicides, fungicides, and growth regulators.

pH. A numerical measure of hydrogen ion activity, the neutral point being 7.0. All pH values below 7.0 are acid, and all above 7.0 are alkaline.

Phosphorus (available). Inorganic phosphorus that is readily available for plant growth.

Physiographic Region (province). Large-scale unit of land defined by its climate, geology, and geomorphic history, and therefore uniform in physiography.

Piping. The formation of "pipes" by underground erosion. Water in the soil carries the fine soil particles away, and a series of eroded tubes or tunnels develop. These openings will grow progressively larger and can cause a dam failure.

Plastic Limit. The moisture content at which a soil changes from a semi-solid to a plastic state.

Plasticity Index. The numerical difference between the liquid limit and the plastic limit of soil. The range of moisture content within which the soil remains plastic.

Plunge Pool. A basin used to dissipate the energy of flowing water. Usually constructed to a design depth and shape. The pool may be protected from erosion by various lining materials.

Point Source. Any discernible, confined, and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or maybe discharged (P.L. 92-500, Section 502[14]).

Porosity. The volume of pore space in soil or rock.

Principal Spillway. A dam spillway generally constructed of permanent material and designed to regulate the normal water level, provide flood protection, and/or reduce the frequency of operation of the emergency spillway.

Private Drain. A drain that: (1) Is located on land owned by one person or by two or more persons jointly; and (2) Was not established under or made subject to any drainage statute.

Professional Engineer. A person licensed under the laws of the State of Indiana to practice professional engineering.

Rainfall Intensity. The rate at which rain is falling at any given instant, usually expressed in inches per hour.

Rational Method. A means of computing storm drainage flow rates (Q) by use of the formula Q = CIA, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.

Reach. The smallest subdivision of the drainage system, consisting of a uniform length of open channel. Also, a discrete portion of river, stream or creek. For modeling purposes, a reach is somewhat homogeneous in its physical characteristics.

Receiving Stream. The body of water into which runoff or effluent is discharged.

Recharge. Replenishment of groundwater reservoirs by infiltration and transmission from the outcrop of an aquifer or from permeable soils.

Recharge Basin. A basin provided to increase infiltration for the purpose of replenishing groundwater supplies.

Recurrence Interval. A statistical expression of the average time between floods equalling or exceeding a given magnitude.

Regulated Drain. A drain, either open channel or closed tile/sewer, subject to the provisions of the Indiana Drainage Code, I.C.-36-9-27.

Regulatory Flood. The discharge or elevation associated with the 100-year flood as calculated by a method and procedure which is acceptable to and approved by the Indiana Department of Natural Resources and the Federal Emergency Management Agency. The "regulatory flood" is also known as the "base flood".

Reservoir. A natural or artificially created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary. The term is also used in the hydrologic modeling of storage facilities.

Retention. The storage of stormwater to prevent it from leaving the development site. May be temporary or permanent.

Retention Facility. A facility designed to completely retain a specified amount of stormwater runoff <u>without</u> release except by means of evaporation, infiltration or pumping. The volumes are often referred to in units of acre-feet.

Revetment. Facing of stone or other material, either permanent or temporary, placed along the edge of a stream to stabilize the bank and protect it from the erosive action of the stream. Also see Revetment riprap.

Rhizome. A modified plant stem that grows horizontally underground. A rhizomatous plant spreads (reproduces) vegetatively and can be transplanted with rhizome fragments.

Rill. A small intermittent watercourse with steep sides, usually only a few inches deep.

Riparian. Of, on, or pertaining to the banks of a stream, river, or pond.

Riparian Rights. A principle of common law requiring that any user of waters adjoining or flowing through his lands must use and protect them in a manner that will enable his neighbor to utilize the same waters undiminished in quantity and undefiled in quality.

Riprap. Broken rock, cobble, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves). Revetment riprap is material graded such that: (1) no individual piece weighs more than 120 lbs. and (2) 90-100% will pass through a 12-inch sieve, 20-60% through a 6-inch sieve, and not more than 10% through a 1½-inch sieve.

Riser. The inlet portions of a drop inlet spillway that extend vertically from the pipe conduit barrel to the water surface.

Riverine. Relating to, formed by, or resembling a stream (including creeks and rivers).

River Restoration. Restoring the channel of a stream or ditch to its perceived original, non-obstructed capacity by means of clearing & snagging, obstruction removal, and inexpensive streambank protection measures. The term "restoration", as noted, does <u>not</u> necessarily imply restoration or improvement of water quality or habitat within the channel or its adjacent area.

Runoff. That portion of precipitation that flows from a drainage area on the land surface, in open channels, or in stormwater conveyance systems.

Sand. (1) Soil particles between 0.05 and 2.0 mm in diameter. (2) A soil textural class inclusive of all soils that are at least 70% sand and 15% or less clay.

Saturation. In soils, the point at which a soil or aquifer will no longer absorb any amount of water without losing an equal amount.

Scour(ing). The clearing and digging action of flowing water, especially the downward erosion caused by stream water in seeping away mud and silt from the stream bed and outside bank of a curved channel.

Sediment. Solid material (both mineral and organic) that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Sediment Delivery Ratio. The fraction of the soil eroded from upland sources that actually reaches a stream channel or storage reservoir.

Sediment Discharge. The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

Sediment Pool. The reservoir space allotted to the accumulation of sediment during the life of the structure.

Sedimentation. The process that deposits soils, debris and other materials either on the ground surfaces or in bodies of water or watercourses.

Seedbed. Soil prepared by natural or artificial means to promote the germination of seed and the growth of seedlings.

Seedling. A young plant grown from seed.

Seepage. The passage of water or other fluid through a porous medium, such as the passage of water through an earth embankment.

Settling Basin. An enlargement in the channel of a stream to permit the settling of debris carried in suspension.

Shoot. The above-ground portion of a plant.

Silt. (1) Soil fraction consisting of particles between 0.002 and 0.05 mm in diameter. (2) A soil textural class indicating more than 80% silt.

Silt Fence. A fence constructed of wood or steel supports and either natural (e.g. burlap) or synthetic fabric stretched across area of <u>non</u>-concentrated flow during site development to trap and retain on-site sediment due to rainfall runoff.

Slope. Degree of deviation of a surface from the horizontal, measured as a numerical ratio or percent. Expressed as a ratio, the first number is commonly the horizontal distance (run) and the second is the vertical distance (rise)--e.g., 2:1. However, the preferred method for designation of slopes is to clearly identify the horizontal (H) and vertical (V) components (length (L) and Width (W) components for horizontal angles). Also note that according to international standards (Metric), the slopes are presented as the vertical or width component shown on the numerator--e.g., 1V:2H. Slope expressions in this handbook follow the common presentation of slopes--e.g., 2:1 with the metric presentation shown in parenthesis--e.g., (1V:2H). Slopes can also be expressed in "percents". Slopes given in percents are always expressed as (100*V/H) --e.g., a 2:1 (1V:2H) slope is a 50% slope.

Soil. The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Also see alluvial soil, Clay, Cohesive soil, Loam, Permeability (soil), Sand, Silt, Soil horizon, Soil profile, Subsoil, Surface soil, Topsoil.

Soil and Water Conservation District (SWCD). A public organization created under state law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries. A subdivision of state government with a local governing body.

Soil Horizon. A horizontal layer of soil that, through processes of soil formation, has developed characteristics distinct from the layers above and below.

Soil Profile. A vertical section of the soil from the surface through all horizons.

Soil Structure. The relation of particles that impact to the whole soil a characteristic manner of breaking--e.g., crumb, block, platy, or columnar structure.

Soil Texture. The physical structure or character of soil determined by the relative proportions of the soil separates (sand, silt, and clay) of which it is composed.

Specific Gravity. The ratio of (1) the weight in air of a given volume of soil solids at a stated temperature to (2) the weight in air of an equal volume of distilled water at a stated temperature.

Spillway. (1) A passage, such as a paved apron or channel, for surplus water over, around, or through a dam or similar structure. (2) An open or closed channel, or both, used to convey excess water from a reservoir. it may contain gates, either manually or automatically controlled. to regulate the discharge of excess water. Also see Emergency spillway, Principal spillway.

Sprig. Section of plant stem material (rhizome, shoot, or stolon) used in vegetative planting.

Stolon. Modified plant stem that grows horizontally on the soil surface.

Storm Duration. The length of time that water may be stored in any stormwater control facility, computed from the time water first begins to be stored.

Storm Event. An estimate of the expected amount of precipitation within a given period of time. For example, a 10-yr. frequency, 24-hr. duration storm event is a storm that has a 10% probability of occurring in any one year. Precipitation is measured over a 24-hr. period.

Storm Frequency. The time interval between major storms of predetermined intensity and volumes of runoff--e.g., a 5-yr., 10-yr. or 20-yr. storm.

Stormwater Runoff. The water derived from rains falling within a tributary basin, flowing over the surface of the ground or collected in channels or conduits.

Storm Sewer. A sewer that carries stormwater, surface drainage, street wash, and other wash waters but excludes sewage and industrial wastes. Also called a storm drain.

Stream. See lntermittent stream, Perennial stream, Receiving stream.

Streambanks. The usual boundaries (not the flood boundaries) of a stream channel. Right and left banks are named facing downstream.

Stream Gauging. The quantitative determination of stream flow using gauges, current meters, weirs, or other measuring instruments at selected locations (see Gauging station').

Stream Length. The length of a stream or ditch, expressed in miles, from the confluence of the stream or ditch with the receiving stream to the upstream extremity of the stream or ditch, as indicated by the solid or dashed, blue or purple line depicting the stream or ditch on the most current edition of the seven and one-half (7½) minute topographic quadrangle map published by the United States Geological Survey, measured along the meanders of the stream or ditch as depicted on the map.

Subarea/Subbasin. Portion of a watershed divided into homogenous drainage units which can be modeled for purposes of determining runoff rates. The subareas/subbasins have distinct boundaries, as defined by the topography of the area.

Subsoil. The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below which roots do not normally grow.

Subsurface Drain. A pervious backfield trench, usually containing stone and perforated pipe, for intercepting groundwater or seepage.

Subwatershed. A watershed subdivision of unspecified size that forms a convenient natural unit. See also Subarea.

Surface Runoff. Precipitation that flows onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface but collects and runs off.

Surface Soil. The uppermost part of the soil ordinarily moved in tillage or its equivalent in an uncultivated soil. Frequently referred to as the plow layer, the Ap layer, or the Ap horizon. Surface soil is usually darker in color due to the presence of organic matter.

Suspended Solids. Solids either floating or suspended in water.

Swale. An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct stormwater into primary drainage channels and may provide some groundwater recharge.

Tackifier. An adhesive material sprayed on top of mulch to hold it in place.

Tailwater. The water surface elevation at the downstream side of a hydraulic structure (i.e. culvert, bridge, weir, dam, etc.).

Tile Drain. Pipe made of perforated plastic, burned clay, concrete, or similar material, laid to a designed grade and depth, to collect and carry excess water from the soil.

Tile Drainage. Land drainage by means of a series of tile lines laid at a specified depth, grade, and spacing.

Time of Concentration (t_c). Is the travel time of a particle of water from the most hydraulically remote point in the contributing area to the point under study. This can be considered the sum of an overland flow time and times of travel in street gutters, , storm sewers, drainage channels, and all other drainage ways.

Toe of Dam. The base or bottom of the sloping faces of a constructed dam at the point of intersection with the natural ground surface--normally a much flatter slope. A dam has an inside toe (the impoundment or upstream side) and an outside toe (the downstream side).

Toe of Slope. The base or bottom of a slope at the point where the ground surface abruptly changes to a significantly flatter grade.

Topographic Map. Graphical portrayal of the topographic features of a land area, showing both the horizontal distances between the features and their elevations above a given datum.

Topography. The representation of a portion of the earth's surface showing natural and man-made features of a give locality such as rivers, streams, ditches, lakes, roads, buildings and most importantly, variations in ground elevations for the terrain of the area.

Topsoil. (1) The dark-colored surface layer, or A horizon, of a soil; when present it ranges in depth from a fraction of an inch to 2-3 ft. (2) Equivalent to the plow layer of cultivated soils. (3) Commonly used to refer to the surface layer(s), enriched in organic matter and having textural and structural characteristics favorable for plant growth.

Toxicity. The characteristic of being poisonous or harmful to plant or animal life. The relative degree or severity of this characteristic.

Trap Efficiency. The capability of a reservoir to trap sediment.

Trash Rack. A structural device used to prevent debris from entering a pipe spillway or other hydraulic structure.

Tributary. Based on the size of the contributing drainage area, a smaller watercourse which flows into a larger watercourse.

Turbidity. (1) Cloudiness of a liquid, caused by suspended solids. (2) A measure of the suspended solids in a liquid.

Turf. Surface soil supporting a dense growth of grass and associated root mat.

Ultra-Violet Radiation Stability. Resistance to degradation from ultraviolet rays. Most synthetic fabrics and plastics, without special treatment, will quickly lose strength when exposed to sunlight.

Underdrain. A small diameter perforated pipe that allows the bottom of a detention basin, channel or swale to drain.

Unified Soil Classification System (USCS). A system of classifying soils that is based on their identification according to particle size, gradation, plasticity index, and liquid limit.

Uniform Flow. A state of steady flow when the mean velocity and cross-sectional area remain constant in all sections of a reach.

Vegetative Stabilization. Protection of erodible or sediment producing areas with: permanent seeding (producing long-term vegetative cover), short-term seeding (producing temporary vegetative cover), or sodding (producing areas covered with a turf of perennial sod-forming grass) .

Water Quality. A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Water Resources. The supply of groundwater and surface water in a given area.

Water Table. (1) The free surface of the groundwater. (2) That surface subject to atmospheric pressure under the ground, generally rising and failing with the season or from other conditions such as water withdrawal.

Watercourse. Any river, stream, creek, brook, branch, natural or man-made drainageway in or into which stormwater runoff or floodwaters flow either continuously or intermittently.

Watershed. The region drained by or contributing water to a specific point that could be along a stream, lake or other stormwater facilities. Watersheds are often broken down into subareas for the purpose of hydrologic modeling.

Watershed Area. All land and water within the confines of a drainage divide. See also Watershed.

Weep Holes (engineering). Openings left in retaining walls, aprons, linings, or foundations to permit drainage and reduce pressure.

Weir. A channel-spanning structure for measuring or regulating the flow of water.

Weir Notch. The opening in a weir for the passage of water.

Wetlands. Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and/or those wetland areas that are under the COE jurisdiction.

Windthrow. (1) Uprooted by the wind. (2) A tree or trees so uprooted.

Zoning Ordinance. An ordinance based on the police power of government to protect the public health, safety, and general welfare. It may regulate the type of use and intense type of development of land and structures to the extent necessary for a public purpose. Requirements may vary among geographically defined areas ("zones"). Regulations generally cover such items as height and bulk of buildings, density of dwelling units, off-street parking, control of signs, and use of land for residential, commercial, industrial, or agricultural purposes. A zoning ordinance is one of the major methods for implementation of a comprehensive plan.

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T.O.C.

APPENDIX B

Drainage Task Force 1994 Report

T.O.C.

FINAL REPORT
FROM THE
DRAINAGE BOARD TASK FORCE
TO THE
WATER RESOURCES STUDY COMMITTEE

October 3, 1994

T.O.C.

-INTRODUCTION-

Following legislative action regarding how state agencies were dealing with statutes governing county drainage projects, Senate Concurrent Resolution 38 was passed. The Water Resources Interim Study Committee was given the charge to "study and review matters concerning state and local drainage laws and regulations." The Study Committee established a Task Force made up of people with diverse interests ranging from county surveyors to environmentalists to regulatory agency personnel. A list of the members is contained in the appendices.

The Task Force began work by first developing a goal based upon the charge given by the Water Resources Study Committee. The goal was defined as:

"To review and recommend changes to Indiana's drainage laws and applicable rules and regulations in order to reconcile the above with other State and Federal laws; to determine economic and environmental impacts, identify potential alternative actions and improve efficiency of permitting decisions."

Although the accuracy of their assertions may be disputed, the following five top discussion priorities were identified which, if resolved, would lead to meeting the goal:

1. **Indiana drainage law is not compatible with other state and federal laws.**

2. **Recommendations that become part of permits issued by state and federal agencies to county drainage boards are contrary to Indiana Code.**

3. **Timeliness of permitting is essential.**

4. **There is a lack of consideration of environmental concerns by some county drainage boards.**

5. **There are no funds in drainage laws to compensate landowners for environmental mitigation required in order to obtain permits for some drainage projects.**

The Task Force offered potential solutions to the first priority. Twenty-two were generated. These are listed in the appendices. Recommendations for the Water Resources Study Committee were developed from these twenty-two solutions. Ultimately, because of time constraints, only the first priority was formally considered. However, in reviewing the many discussions which took place and the recommendations which came out of these discussions, it was felt by the Task Force that all of the top five priorities were addressed.

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While the discussions of the Task Force were wide-ranging and covered many topics, they eventually evolved into a few central themes. Most of the recommendations prepared by the Task Force reflect these ideas, which are:

a. Drain construction and maintenance can and should be done in an environmentally sound manner.

b. A handbook which provides guidelines for environmentally sound drain maintenance and construction practices can be prepared which will benefit both Drainage Boards and the regulatory agencies.

c. The permitting process at times is slow and burdensome. However, an increase in cooperation between the permittees and the regulatory agencies could speed up and smooth the process. This process of cooperation can be formalized in a Memorandum of Agreement.

From these central themes the Task Force has developed eight recommendations for consideration by the Water Resources Study Committee. The Task Force does not see the preparation of these recommendations as the end of this task. All of the recommendations will require an ongoing commitment over several years to insure their successful implementation. In addition to the recommendations, there were a few issues which were not resolved. These are explained along with the recommendations.

Finally, one of the most important accomplishments of the Task Force was to demonstrate that groups with diverse and often contrary interests are able to find some common ground for solutions to difficult problems. We trust that the Water Resources Committee will see fit to approve the recommendations prepared by the Task Force and take appropriate actions to insure that they are implemented in the future.

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-RECOMMENDATIONS-

The recommendations developed by the Drainage Task Force are grouped into seven categories. Summaries of discussions regarding the categories and resulting recommendations are as follows:

I. MEMORANDUM OF AGREEMENT

EARLY COORDINATION. Many of the permit related-problems discussed by the Task Force could be attributed to misunderstandings either about permitting processes or responsibilities. The need for *early coordination* between permit applicants and permitting agencies, to allow all parties to fully understand and ward off potential problems, was repeatedly addressed by the group. Inherent to the issue of early coordination are the desire to 1) prevent projects from starting prior to being permitted, 2) identify projects not requiring permits, and 3) prevent misunderstandings that could result in disagreements between the parties. To fulfill early coordination needs, the permitting agencies must be provided sufficient resources to respond to applicants in a timely manner. Permit applicants must also recognize limitations of the agencies and allow for reasonable processing time for applications.

Recommendation #1

In order to assure necessary coordination between applicants and permitting agencies (to avoid misunderstandings about permitting actions) it is recommended that a memorandum of agreement (MOA) be developed between county drainage boards/surveyors, the Department of Environmental Management, the Department of Natural Resources, the U.S. Fish and Wildlife Service, and, if possible, the U.S. Army Corps of Engineers.

A. **The MOA would establish how permit decision-making could be expedited through consultations and on-site visits conducted <u>prior to</u> formal permit application. This would aid the parties in understanding the work proposed by the applicant, as well as the requirements of the permitting agencies.**

B. **These actions would allow the agencies to provide assurances that permit applications submitted following such early coordination would be acted upon in an expeditious manner, within a defined "reasonable period of time".**

C. **Permitting agencies would not be held unduly accountable for projects begun without necessary permits or by applicants wishing to begin work within an unreasonably short period of time.**

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D. It is further recommended that the agencies involved should devise appropriate means of publicizing the availability and necessity of such early coordination services.

E. In order to assure the success of the coordination process, the legislature should insure that adequate resources are available to the state permitting agencies to allow for full implementation of the process.

ASSESSMENT. The Task Force recognizes the need for individual evaluation of each drainage project. The permitting agencies should evaluate each project on the basis of its individual characteristics. Misunderstandings can arise if reviewers do not have the opportunity (when necessary) to view a project site directly and must evaluate it solely on the basis of written or orally communicated information.

IMPACTS. The Task Force recognizes that drainage projects may have detrimental effects. However, these effects are often short term and ameliorated by revegetation and stabilization of the drain. The Task Force also recognizes that drainage projects, properly exececuted, may correct erosion and other problems which are detrimental to water quality. The evaluation of proposed projects by permitting agencies should weigh the potential positive effects which accrue from a project against short term detrimental impacts.

CUMULATIVE IMPACTS. The Task Force recognizes that the combined effect of a number of seemingly innocuous small drainage projects within a given watershed can have a significant impact in the overall drainage area. These impacts can be either positive or negative. The permitting agencies should be required to consider these cumulative impacts when formulating the permit conditions for a proposed project.

Recommendation #2

It is recommended that the permitting agencies be required to formally consider each project on the basis of its own merits, compare any impacts of each project's implementation to the possible negative effects of no project, and to evaluate both the positive and negative cumulative impacts of several small projects within a proposed project's watershed. The manner in which these actions will be implemented should be described in the proposed Memorandum of Agreement.

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II. PROCEDURAL AND TECHNICAL MANUAL

RIGHTS-OF-ENTRY/RIGHTS-OF-WAY. In its discussions, the Task Force identified several things which contributed to the perception of incompatibility between different state and federal laws regarding drainage. Some of those things related to different activities within the rights-of-way adjacent to regulated drains, and the legality of the activities. The principal action discussed by the Task Force, to resolve controversies, was the cooperative development of a manual. Such a document would describe measures to alleviate concerns of permittees as well as permitting agencies.

NONDEGRADATION. Some members of the Task Force expressed concern that strict interpretation of "non-degradation" language in state environmental law (IC 13-1-3-8) and Water Quality Standards (327 IAC 2-1-2) would result in prohibition of all drainage projects. It was suggested that <u>all</u> drainage projects be exempted from that statute and rule. The Task Force could not reach consensus on that proposal so, alternatively, it was suggested that the statute and rule be amended to exempt only <u>small</u> projects. While it was agreed that application of the statute and rule should be on the basis of the scope and effect of each individual project, there was not consensus regarding exemption. However, the Task Force did agree that language should be incorporated into the proposed manual that would define practices/methods of drain maintenance which, if followed, would not be considered by state regulatory agencies to constitute water quality degradation.

REVIEW PROCEDURES. The belief was expressed that an inadequate "appeal" process exists with regard to decisions made by agency permitting staff. It was therefore agreed that the proposed manual should include a description of a process that will provide "clear and timely access to review by regulatory supervisory personnel".

IMPACT SIGNIFICANCE. The Task Force discussed whether some drainage maintenance activities could be dismissed by the regulatory agencies as being relatively insignificant and not subject to state oversight. It was concluded that the issue could be resolved by including, in the proposed manual, guidelines for assessing the impact of drainage projects and determining whether environmental impacts (including cumulative impacts) will be significantly detrimental or, alternately, short term and relatively insignificant. It was also concluded that permit applicants should contact the permitting agencies to reach agreement on the significance of specific projects.

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Recommendation #3

The Water Resources Study Committee should oversee the creation and activities of a small technical work group which will develop a manual of administrative and technical measures related to drainage projects.

A. The manual would become the accepted standard for conduct of drainage projects, via rulemaking if necessary.

B. The Committee should determine how the work will be coordinated, as well as the source and amount of funding necessary to carry out development of the manual.

C. The work group should be facilitated by a person dedicated to the manual's development, and should be comprised of representatives of local, state, and federal entities potentially involved in the regulation or conduct of such drainage projects and representatives of private agricultural and environmental interests. At a minimum, this should include representatives of county surveyors/drainage boards, the Department of Environmental Management, the U.S.D.A. Soil Conservation Service, and the Department of Natural Resources. The U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers should also be invited and encouraged to participate.

There was not unanimous agreement by the Task Force on the composition of the work group.

D. The manual should contain, at a minimum, technical descriptions of drainage project construction techniques and "best management practices" (BMPs) that are protective of the environment, explanations of permitting processes employed by the various agencies, addresses and telephone numbers of agency personnel responsible for permitting, descriptions of measures which would compensate for unavoidable environmental damages, explanations of procedures to be followed by permittees to allow compliance with all applicable laws and regulations, and descriptions of projects exempt from state and/or federal regulation.

E. The manual should also include a description of a process allowing clear and timely access by permit applicants to supervisory agency personnel so that prospective permit conditions can be reviewed and discussed.

F. **The selection of specific BMPs should consider not only their short term on-site effects but their off-site, cumulative, and downstream impacts as well.**

G. **If members of the work group are unable to agree on significant matters relative to production of the manual, the Water Resources Study Committee shall determine the most appropriate means for resolving any disagreement.**

III. CONSTRUCTION VS. MAINTENANCE PHASES

Discussions occurred concerning whether county surveyors could agree to permit conditions that might apply after their term of office had expired. This led to discussion about long-term maintenance of drainage projects and who would assume responsibility for "environmental" conditions. It was agreed that development of two-stage permitting procedures could alleviate concerns about maintenance.

Recommendation #4

It is recommended that permitting agencies work with prospective permittees to establish procedures allowing for two-phase permitting of projects.

A. **Phase One would be subject to formal permitting and would consist of the active construction period plus any time required to complete actions required by permits, e.g., erosion control during construction, as well as development of permanent vegetative cover following completion of construction. Permit agencies' staff and permittees' staff would jointly evaluate activities during, and for a specified time after, active construction to assure that all permit conditions were satisfied.**

B. **Phase Two would begin after a final inspection allowed for certification of completion of the first phase, at which time the project would be under control of the permittee for continuing maintenance. Appropriate recommended practices for long-term maintenance would be contained in the proposed technical manual. Timing and performance of ongoing simple maintenance, not of sufficient scope to require additional permits, would be left to the professional judgment of the permittee.**

The appropriate method of implementing such a phased approach was not decided upon, so will be subject to further discussion. It could possibly be accomplished via a memorandum of agreement or through modification of existing permitting rules.

IV. REGULATED DRAIN CLASSIFICATION

Physical features of drainageways included in a system of county regulated drains vary considerably. Drain maintenance procedures could be streamlined through the use of a classification system that recognizes the differences. A system of classification of regulated drains could include:

1. Closed tile drains.
2. Excavated (dug) ditches
3. Natural streams modified by humans
4. Natural streams with little or no modification

Each of these suggested classes differs in its ecological value and functionality. Accordingly, the degree of state government oversight/control required for maintenance or reconstruction activities could vary for each class. These classes could be incorporated into the existing drainage code, rules, and defined in the proposed manual. The classification would not apply to surface waters which are not regulated drains.

Recommendation #5

It is recommended that state regulatory agencies work with county drainage boards/surveyors to devise a regulated drain classification system.

A The system should recognize regulated drain characteristics and environmental impacts which would occur to the system when maintenance or reconstruction is performed.

B. Further, the agencies and boards should examine ways in which regulatory oversight on less significant classes could be reduced without causing any long term, irreversible negative environmental impacts.

C. Classification should be explored in conjunction with the development of the proposed manual.

V. FUNDING FOR ENVIRONMENTAL ENHANCEMENT

Permit conditions imposed on county drainage projects by regulatory agencies often require environmentally-oriented actions not normally considered by drainage boards. The Task Force discussed whether the costs of such actions should be paid by the landowners funding the drainage project, or if other benefited parties should assist in funding the measures. Certain of the expenses, such as restoring the work area to a reasonable condition, should be assumed to be part of the "cost of doing business". It was determined by the Task Force that funding of "enhancements" exceeding original conditions should not necessarily be the sole responsibility of the benefited landowners.

Recommendation #6

Drainage projects need to be performed in an environmentally sound manner. Environmental impact remediation needs to be calculated into the costs of the projects. At times, this may entail costs beyond those traditionally calculated for the projects. If it is determined that amelioration of environmental impacts results in an environmental "enhancement" (remediation exceeding original conditions) beneficial to persons outside the project area, then the costs of that enhancement should be borne by the environmentally-benefited public at large, and not just the landowners traditionally assessed for the project. An equitable method of funding the additional costs needs to be identified. Some suggested methods that could be evaluated include:

1. **Creation of incentive programs, such as reducing property taxes on land used for environmental impact remediation.**
2. **County-wide assessments or a county dedicated cumulative fund.**
3. **State general funds or new, additional funding channeled through the "T by 2000" cost-share program.**
4. **A designated percentage of an appropriate tax diverted to fund incentive programs or state cost-share.**

Enhancements should not be required until an adequate method of funding is in place and funds are available.

VI. WETLAND DELINEATION AND MITIGATION

WETLAND DELINEATION. The Task Force discussed concerns related to identification (determination and delineation) of federally regulated wetlands in drainage project areas. The identification of "jurisdictional" wetlands is a complex and still-changing process. The guidelines which are currently used for identification, along with any future changes, are controlled by federal agencies and are not subject to manipulation at the state level. There are few persons in Indiana qualified to identify jurisdictional wetlands. Existing wetland maps prepared by the U.S. Fish and Wildlife Service and the U.S.D.A. Soil Conservation Service are not precise enough to identify wetlands for jurisdictional purposes; on-site evaluations must be conducted by qualified personnel. The number of qualified wetland delineators needs to be increased.

Recommendation #7

A. The Task Force recommends that efforts to provide wetland delineator training be encouraged and supported, and that existing efforts proceed with all possible speed.

B. It is further recommended that a state-sponsored jurisdictional wetland identification training course be supported, developed, and implemented by a state university by the summer of 1995, if possible.

C. The Task Force also urges the U.S. Army Corps of Engineers to proceed as quickly as possible to establish a certification program for jurisdictional wetland delineation.

WETLAND MITIGATION. There is currently no coherent policy in Indiana regarding mitigation of adverse impacts to wetlands.

Recommendation #8

The Task Force recommends that the agencies involved develop a consistent policy for wetland mitigation with respect to impacts arising from land improvement, particularly with respect to drainage maintenance and reconstruction activities, in Indiana. The agencies would include the Department of Environmental Management, the Department of Natural Resources, the U.S. Fish and Wildlife Service, the U.S.D.A. Soil Conservation Service, and, if possible, the U.S. Army Corps of Engineers.

VII. UNRESOLVED ISSUES

POINT SOURCE DISCHARGES. The discharge of pollutants from tile or pipe "point sources" into regulated drains was discussed. IC 36-9-27-23 (Drainage Code) does somewhat address the issue, but livestock waste and human waste are still often illegally disposed of and are sometimes encountered being discharged directly into regulated drains. The idea of statutorily depriving such illegal dischargers of drainage benefits was discussed but no recommendation resulted.

COST/BENEFIT ANALYSIS. Current drainage law regarding cost/benefit evaluations requires only subjective consideration of the cost of physically improving water flow in a regulated drain vs. the value of the land use benefits derived from removing the associated additional amount of water. Concern for environmental impacts has not generally been a consideration. No recommendations resulted from the discussion.

TIMELY NOTIFICATION. The Task Force heard concerns about apparent incongruities in time constraints imposed by various agencies involved in permitting of drainage projects. The result of discussions was agreement that permit applicants must be assured of timely notification by all agencies in order to comply with varied statutory time limits for response. No recommendations were made regarding how this was to be accomplished.

NO NET LOSS OF WETLANDS. This was identified as primarily a federal policy which was a significant issue at one of the Task Force's early meetings, but was never discussed at length, due to time constraints.

T.O.C.

APPENDIX 1

MEMBERS AND PROXIES FOR THE DRAINAGE BOARD TASK FORCE OF THE WATER RESOURCES STUDY COMMITTEE

Mr. Jay Poe, Huntington County Surveyor

Mr. Kenton Ward, Hamilton County Surveyor

Mr. Jim Ray, IDNR, Division of Soil Conservation

Mr. Dennis Clark, IDEM, Chief, Special Projects/Standards Section, Office of Water Management

Mr. Jack Ruger, President, Indiana Association Of Soil and Water Conservation Districts
 Proxy for Mr. Ruger, Robert White, Executive Director, IASWCD

Mr. Robert Eddleman, State Conservationist, USDA Soil Conservation Service
 Proxy for Mr. Eddleman, Philip R. McLoud, Assistant State Conservation Engineer, USDA SCS

Mr. David Hudak, Supervisor, Bloomington Field Office, U. S. Fish and Wildlife Service
 Proxy for Mr. Hudak, Mike Litwin, USFWS

Mr. William Christman, Chief, Regulatory Branch, Louisville District, U.S. Army Corps of Engineers

Mr. James New, J.F. New and Associates

Mr. Jim Barnett, Director, Natural Resources Department, Indiana Farm Bureau, Inc.

