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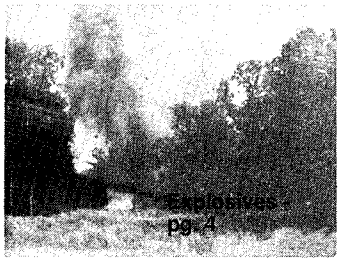
US Army Corps of Engineers
Waterways Experiment Station



Workshop Info - see Insert

WRP/WRTC 1994 Activities - pg. 6

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The Wetlands Research Program

Bulletin

Volume 4
Number 4
December 1994

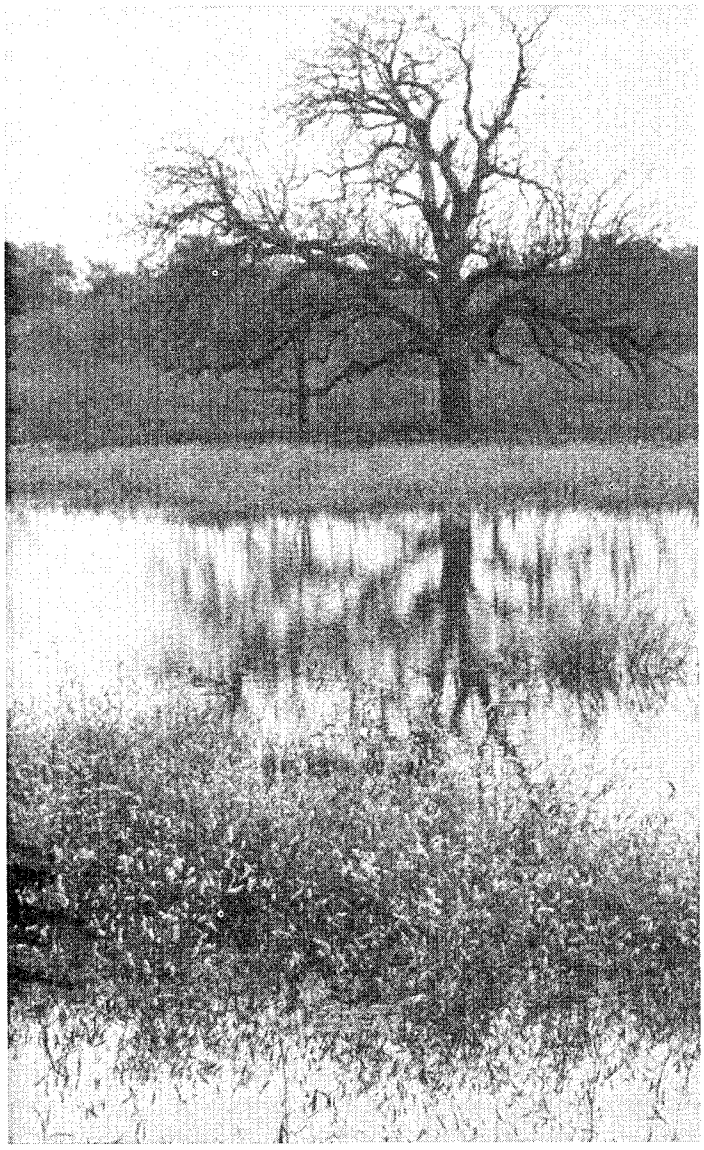
Unlocking the mystery of the wetlands

by Mary Flores, U.S. Army Engineer District, Fort Worth, Texas

The partnering approach to reaching common goals of the Corps' environmental mission is evident in recent and ongoing research activities in north central Texas. The construction of wetlands at Ray Roberts Lake has provided a unique situation for the Corps, various state and federal resource agencies, and an institute of higher learning to put forth a concerted effort and take advantage of new and exciting opportunities. These studies will help expand our understanding of wetland dynamics, the structure and function of constructed wetlands and allow us to fine tune our techniques for wetland construction and restoration.

Ray Roberts Lake, located in Denton, Cooke and Grayson counties in north central Texas, is on the Elm Fork of the Trinity River approximately 40 miles north of the Dallas-Fort Worth Metroplex. Constructed by the Corps' Fort Worth District, Ray Roberts was completed in June 1987 and is one of eight Corps reservoirs in the Trinity River Basin. The total area of the watershed above Ray Roberts Dam is 692 square miles and the conservation and flood control pools contain 29,350 and 36,900 acres, respectively. The authorized purposes of the reservoir are flood control, water supply, and recreation.

In an effort to further address the environmental concerns in all phases of project planning, design,



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WRP studies at Ray Roberts yield information for improved management practices

Ray Roberts Reservoir, Denton County, TX, was a demonstration site for three WRP studies.

Non-Point Source Pollution (NPSP) Management

Storm flows and nonpoint source pollutant concentrations in storm flows entering and leaving the Spring Creek wetland at the Ray Roberts wetlands complex were monitored during the 1993 spring/summer runoff season. Suspended solids removals were significant but other pollutant removals were minor. Removal efficiencies were low due to a very low hydraulic retention time for storm flow events.

The study indicates that constructed wetlands that provide storm flow retention times of only several hours do not effectively remove nonpoint source pollutants. In addition, when planning for off-channel constructed wetlands that rely on stream bank overflow for filling, careful attention should be paid to hydrologic analysis during the design phase. Otherwise, dike elevations and control structures may be undersized, resulting in virtually no retention of storm flows due to complete inundation.

Sediment Management

Ray Roberts Reservoir also served as a demonstration site for sediment management. The objectives of the study were monitoring and documenting suspended sediment removal and sedimentation patterns in a constructed wetlands complex. Storm flows and suspended sediment concentrations entering and leaving the wetland were monitored during the spring/summer runoff period of 1993. Sedimentation patterns in the wetland were measured with plexiglass disks. It was found that the wetland was able to reduce peak suspended sediment concentrations by approximately one-third. Storm flows overtopped the wetland dikes and resulted in very short detention times. These short detention times resulted in relatively poor treatment efficiency. Although treatment efficiency was low, the high flows resulted in significant sediment deposition. Sediment accretion in the wetland averaged 2.2 mm/yr. The areal accumulation in the wetland was 1.4 kg/m^2. The sediments were 19 percent organic (volatile) material.

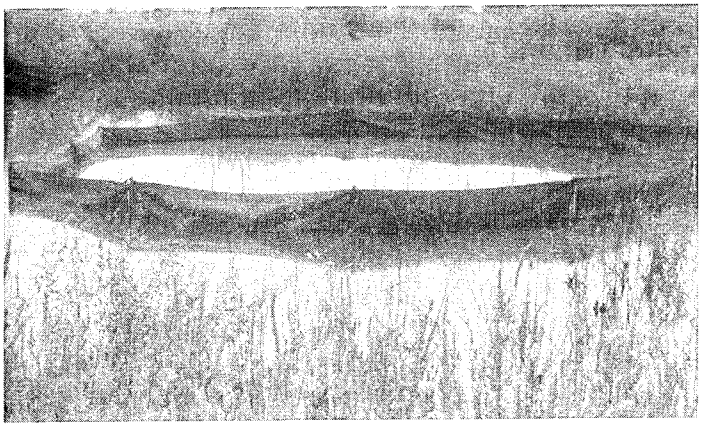
The study documented that hydrologic analysis during the planning phase for a wetland constructed for water quality benefits, such as sediment retention, is critical to success of the project. Hydraulically overloading the wetland results in short hydraulic retention times and low suspended sediment removal. Complete inundation of the project results in damage to control structures and requires continuing repairs.

Natural Communities/Biodiversity Management

Projects on Corps land have historically been managed predominantly for target game species, especially waterfowl. There is an increasing need to improve wetland areas for nongame species and entire communities in an effort to maximize biological diversity. Demonstration studies were conducted at several locations, including Ray Roberts Lake, TX.

Work accomplished included (1) a background survey of literature on biological diversity, emphasizing interior wetlands of the United States, (2) evaluation of strategies for biodiversity management in wetland systems, and (3) specific studies on biological diversity of wetlands at field demonstration sites. Guidance developed based on the results of biodiversity studies has widespread application for improving the diversity and quality of wetland habitats for a variety of species on Corps project lands and has extensive application on other federal, state, and private lands as well.

Point of contact for additional information is Mr. Chester P. Martin at (601) 634-3958.



One of the experimental vegetation plots at the Ray Roberts constructed wetland complex

construction, and operation and maintenance, the Fort Worth District has conducted pre-impoundment and two-year post-impoundment environmental studies at Ray Roberts. The district is currently conducting a five-year, post-impoundment study which includes environmental studies of constructed wetland cells that were completed in 1992. The purpose of the wetland studies, which include monitoring of vegetation and wildlife utilization, is to improve our understanding of constructed wetlands and provide baseline data for future studies.

A series of six wetland cells have been constructed along Range Creek, a tributary of the Elm Fork Trinity River. The complex consists of approximately 170 acres of wetlands that are divided by low earthen levees with water control structures to allow gravity flow of

water from one cell to the next. Water is supplied to the wetlands by flooding of Range Creek, rainfall, and local drainage. Since there is no mechanism to pump water into the wetland cells, the water regime of the wetland complex will vary from year to year and the individual cells will vary in any given year. The system is operated by the Texas Parks and Wildlife Department for the purpose of wildlife management, with emphasis on providing beneficial conditions for waterfowl.