Mr. Lawrence Dorrell, Legislative Director, Indiana Farmers Union, Inc.

Mr. Thomas Dustin, Environmental Affairs Advisor, Indiana Division, Izaak Walton League of America, Inc.
 Proxy for Mr. Dustin, Patricia Werner, Project Director, The Wetlands Project, Hoosier Chapter of the Sierra Club

Mr. Steve Cox, Indiana BASS Chapter Federation

Dr. James Gammon, Department of Biological Sciences, DePauw University
 Proxy for Dr. Gammon, Harold McReynolds

Mr. David Gesl, Detroit District, U. S. Army Corps of Engineers

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APPENDIX 2

Early in the process, task force members identified 22 problems associated with drainage projects. This list was further clarified and is listed in items A through V. Each of the 22 problems were discussed. The final conclusions/consensus are found in one of the eight recommendations in the body of this report. These eight recommendations are included in the following seven discussion categories:

- I. Memorandum of Agreement
- II. Procedural & Technical Manual
- III. Construction vs. Maintenance Phases
- IV. Drain Classification
- V. Funding for Environmental Enhancement
- VII. Wetland Delineation & Mitigation
- VIII. Unresolved Issues

The number preceding each of the items below shows where the recommendations for resolution of each of the 22 problems.

Recommendation		Problems Identified

1	A.	Disputes "filling in wetlands" language (ATF permit)
		- Misunderstand
		  - What is problem with filling wetlands
		  - Language

1	B.	Corps says no wetlands exist where fish and wildlife map shows there are - Maps not 100% accurate, but a good guide
3	C.	Surveyors cannot agree to conditions beyond their term of office - Can't force maintain past term of office (surveyors)
2	D.	Easement problems along drains as required by permit. Easy to do for large projects, but could cost more than small project itself. - How much area left as grass - 75' control or just right of entry - Farmers can farm strip
5	E.	But part of cost is downstream effects - Affect landowners - more water downstream - Downstream not paying - Increase flooding, sedimentation - Cumulative impact
5	F.	Should cost be shouldered solely by landowner?

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- Permit conditions benefit more than just property owners
- Share cost

Recommendation | Problems Identified

- Cost borne by all in watershed
- Cumulative funds - general fund not reimbursed by property owner
- General drainage improvement funds - are paid back by property owners with increased assessment

7 G. Cost/Benefit ratio should be considered case by case
- Code required cost/benefit analysis
- Consider all benefits and costs including environmental and financial
- If the ratio is not positive, then don't do it

7/5 H. Restoration vs. creation
- Replacing habitat
- Creating is adding something that was not there. If required, who should pay?

2 I. Significant vs. Insignificant impact
- Long term significant/termporary or insignificant damage
- DNR letters - say all are significant
- Some impacts are insignificant
- Timing may affect significant, i.e. spawning fish

1 J. Cumulative impacts
- Must consider even with individual insignificant impacts by themselves
- These impacts heal
- Many small projects increase water flow, erosion and flooding
- Measure effect in sediment core samples
- Concerned about wetland lost with many small projects
- Small impacts add up
- If not maintained sediment will go downstream
- Cut off oxbow resulting in more area for water to back up and decreased erosion/sedimentation

4/2 K. All drains equal or treated as such
- Drains are different
- Some constructed, others were natural streams, little modifications, others are more modified
- Each class would have different environmental attributes
- Some were ditches from beginning - should be treated differently
- Staff recognize differences from practical standpoint and do not treat all the same

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2 L. Planting trees in right-of-way
- Yes, could, but not without permission of board
- May shade grass and cause erosion
- Trees are documented as stabilizing stream banks and are required only where trees were removed

Recommendation | Problems Identified

- 75' strip is for continued maintenance by drainage board
- Need is decreased on some stretches
- Nothing says trees can't be removed by property owner even if board was required to plant trees
- Maintenance is important and may prevent a new project
- Strike balance - habitat/aquatic life vs. sufficient flow
- Running side take most trees, but can save some
- Other side leave most, but not in counties
- Can go beyond 75' but pay damages if crops destroyed

2 M. Wood duck and bluebird boxes in right-of-way
- Not a permit condition
- Felt there was already a lot of habitat nearby, bluebirds were not affected
- What determines how much?
- What are the criteria?
- DNR may have guessed at what was there
- County surveyors should point out possibility of leaving brush piles
- Would groups do some of projects - habitat?
- Improve cooperation between surveyors and conservation groups
- What are criteria for permit conditions?
- Don't need rule, but need to identify criteria

2 N. Removal of trees in right-of-way

2 O. In-stream "enhancement" structures
- Corps materials about structures (trees, boulders, etc.) from letters from DNR
- Some structures don't make sense in all drains

3 P. Long term mitigation procedures
- Cost benefit ratio
- Long term impact
- Erosion and sedimentation
- How to maintain mitigation

2 R. IAC 13-1-3-8 can't do apparently anything to contaminate

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- Reasons for stopping projects
- Can't do anything ever and comply
- Should get legal opinion
- Develop rules to implement statute
- Anti-degradation policy required by fed.

2 S. Degradation begins with first bucket 3-27-IAC 2-1-2
- Include in legal question
- What does degradation mean?

5 T. Mitigation costs/project costs ratio
- Should tie mitigation cost and project cost
- Should not limit recommendations
- Corps will balance and may not adopt all
- Consider mitigation cost in cost/benefit analysis
- Mitigation cost should not be 10 X project cost
- Need to deal with Corps on mitigation on Corps permits
- Passing along recommendations is for applicant's information
- Corps cannot change 401
- 401 may require things beyond 404 requirement

7 U. No net loss

1/2 V. Notification of applicant
- Not enough time. Have 18 days

T.O.C.

000038

SENATE CONCURRENT RESOLUTION

INTRODUCED BY

Senator Wheeler, Senator Meeks, and Senator O'Day

JAN 2 8 1982, read first time and assigned AGRICULTURE & SMALL BUSINESS

A SENATE CONCURRENT RESOLUTION URGING THE ESTABLISHMENT OF AN INTERIM STUDY COMMITTEE REGARDING STATE AND LOCAL DRAINAGE LAWS.

A Senate Concurrent Resolution Urging the Establishment of an Interim Study Committee Regarding State and Local Drainage Laws.

WHEREAS, Drainage is a matter that has a great impact upon the development of the physical resources of Indiana;

WHEREAS, the economic productivity, recreational utility, and natural beauty of the state are all affected by the sufficiency of drainage in Indiana;

WHEREAS, laws and regulations relating to drainage have been imposed by state and local governments and conflicts may exist between those laws and regulations;

WHEREAS, many of these laws and regulations have been in existence for many years and may now be antiquated so as to require updating;

WHEREAS, these matters involve complex issues: Therefore,

BE IT RESOLVED BY THE SENATE OF THE INDIANA GENERAL ASSEMBLY, THE HOUSE OF REPRESENTATIVES CONCURRING:

SECTION 1. That the legislative council is urged to establish an interim study committee to study and review matters concerning state and local drainage laws and regulations.

SECTION 2. That the committee, if established, shall operate under the direction of the legislative council and that the committee shall issue a final report when directed to do so by the legislative council.

APPENDIX C

Senate Enrolled Act 303

T.O.C.

First Regular Session 109th General Assembly (1995)

PRINTING CODE. Amendments: Whenever an existing statute (or a section of the Indiana Constitution) is being amended, the text of the existing provision will appear in this style type, additions will appear in **this style type**, and deletions will appear in ~~this style type.~~

Additions: Whenever a new statutory provision is being enacted (or a new constitutional provision adopted), the text of the new provision will appear in **this style type**. Also, the word **NEW** will appear in that style type in the introductory clause of each SECTION that adds a new provision to the Indiana Code or the Indiana Constitution.

Conflict reconciliation: Text in a statute in ***this style type*** or ~~***this style type***~~ reconciles conflicts between statutes enacted by the 1994 General Assembly.

SENATE ENROLLED ACT No. 303

AN ACT concerning natural resources and to make an appropriation.

Be it enacted by the General Assembly of the State of Indiana:

SECTION 1. [EFFECTIVE UPON PASSAGE] **(a) The water resources study committee is established.**

(b) The committee consists of twelve (12) members of the general assembly appointed as follows:

(1) Six (6) senators appointed by the president pro tempore of the senate in consultation with the minority leader of the senate, not more than three (3) of whom may be members of the same political party.

(2) Six (6) representatives appointed by the speaker of the house of representatives in consultation with the minority leader of the house of representatives, not more than three (3) of whom may be members of the same political party.

(c) The president pro tempore of the senate shall appoint a member of the committee to serve as chairman of the committee during the first regular session of a general assembly and as vice chairman during the second regular session. The speaker of the

house of representatives shall appoint a member of the committee to serve as vice chairman during the first regular session of a general assembly and as chairman during the second regular session.

(d) The committee shall study and may make recommendations concerning all matters relating to the surface and ground water resources of Indiana, including the following:

(1) The usage, quality, and quantity of those water resources.

(2) Issues concerning diffused surface water, the common enemy doctrine, and runoff.

(e) The committee shall oversee the activities of the work group to produce a technical and administrative handbook for drainage projects and resolve disputes between members of the work group if necessary.

(f) The committee shall do the following:

(1) Operate under the direction of the legislative council.

(2) Issue reports when directed to do so by the legislative council.

(g) This SECTION expires January 1, 1997.

SECTION 2. [EFFECTIVE UPON PASSAGE] (a) There is created a work group to develop a technical and administrative handbook for drainage projects.

(b) The work group consists of eleven (11) members appointed as follows:

(1) Four (4) individuals, each of whom must be either a county surveyor or a member of a county drainage board appointed by the governor.

(2) The commissioner of the Indiana department of environmental management or the commissioner's designee.

(3) The director of the department of natural resources or the director's designee.

(4) A representative of the Natural Resources Conservation Service of the United States Department of Agriculture, appointed by the state conservationist of the Natural Resources Conservation Service.

(5) A representative of the United States Fish and Wildlife Service of the Department of the Interior, appointed by the Assistant Secretary for Fish and Wildlife and Parks.

(6) A representative of the United States Corps of Engineers, appointed by the Regulatory Program Representative of the Ohio River Division Office of the

T.O.C.

Army Corps of Engineers.

(7) A representative of an agricultural organization appointed by the governor.

(8) A representative of an environmental organization appointed by the governor.

(c) The work group shall be under the direction of an individual who has entered into a contract with the department of natural resources to do the following:

(1) Facilitate the work group.

(2) Conduct public meetings to hear testimony and receive written comments.

(3) Write and edit the technical and administrative handbook for drainage projects.

(4) Issue reports to the water resources study committee when directed to do so.

(d) The handbook must contain at least the following:

(1) Technical descriptions of drainage project construction techniques.

(2) Best management practices for drainage projects that are protective of the environment and take into account onsite and offsite effects, cumulative effects, and downstream impacts.

(3) Explanations of agency permitting processes and procedures to be followed by permittees to assure compliance with all applicable statutes, rules, and regulations.

(4) Addresses and telephone numbers of agency employees who are responsible for permitting.

(5) Descriptions of compensatory measures for unavoidable environmental damage.

(6) Descriptions of projects that are exempt from state or federal regulation.

(7) A description of a process that allows clear and timely access by permit applicants to supervisors in agencies to review and discuss prospective permit conditions.

(8) Any other information the work group considers necessary.

(e) Members of the work group shall attempt to reach a consensus on issues discussed by the group. If the work group is unable to resolve a dispute, the facilitator shall submit the disputed issues to the water resources study committee for resolution.

(f) The department of natural resources shall provide clerical and administrative support to the work group and the facilitator.

(g) Upon completion of the handbook, the department of natural resources shall make the handbook available to county surveyors, drainage boards, other agencies, and the public.

(h) There is appropriated to the department of natural resources an amount sufficient for the purpose of entering into a contract with an individual described in subsection (c). There is appropriated to the department of natural resources fifty thousand dollars ($50,000) to be used to pay the costs incurred under this SECTION, including the publication of the handbook for drainage projects and distribution to persons under subsection (g).

(i) This SECTION expires January 1, 1997.

SECTION 3. An emergency is declared for this act.

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APPENDIX D

List of Work Group Members

INDIANA DRAINAGE HANDBOOK

WORK GROUP MEMBERS

County Surveyors/County Drainage Boards:
Kenton Ward - Hamilton County Surveyor
Hamilton County Surveyor's Office
1 Hamilton County Square, Suite 146
Noblesville, IN 46060
telephone: (317) 776-8495
fax: (317) 776-9628

Greg Deeds - Miami County Surveyor
Miami County Surveyor's Office
Courthouse, 1 North Broadway
Peru, IN 46970
telephone: (317) 472-3901
fax: (317) 472-1412

Carl Colbert - Tipton County Drainage Board
Tipton County Commissioner's Office
Courthouse, 101 East Jefferson
Tipton, IN 46072
telephone: (317) 675-2793
fax: (317) 675-8493

Kenneth Culp, Jr., Jasper County Drainage Board
Jasper County Commissioner's Office
Courthouse, Room 5
Rensselaer, IN 47978
telephone: (219) 866-4930
fax: (219) 866-4940

Environmental Organization:
Karl Glander - Friends of the White River
1698 Ashwood Drive
Greenwood, IN 46143
telephone: (317) 888-2827 (office)
fax: (317) 888-2820

Agricultural Organization:
James Barnett, Natural Resources Department Director
Indiana Farm Bureau, Incorporated
P.O. Box 1290
Indianapolis, IN 46206
telephone: (317) 692-7846
fax: (317) 692-7854

Indiana Department of Environmental Management:
Dennis Clark, Water Quality Standards Section Chief
P.O. Box 6015
Indianapolis, IN 46206-6015
telephone: (317) 233-2482
fax: (317) 232-8406

Indiana Department of Natural Resources:
James Ray, Lake and River Enhancement Section Head
IDNR - Division of Soil Conservation
402 West Washington Street, Room W265
Indianapolis, IN 46204-2748
telephone: (317) 233-3870
fax: (317) 233-3882

United States Fish and Wildlife Service:
David Hudak, Bloomington Field Office Supervisor
USFWS - Division of Ecological Services
620 South Walker Street
Bloomington, IN 47403
telephone: (812) 334-4261
fax: (812) 334-4273

Ohio River Division Corps of Engineers:
Doug Shelton, Regulatory Branch, North Section Chief
Louisville District Office
P.O. Box 59
Louisville, KY 40201-0059
ATTN: Regulatory Branch OPFN
telephone: (502) 582-5607
fax: (502) 582-5072

Natural Resource Conservation Service:
Philip McLoud, State Conservation Engineer
USDA NRCS - 6013 Lakeside Boulevard
Indianapolis, IN 46278
telephone: (317) 290-3217
fax: (317) 290-3225

Last Print/Revision Date: October 13, 1996

T.O.C.

APPENDIX E

Material Related to IDNR-Administered Regulations

T.O.C.

APPENDIX E.1

IDNR Permit Application Package

T.O.C.

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

JOINT PERMIT APPLICATION FOR CONSTRUCTION WITHIN A FLOODWAY OF A STREAM OR RIVER; NAVIGABLE WATERWAY; PUBLIC FRESH WATER LAKE; AND DITCH RECONSTRUCTION

*** INSTRUCTIONS ***

This joint application can be used to apply for: (1) alteration of the bed or shoreline of a public freshwater lake; (2) construction or reconstruction of any ditch or drain having a bottom depth lower than the normal water level of a freshwater lake of 10 acres or more and within 1/2 mile of the lake; (3) construction within the floodway of any river or stream; (4) placing, filling, or erecting a permanent structure in; water withdrawal from; or material extraction from; a navigable waterway; (5) extraction of mineral resources from or under the bed of a navigable waterway; and (6) construction of an access channel. **You must submit readable copy of the completed application form together with items stated in the "Application Checklist" (attached).**

Use the following checklist to determine which permit(s) to apply for. If you have trouble deciding which permit(s) you need, please contact the Permit Administration Section at (317) 233-5635.

Your project may require one or more of the following permits. **IF YOU CHECK ANY BOX UNDER A PERMIT TITLE, THEN YOU MUST APPLY FOR THAT PERMIT.**

" IC 14-26-2: **Lake Preservation Act** states that no person may change the level of the water or shoreline of a public freshwater lake by excavating, filling in, or otherwise causing a change in the area or depth or affecting the natural resources scenic beauty or contour of the lake below the waterline or shoreline, without first securing the written approval of the Department of Natural Resources. A written permit from the Department is also required for construction of marinas; new seawall; seawall refacing; underwater beaches; boatwells; boat well fills; fish attractors; and any permanent structures within the waterline or shoreline of a public freshwater lake. The Act further states that **each permit application must be accompanied by a non-refundable $25 fee.**

" IC 14-26-5: **Lowering of the Ten Acre Lake Act also know as the "Ditch" Act** states that no person may order or recommend the location, establishment, construction, reconstruction, repair, or recleaning any ditch or drain having a bottom depth lower than the normal water level of a freshwater lake of 10 acres or more and within 1/2 mile of the lake without first securing the written approval of the Department of Natural Resources. The Act further states that **each permit application must be accompanied by a non-refundable $25 fee.**

" IC 14-28-1: **Flood Control Act** requires that any person proposing to construct a structure, place fill, or excavate material within the floodway of any river or stream must obtain the written approval of the Department of Natural Resources prior to initiating the activity. The Act further states that **each permit application must be accompanied by a non-refundable $50 fee.**

" IC 14-29-1: **Navigable Waterways Act** requires that prior written approval be obtained from the Department of Natural Resources for placing, filling, or erecting a permanent structure in; water withdrawal from; or mineral extraction from; a navigable waterway or Lake Michigan. **No Fee**

" IC 14-29-3: **Sand and Gravel Permits Act** requires that prior written approval be obtained from the Department of Natural Resources for removal of sand, gravel, stone, or other mineral or substance from or under the bed of a navigable waterway. The Act further states that **each permit application must be accompanied by a non-refundable $50 fee.**

" IC 14-29-4: **Construction of Channels Act** requires that prior written approval of the Department of Natural Resources be obtained for construction of an artificial; or the improved channel of a natural watercourse; connecting to any river or stream for the purpose of providing access by boat or otherwise to public or private industrial, commercial, housing, recreational, or other facilities. **Each permit application must be accompanied by a non-refundable $100 fee.**

T.O.C.

Mail To: Division of Water
Department of Natural Resources
402 West Washington Street, Room W264
Indianapolis, Indiana 46204-2748
Telephone Number: (317) 233-5635
Fax Number: (317) 233-4579

PERMIT APPLICATION

State Form 42946 (R2/3-98)
Approved by the State Board of Accounts

AGENCY USE ONLY		
Application # ________________	Section Coordinates	UTM North________ UTM East__________
30 Day Notice ________________	Fee Submitted $___________ Check # ___________	Receipt # ____________________

Based on the "INSTRUCTIONS", I am submitting this application to perform work under:

9 *IC 14-26-2 Lake Preservation Act*
9 *IC 14-26-5 Lowering of the Ten Acre Lake Act*
9 *IC 14-28-1 Flood Control Act*
9 *IC 14-29-1 Navigable Waterways Act*
9 *IC 14-29-3 Sand and Gravel Permits Act*
9 *IC 14-29-4 Construction of Channels Act*

PLEASE TYPE OR PRINT

1. APPLICANT INFORMATION

Name of Applicant ____________________________ Name of Contact Person _______________________

Mailing Address ____
(Street, P.O. Box or Rural Route)

____________________________ City ______________ State ____________________ Zip Code

Daytime Telephone Number (____)_________________ Fax Number (____)____________________

2. AGENT INFORMATION

Name of Authorized Agent _____________________ Name of Contact Person _____________________

Mailing Address ____
(Street, P.O. Box or Rural Route)

____________________________ City ______________ State ____________________ Zip Code

Daytime Telephone Number (____)_________________ Fax Number (____)____________________

3. PROPERTY OWNER INFORMATION

Name of Property Owner _______________________ Name of Contact Person __________________

Mailing Address ____
(Street, P.O. Box or Rural Route)

____________________________ City _ ______________ State __________________ Zip Code

Daytime Telephone Number (____)__________________ Fax Number (____)___________________

Relationship of applicant to property: 9 Owner 9 Purchaser 9 Lessee Other ___________

Form N-4

4. AFFIRMATION OF PERSONAL SERVICE, 1ST CLASS MAIL SERVICE, OR CERTIFIED MAIL SERVICE

I have provided public notice to the listed property owners in conformance with the provisions of IC 14-11-4 and 312 IAC 2-3-3 through the method indicated below.
(Check the appropriate Box - *Please make copies of this blank page if additional pages are required*)

____________________ Property Owner (if not applicant or adjacent landowner) ____________________ Address ________ ____ ______ City State Zip Code	9 Personal Service was provided on :__________ (date) 9 1st Class Mail Service was provided on: ______(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. 9 Certified Mail service was provided on:______(date) PS Form 3811 (green card) is attached as proof of mailing.
____________________ Adjacent Landowner: ____________________ Address ________ ____ ______ City State Zip Code	9 Personal Service was provided on :__________ (date) 9 1st Class Mail Service was provided on: ______(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. 9 Certified Mail service was provided on:______(date) PS Form 3811 (green card) is attached as proof of mailing.
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T.O.C.

5. PROJECT DESCRIPTION

5.1 Description Narrative: (See Application Information Packet)

6. PROJECT LOCATION

6-1 Location Narrative: (See Application Information Packet)

Stream/Lake Name:

6-2 Driving Directions: (See Application Information Packet)

6-3 Special Information: (See Application Information Packet)

6-4 Project Location Map: (See Application Information Packet)

6-5 Project Site Map: (See Application Information Packet)

7.	DISTURBED AREA DRAWING
7.1 Drawing Requirements: (See Application Information Packet)	

8.	PROJECT PHOTOGRAPHS
8-1 Images: (See Application Information Packet)	
8-2 Photo Orientation Map: (See Application Information Packet)	
8-3 Photo Documentation: (See Application Information Packet)	

9.	RELATED PROJECT INFORMATION
Department of Natural Resources	
Administrative Cause #	Related Application(s) #
Early Coordination #	Utility Exemption #
Recommendation #	Violation #
Department of Environmental Management	
Section 401 #	
Corps of Engineers	
Public Notice #	Section 10 Application #
Section 404 Application #	

10. STATEMENT OF AFFIRMATION

I hereby swear or affirm, under the penalties for perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete, and that the property owner (s), and adjoining landowners have been notified of the activity in conformance with the provisions of 312 IAC 2-3-3. I further certify that I possess the authority to undertake the proposed or completed activities. I hereby grant to the Department of Natural Resources, the right to enter the above-described location to inspect the proposed or completed work.

_______________________________________ ______________________

Signature of Applicant or Authorized Agent *(REQUIRED)* **Date**

11.	REGULATORY FEES
11-1 Regulatory Fees Submitted: (See Application Information Packet)	
11-3 Payment Method: (See Application Information Packet)	

REQUIREMENT FOR ADDITIONAL INFORMATION AND PERMITS

Application made to and approval granted by the Department of Natural Resources does not in any way relieve the applicant of the necessity of securing easements or other property rights, permits and approvals from affected property owners and other local, state, and federal agencies.

Form N2

Public Notice

Adjacent Property Owner's Name
Address
City, State, Zip Code

Date_______________

Indiana Code 14-11-4 was enacted to ensure that adjacent property owners are notified of permit applications and provided with an opportunity to present their views to the Department of Natural Resources prior to action.

Under the legislation, the applicant or agent is responsible for providing notice to the owner of the real property owned by a person, other than the applicant, which is both of the following: 1.) located within one-fourth (1/4) mile of the site where the licensed activity would take place, and 2.) has a border or point in common with the exterior boundary of the property where the licensed activity would take place. Included is property which would share a common border if not for the separation caused by a roadway, stream, channel, right-of-way, easement, or railroad.

Due to your proximity to the project site, you are considered to be an adjacent property owner; therefore, notice is being provided in conformance with the provisions of IC 14-11-4 and 312 IAC 2-3.

Applicant's Name, Address, and Telephone
____
____
____

Agent's Name, Address, and Telephone
____
____
____

Stream or Lake Name____

Project Description and Location____
____

Check relevant Statute or Rule:

- G Flood Control Act, IC 14-28-1
- G Lake Preservation Act, IC 14-26-2
- G "Ditch Act", IC 14-26-5
- G Channels Act, IC 14-29-4
- G Removal of Sands or Gravel, IC 14-29-3

Questions relating to the project should be directed to:

Applicant (or Agent) Name
Mailing Address
City, State, Zip Code
Telephone Number

You may request an informal public hearing, pre-AOPA (Administrative Orders and Procedures Act) hearing, on this application by filing a petition with the Division of Water. The petition must conform to administrative rule 312 IAC 2-3-4 as follows:

(a) This section establishes the requirements for a petition to request a public hearing under IC 14-11-4-8(a)(2).
(b) The petition shall include the signatures of at least twenty-five (25) individuals who are at least eighteen (18) years of age and who reside in the county where the licensed activity would take place or who own real property within one (1) mile of the site of the proposed or existing licensed activity.
(c) The complete mailing addresses of the petitioners shall be typed or printed legibly on the petition.
(d) Each individual who signs the petition shall affirm that the individual qualifies under subsection (b).

(e) The petition shall identify the application for which a public hearing is sought, either by division docket number (application number) or by the name of the applicant and the location of the project.

A pre-AOPA public hearing on the application will be limited to the Department's authority under the permitting statues. Only the issues relevant to the Department's jurisdiction directly related to this application for construction will be addressed. Under permitting statues, the Department has no authority in zoning, local drainage, burning, traffic safety, etc.; therefore, topics beyond the Department's jurisdiction will not be discussed during the public hearing.

The Department's jurisdiction under the Flood Control Act is confined to the floodway of the stream and its review limited to the following criteria.

To be approvable a project must demonstrate that it will:

(a) not adversely affect the efficiency or unduly restrict the capacity of the floodway; defined as, the project will not result in an increase in flood stages of more than 0.14 feet above the base 100-year regulatory flood elevation.

(b) not constitute an unreasonable hazard to the safety of life or property; defined as, the project will not result in either of the following during the regulatory flood: (1) the loss of human life, (2) damage to public or private property to which the applicant has neither ownership nor a flood easement;

(c) not result in unreasonably detrimental effects upon fish, wildlife or botanical resources.

Additionally, the Department must consider the cumulative effects of the above items.

The Department's jurisdiction under the Lakes Preservation Act is confined to the area at or lakeward of the shoreline of the lake and any impact which the project may have on:

(a) the natural resources and/or scenic beauty of the lake;
(b) the water level or contour of the lake below the waterline;
(c) fish, wildlife or botanical resources.

Additionally, the department must consider the cumulative effects of the above items.

A request for a pre-AOPA public hearing or notice of initial determination should be addresses to:

Permit Administration Section
Division of Water
Department of Natural Resources
402 West Washington Street, Room W264
Indianapolis, Indiana 46204-2748
Telephone: (317) 233-5635

You may also request that the Department notify you in writing when an initial determination is made to issue or deny the permit. Following the receipt of the approval or denial notice, you may request administrative review of the determination by the Natural Resources Commission under IC 4-21.5 and 312 IAC 2-3.

T.O.C.

Form N-4

AFFIRMATION OF PERSONAL SERVICE, 1ST CLASS MAIL SERVICE, OR CERTIFIED MAIL SERVICE

I have provided public notice to the listed property owners in conformance with the provisions of IC 14-11-4 and 312 IAC 2-3-3 through the method indicated below. Check the appropriate box.

Property Owner (if not applicant) __________ Address __________ City, State, Zip Code __________	9 Personal service was provided on:_______(date) 9 1st Class Mail service was provided on:________(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. Attached is PS Form 3817 as proof of mailing. 9 Certified Mail service was provided on: ________(date) Attached is PS Form 3811 (green cards) as proof of mailing.
Adjacent Landowner __________ Address __________ City, State, Zip Code __________	9 Personal service was provided on:_______(date) 9 1st Class Mail service was provided on:________(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. Attached is PS Form 3817 as proof of mailing. 9 Certified Mail service was provided on: ________(date) Attached is PS Form 3811 (green cards) as proof of mailing.
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Adjacent Landowner __________ Address __________ City, State, Zip Code __________	9 Personal service was provided on:_______(date) 9 1st Class Mail service was provided on:________(date) I affirm that 21 days have passed without the mailing being returned as undelivered or undeliverable. Attached is PS Form 3817 as proof of mailing. 9 Certified Mail service was provided on: ________(date) Attached is PS Form 3811 (green cards) as proof of mailing.

I hereby swear or affirm, under the penalties of perjury, that the aforementioned statements and representations are true and accurate.

____________________________________(**Signature**)________________(**Date**)

Copy and attach additional sheets if necessary

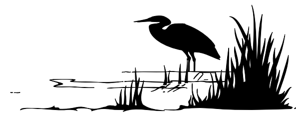
T.O.C.

APPENDIX E.2

IDNR Listing of Public Freshwater Lake Wetland Review Maps

T.O.C.

PUBLIC FRESHWATER LAKE
WETLAND REVIEW MAPS



ELKHART COUNTY

Simonton Lake

FULTON COUNTY

Bruce Lake
Lake Manitou
Nyona Lake

KOSCIUSKO COUNTY

Beaver Dam Lake
Big Barbee & Kuhn Lakes
Big Chapman Lake
Caldwell Lake
Carr Lake
Center Lake
Crystal Lake
Diamond Lake
Hill Lake
Irish Lake
James Lake
Jamison Lake
Lake Wawasee
Little Chapman Lake
Loon Lake
McClures Lake
Palestine Lake
Pike Lake
Rock Lake
Sechrist & Sawmill Lakes
Sellers Lake
Sherburn Lake
Silver Lake
Syracuse Lake
Tippecanoe & Oswego Lakes
Webster Lake
Winona Lake
Yellow Creek Lake

STARKE COUNTY

Bass Lake
Koontz Lake

WABASH COUNTY

Twin Lakes

LAGRANGE COUNTY

Adams Lake
Appleman Lake
Atwood Lake
Basin Lake
Big Long Lake
Dallas Lake
Hackenburg Lake
Lake of the Woods
Little Turkey Lake
Martin Lake
Messick Lake
Olin Lake
Oliver Lake
Pretty Lake
North Twin Lake
South Twin Lake
Wall Lake
Witmer Lake

LAKE COUNTY

Cedar Lake

LAPORTE COUNTY

Pine Lake

MARSHALL COUNTY

Lake of the Woods
Lake Maxinkuckee
Thomas Lake

NOBLE COUNTY

Bear Lake
Jones Lake
Knapp Lake
Latta Lake
Loon Lake
Sacarider Lake
Skinner Lake
Smalley Lake
Sylvan Lake
Waldron Lake

STEUBEN COUNTY

Bass Lake
Big Otter Lake
Big Turkey Lake
Bower Lake
Clear Lake
Crooked Lake
Eve Lake
Hamilton Lake
Handy Lake
Henry Lake
Hogback Lake
Jimmerson Lake
Lake Anne
Lake James
Lake Pleasant
Lime Lake
Little Otter Lake
Long Lake
Loon Lake
McClish Lake
Mirror Lake
Mud Lake
Round Lake
Silver Lake
Snow Lake
Tamarack Lake

WHITLEY COUNTY

Black Lake
Blue Lake
Brown Lake
Goose Lake
Larwill Lake
Leininger Lake
Mud Lake
New Lake
Old Lake
Rine Lake
Robinson Lake
Scott Lake
Tadpole Lake
Tri-Lakes (Cedar Lake, Little Cedar Lake, Round Lake and Shriner Lake)
Troy Cedar Lake
Wilson & Little Wilson Lakes
Winters Lake

Revised 12/21/98

APPENDIX E.3

IDNR Roster of Navigable Waterways in Indiana

NATURAL RESOURCES COMMISSION
Information Bulletin #3
July 1, 1992

SUBJECT: Roster of Indiana Waterways Declared Navigable

I. NAVIGABILITY

Property rights relative to Indiana waterways often are determined by whether the waterway is "navigable". Both common law and statutory law make distinctions founded upon whether a river, stream, embayment, or lake is navigable.