The constructed wetland system is an extraordinary example of an outdoor laboratory that offers excellent research opportunities. In addition to the current wetland environmental studies, sedimentation and water quality studies are being conducted by the Waterways Experiment Station in conjunction with the U.S. Geological Survey and the Texas Parks and Wildlife Department. Also, the Lewisville Aquatic Ecosystem Research Facility, a satellite station of WES located at Lewisville Lake, conducted experimental plantings of wetland and aquatic plants, which were funded by a grant from the Environmental Protection Agency.

The current environmental study of the constructed wetlands, which is funded largely by WES through the Wetlands Research Program, focuses on monitoring wetland vegetation and wildlife utilization of the area. The Institute of Applied Sciences at the University of North Texas is instrumental in this research effort. In fact, two graduate students are basing their theses on research that they are contributing to the study.

Research activities began in the fall of 1993 and continued through 1994. The final report will be submitted as an appendix to the five-year post-impoundment study that will be completed in September 1995.

The vegetation component of the study serves a dual purpose:

- continued monitoring of the experimental vegetation plots that were established by the Lewisville Aquatic Ecosystem Research Facility; and
- establishment and monitoring of permanent vegetation transects in the wetland complex to provide baseline data for documenting future changes in vegetation.

Preliminary finding show that most of the aquatic and wetland vegetation plots have evidence of survival and expansion. Permanent transects were established in all of the wetland cells and vegetation is monitored using the point-intercept method.

At the right is a Data Collection Platform which collects stage gauge rainfall information

Wildlife at the wetland complex is monitored quarterly. Birds are observed from blinds while mammals are monitored by visual observations and track identification. Results indicate that the wetland complex is being heavily utilized by waterfowl and shorebirds. The wildlife monitoring provides data on the utilization of newly constructed wetlands which can be used as a baseline for future studies of the aging wetland system.

Research projects made possible by the cooperative efforts displayed at Ray Roberts wetlands contribute to our knowledge of the intricate relationship of wetlands and the plants and animals that live there. Future studies will build on that knowledge to increase our understanding of how to create and restore viable, functioning wetland systems.

(Reprinted from the Fall 1994 issue of *Nexus*, a professional publication of the U.S. Army Corps of Engineers, Fort Worth District. Point of contact for additional information is Mary Flores, (817) 334-3246).

Mary Flores is an Environmental Resources Specialist in the Environmental Resources Branch of the Planning Division. She has worked for the Fort Worth District for three years and has been involved with the post-impoundment studies of Ray Roberts and Aquilla Lakes.

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Explosives: An Effective Alternative to Mechanical Excavation in Wetlands

by Henry S. McDevitt, Jr., and Hendrik D. Carleton, U.S. Army Engineer Waterways Experiment Station

The Yazoo National Wildlife Refuge is 13,000 acres of federally owned property located in the delta region of north-central Mississippi. Like many of the federal refuges there, the Yazoo Refuge is a combination of agricultural fields, hardwood forests, and swamps. It is home to an abundance of wildlife, including whitetail deer, turkey, a variety of waterfowl, and other wetland dependent species. Some of the largest stands of cypress trees in the South grow in the swampy areas within the confines of the refuge, providing the setting for an experimental ditching project sponsored by the U.S. Army Corps of Engineers Vicksburg District and performed by U.S. Army Engineer Waterways Experiment Station personnel.

Engineers from the Vicksburg District first contacted personnel from the WES Structures Laboratory in July 1993 about the feasibility of using explosives to create drainage ditches in the Swan Lake wetlands of the Yazoo National Wildlife Refuge. Existing drainage ditches and water control structures were in place at two weirs in the area. The weirs were intended to aid with water flow in the area and to provide a means by which U.S. Fish and Wildlife Service personnel could control water levels to enhance the natural habitat for wintering waterfowl. However, these ditches were not long enough to reach into the natural drainage patterns within the Swan Lake area.

A preliminary site visit revealed that very boggy conditions existed even during the dry summer months. This made the use of mechanical equipment difficult and costly. In addition, the large stands of cypress trees needed to be protected from damage.

Swan Lake was a Mississippi River channel thousands of years ago and the entire area is interlaced with a series of natural drainage patterns. The refuge management, together with Vicksburg District and WES personnel, determined that explosive excavation could effectively connect the natural drainage and the two weirs, and could do so with less disturbance to the environment than mechanical equipment might inflict.