A landmark decision in Indiana with respect to determining and applying navigability is State v. Kivett, 228 Ind. 629, 95 N.E.2d 148 (1950). The Indiana Supreme Court stated that the test for determining navigability is whether a waterway:

> was available and susceptible for navigation according to the general rules of river transportation at the time [1816] Indiana was admitted to the Union. It does not depend on whether it is now navigable. . . .The true test seems to be the capacity of the stream, rather than the manner or extent of use. And the mere fact that the presence of sandbars or driftwood or stone, or other objects, which at times render the stream unfit for transportation, does not destroy its actual capacity and susceptibility for that use.

A modified standard for determining navigability applies to a body of water which is artificial. The test for a man-made reservoir, or a similar waterway which did not exist in 1816, is whether it is navigable in fact. Reed v. United States, 604 F. Supp. 1253 (1984).

The court observed in Kivett that "whether the waters within the State under which the lands lie are navigable or non-navigable, is a federal" question and is "determined according to the law and usage recognized and applied in the federal courts, even though" the waterway may not be "capable of use for navigation in interstate or foreign commerce." Federal decisions applied to particular issues of navigability are useful precedents, regardless of whether the decisions originated in Indiana or another state.

The primary issue in Kivett was ownership of the river bed from which the defendant was removing materials. If the waterway was navigable on the date of statehood, title to the bed of the river passed to the state of Indiana and could not ordinarily be conveyed incident to the adjoining riparian property.

In the absence of a contrary state boundary, the appropriate line of demarcation for a navigable waterway is the high water mark. The Indiana Water Resource, Governor's Water Resource Study Commission, State of Indiana (Indiana Department of Natural Resources, 1980), page 107. If not navigable, title to the bed of the river passes to the adjacent property owner or owners.

Ownership is not the only issue determined by whether a waterway is navigable. Public recreational and commercial usage of the surface of a river or stream often depends upon whether the water is navigable. Other legal foundations may, however, authorize public usage. A prescriptive easement may exist. A waterway may be a "public freshwater lake" subject to IC 13-2-11.1 and 310 IAC 6-2. Pursuant to IC 13-2-33, the Natural Resources Commission may, by rule, declare a waterway to be a "recreational stream".

State legislation also establishes regulatory functions which rest upon a determination of navigability. For example, a permit is typically required from the Indiana Department of Natural Resources before a person can

(1) place, fill, or erect a permanent structure in;
(2) remove water from; or
(3) remove material from

a navigable waterway. IC 13-2-4-9 and 310 IAC 21. Other notable regulatory standards applicable to navigable waters include IC 4-18-13 (Lake Michigan fills), IC 13-2-18.5-5 (dedication of channels into navigable waters), IC 14-3-1-14 (general charge of Indiana navigable waters placed in DNR), and IC 14-3-1-14.5 (removal of sand and gravel from the beds of navigable waters).

II. ESTABLISHING A ROSTER

Despite the legal significance of determining whether a particular waterway is or is not navigable, a comprehensive roster of Indiana waters declared navigable has not existed. In part, this absence can be explained by the essentially judicial character of the doctrine of navigability. Since a determination of navigability is ultimately based upon a judicial finding which is both waterway and site specific, any roster is subject to criticism because it is incomplete.

In addition, legislative declarations have identified specific waters as being navigable (or "public highways"). Although most legislative declarations occurred before 1850, more recently governmental agencies have also determined questions of navigability. Notable examples include the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, and, at the state level, the Indiana Natural Resources Commission. A determination by any of these legislative or administrative entities is subject to judicial scrutiny and modification.

Even within these limitations, a roster of waters declared navigable can be productive for efforts to regulate and manage the state's waters. With an understanding that any listing of waterways declared navigable is necessarily imperfect and subject to adjustments as new decisions are made, the roster which follows is intended to aid in the regulatory process and in a general public awareness of waterway usage.

A few explanatory remarks are appropriate to the structure of the roster. A waterway is presumed to be navigable at all points downstream from a determination of navigability. A judicial determination as to whether a particular water is or is not navigable generally supersedes a legislative or administrative decision. Unless otherwise refuted, a legislative determination of navigability is presumed to demonstrate historical usage of a waterway for navigation; and a later statutory repeal does not negate the navigability of the waterway.

A declaration of navigability or nonnavigability must be based upon a primary source. These primary sources are a declaration by a court, the legislature, or an agency with jurisdiction over navigable waters. A waterway declared by a primary source to be nonnavigable is identified in brackets. If a waterway is unlisted, no declaration of navigability or nonnavigability has been located from a primary source.

Secondary sources may be applied to determine the geographic limitations of navigability for a particular waterway. Secondary sources include courthouse records, published county histories, periodicals, newspaper articles, interviews, and similar evidence. For example, in the early 19th Century, the Indiana General Assembly sometimes identified a stream as being a "public highway" downstream from a particular mill. Secondary sources are typically applied to determine where the mill is believed to have been located.

Reported state or federal court decisions are applied in seeking to resolve legal issues of navigability which bear upon particular waters (example: where a navigable river is channelized, the new channel becomes navigable and the former channel loses its navigable character when sedimentation causes the bed to surface). Although this roster does not include citations to the authorities applied in determining navigability, these authorities can be obtained through the Indiana Natural Resources Commission.

Stephen L. Lucas, Director
Division of Hearings
Natural Resources Commission
Indiana Government Center South
402 West Washington, Room W272
Indianapolis, Indiana 46204
(317) 232-4699

III. ROSTER OF INDIANA WATERS DECLARED NAVIGABLE OR NONNAVIGABLE (LISTED BY WATERWAY NAME)

Anderson River (including Middle Fork): Navigable in Spencer County from its junction with the Ohio River for 28.4 river miles to the Perry-Spencer County Line. The Middle Fork is navigable from its junction with the Anderson River for 3.3 river miles.

Armuth Ditch: See Black Creek.

Arnold Creek: Navigable in Ohio County from its junction with the Ohio River for 4.4 river miles.

Baker Creek: Navigable in Spencer County from its junction with Little Pigeon Creek 1.8 river miles.

Bald Knob Creek: Navigable in Perry County from its junction with Oil Creek for 0.5 river miles.

Banbango Creek: See Baugo Creek.

Baugo Creek: Navigable from its junction with the St. Joseph River in South Bend for 15.2 river miles to the main forks (near Wakarusa).

Bayou Creek: Navigable in Vanderburgh County from its junction with the Ohio River for 1.5 river miles.

Beanblossom Creek: Navigable in Monroe County from its junction with the West Fork of the White River for 17.7 river miles to Griffy Creek.

Bear Creek: Navigable in Perry County from its junction with the Ohio River for 1.6 river miles.

Big Blue River: Navigable from its junction with Sugar Creek (to form the Driftwood River) for 55.46 river miles to the Henry-Rush County Line.

Big Blue River: See, also, Blue River.

Big Creek: Navigable in Posey County from its junction with the Wabash River for 25.4 river miles (near Cynthiana). See, also, Little Fork of Big Creek.

Big Deer Creek: See Deer Creek.

Big Indian Creek: See Indian Creek (Morgan County).

Big Oil Creek: Navigable in Perry County from its junction with the Ohio River for 10.6 river miles.

Big Poison Creek: Navigable in Perry County from its junction with the Ohio River for 6.3 river miles.

Big Raccoon Creek: Navigable from its junction with the Wabash River for 42.35 river miles to the Parke-Putnam County Line (now Cecil M. Harden Lake). The dam for Harden Lake is located at river mile 33.7.

Big Saluda Creek: Navigable in Jefferson County from its junction with the Ohio River for 1.0 river miles.

Big Sandy Creek: See Sandy Creek.

Big Vermillion River: Navigable from its junction with the Wabash River for 10.8 river miles to the Illinois State Line. (This river is navigable to Carmargo, Illinois.)

Black Creek: Navigable from its junction with the West Fork of the White River (near Edwardsport) for 11.8 river miles (near Marco).

Blue River: Navigable from its junction with the Ohio River for 57.15 river miles to Fredricksburg.

Blue River: See, also, Big Blue River.

Bryant Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.6 river miles.

Buck Creek: Navigable in Harrison County from its junction with the Ohio River for 5.8 river miles.

Buck Creek: Navigable in Perry County from its junction with the Ohio River for 0.7 river miles.

Buck Run: Navigable in Ohio County from its junction with the Ohio River for 1.1 river miles.

Bull Creek: Navigable in Clark County from its junction with the Ohio River for 1.1 river miles.

Bull Hollow: Navigable in Perry County from its junction with Big Oil Creek for 0.7 river miles.

Burns Ditch: Navigable as a channelization of the Little Calumet River.

Burns Waterway Harbor: Navigable as an extension of Lake Michigan for 1.3 river miles to the Little Calumet River.

Busseron Creek: Navigable from its junction with the Wabash River in Knox County for 20.96 river miles. A channelization and relocation of Busseron Creek is navigable from its junction with the Wabash River in Sullivan County (near Rogers Ditch) for 2.85 river miles to its junction with the original channel.

Busserou Creek: See Busseron Creek.

Cagles Mill Lake: See Eel River, and see Mill Creek.

Calumet River: See Grand Calumet River; also Little Calumet River.

Calumet River Canal: See Indiana Harbor Canal.

Cammie Thomas Ditch: Navigable for 7.45 river miles as a channelization of the Muscatatuck River.

Camp Creek: Navigable in Clark County from its junction with the Ohio River for 1.7 river miles.

Caney Branch: Navigable in Perry County from its junction with Big Poison Creek for 0.2 river miles.

Caney Branch: Navigable in Perry County from its junction with Little Deer Creek for 0.8 river miles.

Caney Creek: Navigable in Spencer County from its junction with the Ohio River for 2.8 river miles.

Carman's Creek: See Turman Creek.

Cecil M. Harden Lake: See Big Raccoon Creek.

Clear Creek: Navigable in Monroe County from its junction with Salt Creek for 2.55 river miles (near Harrodsburg).

Clear Creek: Navigable from its junction with Little Pigeon Creek for 2.4 river miles.

Clover Lick Creek: Navigable in Perry County from its junction with Big Oil Creek for 0.7 river miles.

Conns Creek: Navigable (although with private ownership of the creek bed) from its junction with the Flatrock River for 11.5 river miles to the Rush-Shelby County Line.

Crooked Creek: Navigable in Spencer County from its junction with the Ohio River for 7.7 river miles.

Cypress Creek (including Cypress Creek Diversion Channel): Navigable in Warrick County from its junction with the Ohio River for 6.6 river miles. (The original bed of Cypress Creek is also navigable west of Cypress Creek Diversion Channel for 1.95 river miles, except where the creek bed has emerged and is no longer inundated.)

Deer Creek: Navigable in Perry County from its junction with the Ohio River for 5.9 river miles.

Driftwood River: Navigable from its junction with the East Fork of the White River (near Columbus) 15 river miles to its junction with the Big Blue River (near Edinburgh).

Dry Run Creek: Navigable in Crawford County from its junction with the Big Blue River for 1.4 river miles.

East Calumuck River: See Little Calumet River.

East Deer Creek: Navigable in Perry County from its junction with Deer Creek for 0.6 river miles.

East Fork of the White River: Navigable from its junction with the White River 189 river miles to its junction with the Flatrock and Driftwood Rivers (near Columbus).

East Fork of the Whitewater River: Navigable from its junction with the Whitewater River for 26.25 river miles to the Union-Wayne County Line.

Eel River: Navigable from its junction with the West Fork of the White River for 51.2 river miles to its junction with Mill Creek (now within Cagles Mill Lake).

Elk Creek: Navigable in Washington County from its junction with the Cammie Thomas Ditch for 3.0 river miles.

Fanny Creek: Navigable in Perry County from its junction with the Ohio River for 0.8 river miles.

Fawn River: Navigable for 13.45 river miles within Indiana. The Fawn River has two navigable segments in Indiana, separated by segments in Michigan. Navigability commences at the Indiana-Michigan state line (near Gilmore Lake and two miles south of Sturgis, Michigan) and continues downstream.

Flat Creek: Navigable from its junction with the Patoka River for 12.0 river miles (near Otwell).

Flatrock River: Navigable from its junction with the East Fork of the White River (Columbus) 93 river miles to its uppermost point in Henry County (near Mooreland).

Fourteen Mile Creek: Navigable in Clark County from its junction with the Ohio River for 2.9 river miles.

Garrett Creek: Navigable in Spencer County from its junction with the Ohio River for 2.2 river miles.

Goose Creek: Navigable in Switzerland County from its junction with the Ohio River for 1.5 river miles.

Grand Calumet River: Navigable from the Illinois State Line (near Hammond) for 15.4 river miles to Marquette Park. (The river is also navigable in Illinois.)

Grants Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.5 river miles.

Great Miami River: Navigable for 1.4 river miles in Dearborn County. (Most of this river lies within Ohio; and the Great Miami River has been determined to be navigable from its junction with the Ohio River for 117 river miles. The waterway enters Indiana at two locations.)

Harden Lake: See Big Raccoon Creek.

Harris Ditch: Navigable in Posey County from its junction with the Ohio River for 0.9 river miles to Little Pitcher Lake.

Hogan Creek (including North Fork and South Fork): (The Main Stem of) Hogan Creek is navigable in Dearborn County from the junction on the Ohio River for its entire length of 0.4 river miles. The North Fork is navigable from the junction with Hogan Creek for 4.9 river miles. The South Fork is navigable from the junction with Hogan Creek for 5.0 river miles.

Honey Creek: Navigable in Spencer County from its junction with the Ohio River for 1.8 river miles.

Houchins Ditch: See Patoka River.

Hurricane Fork: See Little Fork of Big Creek.

Independence Creek: See Indian Creek (Harrison County).

Indian Creek: Navigable in Harrison County from its junction with the Ohio River for 4.8 river miles.

Indian Creek: Navigable in Martin County from its junction with the East Fork of the White River for 15.0 river miles to the Lawrence-Martin County Line.

Indian Creek: Navigable in Morgan County from its junction with the West Fork of the White River for 3.3 river miles (near Martinsville).

Indian Creek: Navigable in Switzerland County from its junction with the Ohio River for 4.1 river miles.

Indian Fork: Navigable in Perry County from its junction with Big Oil Creek for 1.4 river miles.

Indian-Kentuck Creek: Navigable in Jefferson County from its mouth on the Ohio River for 3.8 river miles.

Indiana Harbor: Navigable as an extension of Lake Michigan.

Indiana Harbor Canal (including Calumet River Branch and Lake George Branch): The (Main Stem of the) Indiana Harbor Canal is navigable in Lake County for 3.0 river miles from the Indiana Harbor to where it branches into the Calumet River Canal and the Lake George Canal. The Calumet River Canal is navigable in Lake County from the Indiana Harbor Canal for 1.95 river miles to the Grand Calumet River. The Lake George Canal is navigable in Lake County from the Indiana Harbor Canal for 0.85 river miles (near White Oak Avenue if extended southerly).

Iroquios River: Navigable from the Indiana-Illinois State Line for 39 river miles to the Dexter Ditch (near Parr).

Island Branch: Navigable in Ohio County from its junction with the Ohio River for 1.0 river miles.

Jackson Creek: Navigable in Spencer County from its junction with the Ohio River for 1.8 river miles.

Kankakee River: Navigable from the Indiana-Illinois State Line for 86.3 river miles to the Indiana-Michigan State Line. (This river is also navigable downstream in Illinois.)

Kelly Bayou: Navigable in Sullivan County from its downstream junction with an oxbow of the Wabash River for 5.8 river miles to its upstream junction with the Wabash River.

Kelly Hollow: Navigable in Perry County from its junction with Millstone Creek for 1.0 river miles.

Kemper Ditch: See Little Calumet River.

Kingly Creek: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Knob Creek: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Lake Drain: Navigable in Spencer County from its junction with the Ohio River for 1.6 river miles.

Lake George Canal: See Indiana Harbor Canal.

Lake Michigan: Navigable throughout Indiana.

Lancassange Creek: Navigable in Clark County from its junction with the Ohio River for 0.3 river miles.

Laughery Creek: Navigable from its junction with the Ohio River for 10.8 river miles (near Milton).

Lick Creek: Navigable in Orange County from its junction with the Lost River for 19.5 river miles to Old Spring

Mill (near Paoli).

Little Blue River: Navigable in Crawford County from its junction with the Ohio River (near Alton) for 10.6 river miles.

Little Blue River: Navigable from its junction with the Big Blue River (Shelbyville) for 25.6 river miles to its junction with Ball Run.

Little Calumet River: Navigable from the Indiana-Illinois State Line for 21.24 river miles to Burns Waterway Harbor; and navigable for an additional 17.75 river miles to its junction (as Kemper Ditch) with Interstate 94. (The river is also navigable in Illinois.)

Little Creek: See Little Fork of Big Creek.

Little Deer Creek: Navigable from its junction with Deer Creek for 3.9 river miles.

Little Fork of Big Creek: Navigable in Posey County from its junction with Big Creek for 5.1 river miles.

Little Oil Creek: Navigable from its junction with Big Oil Creek for 4.4 river miles.

Little Pigeon Creek: Navigable from its junction with the Ohio River for 15.8 river miles.

Little Pitcher Lake: Navigable in Posey County as an extension of Harris Ditch.

Little Raccoon Creek: Navigable in Parke County from its junction with Big Raccoon Creek for 5.3 river miles (Nevins Covered Bridge).

Little River: Navigable from its junction with the Wabash River 20.2 river miles to Ellison Road (near Fort Wayne).

Little Sandy Creek: Navigable in Spencer County from its junction with the Ohio River for 2.0 river miles.

Little Wabash River: See Little River.

Locust Creek: Navigable in Vanderburgh County from its junction with Pigeon Creek for 1.5 river miles.

Log Lick Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.3 river miles.

Lost River: Navigable from its junction with the East Fork of the White River for 48.87 river miles (near Orangeville).

McFadden Creek: Navigable in Posey County from its junction with the Ohio River for 2.3 river miles.

Marble Powers Ditch: See Kankakee River.

Maumee River: Navigable from the Indiana-Ohio State Line 27.05 river miles to the Hosey Dam, Fort Wayne. (The river is also navigable in Ohio; and the river may be alternatively described as navigable to total river mile 134.9. The Indiana-Ohio State Line is located at total river mile 107.85.)

Mill Creek: Navigable from its junction with the Eel River (now Cagles Mill Lake) for 32.45 river miles to the Hendricks-Morgan County Line. See, also, Mill Creek Ditch.

Mill Creek: Navigable in Crawford County from its junction with the Little Blue River for 1.4 river miles.

Mill Creek Ditch: Navigable from its junction with Mill Creek upstream for 1.35 river miles to the Hendricks-Morgan County Line.

Millstone Creek: Navigable in Perry County from its junction with the Ohio River for 1.4 river miles.

Mississinewa River: Navigable from its junction with the Wabash River for 109.75 river miles to the Indiana-Ohio State Line.

Monroe Lake: See Salt Creek.

Mosquito Creek: Navigable in Harrison County from its junction with the Ohio River for 2.8 river miles.

Mud Creek: Navigable from its junction with Mill Creek (near Little Point) for 5.6 river miles to Tudor Road (near Hazelwood).

Muscatatuck River: Navigable from its junction with the East Fork of the White River for 24.25 river miles to the main forks. See, also, Vernon Fork of Muscatatuck River and South Fork of Muscatatuck River.

Neglie Creek: Navigable in Perry County from its junction with Little Deer Creek for 0.5 river miles.

North Fork of Muscatatuck River: See Vernon Fork of Muscatatuck River.

Ohio River: Navigable throughout the state (from total river mile 491.34 to total river mile 848.0).

Oil Creek: See Big Oil Creek.

Patoka River: Navigable from its junction with the Wabash River for 146.6 river miles (within Greenfield Township, Orange County).

Pickamink River: See Iroquois River.

Pigeon Creek: Navigable from its junction with the Ohio River for 5.9 river miles.

Plum Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.9 river miles.

Poison Creek: See Big Poison Creek.

Potato Run: Navigable in Harrison County from its junction with the Ohio River for 0.4 river miles.

Raccoon Creek: See Big Raccoon Creek.

Rock River: See Sugar Creek.

Rider Ditch: Navigable in Jackson County as a channelization of the Vernon Fork of the Muscatatuck River.

St. Joseph River: Navigable throughout Indiana (Elkhart and St. Joseph Counties) for 39.57 river miles. The river enters Indiana from Michigan and returns to Michigan. (The river is also navigable downstream in Michigan; and the river may be alternatively described as navigable from total river mile 49.93 to total river mile 89.5.)

Salt Creek: Navigable from its junction with the East Fork of the White River for 63.6 river miles to the upstream boundary of Monroe Lake along the North Fork.

Sample Run: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Sand Creek: Navigable in Switzerland County from its junction with Bryant Creek for 0.9 river miles.

Sand Run: See Sand Creek.

Sandy Creek: Navigable in Spencer County from its junction with the Ohio River for 2.6 river miles.

Silver Creek: Navigable in Clark County from its junction with the Ohio River for 3.0 river miles.

Smart Ditch: Navigable in Jackson County as a channelization of the Muscatatuck River (and the Vernon Fork of the Muscatatuck River).

South Fork of Big Creek: See Little Fork of Big Creek.

South Fork of Muscatatuck River: Navigable from its junction with the Muscatatuck River 28.1 river miles to its junction with Graham Creek.

Sugar Creek: Navigable from its junction with the Big Blue River (to form the Driftwood River) for 24.4 river miles (near Boggstown).

Sugar Creek: Navigable from its junction on the Wabash River (near West Union) for 56.83 river miles to the Montgomery-Boone County Line.

Tanners Creek: Navigable from its junction with the Ohio River in Lawrenceburg for 10.6 river miles.

Tate's Hollow: Navigable in Perry County from its junction with the Ohio River for 0.3 river miles.

Thomas Ditch: See Cammie Thomas Ditch.

Trail Creek: Navigable in LaPorte County from its junction with Lake Michigan for 1.0 river miles.

Turman Creek: Navigable in Sullivan County from its junction with the Wabash River for 7.9 river miles (near Dodds Bridge).

Turtle Creek: Navigable in Switzerland County from its junction with the Ohio River for 1.3 river miles.

Twin Creek: Navigable in Washington County from its junction with the East Fork of the White River for 7.98 river miles to the Cox Ferry Road Bridge near the Jefferson-Brown Township Line.

Vermillion River: See Big Vermillion River.

Vernon Fork of Muscatatuck River: Navigable from its junction with the Muscatatuck River for 39.3 river miles to Vernon (S.R. 7).

Wabash River: Navigable from its junction with the Ohio River for 441.9 river miles to the Wells-Adams County Line.

Webb Branch: Navigable in Perry County from its junction with Big Oil Creek for 0.9 river miles.

West Fork of the White River: Navigable from its junction with the White River 277 river miles to Smithfield, Delaware County.

West Fork of the Whitewater River: Navigable from its junction with the Whitewater River for 64.3 river miles to the three forks (near Connersville).

White River: Navigable from its junction with the Wabash River for 49.5 river miles to where it branches into the East Fork of the White River and the West Fork of the White River.

Whitewater River: Navigable from the Ohio State Line for 29.65 river miles to where it branches into the East Fork of the Whitewater River and the West Fork of the Whitewater River. (The river is also navigable downstream in Ohio; and the river may be alternatively described as navigable from total river mile 7.9 to total river mile 96.9.)

Wilson Creek: Navigable in Dearborn County from its junction with the Ohio River for 1.9 river miles.

Yellow River: Navigable from its junction with the Kankakee River for 41.0 river miles to Plymouth.

IV. ROSTER OF INDIANA WATERS DECLARED NAVIGABLE OR NONNAVIGABLE (LISTED BY

COUNTY NAME)

Adams County

(1) [St. Marys's River: Nonnavigable.]

(2) [Wabash River: Nonnavigable.]

Allen County

(1) Little River: Navigable from its junction with the Wabash River 20.2 river miles to Ellison Road.

(2) Maumee River: Navigable from the Indiana-Ohio State Line 27.05 river miles to the Hosey Dam (Fort Wayne).

(3) [St. Mary's River: Nonnavigable.]

Bartholomew County

(1) Driftwood River: Navigable from its junction with the East Fork of the White River (Columbus) to the County Line.

(2) East Fork of White River: Navigable from the County Line to its junction with the Driftwood and Flatrock Rivers (Columbus).

(3) Flatrock River: Navigable from its junction with the East Fork of the White River (Columbus) to the County Line.

Benton County

No waterway has been declared navigable or nonnavigable.

Blackford County

No waterway has been declared navigable or nonnavigable.

Boone County

No waterway has been declared navigable or nonnavigable.

Brown County

(1) Salt Creek: Navigable from its junction with the East Fork of the White River throughout the county.

Carroll County

(1) Wabash River: Navigable throughout the county.

Cass County

(1) Wabash River: Navigable throughout the county.

Clark County

(1) Bull Creek: Navigable from its junction with the Ohio River for 1.1 river miles.

(2) Camp Creek: Navigable from its junction with the Ohio River for 1.7 river miles.

(3) Fourteen Mile Creek: Navigable from its junction with the Ohio River for 2.9 river miles.

(4) Lancassange Creek: Navigable from its junction with the Ohio River for 0.3 river miles.

(5) Ohio River: Navigable throughout the county.

(6) Silver Creek: Navigable from its junction with the Ohio River for 3.0 river miles.

Clay County

(1) Eel River: Navigable throughout the county.

Clinton County

No waterway has been declared navigable or nonnavigable.

Crawford County

(1) Big Blue River: Navigable throughout the county.

(2) Dry Run Creek: Navigable from its junction with the Big Blue River for 1.4 river miles.

(3) Little Blue River: Navigable from its junction with the Ohio River for 10.6 river miles.

(4) Mill Creek: Navigable from its junction with the Little Blue River for 1.4 river miles.
(5) Ohio River: Navigable throughout the county.

Daviess County
(1) East Fork of the White River: Navigable throughout the county.
(2) West Fork of the White River: Navigable throughout the county.

Dearborn County
(1) Great Miami River: Navigable throughout the county.
(2) Hogan Creek (including North Fork and South Fork): Hogan Creek (Main Stem) is navigable from its junction with the Ohio River for the entire length (0.4 river miles). The North Fork of Hogan Creek 28 is navigable from its junction with Hogan Creek for 4.9 river miles. The South Fork of Hogan Creek is navigable from its junction with Hogan Creek for 5.0 river miles.
(3) Laughery Creek: Navigable from its junction with the Ohio River for 10.8 river miles (near Milton).
(4) Ohio River: Navigable throughout the county.
(5) Tanners Creek: Navigable from its junction with the Ohio River in Lawrenceburg for 10.6 river miles.
(6) Whitewater River: Navigable throughout the county.
(7) Wilson Creek: Navigable from its junction with the Ohio River for 1.9 river miles.

Decatur County
(1) Flatrock River: Navigable throughout the county.

DeKalb County
No waterway has been declared navigable or nonnavigable.

Delaware County
(1) Mississinewa: Navigable throughout the county.
(2) West Fork of the White River: Navigable to Smithfield.

Dubois County
(1) Flat Creek: Navigable from its junction with the Patoka River throughout the county.
(2) East Fork of the White River: Navigable throughout the county.
(3) Patoka River: Navigable throughout the county.

Elkhart County
(1) Baugo Creek (formerly Bangango Creek):
(2) St. Joseph River: Navigable throughout the county.

Fayette County
(1) West Fork of the Whitewater River: Navigable to the three forks (near Connersville).

Floyd County
(1) Ohio River: Navigable throughout the county.
(2) Silver Creek: Navigable from its junction with the Ohio River for 3.0 river miles.

Fountain County
(1) Wabash River: Navigable throughout the county.

Franklin County
(1) East Fork of the Whitewater River: Navigable throughout the county from its junction with the Whitewater River.
(2) West Fork of the Whitewater River: Navigable throughout the county from its junction with the Whitewater River.
(3) Whitewater River: Navigable throughout the county.

Fulton County

No waterway has been declared navigable or nonnavigable. There is a discussion of navigability relative to a determination that Nyona Lake is a "public freshwater lake" in Bath v. Courts, Ind. App., 459 N.E. 2d 72 (1984).

Gibson County
(1) Patoka River (also known as Houchins Ditch): Navigable throughout the county from its junction with the Wabash River.
(2) Wabash River: Navigable throughout the county.
(3) White River: Navigable throughout the county from its junction on the Wabash River.

Grant County
(1) Mississinewa River: Navigable throughout the county.

Greene County
(1) Black Creek: Navigable to near Marco.
(2) Eel River: Navigable throughout the county from its junction with the West Fork of the White River.
(3) West Fork of the White River: Navigable throughout the county.

Hamilton County
(1) West Fork of the White River: Navigable throughout the county.

Hancock County
(1) Big Blue River: Navigable throughout the county.

Harrison County
(1) Big Blue River: Navigable throughout the county from its junction with the Ohio River.
(2) Buck Creek: Navigable 5.8 river miles from its junction with the Ohio River.
(3) Indian Creek: Navigable 4.8 river miles from its junction with the Ohio River.
(4) Mosquito Creek: Navigable 2.8 river miles from its junction with the Ohio River.
(5) Ohio River: Navigable throughout the county.
(6) Potato Run: Navigable 0.4 river miles from its junction with the Ohio River.

Hendricks County
(1) Mud Creek: Navigable to Tudor Road (near Hazelwood).

Henry County
(1) Flatrock River: Navigable throughout the county.

Howard County
No waterway has been declared navigable or nonnavigable.

Huntington County
(1) [Huntington Lake: Nonnavigable for interstate commerce.]
(2) Little River: Navigable throughout the county from its junction on the Wabash River.
(3) Wabash River: Navigable throughout the county.

Jackson County
(1) East Fork of White River: Navigable throughout the county.
(2) Muscatatuck River: Navigable throughout the county.

Jasper County
(1) Iroquois River: Navigable to near Parr.
(2) Kankakee River: Navigable throughout the county.

Jay County
No waterway has been declared navigable or nonnavigable.

Jefferson County
(1) Big Saluda Creek: Navigable 1.0 river miles from its junction with the Ohio River.
(2) Indian-Kentuck Creek: Navigable 3.8 river miles from its junction with the Ohio River.
(3) Ohio River: Navigable throughout the county.

Jennings County
(1) Muscatatuck River: Navigable to the main forks.

Johnson County
(1) Big Blue River: Navigable throughout the county.
(2) East Fork of White River: Navigable to its junction with the Flatrock and Driftwood Rivers.
(3) Sugar Creek: Navigable from its junction with the Big Blue River (to form the Driftwood River) throughout the county.
(4) West Fork of White River: Navigable throughout the county.

Knox County
(1) Black Creek: Navigable from its junction with the West Fork of the White River (near Edwardsport) throughout the county.
(2) Busseron Creek: Navigable throughout the county.
(3) Wabash River: Navigable throughout the county.
(4) West Fork of White River: Navigable throughout the county from its junction with the White River.
(5) White River: Navigable throughout the county from its junction with the Wabash River.

Kosciusko County
(1) [Tippecanoe Lake: Nonnavigable.]

Lagrange County
(1) Fawn River: Two segments of the river are navigable in Lagrange County. These segments are separated by portions of the river in Michigan.

Lake County
(1) Burns Ditch: Navigable as a channelization of the Little Calumet River.
(2) Grand Calumet River: Navigable from the Illinois State Line (near Hammond) to Marquette Park.
(3) Indiana Harbor Canal: Navigable throughout the county.
(4) Kankakee River: Navigable throughout the county.
(5) Lake Michigan: Navigable throughout the county.
(6) Little Calumet River: Navigable throughout the county.
(7) [Wolf Lake: Nonnavigable.]

LaPorte County
(1) Kankakee River: Navigable throughout the county.
(2) Lake Michigan: Navigable throughout the county.
(3) Trail Creek: Navigable 1.0 river miles from its junction with Lake Michigan.
(4) [Unnamed Lake: Located in the north one-half of section 8, township 36 north, range 1 west is a nonnavigable lake.]

Lawrence County
(1) East Fork of White River: Navigable throughout the county.
(2) Salt Creek: Navigable from its junction with the East Fork of White River throughout the county.

Madison County
(1) West Fork of White River: Navigable throughout the county.

Marion County
(1) West Fork of the White River: Navigable throughout the county.

Marshall County

(1) Yellow River: Navigable to Plymouth.

Martin County

(1) East Fork of White River: Navigable throughout the county.
(2) Indian Creek: Navigable throughout the county.
(3) Lost River: Navigable from its junction with East Fork of the White River.

Miami County

(1) Mississinewa River: Navigable throughout the county.
(2) Wabash River: Navigable throughout the county.

Monroe County

(1) Beanblossom Creek: Navigable to Griffy Creek.
(2) Clear Creek: Navigable to near Harrodsburg.
(3) Salt Creek: Navigable downstream from the upstream end of Lake Monroe on the North Fork.
(4) West Fork of White River: Navigable throughout the county.

Montgomery County

(1) Sugar Creek: Navigable throughout the county.

Morgan County

(1) Indian Creek: Navigable from its junction with the West Fork of the White River for 3.3 river miles.
(2) [Lambs Creek: Nonnavigable.]
(3) Mill Creek: Navigable throughout the county.
(4) Mill Creek Ditch: Navigable throughout the county.
(5) Mud Creek: Navigable from its junction with Mill Creek throughout the county.
(6) West Fork of White River: Navigable throughout the county.

Newton County

(1) Iroquois River: Navigable throughout the County.
(2) Kankakee River: Navigable throughout the County.

Noble County

No waterway has been declared navigable or nonnavigable.

Ohio County

(1) Arnold Creek: Navigable from its junction with the Ohio River for 4.4 river miles.
(2) Buck Run: Navigable from its junction with the Ohio River for 1.1 river miles.
(3) Island Branch: Navigable from its junction with the Ohio River for 1.0 river miles.
(4) Laughery Creek: Navigable throughout the county.
(5) Ohio River: Navigable throughout the county.

Orange County

(1) Lick Creek: Navigable downstream from Old Spring Mill (near Paoli).
(2) Lost River: Navigable to near Orangeville.
(3) Patoka River: Navigable within Greenfield Township and downstream.

Owen County

(1) Cagles Mill Lake: Navigable throughout the county.
(2) Eel River: Navigable to Cagles Mill Lake.
(3) Mill Creek: See Cagles Mill Lake.
(4) West Fork of White River: Navigable throughout the county.

Parke County

(1) Big Raccoon Creek: Navigable throughout the county.

(2) Little Raccoon Creek: Navigable from its junction with Big Raccoon Creek for 5.3 river miles (Nevins Covered Bridge).
(3) Cecil M. Harden Lake: See Big Raccoon Creek.
(4) Sugar Creek: Navigable throughout the county.
(5) Wabash River: Navigable throughout the county.

Perry County
(1) Anderson River: Navigable from its junction with the Ohio River along the Spencer County line.
(2) Bald Knob Creek: Navigable from its junction with Big Oil Creek for 0.5 river miles.
(3) Bear Creek: Navigable from its junction with the Ohio River for 1.6 river miles.
(4) Big Deer Creek: Navigable from its junction with the Ohio River for 5.9 river miles. See Deer Creek.
(5) Big Oil Creek (including Webb Branch): Navigable from its junction with the Ohio River for 10.6 river miles. Webb Branch is navigable from its junction on Big Oil Creek for 0.9 river miles.
(6) Big Poison Creek: Navigable from its junction with the Ohio River for 6.3 river miles.
(7) Buck Creek: Navigable from its junction with the Ohio River for 0.7 river miles.
(8) Bull Hollow: Navigable from its junction with Big Oil Creek for 0.7 river miles.
(9) Caney Branch of Big Poison Creek: Navigable from its junction with Big Poison Creek for 0.2 river miles.
(10) Caney Branch of Little Deer Creek: Navigable from its junction with Little Deer Creek for 0.8 river miles.
(11) Clover Lick Creek: Navigable from its junction with Big Oil Creek for 0.7 river miles.
(12) Deer Creek: Navigable from its junction with the Ohio River for 5.9 river miles.
(13) East Deer Creek: Navigable from its junction with Deer Creek for 0.6 river miles.
(14) Fanny Creek: Navigable from its junction with the Ohio River for 0.8 river miles.
(15) Indian Fork: Navigable from its junction with Big Oil Creek for 1.4 river miles
(16) Kelly Hollow: Navigable from its junction with Millstone Creek for 1.0 river miles.
(17) Kingly Creek: Navigable from its junction with the Ohio River for 0.2 river miles.
(18) Knob Creek: Navigable from its junction with the Ohio River for 0.2 river miles.
(19) Little Deer Creek (also known as West Fork of Deer Creek): Navigable from its junction with Deer Creek for 3.9 river miles.
(20) Little Oil Creek: Navigable from its junction with Big Oil Creek for 4.4 river miles.
(21) Little Poison Creek: Navigable from its junction with Big Poison Creek for 1.2 river miles.
(22) Millstone Creek: Navigable from its junction with the Ohio River for 1.4 river miles.
(23) Neglie Creek: Navigable from its junction with Little Deer Creek for 0.5 river miles.
(24) Ohio River: Navigable throughout the county.
(25) Oil Creek: See Big Oil Creek.
(26) Poison Creek: See Big Poison Creek.
(27) Sample Run: Navigable from its junction with the Ohio River for 0.2 river miles.
(28) Tates Hollow: Navigable from its junction with the Ohio River for 0.3 river miles.
(29) Webb Branch: See Big Oil Creek.

Pike County
(1) East Fork of White River: Navigable throughout the county.
(2) Flat Creek: Navigable downstream from a point in Franklin Township.
(3) Patoka River: Navigable throughout the county.
(4) White River: Navigable throughout the county.

Porter County
(1) Burns Ditch: Navigable as a channelization of the Little Calumet River.
(2) Burns Waterway Harbor: Navigable as an extension of Lake Michigan for 1.3 river miles to the Little Calumet River.
(3) Kankakee River: Navigable throughout the county.
(4) Lake Michigan: Navigable throughout the county.
(5) Little Calumet River: Navigable throughout the county.

Posey County
(1) Big Creek: Navigable from its junction with the Wabash River for 25.4 river miles (near Cynthiana).

(2) Harris Ditch: Navigable from its junction with the Ohio River for 0.9 river miles.
(3) Hurricane Fork: See Little Fork of Big Creek.
(4) Little Fork of Big Creek: Navigable from its junction with Big Creek for 5.1 river miles (junction of Nev Creek).
(5) Little Pitcher Lake: Navigable as an extension of Harris Ditch.
(6) South Fork: See Little Fork of Big Creek.
(7) McFadden Creek: Navigable from its junction with the Ohio River for 2.3 river miles.
(8) Ohio River: Navigable throughout the county.
(9) Wabash River: Navigable from its junction with the Ohio River throughout the county.

Pulaski County

No waterway has been declared navigable or nonnavigable.

Putnam County

(1) Cagles Mill Lake: See Eel River, and see Mill Creek.
(2) Eel River: Navigable upstream to its junction with Mill Creek (now within Cagles Mill Lake).
(4) Mill Creek: Navigable throughout the county.

Randolph County

(1) Mississinewa River: Navigable throughout the county.

Ripley County

No waterway has been declared navigable or nonnavigable.

Rush County

(1) Big Blue River: Navigable throughout the county.
(2) Flatrock River: Navigable throughout the county.
(3) Little Blue River: Navigable downstream from its junction with Ball Run in Posey Township.

St. Joseph River

(1) Baugo Creek (formerly Banbango Creek): Navigable from its junction with the St. Joseph River throughout the county.
(2) Kankakee River: Navigable throughout the county.
(3) St. Joseph River: Navigable throughout the county.

Scott County

(1) Cammie Thomas Ditch: Navigable as a channelization of the Muscatatuck River.
(2) Muscatatuck River: Navigable throughout the county.
(3) South Fork of Muscatatuck River: Navigable from its junction with the Muscatatuck River upstream to its junction with Graham Creek at river mile 28.1.

Shelby County

(1) Big Blue River: Navigable throughout the county.
(2) Conns Creek: Navigable from its junction with the Flatrock River throughout the county (but with private ownership of the creek bed).
(3) Flatrock River: Navigable throughout the county.
(4) Little Blue River: Navigable from its junction with the Big Blue River (Shelbyville) throughout the county.
(5) Sugar Creek: Navigable to Hough Cemetery (near Boggstown).

Spencer County

(1) Anderson River: Navigable from its junction with the Ohio River throughout the county.
(2) Baker Creek: Navigable from its junction with Little Pigeon Creek for 1.8 river miles.
(3) Caney Creek: Navigable from its junction with the Ohio River for 2.8 river miles.
(4) Clear Creek: Navigable from its junction with Little Pigeon Creek for 2.4 river miles.
(5) Crooked Creek: Navigable from its junction with the Ohio River for 7.7 river miles.

(6) Garrett Creek: Navigable from its junction with the Ohio River for 2.2 river miles.
(7) Honey Creek: Navigable from its junction with the Ohio River for 1.8 river miles.
(8) Jackson Creek: Navigable from its junction with the Ohio River for 1.8 river miles.
(9) Lake Drain: Navigable from its junction with the Ohio River for 1.6 river miles.
(10) Little Pigeon Creek: Navigable form its junction with the Ohio River for 15.8 river miles
(11) Little Sandy Creek: Navigable from its junction with the Ohio River for 2.0 river miles.
(12) Ohio River: Navigable throughout the county.
(13) Sandy Creek: Navigable from its junction with the Ohio River for 2.6 river miles.

Starke County
(1) Kankakee River: Navigable throughout the county.
(2) Yellow River: Navigable from its junction with the Kankakee River throughout the county.

Steuben County
No waterway has been declared navigable or nonnavigable.

Sullivan County
(1) Busseron Creek: Navigable to near Caledonia.
(2) Kelly Bayou: Navigable from its downstream junction with an oxbow of the Wabash River to its upstream junction of the Wabash River.
(3) Turman Creek: Navigable from its junction on the Wabash River for 7.9 river miles.
(4) Wabash River: Navigable throughout the county.

Switzerland County
(1) Bryant Creek: Navigable from its junction with the Ohio River for 2.6 river miles.
(2) Goose Creek: Navigable from its junction with the Ohio River 1.5 river miles.
(3) Grants Creek: Navigable from its junction with the Ohio River for 2.5 river miles.
(4) Indian Creek: Navigable from its junction with the Ohio River for 4.1 river miles.
(5) Log Lick Creek: Navigable from its junction with the Ohio River for 2.3 river miles.
(6) Ohio River: Navigable throughout the county.
(7) Plum Creek: Navigable from its junction with the Ohio River for 2.9 river miles.
(8) Sand Creek: Navigable from its junction with the Ohio River for 0.9 river miles.
(9) Turtle Creek: Navigable from its junction with the Ohio River for 1.3 river miles.

Tippecanoe County
(1) Wabash River: Navigable throughout the county.

Tipton County
No waterway has been declared navigable or nonnavigable.

Union County
(1) East Fork of Whitewater River: Navigable throughout the county.

Vanderburgh County
(1) Bayou Creek: Navigable from its junction with the Ohio River for 1.5 river miles.
(2) Locust Creek: Navigable from its junction with Pigeon Creek for 1.5 river miles.
(3) Ohio River: Navigable throughout the county.
(4) Pigeon Creek: Navigable from its junction with the Ohio River for 5.9 river miles.

Vermillion County
(1) Big Vermillion River: Navigable for 10.8 miles from its junction with the Wabash River throughout the county (and for a total of 22.6 river miles to Carmargo, Illinois).
(2) Wabash River: Navigable throughout the county.

Vigo County
(1) Wabash River: Navigable throughout the county.

Wabash County

(1) Mississinewa River: Navigable throughout the county.
(2) Wabash River: Navigable throughout the county.

Warren County

(1) Wabash River: Navigable throughout the county.

Warrick County

(1) Baker Creek: Navigable from its junction with Little Pigeon Creek for 1.8 river miles.
(2) Big Pigeon Creek: See Pigeon Creek.
(3) Clear Creek: Navigable from its junction with Little Pigeon Creek for 2.4 river miles.
(4) Cypress Creek (including Cypress Creek Diversion Channel): Navigable from its junction with the Ohio River for 6.6 river miles. (The original bed of Cypress Creek is also navigable west of Cypress Creek Diversion Channel, except where the creek bed has emerged and is no longer inundated.)
(5) Little Pigeon Creek: Navigable from its junction on the Ohio River for 15.8 river miles.
(6) Ohio River: Navigable throughout the county.

Washington County

(1) Big Blue River: Navigable to the town of Fredricksburgh at river mile 57.2.
(2) Cammie Thomas Ditch: Navigable as a channelization of the Muscatatuck River.
(3) East Fork of White River: Navigable throughout the county.
(4) Elk Creek: Navigable from its junction with the Cammie Thomas Ditch to river mile 3.0.
(5) Muscatatuck River: Navigable from its junction with the East Fork of the White River throughout the county.
(6) Twin Creek: Navigable from the East Fork of White River to river mile 7.98.

Wayne County

No waterway has been declared navigable or nonnavigable.

Wells County

(1) Wabash River: Navigable throughout the county (with navigability terminating at the Adams County line).

White County

No waterway has been declared navigable or nonnavigable.

Whitley County

No waterway has been declared navigable or nonnavigable.

T.O.C.

APPENDIX E.4

IDNR Listing of Indiana Special Streams

T.O.C.

State Natural and Scenic River Segments

(Source: Indiana Department of Natural Resources, 1994, Rev. 1996)

River	Counties	Quad Maps	Boundaries
BIG PINE CREEK* (10.0 miles) (Studied 1980)	Warren	Williamsport, Pine Village	Rocky Ford (r.m. 13.8) to CR 131 (r.m. 3.75)
BIG WALNUT CREEK (10.6 miles)	Putnam	North Salem, Roachdale	Hendricks-Putnam Co. Line (r.m. 43.7) to SR 36 (r.m. 33.1)
BLUE RIVER (45.5 miles) (Designated 1978)	Crawford, Harrison, Washington	Fredericksburg, Milltown, Corydon, W., Leavenworth	US 150 in Fredericksburg (r.m. 57.0) to SR 462 (r.m. 11.5)
CEDAR CREEK (13.7 miles) (Designated 1976)	Allen, Dekalb	Garrett, Auburn, Huntertown	DeKalb CR 68 (r.m. 13.7) to St. Josheph River (r.m. 0.0)
SAND CREEK* (12.1 miles)	Decatur, Jennings	Butlerville, Westport	Westport Covered Bridge (r.m. 33.2) to Brewersville Rd. (r.m. 21.1)
S. BR. ELKHART* RIVER (13.6 miles) (Studied 1982)	Noble	Albion, Ligonier, Merriam	CR 100N (r.m. 14.2) to US 6 (r.m. 0.6)
SUGAR CREEK* (50.1 miles) (Studied 1977**)	Montgomery, Parke	Montezuma, Alamo Kingman, Wallace New Market, Crawfordsville	Darlington Covered Bridge (r.m. 50.1) to Wabash River (r.m. 0.0)
TIPPECANOE RIVER* (15.9 miles)	Kosciusko, Marshall	Mentone, Bourbon Atwood, Burket	Kosciusko CR 700W (r.m. 139.9) to the mouth of Moores Ditch (r.m. 123.0)
WHITEWATER RIVER* (28.4 miles) (Studied 1979)	Franklin	Metamora, Brookville, Whitecomb, Cedar Grove	Laurel Feeder Dam (r.m. 45.4) to New Trenton Bridge (r.m. 17.1)
WILDCAT CREEK (48.5 miles) (Designated 1980)	Carroll, Tippecanoe	Lafayette E., Pyrmont, Rossville, Burlington	SR 29 (r.m. 43.1 to Eisenhower Rd. (r.m. 4.8) and on the South Fork, SR 38 (r.m. 10.2) to the North Fork, (r.m. 0.0)

* These stream segments qualify for classification as a State Natural & Scenic River Segment. However, they have not yet been officially classified as such.

** The Montgomery County segment has recently been re-studied.

Last Print/Revision Date: October 13, 1996

INDIANA NATURAL AND SCENIC RIVERS LIST

A detailed river segment list and map are attached to the following river summaries.

BIG PINE CREEK

A 10 1/2-mile segment of Big Pine Creek in Warren County (from Rocky Ford, near Rainsville, downstream to County Road 131) qualifies for State Natural and Scenic River designation.

Big Pine Creek is Indiana's premier whitewater creek during high spring water levels and is popular with canoeists and kayakers from Indiana and Illinois. Due to unreliable water levels for canoeing throughout warm weather, commercial canoes are not available for use on the creek.

The Department of Environmental Management has designated the Big Pine Creek segment and some of its headwaters "for exceptional use" due to outstanding quality.

BIG WALNUT CREEK

Slightly more than 10 1/2 miles of Big Walnut Creek in Putnam County (from the county line to the SR 36 bridge) rate as natural as any segment on the DNR's Natural and Scenic Rivers list. The lower part of the segment flows by two state dedicated nature preserves (Hall's Woods and Big Walnut) which the DNR and The Nature Conservancy have cooperated to acquire from a willing seller.

Big Walnut Creek is lightly used by fishermen and canoeists. Commercial canoes are not available for use on the State Natural and Scenic River segment due to unreliable water levels throughout warm weather.

BLUE RIVER

The State Natural and Scenic River segment of Blue River designated in 1978 begins at river mile 57 (Fredericksburg) and runs to river mile 11 1/2 (just upstream of the SR 462 bridge). The DNR owns much of the lower 25 miles of the river corridor and manages its property to enhance the natural integrity of the river. The lower 5 1/2 miles of the river itself are part of the Cannelton Pool of the Ohio River.

The major canoe livery using the river provides about 15,000 canoe trips on the river annually, primarily between river mile 40 (Totten Ford Bridge) and river mile 20 (Rothrock Mill Public Access Site, the DNR's only access site in the State Natural and Scenic River segment). The river is also popular for fishing.

The state authorized Blue River Commission has zoning jurisdiction over the State Natural and Scenic River segment and has worked with the DNR in the conservation of the river since 1978. During that time the DNR, with some assistance from The Nature Conservancy, has also acquired nearly 6 miles of riverbank lands from willing sellers in the lower Natural and Scenic River segment. This will further assure protection of the natural integrity of Blue River.

The DEM has designated the State Natural and Scenic River segment of Blue River as "an outstanding state resource" to prevent water quality degradation and has designated the segment and much of its headwaters "for exceptional use" due to exceptional quality.

CEDAR CREEK

Cedar Creek, 13.7 miles from DeKalb County Road 68 to the confluence with the St. Joseph River in Allen County was designated a State Natural and Scenic River in 1976. The Nature Conservancy has acquired one conservation easement along the creek. Part of the Izaak Walton League's property along the creek has been designated by the state as Rodenbeck Nature Preserve.

The Allen County Parks and Recreation Board has acquired and developed two public access sites along the creek using Land and Water Conservation Funds administered by the DNR. Cedar Creek is used by fishermen and canoeists.

The Cedar Creek Wildlife Project, Fort Wayne Chapter of the Izaak Walton League, and the Cedar Creek Preservation Foundation work with the DNR in the conservation of Cedar Creek.

The DEM has designated the State Natural and Scenic River segment of Cedar Creek as "an outstanding state resource" to prevent water quality degradation.

SAND CREEK

A 12.1-mile segment of Sand Creek, from the Westpost Covered Bridge in Jennings County (river mile 33.2) to Brewersville Road in Decatur County (river mile 21.1) qualifies as a State Natural and Scenic River. Sand Creek is notable for its karst corridor.

It is lightly used by fishermen and canoeists. Commercial canoes are not available for use on the segment due to unreliable water levels throughout warm weather.

SOUTH BRANCH OF ELKHART RIVER

Nearly 14 miles of the South Branch of the Elkhart River, between Noble County Road 100 North and the U.S. 6 bridge, qualifies as a State Natural and Scenic River. It flows through the largest contiguous wetlands remaining in the state, including the DNR's Mallard Roost Wetlands Conservation Area. In the upstream portion of the segment, the river flows through the state designated Bender Woods Nature Preserve, owned by Acres Inc.

The South Branch of Elkhart River is used by fishermen and waterfowl hunters, and the DNR has developed four public access sites along the river. Commercial canoes are not available for use on the river.

SUGAR CREEK

Over 50 miles of Sugar Creek, from the Darlington Covered Bridge in Montgomery County downstream to the confluence with the Wabash River in Parke County, qualify as a State Natural and Scenic River. The creek flows past a community park in Darlington, a city park in Crawfordsville, Pine Hills Nature Preserve (and National Natural Landmark), and Shades and Turkey Run State Parks.

Six public access sites, four acquired and developed by the DNR, are available along the creek. Two major commercial canoe liveries provide about 20,000 trips on Sugar Creek annually, primarily between Crawfordsville and Turkey Run State Park. The creek is also popular with fishermen.

The Friends of Sugar Creek works with the DNR the conservation of Sugar Creek and its tributaries.

TIPPECANOE RIVER

Almost 16 miles of the Tippecanoe River, from Kosciusko County Road 700 West to the mouth of Moores Ditch in Marshall County, qualify as a State Natural and Scenic River.

The upper part of the segment flows through forested wetlands and is seldom used by recreationists. The lower part of the segment is popular with fishermen, and commercial canoes are available. A Kosciusko County Historical Society rest park provides river access near Warsaw, and the DNR has developed two public access sites along the Tippecanoe River segment.

WHITEWATER RIVER

A 28.3-mile segment of the West Fork and Main Stem of the Whitewater River in Franklin County, from the Laurel Feeder Dam (river mile 45.4) to the New Trenton Bridge (river mile 17.1.), qualifies as a State Natural and Scenic River. The DNR's Whitewater Canal State Historic Site owns land adjacent to the river in several sites between its Laurel Feeder Dam Public Access Site and Brookville. Eight miles of the former towpath and an abandoned rail line along the canal and near the river are planned for development as a recreational trail. Two major canoe liveries provide about 20,000 trips on the river annually. The river is also popular with fishermen.

The Franklin County Area Plan Commission's White-water River Advisory Board has worked with the DNR in the conservation of the river since 1979.

WILDCAT CREEK

The State Natural and Scenic River segments of Wildcat Creek total 48.5 miles, extending from Burlington to Tippecanoe County's Eisenhower Road Bridge on the North Fork, and from Dayton on the South Fork to the confluence with the North Fork. The Wildcat was designated in 1980.

The DNR has developed four access sites, including a Public Fishing Area and a county park along the creek. The Tippecanoe County Parks and Recreation Board manages the county park through an agreement with the DNR.

Recreationists use the creek for canoeing, fishing, and tubing. The only commercial canoe livery along the creek provides about 2,000 trips on the creek annually, primarily on the lower several miles of the State Natural and Scenic River segment of the North Fork.

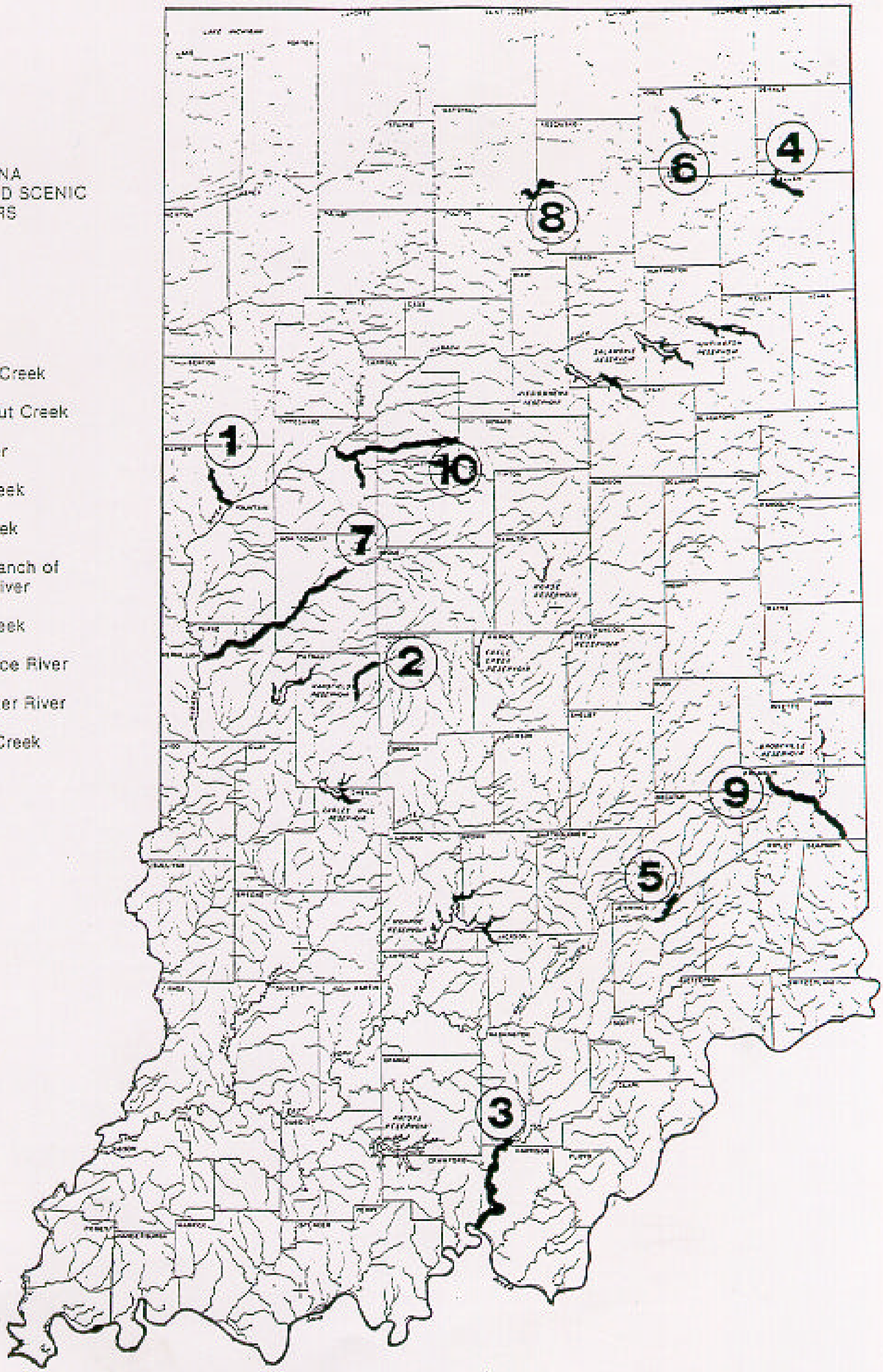
The Wildcat Creek Advisory Group and the Carroll County and Tippecanoe County Area Plan Commissions have worked with the DNR in the conservation of the creek since 1980.

The DEM has designated the State Natural and Scenic River segments of Wildcat Creek as "an outstanding state resource" to prevent water quality degradation.

T.O.C.

INDIANA
NATURAL AND SCENIC
RIVERS

1) Big Pine Creek
2) Big Walnut Creek
3) Blue River
4) Cedar Creek
5) Sand Creek
6) South Branch of Elkhart River
7) Sugar Creek
8) Tippecanoe River
9) Whitewater River
10) Wildcat Creek



Outstanding Rivers:

The Department has prepared a roster of streams in the State which have particular environmental or aesthetic value. The roster was printed as a nonrule policy document in the Indiana Register, Volume 16, Number 6, (16 IR 1677) on March 1, 1993 under the title "Natural Resources Commission, Information Bulletin #4, Outstanding Rivers List for Indiana". For additional information regarding the roster contact:

Division of Outdoor Recreation
Room W271
402 West Washington Street
Indianapolis, Indiana 46204

Telephone: (317) 232-4070

The following table is a synopsis of the roster printed in the Indiana Register. In the event of a conflict, the information in the Register has primacy.

T.O.C.

Outstanding Rivers		
Stream	**County(s)**	**Segment**
Bear Creek	Fountain	From CR 250 W to its confluence with the Wabash River
Big Blue River	Johnson Rush Shelby	From its confluence with the Flatrock River to Carthage
Big Creek	Jefferson	From the east side of the Jefferson Military Reservation boundary to its confluence with Graham Creek
Big Pine Creek	Warren	From SR 18 to its confluence with the Wabash River
Big Walnut Creek	Putnam	From the Hendricks-Putnam county Line to Greencastle
Black River	Posey	From its confluence with Higginbotham Ditch to its confluence with the Wabash River
Blue River	Crawford Harrison Washington	From its confluence with the Middle Fork Blue River to its confluence with the Ohio River
Buck Creek	Harrison	From its headwaters to its confluence with the Ohio River
Cedar Creek	Allen Dekalb	From Dekalb County Road 68 to its confluence with the St. Joseph River
Clifty Creek	Montgomery	From its headwaters to its confluence the Indian Creek
Cypress Slough	Posey	From its confluence with Castlebury Creek to the Southwind Maritime Center
Deep River	Lake Porter	From 1 mile south of US 30 to its confluence with the Little Calumet River
Driftwood River	Bartholomew	From the Atterbury Fish and Wildlife Area to Columbus
East Arm Little Calumet River	Porter	From CR 600 E to SR 249
East Fork White River	Bartholomew Daviess Dubois Jackson Lawrence Martin Pike	From Columbus to its confluence with the West Fork White River
Eel River	Miami Wabash	From South Whitley to Logansport
Elkhart River	Elkhart Noble	From SR 13 to Island Park in Elkhart
Fall Creek	Warren	From US 41 to its confluence with Big Pine Creek

T.O.C.

Outstanding Rivers		
Stream	**County(s)**	**Segment**
Fawn River	LaGrange Steuben	From Nevada Mills to the Indiana-Michigan state line and from the Indiana-Michigan state line to the Indiana-Michigan state line
Fish Creek	Dekalb Steuben	From the Indiana-Ohio state line to the Indiana-Ohio state line
Flatrock River	Bartholomew Shelby	From SR 9 to its confluence with the East Fork White River
Fourteen-Mile Creek	Clark	From its confluence with the East Fork and the West Fork to its confluence with the Ohio River
Graham Creek	Jefferson Jennings Ripley	From New Marion to its confluence with Big Creek
Indian Creek	Harrison	From the Floyd-Harrison county line to its confluence with the Ohio River
Indian Creek	Montgomery	From CR 475 W to its confluence with Sugar Creek
Indian-Kentuck Creek	Jefferson Ripley	From its confluence with Vestal Branch to its confluence with the Ohio River
Iroquois River	Newton	From SR 16 to the Indiana-Illinois state line
Kankakee River	LaPorte Newton Porter	From the upstream boundary of the Kingsbury Fish and Wildlife Area through the LaSalle Fish and Wildlife Area to the Indiana-Illinois state line
Kilmore Creek	Clinton	From US 421 to its confluence with South Fork Wildcat Creek
Laughery Creek	Dearborn Ohio Ripley	From its source just east of Morris in Ripley County to its confluence with the Ohio River
Little Blue River	Crawford	From English to its confluence with the Ohio River
Little Creek	Jefferson	From Kent to Big Creek
Little Indian Creek	Harrison	From Pfrimmer Church to its confluence with Indian Creek
Little Mosquito Creek	Harrison	From its headwaters to its confluence with Mosquito Creek
Little Pine Creek	Warren	From Bridge SW of Green Hill to its confluence with the Wabash River
Little River	Allen Huntington	From its source to its confluence with the Wabash River
Lost River	Martin Orange	From Potato Road to its confluence with the East Fork White River
Middle Fork Wildcat Creek	Clinton Tippecanoe	From SR 26 at Edna Mills to its confluence with South Fork Wildcat Creek
Mississinewa River	Miami	From Mississinewa Reservoir to its confluence with the Wabash River

T.O.C.

Outstanding Rivers		
Stream	**County(s)**	**Segment**
Mosquito Creek	Harrison	From Buena Vista to its confluence with the Ohio River
Mud Pine Creek	Warren	From SR 352 to its confluence with Big Pine Creek
Muscatatuck River	Jackson Jennings Scott Washington	From its confluence with Graham Creek and Big Creek to its confluence with the East Fork White River
Oil Creek	Perry	From St. Croix to its confluence with the Ohio River
Otter Creek	Jennings Ripley	From the covered bridge north of Holton to its confluence with the Vernon Fork Muscatatuck River
Patoka River	Dubois Gibson Pike	From Patoka Reservoir to its confluence with the Wabash River
Pigeon River	LaGrange	From SR 327 to the Indian-Michigan state line
Rattlesnake Creek	Fountain	From CR 350 W to its confluence with Bear Creek
Rattlesnake Creek	Parke	From CR 400/450 S to its confluence with Sugar Creek
Roaring Creek	Parke	From 1 mile upstream of SR 41 to its confluence with Sugar Creek
Sand Creek	Bartholomew Decatur Jackson Jennings	From its confluence with Cobbs Fork to its confluence with the East Fork White River
South Branch Elkhart River	Noble	From CR 100 N to US 6
South Fork Blue River	Washington	From SR 135 to its confluence with Blue River
South Fork Wildcat Creek	Clinton Tippecanoe	From US 421 to its confluence with Wildcat Creek
Stinking Fork	Crawford	From its headwaters to its confluence with Little Blue River
Sugar Creek	Johnson Shelby	Within Johnson and Shelby Counties
Sugar Creek	Montgomery Parke	From the Darlington covered bridge to its confluence with the Wabash River
Sugar Mill Creek	Fountain Parke	From Wallace to its confluence with Sugar Creek
Tippecanoe River	Carroll Fulton Kosciusko Marshall Pulaski Tippecanoe White	From its source, Lake Tippecanoe, to Norway and from Oakdale Dam to its confluence with the Wabash River

T.O.C.