Following the initial site visit, WES personnel established a scope of work for the refuge project. It was determined that four ditches would be required. The ditches would vary in length from 250 feet up to 350 feet, depending upon the location and terrain. The targeted ditch dimensions were 40 inches deep and 10 to 14 feet wide. Calculations and data from prior projects indicated that a series of 4-inch-diameter vertical pipes located 7 feet on centers and driven to a depth of 31 inches would be needed (Fig. 1) with 8 pounds of DBA-105P slurry blasting agent per pipe to create the necessary ditch dimensions. The DBA-105P blasting agent was essentially a formulation developed by a private contractor for military use during the late 1970s. During this time period, U.S. Army R&D elements investigated applications of pourable/pumpable bulk explosives that could be used by combat engineers to create obstacles.

Beginning in late August 1993, a team of five WES personnel began clearing brush along the proposed ditch routes. Routes chosen avoided cypress and other hardwood timber and most effectively tied into the natural drainage system. The job was labor intensive as the crew worked in knee deep mud and water to drive the vertical pipes into the ground with a sledge hammer to the proper depth of 31 inches below-grade.

Once the pipes were in place, the crew began pouring pre-weighed slurry charges of 8 pounds into each pipe (Fig. 2). The height of each charge within the 4-inch pipes was approximately 12 inches.

The booster for each charge was two ounces of Composition 4 (C-4) molded around a ULI knot on a 50-grain detonating cord down line. After the placement of the detonating cord and booster, a styrofoam disc was placed on top of each poured charge to separate the charge from water poured into the hole for stemming. Each down line was connected to a single line main of 50-grain detonating cord.

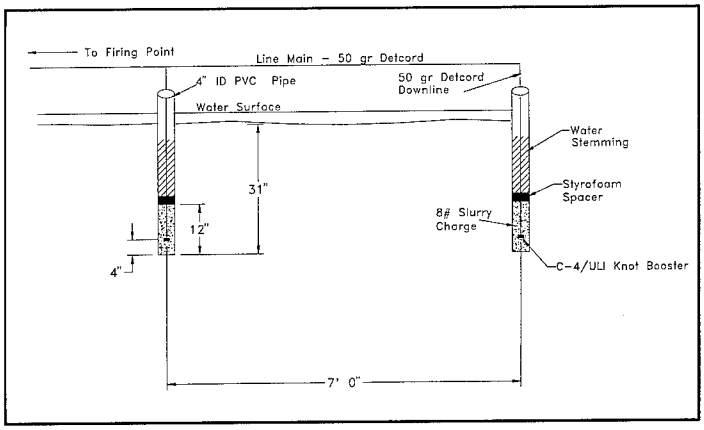


Figure 1. Configuration of the line charges used in the Yazoo Refuge

National Interagency Workshop on Wetlands "Technology Advances for Wetlands Science"

April 3 through April 7, 1995

Clarion Hotel (will become Raddison Hotel in February 1995), 500 Canal Street, New Orleans, Louisiana

Sponsored by: U.S. Army Corps of Engineers
Waterways Experiment Station

In cooperation with:

- Department of the Interior
  - U.S. Fish and Wildlife Service
  - National Biological Service
  - National Park Service
  - Bureau of Reclamation
  - Bureau of Mines
  - U.S. Geological Survey
- Department of Agriculture
  - Natural Resources Conservation Service
  - U.S. Forest Service
- Department of Transportation
  - Federal Highway Administration
- Environmental Protection Agency
- National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service

Agenda

Monday, April 3
1:30 - 6:00 p.m. Registration
6:00 - 8:00 p.m. Icebreaker (cash bar)

Tuesday, April 4
Opening Plenary Session
Moderator: Dr. Russell F. Theriot, Director, Wetlands Research & Technology Center, U.S. Army Engineer Waterways Experiment Station
Speakers: COL Kenneth H. Clow, Commander, U.S. Army Engineer District, New Orleans; Dr. William Roper, Assistant Director for Research & Development (Civil Works), Headquarters, U.S. Army Corps of Engineers
Keynote Address: Mr. Michael Davis, Associate Director for Natural Resources, White House Office on Environmental Policy
Panel Discussions: Panels consist of Federal agency representatives discussing ongoing wetlands technology and science initiatives within each agency
Panel 1: Results of the Corps of Engineers Wetlands Research Program
Panel 2 through 4: Federal Agency Wetlands Initiatives

Wednesday & Thursday, April 5 & 6
Technical Sessions: Concurrent sessions will cover the following nine topic areas:

- **Restoration, Protection and Creation**

Sessions
RE1 - Freshwater Wetland Creation & Restoration in the Northeastern United States
RE2 - Chesapeake Bay Wetland Restoration
RE3 - Freshwater Wetland Creation & Restoration in South Carolina
RE4 - Bottomland Hardwood Restoration in the Southeastern Coastal Plain
RE5 - Lower Mississippi River Floodplain Forest Restoration
RE6 - Central U.S. Wetland Restoration & Creation Projects
RE7 - General Freshwater Wetland Restoration & Creation Projects
RE8 - Coastal Creation & Restoration Projects in California
RE9 - Wetland Restoration at Vandenburg Air Force Base, California
RE10 - Vernal Pool Creation and Restoration
RE11 - Alaska and Pacific Northwest Restoration
RE12 - Wetland Restoration in Coastal Louisiana and Texas
RE13 - Beneficial Uses of Dredged Material
RE14 - General Coastal Wetland Creation & Restoration
RE15 - Engineering and Geographic Information Systems
RE16 - Restoration and Creation Theory

- **Identification and Delineation**

Sessions
ID1 - Identification and Delineation I
ID2 - Identification and Delineation II

- **Assessing Wetland Functions**

Sessions
FA1 - Assessing Wetland Functions: Hydrogeomorphic Approaches
FA2 - Assessing Wetland Functions: Regional Approaches
FA3 - Assessing Wetland Functions: The Mitigation Context

- **Critical Processes**

Sessions
CP1 - Wetland Processes
CP2 - Wetland Processes: Hydrology
CP3 - Wetland Processes: Vegetation I
CP4 - Wetland Processes: Vegetation II
CP5 - Wetland Processes: Soils

- **Wetland Stewardship and Management**

Sessions
SM1 - Mapping and Inventory
SM2 - Change Assessment and Cumulative Impact Analysis
SM3 - Fish and Wildlife Habitat Management
SM4 - Other Management Technologies

- **Mitigation and Mitigation Banking**

Sessions
MB1 - Effectiveness of Mitigation
MB2 - Strategies in Mitigation
MB3 - Mitigation Banking: Functions and Credits
MB4 - Mitigation Banking: Legal & Regulatory I
MB5 - Mitigation Banking: Legal & Regulatory II

- **Watershed Planning**

Sessions
WP1 - Watershed Planning I
WP2 - Watershed Planning II

- **Constructed Wetlands**

Sessions
CW1 - Water and Waste Water Treatment
CW2 - Nitrogen and Phosphorus Removal Efficiencies
CW3 - Mining Applications
CW4 - Vegetation Management

- **Wetland Education**

Sessions
WT - Wetland Education and Training

Friday, April 7
Panel: Summaries by Topic Area Chairs
Panel: Technology Twenty-One; Future Needs

Workshop Information

The Workshop will provide a national-level forum to address issues of importance to our wetland ecosystems. Scientists, engineers, and other experts throughout federal, state, and local governments, academia, and private industry will be able to exchange information and ideas and develop opportunities for mutually beneficial interactions. The theme "Technology Advances for Wetlands Science" emphasizes the importance of science and technology in protecting and enhancing our wetlands resources.

Location

A block of rooms has been reserved at the Clarion Hotel (new name will be Raddison Hotel in February, 1995), 1500 Canal Street, New Orleans, Louisiana. Rooms are $66 per day single and $78 per day double occupancy, excluding taxes. For reservations call 1-800-824-3359 (outside Louisiana) or 1-800-627-4500 (in Louisiana). Identify yourself as a participant in the National Interagency Workshop on Wetlands. These rates are offered until March 3, 1995, after which the prevailing rate will apply. Early reservation ensures the reduced rate and room availability.

Advance Registration

A $100 registration fee will be charged for the workshop. This fee includes refreshments at the icebreaker and breaks, Wednesday's luncheon, and a copy of the *Workshop Proceedings,* to be distributed at registration. The fee is due at registration.

A $20 discount may be received if payment is received by March 17, 1995. Payment may be a personal or cashier's check or money order. Make check or money order payable to the "National Wetlands Workshop." No government purchase orders or vouchers will be accepted.

Afternoon Field Trips

1. LaBranche Wetland Restoration Project - A once subsided and degraded wetland on the southwest shore of Lake Ponchartrain that has been restored to its original condition using dredged material and innovative technology.
2. Caernarvon Freshwater Diversion Structure - Built by the U.S. Army Corps of Engineers to control and direct Mississippi River flows to optimize shellfish production. Intertidal wetlands were restored by sediment deposition from the structure.
3. Jean Lafitte National Park - Natural, intertidal wetlands with boardwalk access.

(We may be able to arrange smaller sized trips to other locations on Friday afternoon or Saturday. Please specify if desired.)

(Clip and mail)

"Enclosed is my advance registration fee of $80 for the National Interagency Workshop on Wetlands. I understand this fee must be received by the workshop coordinator no later than March 17, 1995, and that payments received after March 17 will be recorded as a partial payment, and an additional $20 charged upon my arrival and registration in New Orleans."