Outstanding Rivers		
Stream	**County(s)**	**Segment**
Turkey Fork	Crawford	From I-64 to its confluence with the Little Blue River
Vernon Fork Muscatatuck River	Jackson Jennings	From Zenas to its confluence with the Muscatatuck River
Wabash River	Adams Allen Carroll Cass Fountain Gibson Huntington Jay Knox Miami Parke Posey Sullivan Tippecanoe Vermillion Vigo Wabash Warren Wells	From the Indiana-Ohio state line to its confluence with the Ohio River including the Little River and the portage between the Little River and the Maumee River
West Branch Mosquito Creek	Harrison	From its headwaters to its confluence with Mosquito Creek
West Fork White River	Daviess Delaware Gibson Greene Hamilton Knox Madison Marion Morgan Owen Randolph	From Farmland to its confluence with the Wabash River
Whitewater River	Dearborn Fayette Franklin Wayne	From Cambridge City to the Indiana-Ohio state line west of Harrison, Ohio
Wildcat Creek	Carroll Tippecanoe	From SR 29 to its confluence with the Wabash River

APPENDIX E.5

IDNR Obstruction Removal Notification Form

T.O.C.

NOTIFICATION OF CONSTRUCTION IN A FLOODWAY UNDER IC 14-28-1 FOR OBSTRUCTION REMOVAL FOR RIVER AND STREAM MAINTENANCE

Submit To:
Division of Fish and Wildlife
Environmental Unit
Department of Natural Resources
402 West Washington Street, Room W273
Indianapolis,Indiana 46204-2748
Telephone:(317)232-4080

Application #__________________

REQUIREMENT FOR ADDITIONAL INFORMATION AND PERMITS

Notification made to the Department of Natural Resources does not in any way relieve the notifier of the necessity of securing easements or other property rights, permits and approvals from affected property owners and other local, state, and federal agencies.

NOTIFIER INFORMATION

Name of Notifier: ______________________________

Name of Contact Person: ______________________________

Address(street, P.O. Box or R.R.): ______________________________

Telephone:(_____)____________________

FAX: (_____)____________________

City, State, and Zip Code: ____

PROPOSED PROJECT INFORMATION

Name of Watercourse: ______________________________

County: ______________________________

Nearest City or Town: ______________________________

Name of USGS Quadrangle Map (include a copy with project site circled): ______________________________

Quarter Section (check):

NE NW SE SW

Section Or Grant: __________

Township: ______N S

Range: ______ E

Additional Location Information: Rreference readily discernable landmarks such as major roadways, bridges, dams, etc. Use a separate sheet to provide a narrative description of these locations. These locations must also be designated on a USGS Topographic Map and National Wetland Inventory Map completed for the following: 1) Project terminal points; 2) Access routes to obstructions; and 3) Debris disposal sites.

PERMISSION TO ENTER UPON THE PROJECT SITE AND PERFORM OBSTRUCTION REMOVAL

1. Demonstrate proof that the notifier is the owner of the stream or river(or sole riparian owner along a navigable river or stream), or demonstrate another basis by which the notifier has permission to enter upon the project site and to perform the obstruction removal.
2. Demonstrate proof that the notifier has permission for any access route and site where logs and other debris will be secured following removal from the stream or river.
3. The notifier must show participation or agreement by other interested persons in the following circumstances: 1) by the Drainage Board with respect to a regulated drain; 2) by all beneficiaries to the drain with respect to a mutual drain; and 3) by the governing body of any municipality or conservancy district in which the project is located.

DESCRIPTION

1. Anticipated start date of the project:____
2. Provide photographs and/or video tapes or other graphic documentation of the obstruction and access route to the obstruction, and demonstrate that the following conditions exist on the stream or river:
   a. Accumulations of logs, root wads, and other debris that occasionally span the waterway and may be interlocked.
   b. Large amounts of fine sediments have <u>not</u> covered nor become lodged in the obstruction.
   c. Accumulations are extensive enough to cause bank erosion and upstream ponding damages.
3. Provide a narrative describing the obstruction removal project and the purpose for the project.
4. Circle the type of equipment that will be used for the obstruction removal:
   - Hand operated equipment: axes, chain saws, portable winches, other.
   - Heavy equipment: trucks, tractors, backhoes, dozers, log skidders, other(describe):____

TERMS AND AGREEMENTS

1. Hand-operated equipment will be used for the obstruction removal.
2. Where hand-operated equipment is impracticable, heavy equipment must not be equipped for excavation. Examples are small tractors, a backhoe with a hydraulic thumb, a dozer with the blade up, and a log skidder.
3. Any free logs or affixed logs that are crossways in the channel will be cut, relocated, and removed from the flood plain, unless the logs are piled and secured by cables in an area not threatened by the flow of the water. Logs will be removed with minimal damage to vegetation and placed outside of any wetlands.
4. Isolated or single logs that are embedded, lodged, or rooted in the channel, and which do not span the channel or cause flow problems, will not be removed unless they are associated with or in close proximity to larger obstructions, or they pose a hazard to navigation.
5. A severely damaged, leaning, or other tree which is in immediate danger of falling into the waterway may be cut and removed, but only if the tree is associated with or in close proximity to an obstruction. The root system and stump of the tree will be left in place.
6. No access road will be constructed that will destroy more than one acre of trees in the floodway, traverse a wetland indicated on the National Wetland Inventory Map unless pads are used, raise the elevation of the flood plain, or cross a river or stream.
7. All work will be conducted exclusively from one(1) side of the river or stream.

I hereby submit this notification for construction in the flodway under IC 14-28-1 for obstruction removal as described above, and swear and affirm, under the penalties for perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete, and that this project for <u>obstruction removal for river or stream maintenance in a floodway will be in compliance with the provisions of IC 14-28-1.</u>

Signature of Notifier or Authorized Representative: ____

Date: ________________________

T.O.C.

DEPARTMENT REVIEW

The obstruction removal for river and stream maintenance will require a permit under IC 14-28-1 if:

1. The project does not satisfy the performance standards of IC 14-28-1.

2. The Department of Natural Resources determines there is a documented occurrence of any of the following:

   a. Within a river or stream listed at 16 IR 1677 in the Outstanding Rivers List for Indiana.

   b. Within 1/2 mile of the project area:

      I) A species listed in the Roster of Indiana Animals and Plants which are Extirpated, Endangered, Threatened, or Rare.

      _____Yes _____No

      ii) A known mussel resource.

      _____Yes _____No

      iii) An Outstanding Natural Area.

      _____Yes _____No

Description of occurrence:____

____

DEPARTMENT DECISION

___ This project for obstruction removal for river or stream maintenance does not qualify for exemption to IC 14-28-1 for the following reason:

____

____

___ This project for construction removal for river or stream maintenance is exempt from the reqirements of IC 14-28-1 if the following conditions are followed:

____

____

Environmental Coordinator: ____

Division of Fish and Wildlife:

Date Received Date of Response

If a permit under IC 14-28-1 is required contact the Division of Water for additional information:

Permit Administration Section
Division of Water
402 West Washington Street, Room W264
Indianapolis, Indiana 46204-2748

APPENDIX E.6

IDNR Sample SEA 368 Request Submittal

SAMPLE SEA 368 REQUEST SUBMITTAL

The first thing that the County Surveyor should do when the County Drainage Board programs a Reconstruction or Maintenance project is to determine if the project will require an SEA 368 review. To determine this, ask yourself these three questions:

1) Is the open regulated drain or stream ten (10) miles or more in "total length"? (IC 14-28-1, Flood Control Act = IDNR jurisdiction) **"Total Length"** as defined in IC 14-28-1-22(a) …***"means the length of the stream, expressed in miles, from the confluence of the stream with the receiving stream to the upstream or headward extremity of the stream, as indicated by the solid or dashed, blue or purple line depicting the stream on the most current edition of the seven and one-half (7½) minute topographic quadrangle map published by the United States Geological Survey, measured along the meanders of the stream as depicted on the map."*** If there is still a question about the length, contact the Division of Water, IDNR, for an official determination of "Total Length".

OR

2) Is any portion of the project within one-half (½) mile of a freshwater lake? Measure the distance from the lake to the project, straight-line from the shoreline. (IC 14-26-5, Lowering of the Ten Acre Lake Act; commonly referred to as the "Ditch" Act = IDNR jurisdiction)

OR

3) Will the U.S. Army Corps of Engineers require an **individual permit** under Section 404 of the Clean Water Act? Call or write the Corps and ask. If they give you a response over the phone or give you a written response that the project will **not** require an individual permit, then document this in your files and give that information to IDNR.

If the answer to any one (1) of these questions is **YES**, then an SEA 368 review is required.

A **written request** for an SEA 368 review shall be submitted to the Division of Water, IDNR:

SEA 368 Review
Division of Water
Department of Natural Resources
402 W. Washington St., W264
Indianapolis, IN 46204-2641

In-state toll free: 1-877-WATER55 (877-928-3755)

ITEMS THAT SHOULD BE INCLUDED IN A WRITTEN REQUEST

The written request should include the following items for scheduling an SEA 368 review:

1) Narrative description of the project
2) Written location of the project
3) Simple set of drawings, including the following;
   - Scaled map showing the project location and length, this can be a USGS Quadrangle Map or a 1:400 scale aerial photograph map with project highlighted
   - Typical Cross Section of proposed work
4) U.S. Army Corps of Engineers' determination of what type of Corps permit is required, either by telephone or written confirmation

T.O.C.

1) Example Narrative Description:

Wyland Ditch will be reconstructed upstream of Sellers Lake to improve agricultural drainage. The project will commence at the downstream side of State Road 13 (Station 0+00) and will terminate 1,400' further downstream (Station 14+00, 100' upstream of Sellers Lake). An average of 1' - 2' of material will be removed from the ditch to create a 4' bottom width, 3:1 sideslopes, and a 0.007% bottom grade throughout the project length. The excavated material will be sidecast and graded on the adjacent lands to a maximum depth of 6". A 100' long sediment trap will be excavated between Stations 6+00 and 7+00 and between Stations 13+00 and 14+00. Both traps will be approximately 2' deep and 4' wide.

2) Example Project Location:

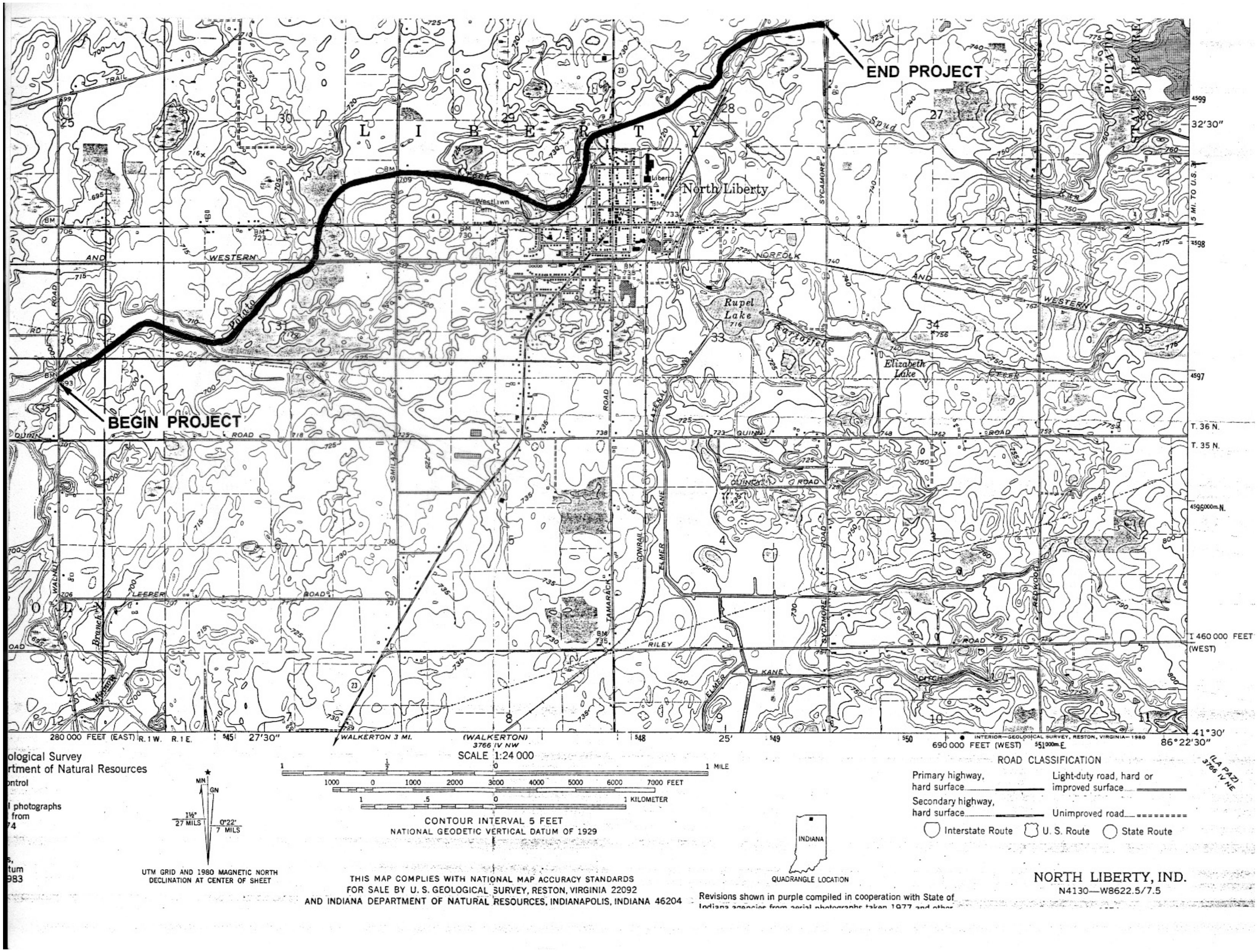
Along the left (south) bank of Honey Creek beginning approximately 50' west of SR 135 and extending upstream for approximately 900' near Bargersville, White River Township, Johnson County.

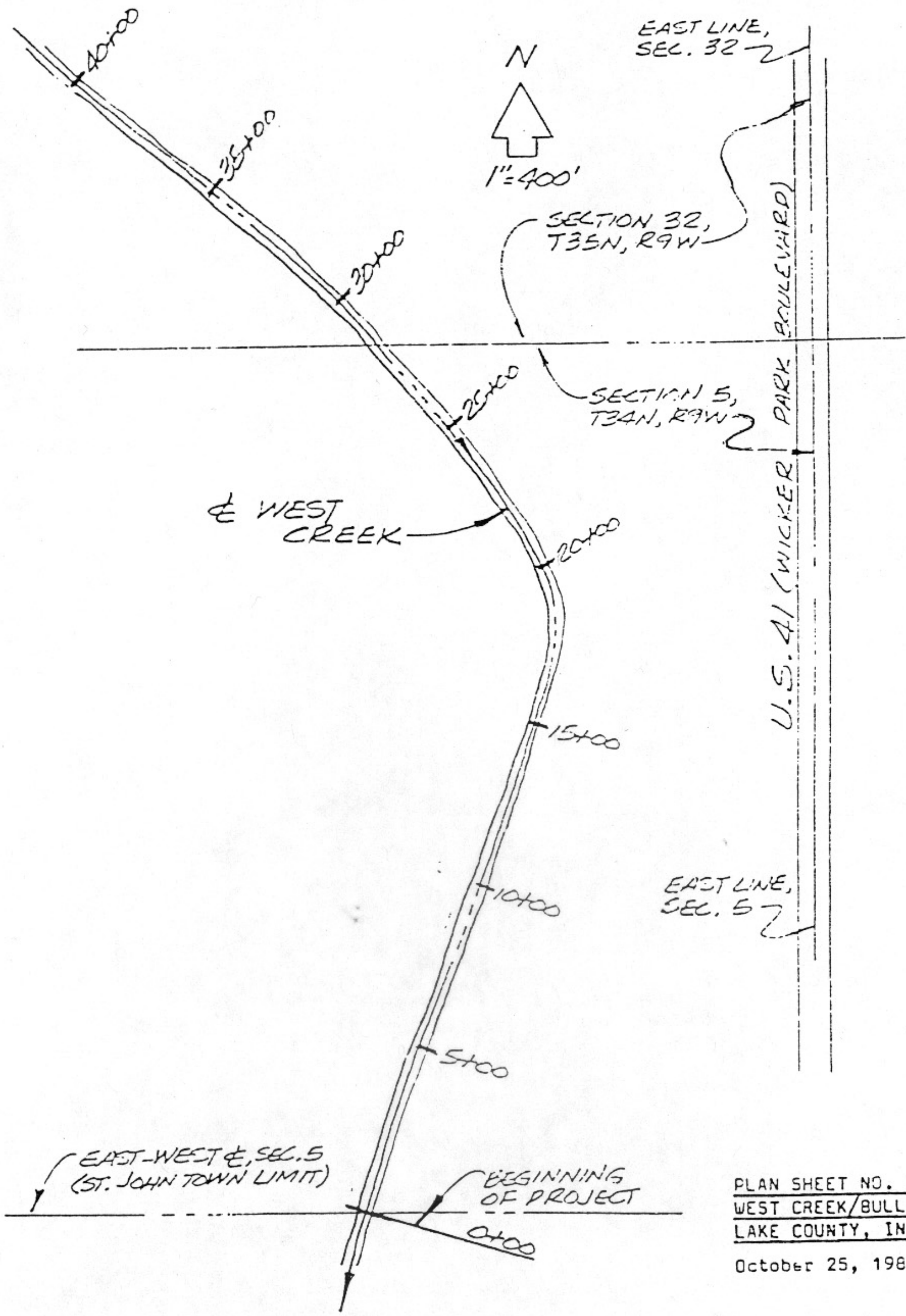
Downstream SE¼, NE¼, SE¼, Section 14, to upstream SE¼, NW¼, SW¼, Section 13, Township 13 North, Range 3 East, Bargersville Quadrangle Map.

NOTE: Project locations are typically described from the downstream end toward the upstream end.

ATTACHED: USGS Quadrangle Map with project highlighted is preferred to best show project location.

T.O.C.


END PROJECT
BEGIN PROJECT
North Liberty
Rupel Lake
Elizabeth Lake
SCALE 1:24 000
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
AND INDIANA DEPARTMENT OF NATURAL RESOURCES, INDIANAPOLIS, INDIANA 46204
QUADRANGLE LOCATION
INDIANA
Revisions shown in purple compiled in cooperation with State of
NORTH LIBERTY, IND.
N4130—W8622.5/7.5



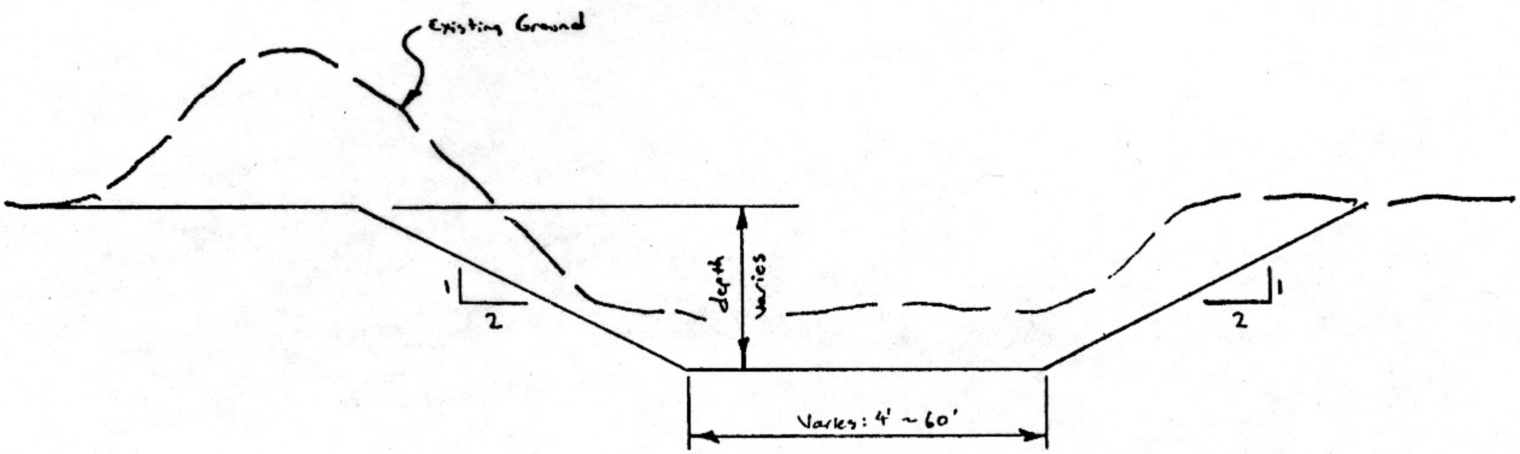
PLAN SHEET NO. 1 OF 3
WEST CREEK/BULL RUN—1983
LAKE COUNTY, INDIANA

October 25, 1983

RECONSTRUCTION

OF THE

BIG MONON DITCH



TYPICAL SECTION

LOOKING DOWNSTREAM

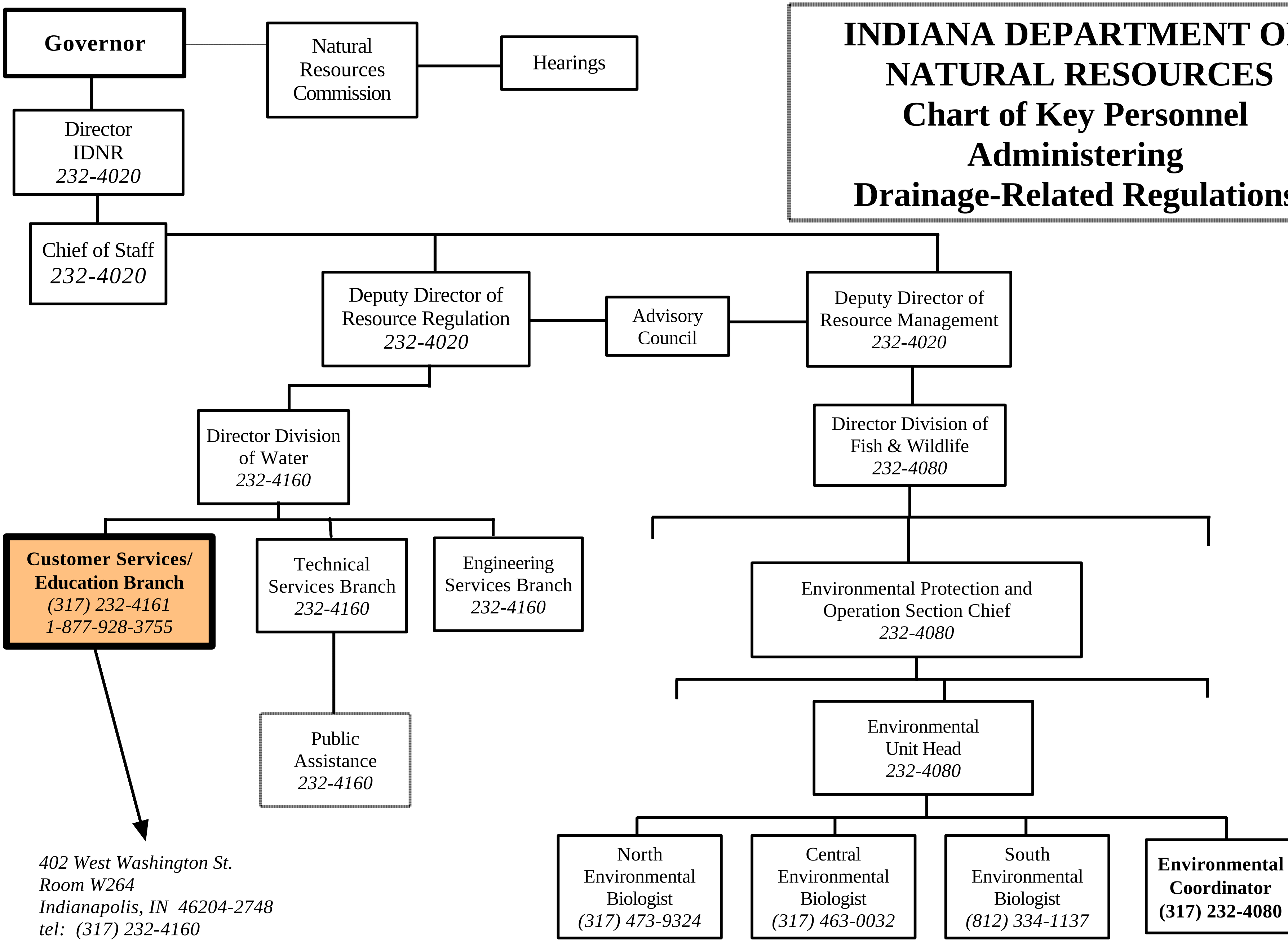
(NO SCALE)

APPENDIX E.7

IDNR Drainage-Related Personnel Information

T.O.C.

INDIANA DEPARTMENT OF NATURAL RESOURCES
Chart of Key Personnel Administering Drainage-Related Regulations



402 West Washington St.
Room W264
Indianapolis, IN 46204-2748
tel: (317) 232-4160
Tol Free: (877) 928-3755
fax: (317) 233-4579
Internet Address: www.ai.org/dnr/water

Note: The bolded box indicates individual who should be contacted first.

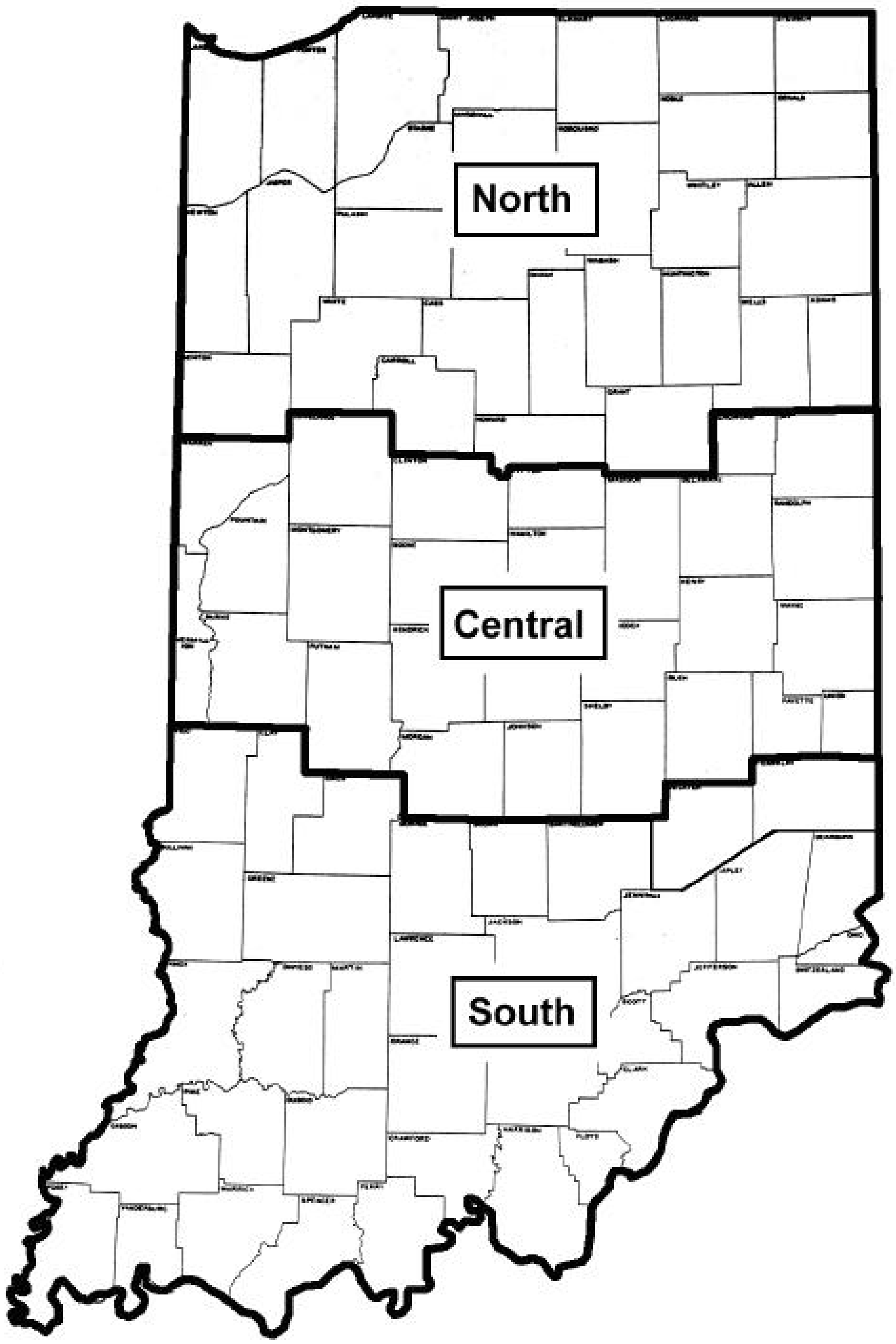
T.O.C.

IDNR-Fish & Wildlife Environmental Biologist Districts

Environmental Biologist Districts						
North	Environmental Biologist R.R. 6, Box 344 Peru, IN 46970				Telephone: (765) 472-7981 FAX: (765) 473-9715	
	Counties:					
	Adams	Dekalb	Huntington	LaPorte	Porter	Wabash
	Allen	Elkhart	Jasper	Marshall	Pulaski	Wells
	Benton	Fulton	Kosciusko	Miami	St. Joseph	White
	Carroll	Grant	LaGrange	Newton	Starke	Whitley
	Cass	Howard	Lake	Noble	Steuben	
Central	Environmental Biologist 3900 Soldiers Home Road West Lafayette, IN 47906				Telephone: (765) 463-0032 FAX: (765) 497-3425	
	Counties:					
	Blackford	Fountain	Jay	Morgan	Shelby	Warren
	Boone	Hamilton	Johnson	Parke	Tippecanoe	Wayne
	Clinton	Hancock	Madison	Putnam	Tipton	
	Delaware	Hendricks	Marion	Randolph	Union	
	Fayette	Henry	Montgomery	Rush	Vermillion	
South	Environmental Biologist 2600 North Sate Road 7 North Vernon, IN 47265				Telephone: (812) 346-2223 FAX: (812) 352-0140	
	Counties:					
	Bartholomew	Dearborn	Greene	Lawrence	Perry	Sullivan
	Brown	Decatur	Harrison	Martin	Pike	Switzerland
	Clark	Dubois	Jefferson	Orange	Spencer	Vanderburgh
	Clay	Floyd	Jackson	Monroe	Posey	Vigo
	Crawford	Franklin	Jennings	Ohio	Ripley	Warrick
	Daviess	Gibson	Knox	Owen	Scott	Washington

Last Print/Revision Date: October 1999

Environmental Biologist Districts



Last Print/Revision Date: October 13, 1996

APPENDIX F

Material Related to IDEM-Administered Regulations

T.O.C.

APPENDIX F.1

IDEM 401 WQC Permit Application Package

T.O.C.

Indiana Department of Environmental Management
Section 401 Water Quality Certification Program

Application Form and Instructions for Section 401 Water Quality Certification

Revised October 27, 1997

T.O.C.

Dear Section 401 Water Quality Certification Applicants:

Thank you for doing your part to ensure that we are all good stewards of Indiana's lakes, rivers, streams, and wetlands. We at the Indiana Department of Environmental Management (IDEM) are committed to protecting the integrity of our State's precious aquatic resources.

Section 404 of the Clean Water Act (CWA) requires anyone wishing to discharge dredged or fill material into a water of the United States to first receive a permit from the U.S. Army Corps of Engineers (Corps). Before the Corps can issue a permit, however, Section 401 of the CWA requires the applicant to obtain a Water Quality Certification (or waiver) for the project from the State in which the project is located.

IDEM's goal is to preserve, protect, and enhance the quality of Indiana's aquatic resources. We want to work with you to find sound ecological solutions that meet your project needs. We have developed an application packet that sets forth the information we need from you to make a decision regarding your project. We believe it is relatively simple to complete.

Please contact us with any questions or concerns you may have. You can reach us at 317-232-8683 or you may reach us through the IDEM Environmental Helpline at 1-800-451-6027. Thank you again for doing your part to ensure that Indiana's aquatic resources are protected for future generations of Hoosiers.

Sincerely,

Matthew C. Rueff
Assistant Commissioner
Office of Water Management

FREQUENTLY ASKED QUESTIONS REGARDING WATER QUALITY CERTIFICATION (WQC)

1. Who needs a WQC?

Any applicant for a federal license or permit to conduct any activity that may result in a discharge into waters of the United States must first obtain a WQC (or waiver) from the state. In general, anyone who is required to obtain a permit from the U.S. Army Corps of Engineers to engage in dredging, excavation or filling activities must obtain a WQC.

2. What is a water of the United States?

Very few waterbodies are not waters of the United States. Waters of the United States include: waters that are or have been used to transport commerce and their tributaries; all interstate waters; and all intrastate waters the use, degradation or destruction of which could affect commerce. This generally includes lakes, rivers, streams, creeks, drainage ditches and wetlands. The Corps can tell you whether the particular waterbody you plan on impacting is a water of the United States.

3. What type of project may require a WQC and Corps permit?

The Corps has the authority to decide which projects require a permit and whether they will qualify for a Nationwide Permit, General Permit, or Individual Permit. The addresses and telephone numbers for the two Corps Districts that have jurisdiction in Indiana are included at the back of this packet. The following are examples of projects that would likely require a Corps permit and WQC: dredging a lake, river, stream, or wetland; filling a lake, river, stream, or wetland; bank stabilization; pond construction in wetlands; and roadway/bridge construction projects involving water crossings.

4. If my project qualifies for a Nationwide Permit from the Corps, do I still need a WQC?

IDEM has given a blanket WQC for some, but not all, of the Nationwide Permits (NWPs) established by the Corps. If IDEM has not given a blanket WQC for the particular NWP the Corps has authorized you to work under, then an individual WQC from IDEM will be necessary. The Corps will inform you if your project needs an individual WQC. You may also request a list of the NWPs for which IDEM has granted blanket certification and NWPs that IDEM has certified with special conditions.

5. How long will it take me to obtain a WQC?

If IDEM receives all the necessary information, then IDEM can usually make a decision on your application within sixty days of receiving it. However, the Clean Water Act authorizes IDEM to take up to a year to make a decision on your application.

6. Is there an application fee for obtaining a WQC?

Currently, there are no fees required for applying for a WQC.

T.O.C.

Instructions for Completing the Application for Water Quality Certification

* The numbers below correspond to the numbers on the application form

* If you have questions, please call IDEM's Water Quality Certification Program at 1-800-451-6027 or 317-232-8683

* Print clearly or type

* Attach additional 8 1/2 x 11" sheets if necessary

1. Provide the applicant's name, address, and telephone number.

2. Provide the agent's address and telephone information (an agent is anyone representing the applicant on the project, such as an attorney or consultant). Applicants are not required to have an agent.

3. Provide specific project information relating to the location and the proposed project.

4. Give a narrative description of the proposed project.

5. Describe the purpose of the project (i.e., why the project is being proposed).

6. Provide the proposed or actual start date and the anticipated completion date. If you have started your project before obtaining a permit and WQC, you may be in violation of federal and state law.

7. Describe possible alternatives to the proposed project that would avoid impacts to the aquatic resource; also describe ways to minimize impacts, including a description of how you plan on containing any dredged/excavated material to prevent reentry into waterways or wetland. If you can avoid impacts to the aquatic resource, you may be able to avoid the requirement to obtain a WQC. Alternatives may include: construction on the upland portions of the property; rerouting a roadway to avoid a wetland; or alternate design plans. Minimization of the impacts may decrease any mitigation requirements that might otherwise apply and increase the chances of receiving WQC. Minimization may include reduction of the amount of dredging, filling, or vegetative clearing.

8. If you are proposing to dredge, identify any pollutants that may be present in the sediment. IDEM will contact you if further information is needed.

9. Some aquatic resources may contain or be utilized by unique aquatic life (such as mussels) or threatened or endangered species. Please identify any such species.

10. Describe the type, composition, and quantity of fill material to be placed in the wetlands or other aquatic resources.

11. Provide information regarding your application to the U.S. Army Corps of Engineers. If you have not contacted the Corps of Engineers, please call the Louisville Corps District at 502/582-5607 or the Detroit Corps District at 313/226-6828. Please consult the map on the next page to determine which district your project is located in.

12. Provide information regarding any other federal, state, or local permits, variances, licenses, or certifications required for your project. Please indicate whether they were approved, denied, or are pending.

13. Provide the information specified on page 3 of the application (list of adjacent landowners and affected persons, drawings, photos, mitigation plan and map). Submit a copy of the wetland delineation and data sheets (done in accordance with the Corps' regulations) if the Corps' regulations require a delineation for the project. If a delineation is not required by the Corps, then the applicant may instead submit a drawing to scale showing the location and extent of the wetland.

14. The applicant must sign and date the application.

15. IDEM may need additional information from you, including an antidegradation demonstration. IDEM will contact you if we determine that is necessary.

For more information about WQC, contact IDEM at the address below. Please contact the Indiana Department of Natural Resources or respective Corps District at the proper address below for questions regarding their programs.

IDEM - Office of Water Management
Section 401 Water Quality Certification Program
P.O. Box 6015
IGCN Room 1255
Indianapolis, IN 46206-6015
1-800-451-6027 or 317-232-8683

US Army Corps of Engineers
Detroit District
P.O. Box 1027
Detroit, MI 48231-1027
313-226-2218

Indiana Department of Natural Resources
Division of Water
402 W. Washington Street, Room W200
Indianapolis, IN 46204
317-232-4161

US Army Corps of Engineers
Louisville District
P.O. Box 59
Louisville, KY 40201-0059
502-582-5607

T.O.C.

Application for Water Quality Certification

Address all applications or questions to:

Indiana Department of Environmental Management
Section 401 Water Quality Certification Program
100 North Senate Avenue P.O. Box 6015 Indianapolis, Indiana 46206-6015
1-800-451-6027 or 317-232-8683

PLEASE PULL OUT APPLICATION FROM PACKET

Failure to provide the information requested in this application may result in a delay of processing or denial of your application.

For office use only
Project Manager:
Date Received:
IDEM I.D. Number:
County:

T.O.C.

1. APPLICANT INFORMATION			
Name of Applicant			Mailing Address (Street , P.O. Box or Rural Route)
City	State	Zip	
Daytime Telephone Number			Fax Number

2. AGENT INFORMATION			
Name of Agent			Mailing Address (Street, P.O. Box or Rural Route)
City	State	Zip	
Daytime Telephone Number			Fax Number

3. PROJECT INFORMATION	
County project is located in	Nearest Town
Project Name or Title (if applicable)	Project Street Address
Type of aquatic resource to be impacted	Name of waterbody
Linear feet of bank/shoreline impact (if applicable)	Acreage of wetland proposed to be impacted (if applicable)
Acreage of wetlands on site	Cowardin Classification (if known)

4. Describe proposed project:

5. Purpose of the project:

6. Date project will begin if permit is issued: _______________ If work has been started, date it was started: _____________

Anticipated completion date: ____________________

7. Describe possible alternatives to the proposed project to avoid or minimize impacts to the aquatic resource. Also describe where and how you plan on putting and containing the dredged/excavated material (if any) to prevent reentry into the aquatic resource.

8. Do you expect to dredge any sediments that you know, or have reason to believe, are contaminated with pollutants?
____ Yes ____ No Please identify the pollutants that may be present in the sediment.

9. Are you aware of any unique resources (e.g., mussels) or threatened or endangered (state or federal) species present in the aquatic resource you are proposing to impact? ____ Yes ____ No Please identify.

10. If fill is to be placed, describe the type, composition and quantity:

11. Have you applied for an Army Corps of Engineers Section 404 permit? _____ Yes _____ No If yes, please supply the Corps of Engineers ID Number, the Corps of Engineers District, the project manager, and a copy of any correspondence with the Corps. If no, please contact the Army Corps of Engineers regarding the possible need for a permit application. (See instructions 11.)

12. Have you applied for, received, or been denied any other federal, state, or local permits, variances, licenses, or certifications for this project? Please give the permit name, agency from which it was obtained, permit number, and date of issuance or denial.

13. Please attach the following information:

____ A. List of adjacent landowners and persons who may be adversely affected by the project (Attachment A).

____B. A standard size drawing (8.5"x11") of the proposed activity showing an overhead view and cross section that clearly illustrate the scale, north arrow, **wetland delineation** (and data sheets if required by the Corps -- see instructions),erosion control devices, existing and proposed structures and their dimensions, water depths and bottom configurations (if applicable), existing and proposed waterway configurations and elevations, dredge cuts and fills, and ordinary high water mark.

____C. Photographs of the proposed project site; label the photos and identify the location(s) where the photographs were taken on the drawing.

____D. If proposed, a mitigation plan to minimize impacts to water quality including the restoration or creation of wetlands to replace the wetlands that will be lost as a result of the proposed project.

____E Directions to the project location and a copy of a vicinity map and/or a copy of the portion of the U.S.G.S. 7.5 minute topographic map clearly showing the project location.

I hereby request a Water Quality Certification to authorize the activities described in this application. I certify that I am familiar with the information contained in this application and to the best of my knowledge and belief, such information is true and accurate. I certify that I have the authority to undertake and will undertake the activities as described in this application. I am aware that there are penalties for submitting false information. I understand that any changes in project design subsequent to IDEM's granting of WQC are not covered by the WQC, and I may be subject to civil and criminal penalties for proceeding without proper authorization. I agree to allow representatives of the IDEM to enter and inspect the project site. I understand that the granting of other permits by local, state, or federal agencies does not release me from the requirement of obtaining the WQC requested herein before commencing the project.

Applicant's Signature: ____ Date:_____________________

ATTACHMENT A

Please be sure to include this attachment with your application. Failure to include it may result in a delay of processing or denial of your application.

Adjacent landowners and other persons (or entities) who may be affected by your project need to be notified of your project. Please list the names and addresses of landowners adjacent to the property on which your project is located and the names and addresses of other persons (or entities) potentially affected by your project. Attach additional sheets if needed.

Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:
Name: Address:

Please provide the names and telephone numbers of the two largest newspapers of general circulation in the project area.

Newspaper name: Telephone number:
Newspaper name: Telephone number:

T.O.C.

Indiana Department of Environmental Management
Section 401 Water Quality Certification Program
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015

APPENDIX F.2

IDEM Listing of Indiana Waters Designated for Special Protection

Indiana Waters Designated for Special Protection

Designated Salmonid Waters:

1. Trail Creek & tributaries upstream of US Highway 35.
2. East Branch of the Little Calumet River and its tributaries downstream to Lake Michigan via Burns Ditch.
3. Kintzele Ditch (Black Ditch) from Beverly Drive downstream to Lake Michigan.
4. Salt Creek above its confluence with the Little Calumet River.
5. Galena River and its tributaries in Laporte County.
6. The St. Joseph River and its tributaries in St. Joseph County from the Twin Branch Dam in Mishawaka downstream to the Indiana/Michigan state line.

Streams which have been designated all or partially as Outstanding State Resource Waters:

1. The Blue River in Washington, Crawford, and Harrison counties.
2. Cedar Creek in Allen and DeKalb counties.
3. The North Fork of Wildcat Creek in Carroll and Tippecanoe counties.
4. The South Fork of Wildcat Creek in Tippecanoe County.
5. The Indiana portion of Lake Michigan.
6. All waters incorporated in the Indiana Dunes National Lakeshore.

Streams which have designated all or partially as Exceptional Use Streams:

1. Big Pine Creek in Warren County.
2. Mud Pine Creek in Warren County.
3. Fall Creek in Warren County.
4. Indian Creek in Montgomery County.
5. Clifty Creek in Montgomery County.
6. Bear Creek in Fountain County.
7. Rattlesnake Creek in Fountain County.
8. The small tributary to Bear Creek in Fountain County within the Portalnd Arch Nature Preserve which enters Bear Creek at the sharpest bend and has formed the small natural bridge called Portland Arch.
9. Blue River from the confluence of the West Middle Forks of the Blue River in Washington County.
10. The South Fork of the Blue River in Washington County.
11. Lost River and all surface and underground tributaries upstream from the Orangeville Rise (T2N, R1W, Section 6) and the Rise of Lost River (t2N, R1W, Section 7) and the mainstream of the Lost River from Orangeville Rise downstream to its confluence with the East Fork of the White River.

APPENDIX F.3

IDEM February 8, 1997 Decision Letter
Regarding COE Nationwide Permits

Reprint of IDEM's Section WQC Letter Regarding the 1997 Reauthorization

February 8, 1997

Mr. Doug Shelton
U.S. Army Corps of Engineers
Louisville District
P.O. Box 59
Louisville, Kentucky 40201-0059

Dear Mr. Shelton:

RE: Section 401 Water Quality Certification
1997 Nationwide Permit Program Reauthorization
Final Agency Decision

Office of Water Management staff have completed our review of the 1997 U.S. Army Corps of Engineers Reauthorization of the Nationwide Permit Program. The final language is summarized in the Public Notice issued by your office on December 19, 1996. The following represents the Indiana Department of Environmental Management's (IDEM) final decisions on the approval or denial of Section 401 Water Quality Certification for each of the 39 new, modified or reissued nationwide permits. For each nationwide permit we have indicated our decision and listed any specific conditions that must be satisfied in order for a valid authorization under that nationwide to occur.

Although a site specific Section 401 Water Quality Certification will be required for any nationwide formally denied 401 Water Quality Certification or denied without prejudice by the Corps of Engineers, applicants complying with IDEM's stated conditions will generally be granted Section 401 Water Quality Certification. As noted, any nationwide for which Section 401 Water Quality Certification has been granted **WILL NOT REQUIRE** a separate application to this office.

Nationwide Permit:

1. Aids to Navigation
DECISION: Grant Section 401 Water Quality Certification with no conditions

2. **Structures in Artificial Canals**
DECISION: Grant Section 401 Water Quality Certification with no conditions

3. **Maintenance**
DECISION: Grant Section 401 Water Quality Certification with no conditions

4. **Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities**
DECISION: Grant Section 401 Water Quality Certification with no conditions

5. **Scientific Measurement Devices**
DECISION: Grant Section 401 Water Quality Certification with no conditions

6. **Survey Activities**
DECISION: Grant Section 401 Water Quality Certification with no conditions

7. **Outfall Structures**
DECISION: Grant Section 401 Water Quality Certification with no conditions

8. **Oil and Gas Structures**
DECISION: Grant Section 401 Water Quality Certification with no conditions

9. **Structures in Fleeting and Anchorage Areas**
DECISION: Grant Section 401 Water Quality Certification with no conditions

10. **Mooring Buoys**
DECISION: Grant Section 401 Water Quality Certification with no conditions

11. **Temporary Recreational Structures**
DECISION: Grant Section 401 Water Quality Certification with no conditions

12. **Utility Line Discharges**
DECISION: Grant Section 401 Water Quality Certification with no conditions

13. Bank Stabilization
DECISION: Grant Section 401 Water Quality Certification with the following condition:

1. Section 401 Water Quality Certification is granted for all projects under 500 linear feet in length. A site-specific Section 401 Water Quality Certification is required for any and all projects which qualify for this nationwide permit and are 500 linear feet or greater in length.

14. Road Crossings
DECISION: Deny Section 401 Water Quality Certification

15. U.S. Coast Guard Approved Bridges
DECISION: Deny Section 401 Water Quality Certification

16. Return Water from Upland Contained Disposal Areas
DECISION: Grant Section 401 Water Quality Certification with the following condition:

1. The discharge of return water from upland contained disposal areas is regulated by the Indiana Department of Environmental Management's (IDEM) National Pollution and Discharge Elimination System Permitting Program. Persons qualifying for this nationwide permit are advised to contact IDEM regarding the possible need for additional permits or authorizations.

17. Hydropower projects
DECISION: Deny Section 401 Water Quality Certification

18. Minor Discharges
DECISION: Grant Section 401 Water Quality Certification with no conditions

19. Minor Dredging
DECISION: Grant Section 401 Water Quality Certification with no conditions

20. Oil Spill Cleanup
DECISION: Deny Section 401 Water Quality Certification

21. Surface Coal Mining Activities
DECISION: Grant Section 401 Water Quality Certification with no conditions

22. Removal of Vessels

DECISION: Grant Section 401 Water Quality Certification with no conditions

23. Approved Categorical Exclusions
DECISION: Deny Section 401 Water Quality Certification

24. State Administered Section 404 Programs
DECISION: Grant Section 401 Water Quality Certification with no conditions

25. Structural Discharges
DECISION: Grant Section 401 Water Quality Certification with no conditions

26. Headwaters and Isolated Waters Discharges
DECISION: Deny Section 401 Water Quality Certification

27. Wetland and Riparian Restoration and Creation Activities
DECISION: Grant Section 401 Water Quality Certification with no conditions

28. Modifications of Existing Marinas
DECISION: Grant Section 401 Water Quality Certification with no conditions

29. Single-Family Housing
DECISION: Grant Section 401 Water Quality Certification with the following conditions:

1. No activities authorized by this nationwide will be permitted in or adjacent to any of the state's designated salmonid waters, State Resource Waters, and Exceptional Use Streams.

2. Septic fields or any other septic treatment systems shall not be built within waters of the state. All efforts should be made to pump septic wastes offsite or to a viable upland area onsite.

3. This certification shall be limited to a house, an attached garage, a driveway, a storage shed, and limited perimeter fill. The perimeter fill shall not exceed 15 feet from the edge of any authorized structure. The base width of the driveway shall be limited to 20 feet, where practicable. Culverts shall be installed under the driveway to maintain existing hydrology.

4. The homesite and other certified structures shall not bisect or otherwise isolate hydrologically any part of a wetland from the larger wetland complex.

5. Certified activities shall be limited to isolated waters, including wetlands. "Isolated waters" means any water body, not including fens and bogs, which has no direct

hydrologic connection to any other water body. Impacts to any river, stream, lake, riparian corridor, fringe wetland or any other non-isolated water shall require a site specific Section 401 Water Quality Certification unless authorized by any nationwide permit which has been previously granted Section 401 Water Quality Certification.

6. Authorized impacts to waters of the state shall not exceed 0.10 acres. All efforts to avoid and minimize impacts to waters of the state must take place before impacts to waters of the state are certified.

30. Moist Soil Management for Wildlife
DECISION: Grant Section 401 Water Quality Certification with no conditions

31. Maintenance of Existing Flood Control Projects
DECISION: Deny Section 401 Water Quality Certification

32. Completed Enforcement Activities
DECISION: Deny Section 401 Water Quality Certification

33. Temporary Construction, Access, and Dewatering
DECISION: Grant Section 401 Water Quality Certification with no conditions

34. Cranberry Production Activities
DECISION: Deny Section 401 Water Quality Certification

35. Maintenance Dredging of Existing Basins
DECISION: Grant Section 401 Water Quality Certification with no conditions

36. Boat Ramps
DECISION: Grant Section 401 Water Quality Certification with no conditions

37. Emergency Watershed Protection and Rehabilitation
DECISION: Grant Section 401 Water Quality Certification with no conditions

38. Cleanup of Hazardous and Toxic Waste
DECISION: Deny Section 401 Water Quality Certification

39. * Reserved *
- No decision required

40. Farm Buildings
DECISION: Deny Section 401 Water Quality Certification

In addition, the following nationwide permits are denied Section 401 Water Quality Certification if the activity occurs on or in any Designated State Salmonid Water, any Outstanding State Resource Water, any Outstanding National Resource Water or any listed Exceptional Use Stream -

12. Utility Line Discharges
18. Minor Discharges
19. Minor Dredging
33. Temporary Construction, Access, and Dewatering
36. Boat Ramps

See Appendix 1 for the complete list of waters affected by this decision. As of the date of this letter, no waterbodies within the state of Indiana have been designated Outstanding National Resource Waters.

If you have any questions regarding this decision, please contact Mr. Andrew Pelloso, Senior Environmental Manager, at 317/233-2481 or Mr. Dennis Clark, Section Chief, at 317/233-2482. All Section 401 Water Quality Certification decisions will remain in force without change until the specific nationwide is revoked, modified, or reauthorized.

Sincerely,

ORIGINAL SIGNED

R.J. Henley
Assistant Commissioner
Office of Water Management

cc: Mr. John Konik, USACOE-Detroit
Mr. Rodney Woods, USACOE Ohio River Division
Mr. Michael Loesch, USACOE North Central Division
Mr. Kevin Pierard, USEPA Region V
Mr. David Hudak, USFWS-Bloomington
Mr. Robert Eddleman, NRCS
Mr. Patrick Ralston, IDNR
Mr. Grady McCallie, National Wildlife Federation
Ms. Susan Thomas, Sierra Club Wetlands Project
Mr. Tim Maloney, Hoosier Environmental Council

T.O.C.

Appendix 1: List of Indiana Waters in Which Conditional Denial of Certain NWPs apply

Designated Salmonid Waters:

(1) Trail Creek and tributaries upstream of U.S. Highway 35.
(2) East Branch of the Little Calumet river and its tributaries downstream to Lake Michigan via Burns Ditch.
(3) Kintzele Ditch (Black Ditch) from Beverly Drive downstream to Lake Michigan.
(4) Salt Creek above its confluence with the Little Calumet River.
(5) Galena River and its tributaries in LaPorte County.
(6) The St. Joseph River and its tributaries in St. Joseph County from the Twin Branch Dam in Mishawaka downstream to the Indiana/Michigan State Line.

Streams which have been designated all or partially as Outstanding State Resource Waters:

(1) The Blue River in Washington, Crawford, and Harrison Counties.
(2) Cedar Creek in Allen and DeKalb Counties.
(3) The North Fork of Wildcat Creek in Carroll and Tippecanoe Counties.
(4) The South Fork of Wildcat Creek in Tippecanoe County.
(5) The Indiana portion of Lake Michigan.
(6) All waters incorporated in the Indiana Dunes National Lakeshore.

Streams which have been designated all or partially as Exceptional Use Streams.

(1) Big Pine Creek in Warren County.
(2) Mud Pine Creek in Warren County.
(3) Fall Creek in Warren County.
(4) Indian Creek in Montgomery County.
(5) Clifty Creek in Montgomery County.
(6) Bear Creek in Fountain County.
(7) Rattlesnake Creek in Fountain County.
(8) The small tributary to Bear Creek in Fountain County with in the Portland Arch Nature Preserve which enters Bear Creek at the sharpest bend and has formed the small natural bridge called Portland Arch.
(9) Blue River from the confluence of the West Middle Forks of the Blue River in Washington County.
(10) The South Fork of the Blue River in Washington County.
(11) Lost River and all surface and underground tributaries upstream from the Orangeville Rise (T2N, R1W, Section 6) and the Rise of Lost River (T2N, R1W, Section 7) and the mainstream of the Lost River from the Orangeville Rise downstream to its confluence with the East Fork of the White River.

T.O.C.

APPENDIX F.4

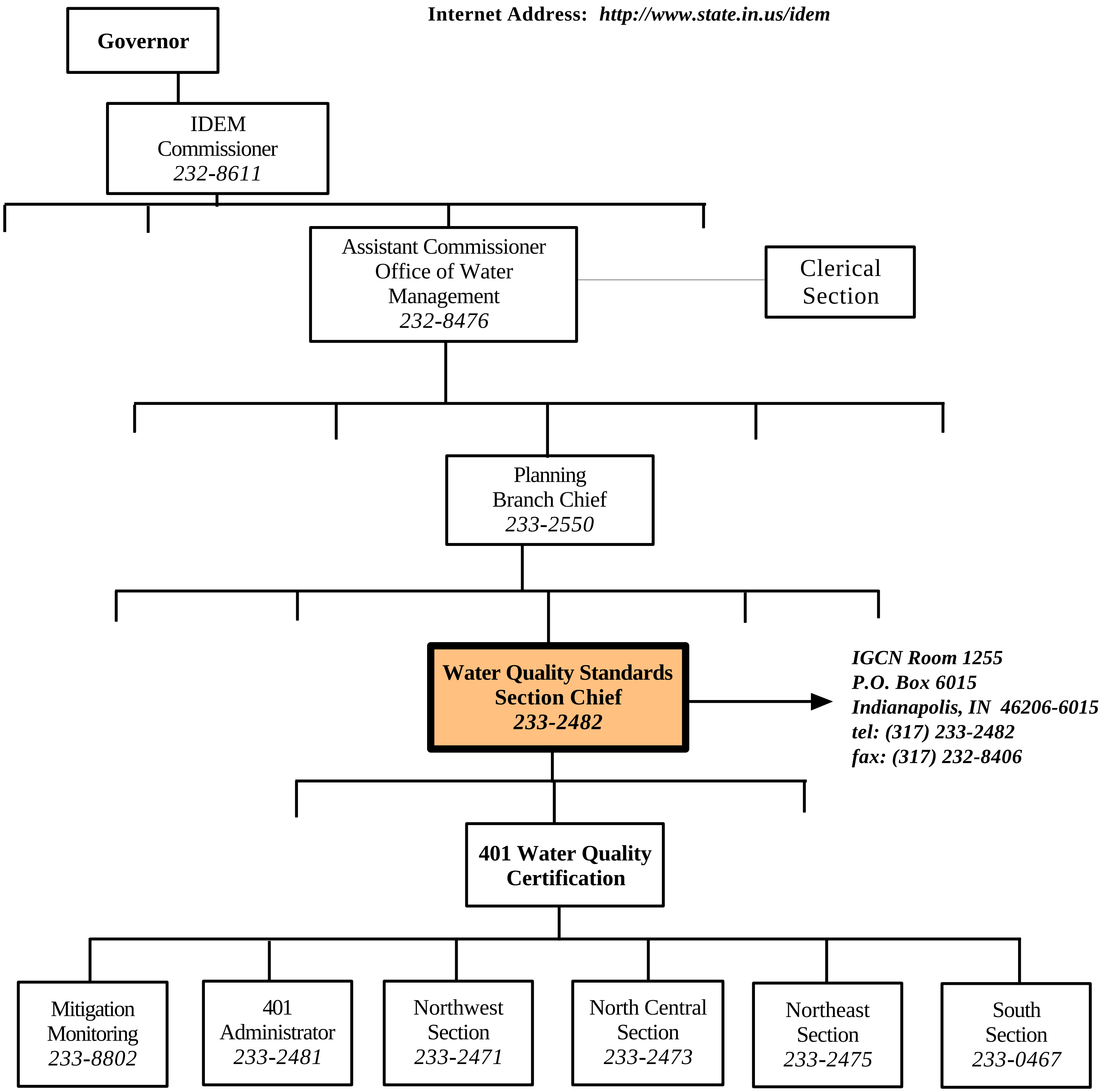
IDEM Drainage-Related Personnel Information

T.O.C.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Chart of Key Personnel Administering Drainage-Related Programs

Note: The bolded box indicates individual who should be contacted frist.

Internet Address: ***http://www.state.in.us/idem***



T.O.C.

Section 401 Water Quality Certification Program Staff and Contact Information

NORTH-EAST

Project Manager
(317) 233-2475

NORTH-WEST

Project Manager
(317) 233-2471

SOUTH

Project Manager
(317) 233-0467

CENTRAL

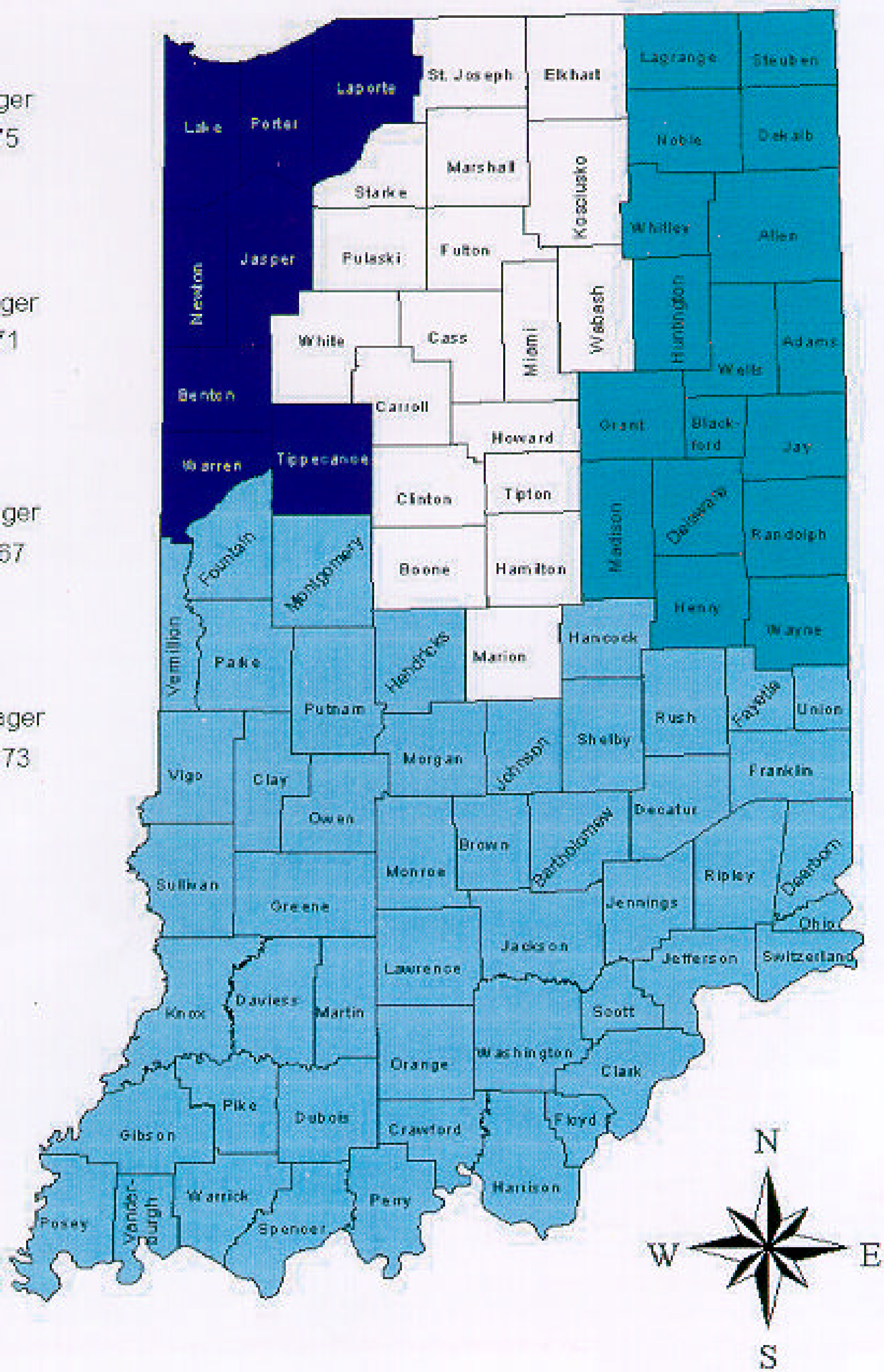
Project Manager
(317) 233-2473

MITIGATION COORDINATOR

(317) 233-8802

RULES AND OUTREACH

(317) 233-2481



APPENDIX G

Material Related to COE-Administered Regulations

T.O.C.

APPENDIX G.1

COE Permit Application Package

T.O.C.

Instructions for Preparing a Department of the Army Permit Application

Blocks 1 through 4. To be completed by Corps of Engineers.

Block 5. Applicant's Name. Enter the name of the responsible party or parties. If the responsible party is an agency, company, corporation or other organization, indicate the responsible officer and title. If more than one party is associated with the application, please attach a sheet with the necessary information marked **Block 5.**

Block 6. Address of Applicant. Please provide the full address of the party or parties responsible for the application. If more space is needed, attach an extra sheet of paper marked **Block 6.**

Block 7. Applicant Telephone Number(s). Please provide the number where you can usually be reached during normal business hours.

Blocks 8 through 11. To be completed if you choose to have an agent.

Block 8. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer or any other person or organization. *Note*: An agent is not required.