Name _____

Address _____

_____

_____

_____

Phone _____

FAX _____

Interested in a field trip on Friday p.m. (circle if desired) (fees to be determined)

LaBranche Caernarvon Jean Lafitte Other (specify)

Mail to:

U.S. Army Engineer Waterways Experiment Station
Wetlands Research & Technology Center
ATTN: CEWES-EP-W
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Telephone (601) 634-2569/4217, FAX (601) 634-3664
E-mail coleman@elmsg.wes.army.mil or colemar@ex1.wes.army.mil

To detonate each line main, a single M-6 electric blasting cap and an M-122 remote firing device were used. Due to the burn rate of the detonating cord and the detonating velocity of the slurry, each line of pipes detonated almost as if it were a single charge. The blasts sent mud and debris over 100 feet into the air (Fig. 3) and created ditches approximately 15 feet wide and 40 inches deep (Fig. 4).

Over the course of two weeks, a total of 175 pipes were emplaced at four locations, filled with explosives and detonated to create nearly 1,200 feet of drainage ditch at Swan Lake. To accomplish the same amount of work through conventional construction/excavation practices would have taken more than twice as long at a significantly higher cost. In addition, conventional construction practices would have had a detrimental impact on the wetland environment at Swan Lake.

Tim Wilkens, Yazoo Refuge manager, stated, "It (the blasting) is more sensitive to the environment, and it looks very natural." The results of the project show that techniques originally developed for military applications can be modified and adapted successfully to a civil works project. Additional benefits of minimized environmental impact, time, and cost were realized. The technique holds promise for similar applications.

Hank McDevitt can be reached at (601) 634-2705; Dan Carleton is at (601) 634-3812.

Hendrik D. Carleton is a geophysicist in the Structures Laboratory at the U.S. Army Engineer Waterways Experiment Station. He received a bachelor's degree in geology from Louisiana State University. He was a recipient of the Department of the Army Research & Development Achievement Award in 1984 for work in the area of explosive excavation.

Henry S. McDevitt, Jr., is a research civil engineer in the Geomechanics and Explosion Effects Division of the Structures Laboratory at the U.S. Army Engineer Waterways Experiment Station. He is responsible for directing several R&D projects dealing with state-of-the-art demolition techniques that support combat engineering and special operations missions. He recently received a U.S. Patent pertaining to hardware developed through his research. McDevitt holds a bachelor's degree in civil engineering.

Figure 2. WES crew prepares the line charges for detonation

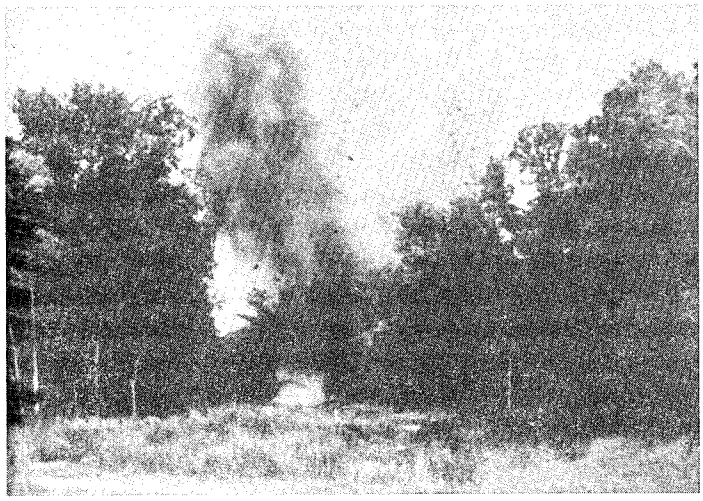


Figure 3. The blast deposited mud over a wide area, instead of having large spoil piles typical of conventional mechanical

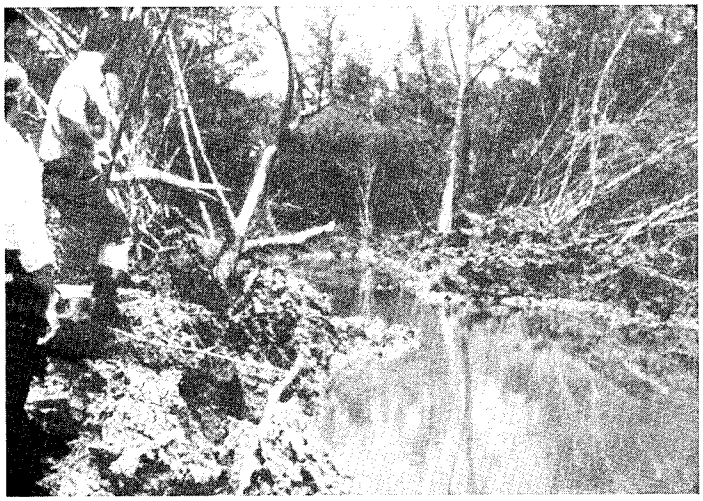


Figure 4. One of the explosively created ditches in the Yazoo National Wildlife Refuge

WRP/WRTC 1994 Activities

Corps wetland research continues under new guidelines

September 30, 1994, the 4-year U.S. Army Corps of Engineers Wetlands Research program officially ended. Technology transfer efforts continue, as research results emerge.