Block 9 and 10. Agent's Address and Telephone number. Please provide the complete mailing address of the agent, along with the telephone number where he/she can be reached during normal business hours.

Block 11. Statement of Authorization. To be completed by applicant if an agent is to be employed.

Block 12. Proposed Project Name or Title. Please provide name identifying the proposed project (i.e., Landmark Plaza, Burned Hills Subdivision or Edsall Commercial Center).

Block 13. Name of Waterbody. Please provide the name of any stream, lake, marsh or other waterway to be directly impacted by the activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 14. Proposed Project Street Address. If the proposed project is located at a site having a street address (not a box number), please enter here.

Block 15. Location of Proposed Project. Enter the county and state where the proposed project is located. If more space is required, please attach a sheet with the necessary information marked **Block 15.**

Block 16. Other Location Descriptions. If available, provide the Section, Township and Range of the site and/or the latitude and longitude. You may also provide description of the proposed project location, such as lot numbers, tract numbers or you may choose to locate the proposed project site from a known point (such as the right descending bank of Smith Creek, one mile down from the Highway 14 bridge). If a large river or stream, include the river mile of the proposed project site if known.

Block 17. Directions to the Site. Provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site.

Block 18. Nature of Activity. Describe the overall activity or project. Give appropriate dimensions of structures such as wingwalls, dikes (identify the materials to be used in construction, as well as the methods by which the work is to be done), or excavations (length, width, and height). Indicate whether discharge of dredged or fill material is involved. Also, identify any structure to be constructed on a fill, piles or float supported platforms.

The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked **Block 18.**

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Block 19. Proposed project Purpose. Describe the purpose and need for the proposed project. What will it be used for and why? Also include a brief description of any related activities to be developed as the result of the proposed project. Give the approximate dates you plan to both begin and complete all work.

Block 20. Reason(s) for Discharge. If the activity involves the discharge of dredged and/or fill material into a wetland or other waterbody, including the temporary placement of material, explain the specific purpose of the placement of the material (such as erosion control).

Block 21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards. Describe the material to be discharged and amount of each material to be discharged within Corps jurisdiction. Please be sure this description will agree with your illustrations. Discharge material includes: rock, sand, clay, concrete, etc.

Block 22. Surface Areas of Wetlands or Other Waters Filled. Describe the area to be filled at each location. Specifically identify the surface areas, or part thereof, to be filled. Also include the means by which the discharge is to be done (backhoe, dragline, etc.). If dredged material is to be discharged on an upland site, identify the site and the steps to be taken (if necessary) to prevent runoff from the dredged material back into a waterbody. If more space is needed, attach an extra sheet of paper marked **Block 22**.

Block 23. Is Any Portion of the Work Already Complete? Provide any background on any part of the proposed project already completed. Describe the area already developed, structures completed, any dredged or fill material already discharged, the type of material, volume in cubic yards, acreas filled, if a wetland or other waterbody (in acres or square feet). If the work was done under an existing Corps permit, identify the authorization if possible.

Block 24. Names and Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Project Site. List complete names and full mailing addresses of the adjacent property owners (public and private) lessees, etc., whose property adjoins the waterbody or aquatic site where the work is being proposed so that they may be notified of the proposed activity (usually by public notice). If more space is needed, attach an extra sheet of paper marked **Block 24**.

Information regarding adjacent landowners is usually available through the office of the tax assessor in the county of counties where the project is to be developed.

Block 25. Information about Approvals or Denials by Other Agencies. You may need the approval of other Federal, state or local agencies for your project. Identify any applications you have submitted and the status, if any (approved or denied) of each application. You need not have obtained all other permits before applying for a Corps permit.

Block 26. Signature of Applicant or Agent. The application must be signed by the owner or other authorized party (agent). This signature shall be an affirmation that the party applying for the permit possesses the requisite property rights to undertake the activity applied for (including compliance with special conditions, mitigation, etc.).

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a **Vicinity Map**, a **Plan View** **or** a **Typical Cross-Section Map**. Identify each illustration with a figure or attachment number.

Please submit one original, or good quality copy, of all drawings on 8 1/2x11 inch plain white paper (tracing paper or film may be substituted). Use the fewest number of sheets necessary for your drawings or illustrations.

Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view or cross-section). **While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate and contain all necessary information.**

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APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

OMB APPROVAL NO. 0710-003
Expires October 1996

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of InformationOperations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NO RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)*
6. APPLICANT'S ADDRESS	9. AGENT'S ADDRESS
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence b. Business	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. Business

11. STATEMENT OF AUTHORIZATION

I hereby authorize, ______________________ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*

13. NAME OF WATERBODY, IF KNOWN *(if applicable)*	14. PROJECT STREET ADDRESS *(if applicable)*
15. LOCATION OF PROJECT COUNTY STATE	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN, *(see instructions)*

17. DIRECTIONS TO THE SITE

T.O.C.

18. Nature of Activity (*Description of project, include all features*)

19. Project Purpose (*Describe the reason or purpose of the project, see instructions*)

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

22. Surface Area in Acres of Wetlands or Other Waters Filled (*see instructions*)

23. Is Any Portion of the Work Already Complete? Yes ____ No ____ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

25. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

*Would include but is not restricted to zoning, building and flood plain permits

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

______________________	__________	______________________	__________
SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

*U.S.GPO:1994-520-478/82018

APPENDIX G.2

Nationwide Permit Program (33 CFR 330)

T.O.C.

New Hampshire

New England Division Engineer, ATTN: CENED–OD–R, 424 Trapelo Road, Waltham, MA 02254–9149

New Jersey

Philadelphia District Engineer, ATTN: CENAP–OP–R, Wannamaker Building, 100 Penn Square East, Philadelphia, PA 19106–2991

New Mexico

Albuquerque District Engineer, ATTN: CESWA–CO–R, 4101 Jefferson Plaza NE, Rm 313, Albuquerque, NM 87109–3435

New York

New York District Engineer, ATTN: CENAN–OP–R, Jacob K. Javits Federal Building, New York, NY 10278–0090

North Carolina

Wilmington District Engineer, ATTN: CESAW–CO–R, P.O. Box 1890, Wilmington, NC 28402–1890

North Dakota

Omaha District Engineer, ATTN: CEMRO–OP–R, 215 North 17th Street, Omaha, NE 68102–4978

Ohio

Huntington District Engineer, ATTN: CEORH–OR–F, 502 8th Street, Huntington, WV 25701–2070

Oklahoma

Tulsa District Engineer, ATTN: CESWT–OD–R, P.O. Box 61, Tulsa, OK 74121–0061

Oregon

Portland District Engineer, ATTN: CENPP–PL–R, P.O. Box 2946, Portland, OR 97208–2946

Pennsylvania

Baltimore District Engineer, ATTN: CENAB–OP–R, P.O. Box 1715, Baltimore, MD 21203–1715

Rhode Island

New England Division Engineer, ATTN: CENED–OD–R, 424 Trapelo Road, Waltham, MA 02254–9149

South Carolina

Charleston District Engineer, ATTN: CESAC–CO–P, P.O. Box 919, Charleston, SC 29402–0919

South Dakota

Omaha District Engineer, ATTN: CEMRO–OP–R, 215 North 17th Street, Omaha, NE 68102–4978

Tennessee

Nashville District Engineer, ATTN: CEORN–OR–F, P.O. Box 1070, Nashville, TN 37202–1070

Texas

Ft. Worth District Engineer, ATTN: CESWF–OD–R, P.O. Box 17300, Ft. Worth, TX 76102–0300

Utah

Sacramento District Engineer, ATTN: CESPK–CO–O, 1325 J Street, CA 95814–4794

Vermont

New England Division Engineer, ATTN: CENED–OD–R, 424 Trapelo Road, Waltham, MA 02254–9149

Virginia

Norfolk District Engineer, ATTN: CENAO–OP–P, 803 Front Street, Norfolk, VA 23510–1096

Washington

Seattle District Engineer, ATTN: CENPS–OP–RG, P.O. Box 3755, Seattle, WA 98124–2255

West Virginia

Huntington District Engineer, ATTN: CEORH–OR–F, 502 8th Street, Huntington, WV 25701–2070

Wisconsin

St. Paul District Engineer, ATTN: CENCS–CO–R, 190 Fifth Street, East, St. Paul, MN 55101–1638

Wyoming

Omaha District Engineer, ATTN: CEMRO–OP–R, 215 North 17th Street, NE 68102–4978

District of Columbia

Baltimore District Engineer, ATTN: CENAB–OP–R, P.O. Box 1715, Baltimore, MD 21203–1715

Pacific Territories

Honolulu District Engineer, ATTN: CEPOD–ET–PO, Building 230, Fort Shafter, Honolulu, HI 96858–5440

Puerto Rico & Virgin Is

Jacksonville District Engineer, ATTN: CESAJ–RD, P.O. Box 4970, Jacksonville, FL 32232–0019

Approved:

Russell L. Fuhrman,

Major General, U.S. Army, Director of Civil Works.

Accordingly, these Nationwide Permits are issued as follows:

Nationwide Permits and Conditions

A. Index of the Nationwide Permits and Conditions

Nationwide Permits

1. Aids to Navigation
2. Structures in Artificial Canals
3. Maintenance
4. Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities
5. Scientific Measurement Devices
6. Survey Activities
7. Outfall Structures
8. Oil and Gas Structures
9. Structures in Fleeting and Anchorage Areas
10. Mooring Buoys
11. Temporary Recreational Structures
12. Utility Line Discharges
13. Bank Stabilization
14. Road Crossings
15. U.S. Coast Guard Approved Bridges
16. Return Water from Upland Contained Disposal Areas
17. Hydropower Projects
18. Minor Discharges
19. Minor Dredging
20. Oil Spill Cleanup
21. Surface Coal Mining Activities
22. Removal of Vessels
23. Approved Categorical Exclusions
24. State Administered Section 404 Programs
25. Structural Discharges
26. Headwaters and Isolated Waters Discharges
27. Wetland and Riparian Restoration and Creation Activities
28. Modifications of Existing Marinas
29. Single-Family Housing
30. Moist Soil Management for Wildlife
31. Maintenance of Existing Flood Control Projects
32. Completed Enforcement Actions
33. Temporary Construction, Access and Dewatering
34. Cranberry Production Activities
35. Maintenance Dredging of Existing Basins
36. Boat Ramps
37. Emergency Watershed Protection and Rehabilitation
38. Cleanup of Hazardous and Toxic Waste
39. Reserved
40. Farm Buildings

Nationwide Permit Conditions

General Conditions:

1. Navigation
2. Proper Maintenance
3. Erosion and Siltation Controls
4. Aquatic Life Movements
5. Equipment
6. Regional and Case-by-Case Conditions
7. Wild and Scenic Rivers
8. Tribal Rights
9. Water Quality Certification
10. Coastal Zone Management
11. Endangered Species
12. Historic Properties
13. Notification
14. Compliance Certification
15. Multiple Use of Nationwide Permits.

Section 404 Only Conditions

1. Water Supply Intakes
2. Shellfish Production
3. Suitable Material
4. Mitigation
5. Spawning Areas
6. Obstruction of High Flows
7. Adverse Effects from Impoundments
8. Waterfowl Breeding Areas
9. Removal of Temporary Fills

B. Nationwide Permits and Conditions

1. Aids to Navigation: The placement of aids to navigation and regulatory markers which are approved by and installed in accordance with the requirements of the U.S. Coast Guard.

(See 33 CFR part 66, chapter I, subchapter C). (Section 10)

2. Structures in Artificial Canals: Structures constructed in artificial canals within principally residential developments where the connection of the canal to a navigable water of the United States has been previously authorized (see 33 CFR 322.5(g)). (Section 10)

3. Maintenance: The repair, rehabilitation, or replacement of any previously authorized, currently serviceable, structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area including those due to changes in materials, construction techniques, or current construction codes or safety standards which are necessary to make repair, rehabilitation, or replacement are permitted, provided the environmental effects resulting from such repair, rehabilitation, or replacement are minimal. Currently serviceable means useable as is or with some maintenance, but not so degraded as to essentially require reconstruction. This NWP authorizes the repair, rehabilitation, or replacement of those structures destroyed by storms, floods, fire or other discrete events, provided the repair, rehabilitation, or replacement is commenced or under contract to commence within two years of the date of their destruction or damage. In cases of catastrophic events, such as hurricanes or tornadoes, this two-year limit may be waived by the District Engineer, provided the permittee can demonstrate funding, contract, or other similar delays. Maintenance dredging and beach restoration are not authorized by this NWP. (Sections 10 and 404)

4. Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities: Fish and wildlife harvesting devices and activities such as pound nets, crab traps, crab dredging, eel pots, lobster traps, duck blinds, clam and oyster digging; and small fish attraction devices such as open water fish concentrators (sea kites, etc.). This NWP authorizes shellfish seeding provided this activity does not occur in wetlands or sites that support submerged aquatic vegetation (including sites where submerged aquatic vegetation is documented to exist, but may not be present in a given year.). This NWP does not authorize artificial reefs or impoundments and semi-impoundments of waters of the United States for the culture or holding of motile species such as lobster, or the use of covered oyster trays or clam racks. (Sections 10 and 404)

5. Scientific Measurement Devices: Devices whose purpose is to measure and record scientific data such as staff gages, tide gages, water recording devices, water quality testing and improvement devices and similar structures. Small weirs and flumes constructed primarily to record water quantity and velocity are also authorized provided the discharge is limited to 25 cubic yards and further for discharges of 10 to 25 cubic yards provided the permittee notifies the District Engineer in accordance with the "Notification" general condition. (Sections 10 and 404)

6. Survey Activities: Survey activities including core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, soil survey and sampling, and historic resources surveys. Discharges and structures associated with the recovery of historic resources are not authorized by this NWP. Drilling and the discharge of excavated material from test wells for oil and gas exploration is not authorized by this NWP; the plugging of such wells is authorized. Fill placed for roads, pads and other similar activities is not authorized by this NWP. The NWP does not authorize any permanent structures. The discharge of drilling muds and cuttings may require a permit under section 402 of the Clean Water Act. (Sections 10 and 404)

7. Outfall Structures. Activities related to construction of outfall structures and associated intake structures where the effluent from the outfall is authorized, conditionally authorized, or specifically exempted, or are otherwise in compliance with regulations issued under the National Pollutant discharge Elimination System program (Section 402 of the Clean Water Act), provided that the permittee notifies the District Engineer in accordance with the "Notification" general condition. (Also see 33 CFR 330.1(e)). Intake structures per se are not included—only those directly associated with an outfall structure. (Sections 10 and 404)

8. Oil and Gas Structures. Structures for the exploration, production, and transportation of oil, gas, and minerals on the outer continental shelf within areas leased for such purposes by the Department of the Interior, Minerals Management Service. Such structures shall not be placed within the limits of any designated shipping safety fairway or traffic separation scheme, except temporary anchors that comply with the fairway regulations in 33 CFR 322.5(l). (Where such limits have not been designated, or where changes are anticipated, District Engineers will consider asserting discretionary authority in accordance with 33 CFR 330.4(e) and will also review such proposals to ensure they comply with the provisions of the fairway regulations in 33 CFR 322.5(l). Any Corps review under this permit will be limited to the effects on navigation and national security in accordance with 33 CFR 322.5(f)). Such structures will not be placed in established danger zones or restricted areas as designated in 33 CFR part 334: nor will such structures be permitted in EPA or Corps designated dredged material disposal areas. (Section 10)

9. Structures in Fleeting and Anchorage Areas. Structures, buoys, floats and other devices placed within anchorage or fleeting areas to facilitate moorage of vessels where such areas have been established for that purpose by the U.S. Coast Guard. (Section 10)

10. Mooring Buoys. Non-commercial, single-boat, mooring buoys. (Section 10)

11. Temporary Recreational Structures. Temporary buoys, markers, small floating docks, and similar structures placed for recreational use during specific events such as water skiing competitions and boat races or seasonal use provided that such structures are removed within 30 days after use has been discontinued. At Corps of Engineers reservoirs, the reservoir manager must approve each buoy or marker individually. (Section 10)

12. Utility Line Discharges. Discharges of dredged or fill material associated with excavation, backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction contours. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquefiable, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. The term "utility line" does not include activities which drain a water of the United States, such as drainage tile; however, it does apply to pipes conveying drainage from another area. This NWP authorizes mechanized landclearing necessary for the installation of utility lines, including overhead utility lines, provided the cleared area is kept to the minimum necessary and preconstruction contours

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are maintained. However, access roads, temporary or permanent, or foundations associated with overhead utility lines are not authorized by this NWP. Material resulting from trench excavation may be temporarily sidecast (up to three months) into waters of the United States, provided that the material is not placed in such a manner that it is dispersed by currents or other forces. The DE may extend the period of temporary side-casting not to exceed a total of 180 days, where appropriate. The area of waters of the United States that is disturbed must be limited to the minimum necessary to construct the utility line. In wetlands, the top 6" to 12" of the trench should generally be backfilled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of construction. Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line. (See 33 CFR part 322).

Notification: The permittee must notify the district engineer in accordance with the "Notification" general condition, if any of the following criteria are met:

(a) Mechanized landclearing in a forrested wetland;

(b) A Section 10 permit is required for the utility line;

(c) The utility line in waters of the United States exceeds 500 feet; or,

(d) The utility line is placed within a jurisdictional area (i.e., a water of the United States), and it runs parallel to a streambed that is within that jurisdictional area. (Sections 10 and 404)

13. Bank Stabilization. Bank stabilization activities necessary for erosion prevention provided the activity meets all of the following criteria:

a. No material is placed in excess of the minimum needed for erosion protection;

b. The bank stabilization activity is less than 500 feet in length;

c. The activity will not exceed an average of one cubic yard per running foot placed along the bank below the plane of the ordinary high water mark or the high tide line;

d. No material is placed in any special aquatic site, including wetlands;

e. No material is of the type, or is placed in any location, or in any manner, so as to impair surface water flow into or out of any wetland area;

f. No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored trees and treetops may be used in low energy areas); and,

g. The activity is part of a single and complete project.

Bank stabilization activities in excess of 500 feet in length or greater than an average of one cubic yard per running foot may be authorized if the permittee notifies the District Engineer in accordance with the "Notification" general condition and the District Engineer determines the activity complies with the other terms and conditions of the NWP and the adverse environmental effects are minimal both individually and cumulatively. This NWP may not be used for the channelization of a water of the Unitied States. (Sections 10 and 404)

14. Road Crossings. Fills for roads crossing waters of the United States (including wetlands and other special aquatic sites) provided the activity meets all of the following criteria:

a. The width of the fill is limited to the minimum necessary for the actual crossing;

b. The fill placed in waters of the United States is limited to a filled area of no more than 1/3 acre. Furthermore, no more than a total of 200 linear feet of the fill for the roadway can occur in special aquatic sites, including wetlands;

c. The crossing is culverted, bridged or otherwise designed to prevent the restriction of, and to withstand, expected high flows and tidal flows, and to prevent the restriction of low flows and the movement of aquatic organisms;

d. The crossing, including all attendant features, both temporary and permanent, is part of a single and complete project for crossing of a water of the United States; and,

e. For fills in special aquatic sites, including wetlands, the permittee notifies the District Engineer in accordance with the "Notification" general condition. The notification must also include a delineation of affected special aquatic sites, including wetlands.

This NWP may not be combined with NWP 18 or NWP 26 for the purpose of increasing the footprint of the road crossing. Some road fills may be eligible for an exemption from the need for a Section 404 permit altogether (see 33 CFR 323.4). Also, where local circumstances indicate the need, District Engineers will define the term "expected high flows" for the purpose of establishing applicability of this NWP. (Sections 10 and 404)

15. U.S. Coast Guard Approved Bridges. Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the United States, including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided such discharges have been authorized by the U.S. Coast Guard as part of the bridge permit. Causeways and approach fills are not included in this NWP and will require an individual or regional Section 404 permit. (Section 404)

16. Return Water From Upland Contained Disposal Areas. Return water from an upland, contained dredged material disposal area. The dredging itself may require a section 404 permit (33 CFR 323.2(d)), but will require a Section 10 permit if located in navigable waters of the United States. The return water from a contained disposal area is administratively defined as a discharge of dredged material by 33 CFR 323.2(d) even though the disposal itself occurs on the upland and thus does not require a Section 404 permit. This NWP satisfies the technical requirement for a Section 404 permit for the return water where the quality of the return water is controlled by the state through the Section 401 certification procedures. (Section 404)

17. Hydropower Projects: Discharges of dredged or fill material associated with (a) small hydropower projects at existing reservoirs where the project, which includes the fill, are licensed by the Federal Energy Regulatory Commission (FERC) under the Federal Power Act of 1920, as amended; and has a total generating capacity of not more than 5000 KW; and the permittee notifies the District Engineer in accordance with the "Notification" general condition; or (b) hydropower projects for which the FERC has granted an exemption from licensing pursuant to section 408 of the Energy Security Act of 1980 (16 U.S.C. 2705 and 2708) and section 30 of the Federal Power Act, as amended; provided the permittee notifies the District Engineer in accordance with the "Notification" general condition. (Section 404)

18. Minor Discharges: Minor discharges of dredged or fill material into all waters of the United States provided that the activity meets all of the following criteria:

a. The quantity of discharged material and the volume of excavated area does not exceed 25 cubic yards below the plane of the ordinary high water mark or the high tide line;

b. The discharge, including any excavated area, will not cause the loss of more than 1/10 acre of a special aquatic site, including wetlands. For the purposes of this NWP, the acreage limitation includes the filled area and excavated area plus special aquatic sites that are adversely affected by flooding and special aquatic sites that are drained so that they would no longer be a water of the United States as a result of the project;

c. If the discharge, including any excavated area, exceeds 10 cubic yards below the plane of the ordinary high water mark or the high tide line or if the discharge is in a special aquatic site, including wetlands, the permittee notifies the District Engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands (Also see 33 CFR 330.1(e)); and

d. The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project and is not placed for the purpose of a stream diversion.

e. This NWP can not be used in conjunction with NWP 26 for any single and complete project. (Sections 10 and 404)

19. Minor Dredging: Dredging of no more than 25 cubic yards below the plane of the ordinary high water mark or the mean high water mark from navigable waters of the United States (i.e., section 10 waters) as part of a single and complete project. This NWP does not authorize the dredging or degradation through siltation of coral reefs, sites that support submerged aquatic vegetation (including sites where submerged aquatic vegetation is documented to exist, but may not be present in a given year), anadromous fish spawning areas, or wetlands, or the connection of canals or other artificial waterways to navigable waters of the United States (see 33 CFR 322.5(g)). (Sections 10 and 404)

20. Oil Spill Cleanup: Activities required for the containment and cleanup of oil and hazardous substances which are subject to the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR part 300) provided that the work is done in accordance with the Spill Control and Countermeasure Plan required by 40 CFR part 112.3 and any existing State contingency plan and provided that the Regional Response Team (if one exists in the area) concurs with the proposed containment and cleanup action. (Sections 10 and 404)

21. Surface Coal Mining Activities: Activities associated with surface coal mining activities provided they are authorized by the Department of the Interior, Office of Surface Mining (OSM), or by states with approved programs under Title V of the Surface Mining Control and Reclamation Act of 1977 and provided the permittee notifies the District Engineer in accordance with the "Notification" general condition. The notification must include an OSM or state approved mitigation plan. The Corps, at the discretion of the District Engineer, may require a bond to ensure success of the mitigation, if no other Federal or state agency has required one. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. (Also see 33 CFR 330.1(e)) (Sections 10 and 404)

22. Removal of Vessels: Temporary structures or minor discharges of dredged or fill material required for the removal of wrecked, abandoned, or disabled vessels, or the removal of man-made obstructions to navigation. This NWP does not authorize the removal of vessels listed or determined eligible for listing on the National Register of Historic Places unless the District Engineer is notified and indicates that there is compliance with the "Historic Properties" general condition. This NWP does not authorize maintenance dredging, shoal removal, or river bank snagging. Vessel disposal in waters of the United States may need a permit from EPA (see 40 CFR 229.3). (Sections 10 and 404)

23. Approved Categorical Exclusions: Activities undertaken, assisted, authorized, regulated, funded, or financed, in whole or in part, by another Federal agency or department where that agency or department has determined, pursuant to the Council on Environmental Quality Regulation for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR part 1500 et seq.), that the activity, work, or discharge is categorically excluded from environmental documentation because it is included within a category of actions which neither individually nor cumulatively have a significant effect on the human environment, and the Office of the Chief of Engineers (ATTN: CECW-OR) has been furnished notice of the agency's or department's application for the categorical exclusion and concurs with that determination. Prior to approval for purposes of this NWP of any agency's categorical exclusions, the Chief of Engineers will solicit public comment. In addressing these comments, the Chief of Engineers may require certain conditions for authorization of an agency's categorical exclusions under this NWP. (Sections 10 and 404)

24. State Administered Section 404 Program. Any activity permitted by a state administering its own section 404 permit program pursuant to 33 U.S.C. 1344(g)–(l) is permitted pursuant to section 10 of the Rivers and Harbors Act of 1899. Those activities which do not involve a section 404 state permit are not included in this NWP, but certain structures will be exempted by section 154 of Pub. L. 94–587, 90 Stat. 2917 (33 U.S.C. 591) (see 33 CFR 322.3(a)(2)). (Section 10)

25. Structural Discharges: Discharges of material such as concrete, sand, rock, etc. into tightly sealed forms or cells where the material will be used as a structural member for standard pile supported structures, such as bridges, transmission line footings, and walkways or for general navigation, such as mooring cells, including the excavation of bottom material from within the form prior to the discharge of concrete, sand, rock, etc. This NWP does *not* authorize filled structural members that would support buildings, homes, parking areas, storage areas and other such structures. Housepads or other building pads are also not included in this NWP. The structure itself may require a section 10 permit if located in navigable waters of the United States. (Section 404)

26. Headwaters and Isolated Waters Discharges: Discharges of dredged or fill material into headwaters and isolated waters provided that the activity meets all of the following criteria:

a. The discharge does not cause the loss of more than 3 acres of waters of the United States nor cause the loss of waters of the United States for a distance greater than 500 linear feet of the stream bed;

b. For discharges causing the loss of greater than ⅓ acre of waters of the United States, the permittee notifies the District Engineer in accordance with the "Notification" general condition;

c. For discharges causing a loss of ⅓ acre or less of waters of the United States the permittee must submit a report within 30 days of completion of the work, containing the information listed below;

d. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands (Also see 33 CFR 330.1(e)); and

e. The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. Note, this NWP will expire on February 11, 1999.

For the purposes of this NWP, the acreage of loss of waters of the United States includes the filled area plus waters of the United States that are adversely affected by flooding, excavation or drainage as a result of the project. The 3 acre and 1/3 acre limits of NWP 26 are absolute, and cannot be increased by any mitigation plan offered by the applicant or required by the District Engineer. Whenever any other NWP is used in conjunction with this NWP, the total acreage of impacts to waters of the United States of all NWPs combined, can not exceed 3 acres.

Subdivisions: For any real estate subdivision created or subdivided after October 5, 1984, a notification pursuant to subsection (b) of this NWP is required for any discharge which would cause the aggregate total loss of waters of the United States for the entire subdivision to exceed 1/3 acre. Any discharge in any real estate subdivision which would cause the aggregate total loss of waters of the United States in the subdivision to exceed 3 acres is not authorized by this NWP; unless the District Engineer exempts a particular subdivision or parcel by making a written determination that: (1) The individual and cumulative adverse environmental effects would be minimal and the property owner had, after October 5, 1984, but prior to February 11, 1997, committed substantial resources in reliance on NWP 26 with regard to a subdivision, in circumstances where it would be inequitable to frustrate the property owner's investment-backed expectations, or (2) that the individual and cumulative adverse environmental effects would be minimal, high quality wetlands would not be adversely affected, and there would be an overall benefit to the aquatic environment. Once the exemption is established for a subdivision, subsequent lot development by individual property owners may proceed using NWP 26. For purposes of NWP 26, the term "real estate subdivision" shall be interpreted to include circumstances where a landowner or developer divides a tract of land into smaller parcels for the purpose of selling, conveying, transferring, leasing, or developing said parcels. This would include the entire area of a residential, commercial or other real estate subdivision, including all parcels and parts thereof.

Report: For discharges causing the loss of 1/3 acre or less of waters of the United States the permittee must submit a report within 30 days of completion of the work, containing the following information:

(a) Name, address, and telephone number of the permittee;

(b) Location of the work;

(c) Description of the work; and,

(d) Type and acreage (or square feet) of the loss of waters of the United States (e.g., 1/10 acre of marsh and 50 Square feet of a stream.) (Section 404)

27. Wetland and Riparian Restoration and Creation Activities: Activities in waters of the United States associated with the restoration of former non-tidal wetlands and riparian areas, the enhancement of degraded wetlands and riparian areas, and creation of wetlands and riparian areas; (i) On non-Federal public lands and private lands, in accordance with the terms and conditions of a binding wetland restoration or creation agreement between the landowner and the U.S. Fish and Wildlife Service or the Natural Resources Conservation Service (NRCS) or voluntary wetland restoration, enhancement, and creation actions documented by the NRCS pursuant to NRCS regulations; or (ii) on any Federal land; or (iii) on reclaimed surface coal mined lands, in accordance with a Surface Mining Control and Reclamation Act permit issued by the Office of Surface Mining or the applicable state agency. (The future reversion does not apply to wetlands created, restored or enhanced as mitigation for the mining impacts, nor naturally due to hydrologic or topographic features, nor for a mitigation bank.); or (iv) on any public or private land, provided the permittee notifies the District Engineer in accordance with the "Notification" general condition.

Such activities include, but are not limited to: Installation and maintenance of small water control structures, dikes, and berms; backfilling of existing drainage ditches; removal of existing drainage structures; construction of small nesting islands; plowing or discing for seed bed preparation; and other related activities. This NWP applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas. This NWP does not authorize the conversion of natural wetlands to another aquatic use, such as creation of waterfowl impoundments where a forested wetland previously existed.

Reversion: For restoration, enhancement and creation projects conducted under paragraghs (ii) and (iv), this NWP does not authorize any future discharge of dredged or fill material associated with the reversion of the area to its prior condition. In such cases a separate permit at that time would be required for any reversion. For restoration, enhancement and creation projects conducted under paragraghs (i) and (iii), this NWP also authorizes any future discharge of dredged or fill material associated with the reversion of the area to its documented prior condition and use (i.e., prior to the restoration, enhancement, or creation activities) within five years after expiration of a limited term wetland restoration or creation agreement or permit, even if the discharge occurs after this NWP expires. The five year reversion limit does not apply to agreements without time limits reached under paragraph (i). The prior condition will be documented in the original agreement or permit, and the determination of return to prior conditions will be made by the Federal agency or appropriate state agency executing the agreement or permit. Prior to any reversion activity the permittee or the appropriate Federal or state agency must notify the District Engineer and include the documentation of the prior condition. Once an area has reverted back to its prior physical condition, it will be subject to whatever the Corps regulatory requirements will be at that future date. (Sections 10 and 404)

28. Modifications of Existing Marinas: Reconfiguration of existing docking facilities within an authorized marina area. No dredging, additional slips or dock spaces, or expansion of any kind within waters of the United States is authorized by this NWP. (Section 10)

29. Single-Family Housing: Discharges of dredged or fill material into non-tidal waters of the United States, including non-tidal wetlands for the construction or expansion of a single-family home and attendant features (such as a garage, driveway, storage shed, and/or septic field) for an individual permittee provided that the activity meets all of the following criteria:

a. The discharge does not cause the loss of more than 1/2 acre of non-tidal waters of the United States, including non-tidal wetlands;

b. The permittee notifies the District Engineer in accordance with the "Notification" general condition;

c. The permittee has taken all practicable actions to minimize the on-site and off-site impacts of the discharge. For example, the location of the home may need to be adjusted on-site to avoid flooding of adjacent property owners;

d. The discharge is part of a single and complete project; furthermore, that for any subdivision created on or after November 22, 1991, the discharges authorized under this NWP may not exceed an aggregate total loss of waters of the United States of 1/2 acre for the entire subdivision;

e. An individual may use this NWP only for a single-family home for a personal residence;

f. This NWP may be used only once per parcel;

g. This NWP may not be used in conjunction with NWP 14, NWP 18, or NWP 26, for any parcel; and,

h. Sufficient vegetated buffers must be maintained adjacent to all open water bodies, streams, etc., to preclude water quality degradation due to erosion and sedimentation.