The program will be featured during the National Interagency Workshop on Wetlands under the motto "Technology Advances for Wetland Science." Corps wetland research will continue under the WRTC as an annually funded program, currently within the Environmental Impacts Research Program.

High profile wetland projects progressing

(Input from Karen Kochenbach, U.S. Army Corps of Engineers, Washington, D.C.)

Here is an update on ongoing and developing projects pertaining to U.S. Army Corps of Engineers wetlands work.

- Wetland Characterization.
  The National Academy of Sciences (NAS) Committee on Wetlands Characterization has requested, and received, an additional time extension from EPA for the completion of their report. The report is now scheduled to be completed by March 31, 1995.

- Wetland Delineation Certification.
  Proposed regulations for the Corps Wetland Delineation Certification Program are expected to be published in the *Federal Register* to initiate a 30 day comment period during the winter of 1995. Copies will be available from the Regulatory Branches of all Corps Districts, Divisions, and Headquarters, in addition to the EPA Wetlands Hotline at 1-800-832-7828. Comments and questions should be directed to Ms. Karen Kochenbach or Mr. Sam Collinson of Office of the Chief of Engineers, U.S. Army Corps of Engineers, ATTN: CECW-OR, 20 Massachusetts Ave., NW, Washington, DC 20314-1000, (202) 272-0199.

- Hydrogeomorphic Assessment.
  The Corps, in cooperation with the EPA, NRCS (formerly the SCS), FWS, and the FHWA, is developing an interagency implementation plan for the Corps new wetland assessment procedure, the Hydrogeomorphic Classification Method, commonly referred to as HGM. The implementation of this plan will be an interagency, nationwide effort and will complement ongoing HGM work through the Corps Wetlands Research Program.

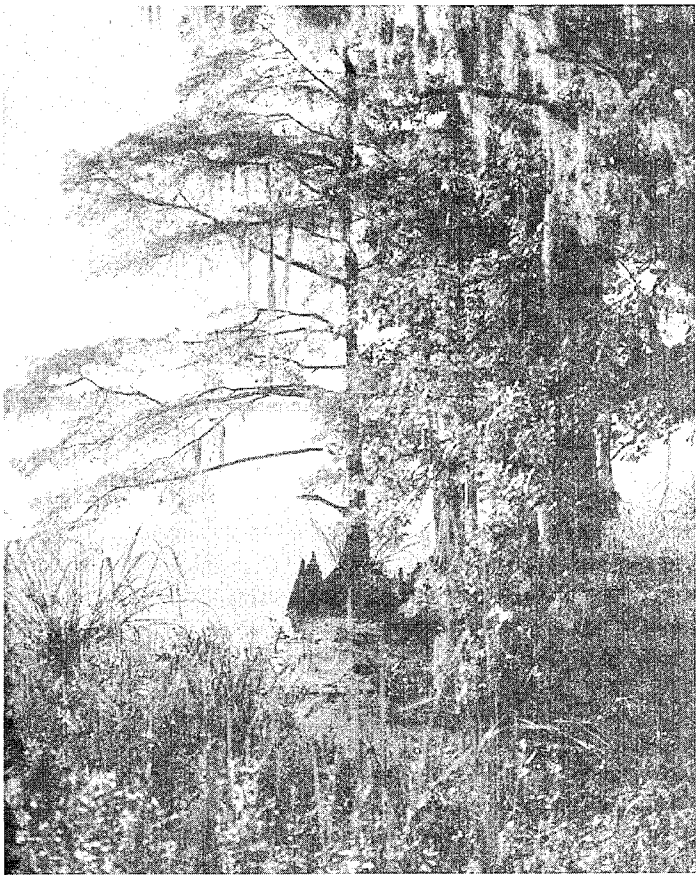
WRTC training marks successful year, continues growth

(Input from Robert L. Lazor, WRTC Training Coordinator)

In FY 94, under the sponsorship of Headquarters, U.S. Army Corps of Engineers, in conjunction the U.S. Army Engineer Huntsville Training Division, the Wetlands Research and Technology Center conducted wetland training for 750 Corps, Department of Defense (U.S. Air Force and U.S. Army National Guard Bureau), and other federal agency personnel. During FY 95, approximately 32 full weeks of wetland training will be conducted for 800 personnel, covering wetland identification, -delineation, -function and -values, -evaluation methods, -fundamentals, -executive, -development, and -restoration. Proposed new WRTC wetland courses offered for survey of student training needs in FY 95, and to be conducted in FY 96, include the new constructed wetland and the wetland soils courses. Only U.S. Army Corps of Engineers and Department of Defense personnel are eligible to attend.