For the purposes of this NWP, the acreage of loss of waters of the United States includes the filled area previously permitted, the proposed filled area, and any other waters of the United States that are adversely affected by flooding, excavation, or drainage as a result of the project. Whenever any other NWP is used in conjunction with this NWP, the total acreage of impacts to waters of the United States of all NWPs combined, can not exceed 1/2 acres. This NWP authorizes activities only by individuals; for this purpose, the term "individual" refers to a natural person and/or a married couple, but does not include a corporation, partnership, or similar entity. For the purposes of this NWP, a parcel of land is defined as "the entire contiguous quantity of land in possession of, recorded as property of, or owned (in any form of ownership, including land owned as a partner, corporation, joint tenant, etc.) by the same individual (and/or that individual's spouse), and comprises not only the area of wetlands sought to be filled, but also all land contiguous to those wetlands, owned by the individual (and/or that individual's spouse) in any form of ownership". (Sections 10 and 404)

30. Moist Soil Management for Wildlife: Discharges of dredged or fill material and maintenance activities that are associated with moist soil management for wildlife performed on non-tidal Federally-owned or managed and State-owned or managed property, for the purpose of continuing ongoing, site-specific, wildlife management activities where soil manipulation is used to manage habitat and feeding areas for wildlife. Such activities include, but are not limited to: The repair, maintenance or replacement of existing water control structures; the repair or maintenance of dikes; and plowing or discing to impede succession, prepare seed beds, or establish fire breaks. Sufficient vegetated buffers must be maintained adjacent to all open water bodies, streams, etc., to preclude water quality degradation due to erosion and sedimentation. This NWP does not authorize the construction of new dikes, roads, water control structures, etc. associated with the management areas. This NWP does not authorize converting wetlands to uplands, impoundments or other open water bodies. (Section 404)

31. Maintenance of Existing Flood Control Facilities: Discharges of dredged or fill material for the maintenance of existing flood control facilities, including debris basins, retention/ detention basins, and channels that were (i) previously authorized by the Corps by individual permit, general permit, or by 33 CFR 330.3 and constructed or (ii) constructed by the Corps and transferred to a local sponsor for operation and maintenance. The maintenance is limited to that approved in a maintenance baseline determination made by the district engineer (DE). The prospective permittee will provide the DE with sufficient evidence for the DE to determine the approved and constructed baseline. Subsequent to the determination of the maintenance baseline and prior to any maintenance work, the permittee must notify the DE in accordance with the "Notification" general condition.

All dredged material must be placed in an upland site or a currently authorized disposal site in waters of the United States, and proper siltation controls must be used. This NWP does not authorize the removal of sediment and associated vegetation from natural water courses. (Activities that involve only the cutting and removing of vegetation above the ground, e.g., mowing, rotary cutting, and chainsawing, where the activity neither substantially disturbs the root system nor involves mechanized pushing, dragging, or other similar activities that redeposit excavated soil material, does not require a Section 404 permit in accordance with 33 CFR 323.2(d)(2)(ii)). Only constructed channels within stretches of natural rivers that have been previously authorized as part of a flood control facility could be authorized for maintenance under this NWP.

Maintenance Baseline: Upon receipt of sufficient evidence, the DE will determine the maintenance baseline. The maintenance baseline is the existing flood control project that the DE has determined can be maintained under this NWP, subject to any case-specific conditions required by the DE. In determining the maintenance baseline, the DE will consider the following factors: The approved facility, the actual constructed facility, the Corps constructed project that was transferred, the maintenance history, if the facility has been functioning at a reduced capacity and for how long, present vs. original flood control needs, and if sensitive/unique functions and values may be adversely affected. Revocation or modification of the final determination of the maintenance baseline can only be done in accordance with 33 CFR 330.5. This NWP can not be used until the DE determines the maintenance baseline and the need for mitigation and any regional or activity-specific conditions. The maintenance baseline will only be determined once and will remain valid for any subsequent reissuance of this NWP. However, if the project is effectively abandoned or reduced due to lack of proper maintenance, a new determination of a maintenance baseline would be required before this NWP could be used for subsequent maintenance.

Mitigation: In determining the need for mitigation, the DE will consider the following factors: Any original mitigation required, the current environmental setting, and any adverse effects of the maintenance project that were not mitigated in the original construction. The DE will not delay needed maintenance for completion of any required mitigation, provided that the DE and the applicant establish a schedule for the identification, approval, development, construction and completion of such required mitigation. (Sections 10 and 404)

32. Completed Enforcement Actions: Any structure, work or discharge of dredged or fill material, remaining in place, or undertaken for mitigation, restoration, or environmental benefit in compliance with either:

(i) The terms of a final written Corps non-judicial settlement agreement resolving a violation of section 404 of the Clean Water Act (CWA) and/or section 10 of the Rivers and Harbors Act of 1899; or the terms of an EPA 309(a) order on consent resolving a violation of section 404 of the CWA, provided that:

a. The unauthorized activity affected no more than 5 acres of nontidal wetlands or 1 acre of tidal wetlands;

b. The settlement agreement provides for environmental benefits, to an equal or greater degree, than the environmental detriments caused by the unauthorized activity that is authorized by this nationwide permit; and

c. The District Engineer issues a verification letter authorizing the activity subject to the terms and conditions of this nationwide permit and the settlement agreement, including a specified completion date; or

(ii) The terms of a final Federal court decision, consent decree, or settlement agreement resulting from an

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enforcement action brought by the United States under section 404 of the CWA and/or section 10 of the Rivers and Harbors Act of 1899.

For both (i) or (ii) above, compliance is a condition of the NWP itself. Any authorization under this NWP is automatically revoked if the permittee does not comply with the terms of this NWP or the terms of the court decision, consent decree, or judicial/non-judicial settlement agreement or fails to complete the work by the specified completion date. This NWP does not apply to any activities occurring after the date of the decision, decree, or agreement that are not for the purpose of mitigation, restoration, or environmental benefit. Prior to reaching any settlement agreement the Corps will ensure compliance with the provisions of 33 CFR part 326 and 33 CFR 330.6 (d)(2) and (e). (Sections 10 and 404)

33. Temporary Construction, Access and Dewatering: Temporary structures, work and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites; provided that the associated primary activity is authorized by the Corps of Engineers or the U.S. Coast Guard, or for other construction activities not subject to the Corps or U.S. Coast Guard regulations. Appropriate measures must be taken to maintain near normal downstream flows and to minimize flooding. Fill must be of materials, and placed in a manner, that will not be eroded by expected high flows. The use of dredged material may be allowed if it is determined by the District Engineer that it will not cause more than minimal adverse effects on aquatic resources. Temporary fill must be entirely removed to upland areas, or dredged material returned to its original location, following completion of the construction activity, and the affected areas must be restored to the pre-project conditions. Cofferdams cannot be used to dewater wetlands or other aquatic areas so as to change their use. Structures left in place after cofferdams are removed require a section 10 permit if located in navigable waters of the United States. (See 33 CFR part 322). The permittee must notify the District Engineer in accordance with the "Notification" general condition. The notification must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources. The District Engineer will add special conditions, where necessary, to ensure that adverse environmental effects are minimal. Such conditions may include: Limiting the temporary work to the minimum necessary; requiring seasonal restrictions; modifying the restoration plan; and requiring alternative construction methods (e.g., construction mats in wetlands where practicable.). (Sections 10 and 404)

34. Cranberry Production Activities: Discharges of dredged or fill material for dikes, berms, pumps, water control structures or leveling of cranberry beds associated with expansion, enhancement, or modification activities at existing cranberry production operations provided that the activity meets all of the following criteria:

a. The cumulative total acreage of disturbance per cranberry production operation, including but not limited to, filling, flooding, ditching, or clearing, does not exceed 10 acres of waters of the United States, including wetlands;

b. The permittee notifies the District Engineer in accordance with the "Notification" general condition. The notification must include a delineation of affected special aquatic sites, including wetlands; and,

c. The activity does not result in a net loss of wetland acreage.

This NWP does not authorize any discharge of dredged or fill material related to other cranberry production activities such as warehouses, processing facilities, or parking areas. For the purposes of this NWP, the cumulative total of 10 acres will be measured over the period that this NWP is valid. (Section 404)

35. Maintenance Dredging of Existing Basins: Excavation and removal of accumulated sediment for maintenance of existing marina basins, access channels to marina basins or boat slips, and boat slips to previously authorized depths or controlling depths for ingress/egress, whichever is less, provided the dredged material is disposed of at an upland site and proper siltation controls are used. (Section 10)

36. Boat Ramps: Activities required for the construction of boat ramps provided:

a. The discharge into waters of the United States does not exceed 50 cubic yards of concrete, rock, crushed stone or gravel into forms, or placement of pre-cast concrete planks or slabs. (Unsuitable material that causes unacceptable chemical pollution or is structurally unstable is not authorized);

b. The boat ramp does not exceed 20 feet in width;

c. The base material is crushed stone, gravel or other suitable material;

d. The excavation is limited to the area necessary for site preparation and all excavated material is removed to the upland; and,

e. No material is placed in special aquatic sites, including wetlands.

Dredging to provide access to the boat ramp may be authorized by another NWP, regional general permit, or individual permit pursuant to section 10 if located in navigable waters of the United States. (Sections 10 and 404)

37. Emergency Watershed Protection and Rehabilitation: Work done by or funded by the Natural Resources Conservation Service qualifying as an "exigency" situation (requiring immediate action) under its Emergency Watershed Protection Program (7 CFR part 624) and work done or funded by the Forest Service under its Burned-Area Emergency Rehabilitation Handbook (FSH 509.13) provided the District Engineer is notified in accordance with the "Notification" general condition. (Also see 33 CFR 330.1(e)). (Sections 10 and 404)

38. Cleanup of Hazardous and Toxic Waste: Specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the District Engineer in accordance with the "Notification" general condition. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. Court ordered remedial action plans or related settlements are also authorized by this NWP. This NWP does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste. Activities undertaken entirely on a CERCLA site by authority of CERCLA as approved or required by EPA, are not required to obtain permits under section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. (Sections 10 and 404)

39. Reserved.

40. Farm Buildings: Discharges of dredged or fill material into jurisdictional wetlands (but not including prairie potholes, playa lakes, or vernal pools) that were in agricultural crop production prior to December 23, 1985, i.e., farmed wetlands, for foundations and building pads for farm buildings. The discharge will be limited to the minimum necessary but will in no case exceed 1 acre (see the "Mitigation" Section 404 only condition). The permittee must notify the District Engineer in accordance with the "Notification" general condition for any farm building within 500 linear feet of any flowing water. (Section 404)

C. Nationwide Permit Conditions

General Conditions

The following general conditions must be followed in order for any authorization by a NWP to be valid:

1. Navigation: No activity may cause more than a minimal adverse effect on navigation.

2. Proper Maintenance: Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.

3. Erosion and Siltation Controls: Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.

4. Aquatic Life Movements: No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including those species which normally migrate through the area, unless the activity's primary purpose is to impound water.

5. Equipment: Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. Regional and Case-by-Case Conditions: The activity must comply with any regional conditions which may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its section 401 water quality certification.

7. Wild and Scenic Rivers: No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service.)

8. Tribal Rights: No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. Water Quality Certification: In certain states, an individual Section 401 water quality certification must be obtained or waived (see 33 CFR 330.4(c)).

10. Coastal Zone Management: In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see Section 330.4(d)).

11. Endangered Species: (a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

(b) Authorization of an activity by a nationwide permit does not authorize the "take" of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g., an ESA section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal "takes" of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. Fish and Wildlife Service and National Marine Fisheries Service or their world wide web pages at http://www.fws.gov/~r9endspp/endspp.html and http://kingfish.spp.mnfs.gov/tmcintyr/prot_res.html#ES and Recovery, respectively.

12. Historic Properties: No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the DE has complied with the provisions of 33 CFR part 325, appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)).

13. Notification:

(a) Timing: Where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a Pre-Construction Notification (PCN) as early as possible and shall not begin the activity:

(1) Until notified by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or

(2) If notified by the District or Division Engineer that an individual permit is required; or

(3) Unless 30 days (or 45 days for NWP 26 only) have passed from the District Engineer's receipt of the notification and the prospective permittee has not received notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Notification: The notification must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s) or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity; and

(4) *For NWPs 14, 18, 21, 26, 29, 34, and 38,* the PCN must also include a delineation of affected special aquatic sites, including wetlands (see paragraph 13(f));

(5) *For NWP 21—Surface Coal Mining Activities,* the PCN must include an OSM or state approved mitigation plan.

(6) *For NWP 29—Single-Family Housing,* the PCN must also include:

(i) Any past use of this NWP by the individual permittee and/or the permitee's spouse;

(ii) A statement that the single-family housing activity is for a personal residence of the permittee;

(iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 0.5 acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 0.5 acre in size, a formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));

(iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;

(7) *For NWP 31—Maintenance of Existing Flood Control Projects*, the prospective permittee must either notify the District Engineer with a Pre-Construction Notification (PCN) prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:

(i) Sufficient baseline information so as to identify the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided that the approved flood control protection or drainage is not increased;

(ii) A delineation of any affected special aquatic sites, including wetlands; and,

(iii) Location of the dredged material disposal site.

(8) *For NWP 33—Temporary Construction, Access, and Dewatering*, the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources.

(c) Form of Notification: The standard individual permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)–(7) of General Condition 13. A letter may also be used.

(d) District Engineer's Decision: In reviewing the pre-construction notification for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may, optionally, submit a proposed mitigation plan with the pre-construction notification to expedite the process and the District Engineer will consider any optional mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects are minimal, the District Engineer will notify the permittee and include any conditions the DE deems necessary.

Any mitigation proposal must be approved by the District Engineer prior to commencing work. If the prospective permittee elects to submit a mitigation plan, the District Engineer will expeditiously review the proposed mitigation plan, but will not commence a second 30-day (or 45-day for NWP 26) notification procedure. If the net adverse effects of the project (with the mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant stating that the project can proceed under the terms and conditions of the nationwide permit.

If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then he will notify the applicant either: (1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (2) that the project is authorized under the NWP subject to the applicant's submitting a mitigation proposal that would reduce the adverse effects to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions.

(e) Agency Coordination: The District Engineer will consider any comments from Federal and State agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(i) For NWP 14, 21, 26 (between 1 and 3 acres of impact) , 29, 33, 37, and 38. The District Engineer will, upon receipt of a notification, provide immediately, e.g., facsimile transmission, overnight mail or other expeditious manner, a copy to the appropriate offices of the Fish and Wildlife Service, State natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the National Marine Fisheries Service. With the exception of NWP 37, these agencies will then have 5 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 10 calendar days (16 calendar days for NWP 26 PCNs) before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(ii) Optional Agency Coordination. For NWPs 5, 7, 12, 13, 17, 18, 27, 31, and 34, where a Regional Administrator of EPA, a Regional Director of USFWS, or a Regional Director of NMFS has formally requested general notification from the District Engineer for the activities covered by any of these NWPs, the Corps will provide the requesting agency with notification on the particular NWPs. However, where the agencies have a record of not generally submitting substantive comments on activities covered by any of these NWPs, the Corps district may discontinue providing notification to those regional agency offices. The District Engineer will coordinate with the resources agencies to identify which activities involving a PCN that the agencies will provide substantive comments to the Corps. The District Engineer may also request comments from the agencies on a case by case basis when the District Engineer determines that such comments would assist the Corps in reaching a decision whether effects are more than minimal either individually or cumulatively.

(iii) Optional Agency Coordination, 401 Denial. For NWP 26 only, where the state has denied its 401 water quality certification for activities with less than 1 acre of wetland impact, the EPA regional administrator may request agency coordination of PCNs between ⅓ and 1 acre. The request may only include acreage limitations within the ⅓ to 1 acre range for which the state has denied water quality certification. In cases where the EPA has requested coordination of projects as described here, the Corps will forward the PCN to EPA only. The PCN will then be forwarded to the Fish and Wildlife Service and the National Marine Fisheries Service by EPA under agreements among those agencies. Any agency receiving the PCN will be bound by the EPA timeframes for providing comments to the Corps.

(f) Wetlands Delineations: Wetland delineations must be prepared in accordance with the current method required by the Corps. For NWP 29 see paragraph (b)(6)(iii) for parcels less than 0.5 acres in size. The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 30-day period (45 days for NWP 26) will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

(g) Mitigation: Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to:

(i) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes;

(ii) To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds, "in lieu fees" to organizations such as The Nature Conservancy, state or county natural resource management agencies, where such fees contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands. Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: Reducing the size of the project; establishing wetland or upland buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar functions and values. In addition, mitigation must address wetland impacts, such as functions and values, and cannot be simply used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the NWPs (e.g., for NWP 26, 5 acres of wetlands cannot be created to change a 6-acre loss of wetlands to a 1 acre loss; however, 2 created acres can be used to reduce the impacts of a 3-acre loss.).

14. *Compliance Certification:* Every permittee who has received a Nationwide permit verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include: a. A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions; b. A statement that any required mitigation was completed in accordance with the permit conditions; c. The signature of the permittee certifying the completion of the work and mitigation.

15. *Multiple Use of Nationwide Permits:* In any case where any NWP number 12 through 40 is combined with any other NWP number 12 through 40, as part of a single and complete project, the permittee must notify the District Engineer in accordance with paragraphs a, b, and c on the "Notification" General Condition number 13. Any NWP number 1 through 11 may be combined with any other NWP without notification to the Corps, unless notification is otherwise required by the terms of the NWPs. As provided at 33 CFR 330.6(c) two or more different NWPs can be combined to authorize a single and complete project. However, the same NWP cannot be used more than once for a single and complete project.

Section 404 Only Conditions

In addition to the General Conditions, the following conditions apply only to activities that involve the discharge of dredged or fill material into waters of the U.S., and must be followed in order for authorization by the NWPs to be valid:

1. *Water Supply Intakes:* No discharge of dredged or fill material may occur in the proximity of a public water supply intake except where the discharge is for repair of the public water supply intake structures or adjacent bank stabilization.

2. *Shellfish Production:* No discharge of dredged or fill material may occur in areas of concentrated shellfish production, unless the discharge is directly related to a shellfish harvesting activity authorized by NWP 4.

3. *Suitable Material:* No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.,) and material discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

4. *Mitigation:* Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site (i.e., on-site), unless the District Engineer approves a compensation plan that the District Engineer determines is more beneficial to the environment than on-site minimization or avoidance measures.

5. *Spawning Areas:* Discharges in spawning areas during spawning seasons must be avoided to the maximum extent practicable.

6. *Obstruction of High Flows:* To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

7. *Adverse Effects From Impoundments:* If the discharge creates an impoundment of water, adverse effects on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized to the maximum extent practicable.

8. *Waterfowl Breeding Areas:* Discharges into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

9. *Removal of Temporary Fills:* Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

[FR Doc. 96–31645 Filed 12–12–96; 8:45 am]
BILLING CODE 3710–92–P

T.O.C.

APPENDIX G.3

COE Listing of Navigable Waters in Indiana

U.S. ARMY CORPS OF ENGINEERS
NAVIGABLE STREAMS IN INDIANA

Louisville District: (Ohio River and Tributaries)

Ohio River Mile	Stream Name	Jurisdiction Above Mouth (miles)
	Ohio River	Entire Length
494.2	Tanners Creek	10.6
495.8	Wilson Creek	1.9
496.7	Hogan Creek	0.4
	North Hogan Creek (Tributary to Hogan Creek)	4.9
	South Hogan Creek (Tributary to Hogan Creek)	5.0
498.7	Laughery Creek	10.2
508.7	Arnold Creek	4.4
508.8	Grant Creek	2.5
518.2	Goose Creek	1.5
527.0	Bryant Creek	2.6
	Sand Run (Tributary to Bryant Creek)	0.9
532.9	Log Lick Creek	2.3
535.8	Plum Creek	2.9
540.0	Indian Creek	4.1
550.4	Indian-Kentuck Creek	3.8
569.3	Big Saluda Creek	1.0
578.3	Camp Creek	1.7
584.5	Bull Creek	1.1
589.3	Fourteen Mile Creek	2.9
597.7	Lancassange Creek	0.3

T.O.C.

U.S. ARMY CORPS OF ENGINEERS
NAVIGABLE STREAMS IN INDIANA

Louisville District: (Ohio River and Tributaries)

Ohio River Mile	Stream Name	Jurisdiction Above Mouth (miles)
606.8	Silver Creek	3.0
634.5	Mosquito Creek	2.8
647.3	Buck Creek	5.8
657.0	Indian Creek	4.8
661.3	Potato Run	0.4
662.9	Blue River	57.2
	Dry Creek (Tributary to Blue River)	1.4
678.6	Little Blue River	10.6
	Mill Creek (Tributary to Little Blue River)	1.4
691.7	Oil Creek	10.6
	Clover Lick Creek (Tributary to Oil Creek)	0.7
	Little Oil Creek (Tributary to Oil Creek)	4.4
	Webb Branch (Tributary to Oil Creek)	0.9
	Bull Hollow (Tributary to Oil Creek)	0.7
	Indian Fork (Tributary to Oil Creek)	1.4
	Bald Knob Creek (Tributary to Oil Creek)	0.5
696.6	Big Poison Creek	6.3

T.O.C.

U.S. ARMY CORPS OF ENGINEERS
NAVIGABLE STREAMS IN INDIANA

Louisville District: (Ohio River and Tributaries)

Ohio River Mile	Stream Name	Jurisdiction Above Mouth (miles)
	Caney Branch (Tributary to Big Poison Creek)	0.2
	Little Poison Creek (Tributary to Big Poison Creek)	1.2
703.25	Bear Creek	1.6
717.2	Millstone Creek	1.4
718.75	Deer Creek	5.9
	Little Dear Creek (Tributary to Deer Creek)	3.9
	Caney Branch (Tributary to Deer Creek)	0.8
	Neglie Branch (Tributary to Deer Creek)	0.5
	East Deer Creek (Tributary to Deer Creek)	0.6
731.4	Anderson River	14.2
	Middle Fork Anderson River (Tributary to Anderson River)	3.3
733.2	Crooked Creek	7.7
741.3	Little Sandy Creek	2.0
742.1	Sandy Creek	2.6
744.25	Honey Creek	1.8
746.8	Lake Drain	1.6
751.9	Yellow Creek	2.0
	Van Buren Creek (Tributary to Yellow Creek)	0.9

T.O.C.

U.S. ARMY CORPS OF ENGINEERS
NAVIGABLE STREAMS IN INDIANA

Louisville District: (Ohio River and Tributaries)

Ohio River Mile	Stream Name	Jurisdiction Above Mouth (miles)
759.4	Caney Creek	2.8
760.5	Garret Creek	2.2
763.2	Jackson Creek	1.8
772.8	Little Pigeon Creek	15.8
	Clear Creek (Tributary to Little Pigeon Creek)	2.4
	Baker Creek (Tributary to Little Pigeon Creek)	1.8
775.3	Cypress Creek (Diversion Channel)	6.6
793.0	Pigeon Creek	5.9
	Locust Creek (Tributary to Pigeon Creek)	1.5
815.0	Bayou Creek	1.5
828.9	McFadden Creek	2.3

Louisville District: (Wabash River and Tributaries)

Stream Name	Jurisdiction Above Mouth (miles)
Wabash River	441.9 (To Wells-Adams County Line)
White River	66.2
East Fork White River	21.9
Vermillion River	10.8 (To Indiana-Illinois State Line)
Little River	20.2 (To Ellison Road)

U.S. ARMY CORPS OF ENGINEERS
NAVIGABLE STREAMS IN INDIANA

Detroit District: (Great Lakes and Kankakee River Tributaries)

Stream Name	Jurisdiction Limits in Indiana
Grand Calumet River	Entire Length
Little Calumet River	Entire Length
Indiana Harbor Canal	
Main Stem	Entire Length
Calumet River Branch	Entire Length
Lake George Branch	From the Main Stem to White Oak Avenue in East Chicago
Trail Creek	From mouth to E Street Bridge in Michigan City
Kankakee River	Entire Length
Iroquois River	Entire Length
Maumee River	From mouth to Hosey Dam in Fort Wayne

Last Print/Revision Date: October 13, 1996

T.O.C.

APPENDIX G.4

COE Drainage-Related Personnel Information

U.S. Army Corps of Engineers Districts
Detroit District Chief of Regulatory Branch U.S. Army Corps of Engineers Detroit District P.O. Box 1027 Detroit, MI 48231-1027 (313) 226-2218
Louisville District Chief of Regulatory Branch U.S. Army Corps of Engineers Louisville District P.O. Box 59 Louisville, KY 40201-0059 (502) 582-6461

T.O.C.

APPENDIX H

Material Related to USFWS-Administered Regulations

APPENDIX H.1

USFWS Application Form

T.O.C.

Send completed application to:
U.S. Fish and Wildlife Service
Division of Endangered Species
1 Federal Drive
Ft. Snelling, Minnesota 55111-4056 (612)725-3276

OMB NO. 42-R1670

U.S. FISH & WILDLIFE SERVICE

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE LICENSE/PERMIT APPLICATION

1. APPLICATION FOR *(Indicate only one)*

☐ IMPORT OR EXPORT LICENSE ☒ PERMIT

2. BRIEF DESCRIPTION OF ACTIVITY FOR WHICH REQUESTED LICENSE OR PERMIT IS NEEDED.

ENDANGERED/THREATENED SPECIES

_____ Take

_____ Interstate Commerce

3. APPLICANT. *(Name, complete address and phone number of individual, business, agency, or institution for which permit is requested)*

4. IF "APPLICANT" IS AN INDIVIDUAL, COMPLETE THE FOLLOWING:

☐ MR. ☐ MRS. ☐ MISS ☐ MS.	HEIGHT	WEIGHT
DATE OF BIRTH	COLOR HAIR	COLOR EYES
PHONE NUMBER WHERE EMPLOYED	SOCIAL SECURITY NUMBER	
OCCUPATION		
ANY BUSINESS, AGENCY, OR INSTITUTIONAL AFFILIATION HAVING TO DO WITH THE WILDLIFE TO BE COVERED BY THIS LICENSE/PERMIT		

5. IF "APPLICANT" IS A BUSINESS, CORPORATION, PUBLIC AGENCY, OR INSTITUTION, COMPLETE THE FOLLOWING:

EXPLAIN TYPE OR KIND OF BUSINESS, AGENCY, OR INSTITUTION

NAME, TITLE, AND PHONE NUMBER OF PRESIDENT, PRINCIPAL OFFICER, DIRECTOR, ETC.

IF "APPLICANT" IS A CORPORATION, INDICATE STATE IN WHICH INCORPORATED

6. LOCATION WHERE PROPOSED ACTIVITY IS TO BE CONDUCTED

7. DO YOU HOLD ANY CURRENTLY VALID FEDERAL FISH AND WILDLIFE LICENSE OR PERMIT? ☐ YES ☐ NO
(If yes, list license or permit numbers)

8. IF REQUIRED BY ANY STATE OR FOREIGN GOVERNMENT, DO YOU HAVE THEIR APPROVAL TO CONDUCT THE ACTIVITY YOU PROPOSE? ☐ YES ☐ NO
(If yes, list jurisdictions and type of documents)

9. ~~CERTIFIED~~ CHECK OR MONEY ORDER *(if applicable)* PAYABLE TO THE U.S. FISH AND WILDLIFE SERVICE ENCLOSED IN AMOUNT OF
$ 25.00

10. DESIRED EFFECTIVE DATE

11. DURATION NEEDED

12. ATTACHMENTS. THE SPECIFIC INFORMATION REQUIRED FOR THE TYPE OF LICENSE/PERMIT REQUESTED *(See 50 CFR 13.12(b))* MUST BE ATTACHED. IT CONSTITUTES AN INTEGRAL PART OF THIS APPLICATION. LIST SECTIONS OF 50 CFR UNDER WHICH ATTACHMENTS ARE PROVIDED.

CERTIFICATION

I HEREBY CERTIFY THAT I HAVE READ AND AM FAMILIAR WITH THE REGULATIONS CONTAINED IN TITLE 50, PART 13, OF THE CODE OF FEDERAL REGULATIONS AND THE OTHER APPLICABLE PARTS IN SUBCHAPTER B OF CHAPTER I OF TITLE 50, AND I FURTHER CERTIFY THAT THE INFORMATION SUBMITTED IN THIS APPLICATION FOR A LICENSE/PERMIT IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF. I UNDERSTAND THAT ANY FALSE STATEMENT HEREIN MAY SUBJECT ME TO THE CRIMINAL PENALTIES OF 18 U.S.C. 1001.

SIGNATURE *(In ink)*	DATE

3-200
(6/74)

*Applicant listed in 3 above or principal officer listed in 5 above must sign.

APPENDIX H.2

USFWS List of Indiana Streams and Habitats

Associated with Endangered Species

T.O.C.

INDIANA STREAMS WITH CURRENT RECORDS OF OR KNOWN OCCURRENCES
OF FEDERALLY THREATENED OR ENDANGERED SPECIES

Species Name	Stream	County
Indiana Bat	Salamonie River	Blackford
	Chippewanuck Creek	Fulton
	Mill Creek	Fulton
	Deeds Creek	Kosciusko
	Stoney Creek	Randolph
	Potato Creek	St. Joseph
	Little Potato Creek	Montgomery
	Cornstalk Creek	Montgomery
	Lye Creek	Montgomery
	Big Blue River	Rush, Shelby
	Muddy Fork	Clark
	Sixmile Creek	Hancock
	Sugar Creek	Boone
	Kilmore Creek	Clinton
	South Fork Wildcat Creek	Clinton
	Coal Creek	Fountain
	North Fork Coal Creek	Fountain
	Grassy Fork	Howard
	South Fork	Parke
	Rocky Fork	Parke
	Vermillion Branch	Putnam
	Ramp Creek	Putman
	Middle Fork Wildcat Creek	Tippecanoe
	Little Vermillion River	Vermillion
	Fall Creek	Marion
	Graham Creek	Jennings, Ripley
	Otter Creek	Jennings, Ripley
	Patoka River	Gibson
	Prairie Creek	Vigo
	Muscatatuck River	Jennings
Gray Bat	Silver Creek	Clark
	Muddy Fork	Clark

INDIANA STREAMS WITH CURRENT RECORDS OF OR KNOWN OCCURRENCES OF FEDERALLY THREATENED OR ENDANGERED SPECIES

Species Name	Stream	County
Mussels	Fish Creek Tippecanoe River & Tribs[1] Wabash River White River	Dekalb, Steuben All Counties Within Watershed Gibson, Posey, Tippecanoe, Wabash, White Lawrence, Martin
Bald Eagle	Wabash River West Fork White River	Parke, Vermillion, Tippecanoe, Knox Greene, Morgan, Owen, Knox
Mitchell Satyr	Stillwell Quadrangle Area	LaPorte
Copperbelly Watersnake	Fish Creek Mud Lake Upper Tippecanoe R. Lakes	Steuben St. Joseph Kosciusko
Gray Bat	Silver Creek Muddy Fork	Clark Clark

1 - For Tippecanoe River Tributaries, area of concern is the reach of the tributaries within 2 miles of the Tippecanoe River. Mussels not found in tribs as of yet.

WATERWAY HABITATS ASSOCIATED WITH THREATENED/ENDANGERED SPECIES

Habitat Type	Species
Riparian Forest	Indiana and Gray Bats
Scrub-Shrub Wetlands, Bottomland Forest	Fens (Mitchell Satyr), Copperbelly Watersnake (proposed species)

Last Print/Revision Date: October 1999

APPENDIX H.3

USFWS Drainage-Related Personnel Information

United States Fish and Wildlife Service Indiana Offices
Bloomington Field Office 620 South Walker Street Bloomington, IN 47403 telephone: (812) 334-4261 fax: (812) 334-4273
Northern Indiana Sub-Office 120 South Lake Street Warsaw, IN 46580 telephone: (219) 269-7640 fax: (219) 269-7432

T.O.C.

APPENDIX I

USDA-NRCS Drainage-Related Personnel Information

T.O.C.

United States Department of Agriculture
Natural Resources Conservation Service

Indiana State Office

State Conservationist
6013 Lakeside Boulevard
Indianapolis, IN 46278-2933

telephone: (317) 290-3200
fax: (317) 290-3225

Through the Indiana Conservation Partnership, the USDA-NRCS can put interested parties in contact with several other conservation groups and agencies. Contact the Central Office of the USDA-NRCS at the address or phone number above for further information.

Last Print/Revision Date: October 1999