Course descriptions, locations, dates, and points of contact:

- Wetland Development and Restoration.
  Provides introductory training in the concepts and practices of wetlands restoration and development in both inland (freshwater) and coastal areas. The course is directed towards biologists and engineers concerned with wetlands and seagrass development on dredged material, restoration of disturbed wetlands and seagrass beds, and techniques for reducing engineering impacts. Practical, hands-on field application of state-of-the-art techniques is emphasized. Session locations and dates:
  Apalachicola, FL, April 15-19, 1996
  Tiburon, CA, May 6-10, 1996
  Duck, NC, June 3-7, 1996
  St. Louis, MI (Alton, IL), June 17-21, 1996
  St. Louis, MI (Alton, IL), June 24-28, 1996
  Huntsville Division Point of Contact: Mrs. Ezella Casey, (205) 722-5830.



- Wetlands Executive.
  The Corps has a goal, set by law, to achieve no net loss of wetlands and ultimately increase the amount of the nation's wetlands. This course provides Corps executives (senior leadership, managers, supervisors) with insight into the national and federal interagency aspects of wetlands. Policy, current issues, developing initiatives, and a field overview of the scientific/technical aspects of wetlands are included. Session locations and dates:
  Washington, DC (Vicinity), May 29-30, 1996
  Olympia, WA, July 31-August 1, 1996
  Huntsville Division Point of Contact: Mr. John Buckley (205) 722-5898

- Fundamentals of Wetlands.
  Provides students with an overview of the state-of-the-art knowledge of wetland flora and fauna, hydrology, soils, and ecology. Course emphasizes wetlands functions and values in an ecosystem perspective. Both saltwater and freshwater wetlands will be addressed. Provides an introduction and overview of basic wetland concepts and principles in the context of planning and operating Civil Works Environmental restoration and mitigation projects. In addition to providing a basic overview, the course may also serve to update students in the current wetlands science and ecology of the 1990's. Session locations and dates:
  Apalachicola, FL, March 4-8, 1996
  Olympia, WA, August 5-9, 1996
  Huntsville Division Point of Contact: Mr. John Buckley (205) 722-5898

- Wetland Evaluation Methods.
  Provides an in-depth introduction and overview of existing wetland evaluation procedures and case study application to wetland systems for environmental impact assessment and evaluation purposes. Methods to identify and evaluate the functions of wetlands and their corresponding values to the ecosystem and society will be discussed. The requirements for wetlands evaluation and justification during project planning, operations, and the natural resources management phases of the civil works program will be stressed. Session locations and dates:
  Apalachicola, FL, February 19-23, 1996
  Olympia, WA, August 19-23, 1996
  Huntsville Division Point of Contact: Mr. John Buckley (205) 722-5898

- Constructed Wetlands (New Course).
  Provides state-of-the-art technical knowledge on how to construct wetlands from planning, design, engineering, construction, operations and maintenance, and monitoring viewpoints for civil works projects. Session location and date:
  San Francisco, CA, July 15-19, 1996
  Huntsville Division Point of Contact: Mr. John Buckley (205) 722-5898

- Wetland Soils (New Course).
  Provides an overview and introduction on wetland soils including hydric soils. Taxonomy, systematics, identification, and classification are included. Field collection, identification, and analysis are stressed. A strong engineering properties of wetland soils is included. Session locations and dates:
  San Francisco, CA, July 15-19, 1996
  Mobile, AL, April 22-26, 1996
  Huntsville Division Point of Contact: Mr. John Buckley (205) 722-5898

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WRTC/WRP goes on-line via Internet

Since early November 1994, the WRP Bulletin is available on Internet's World Wide Web as part of the home page for the Wetlands Research and Technology Center at the U.S. Army Engineer Waterways Experiment Station (WES).

Internet users may access the information via browsers such as Mosaic or Netscape. The WES address is "http://www.wes.army.mil/" and the WRTC/WRP home page can be found under "Other WES Resources, Centers, and Programs." Currently, the October issue of the bulletin, a listing of all technical notes published to date, and some biographies can be accessed. Technical notes and the December issue of the bulletin will be added during January 1995.

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