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Environmental Effects of Dredging Technical Notes

THE WETLAND EVALUATION TECHNIQUE (WET): A TECHNIQUE FOR ASSESSING WETLAND FUNCTIONS AND VALUES

PURPOSE: This technical note provides a brief overview of a technique for assessing functions and values of wetlands. The Wetland Evaluation Technique (WET) version 2.0 (Adamus et al. 1987) represents a revision of a technique developed for the Federal Highway Administration (FHWA) (Adamus 1983). WET is intended to address regulatory and environmental planning needs for multifunction assessment of wetland areas. It consists of documentation to implement the technique and software to aid in data analysis.

BACKGROUND: In 1981 the US Army Engineer Waterways Experiment Station was assigned responsibility for developing a technique to assess wetland functions and values for regulatory and planning needs. Numerous techniques were reviewed (Lonard et al. 1984) and a survey of Corps' needs was conducted (Forsythe, Clairain, and Smith 1985). A technique developed by the FHWA was selected as the method most capable of examining many different wetland functions and values and meeting the Corps' time and manpower constraints for assessment. This technique has been revised and published as an operational draft for testing and subsequent further revision.

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Introduction

Wetlands have long been recognized as important habitat for many fish and wildlife species, and within the last two decades an increasing awareness of other functions provided by wetlands has occurred. Executive Order 11990, "Protection of Wetlands," identifies numerous functions and values associated with wetlands including water-quality improvement, sediment retention, groundwater recharge and discharge, flood storage, production of fauna and flora, recreation, scientific advancement, and cultural benefits in addition to the

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traditional fish and wildlife habitat functions. That order requires that the planning effort for any federally funded projects in wetlands consider wetland functions and values and minimize adverse impacts in wetlands. Wetland functions and values must also be assessed under legislative mandates such as the National Environmental Policy Act (NEPA) and the Clean Water Act (CWA). NEPA requires environmental planning for federal construction projects. Section 404b.(1) of the CWA requires consideration of functions and values as part of the Corps of Engineers' regulatory responsibility for dredged and fill activities in wetlands. Additionally, numerous state laws and local ordinances require governing bodies to evaluate wetland functions and values when these habitats are threatened. Although several evaluation techniques such as the Habitat Evaluation Procedures (US Fish and Wildlife Service 1980) and the Habitat Evaluation System (US Army Engineer Division, Lower Mississippi Valley 1980) assess wildlife habitat, few techniques assess all wetland functions (Lonard et al. 1984, Lonard and Clairain 1986, and US Environmental Protection Agency 1984).

Assessment of wetland functions and values typically relies on professional judgment. An alternative requires detailed, site-specific studies, which are often expensive and time-consuming and usually not practical in a regulatory decision-making context where time and funds are often constrained. Results derived from professional judgment can be extremely variable and depend largely on the expert's past experience and expertise. In addition, obtaining the services of several professionals is often necessary, which limits this approach in the regulatory context.

What is WET?

The Wetland Evaluation Technique (WET) is a procedure for the assessment of a number of wetland functions and values, providing a balance between professional judgment and detailed, site-specific studies. WET is a rapid, systematic wetland assessment technique based upon information derived from the published literature--the best professional judgment available, expressed in documented format. The objective of WET is to provide an evaluation technique that: (1) assesses most recognized wetland functions and values, (2) is applicable to a wide variety of wetland types, (3) is reproducible and rapid (can usually be implemented within one day or less), and (4) has a sound

technical basis in the scientific literature. WET examines the following 11 wetland functions and values:

- Groundwater recharge
- Groundwater discharge
- Floodflow alteration
- Sediment stabilization
- Sediment/toxicant retention
- Nutrient removal/transformation
- Production export
- Wildlife diversity/abundance
- Aquatic diversity/abundance
- Recreation
- Uniqueness/heritage

WET also assesses the suitability of wetland habitat for 14 waterfowl species groups, 4 freshwater fish species groups, 120 species of wetland-dependent birds, 58 species of saltwater fish and invertebrates, and 47 species of freshwater fish.

How Does WET Work?

WET assesses wetland functions and values by characterizing a wetland in terms of its physical, chemical, and biological processes and attributes. These attributes (examples are hydroperiod, pH, and vegetative type) are referred to as predictors. Information about the predictors is established by addressing a series of questions. Responses to these questions are analyzed in interpretation keys.

WET is structured into several levels of analysis to provide a systematic approach for assessing wetland functions and values under different time and data constraints. This feature is important in regulatory activities of the Corps of Engineers because permit decisions must often be provided within a short time period and site-specific data are usually nonexistent or not readily available. However, WET also allows the user to incorporate new information into the original assessment to refine results if additional data or time becomes available.

Analysis of data in the interpretation keys results in the assignment of qualitative probability ratings of high, moderate, or low to functions and values in terms of social significance, effectiveness, and opportunity. Social significance assesses the value of a wetland to society due to special designation, potential economic value, or strategic location. Effectiveness assessment examines the capability of a wetland to perform a function due to its physical, chemical, or biological characteristics. Opportunity assesses

the chance a wetland has to perform a function to its level of capability.

The following example illustrates the concepts of opportunity, effectiveness, and social significance as they apply to floodflow alteration. Opportunity for a wetland to alter floodflows will depend on many factors (predictors) associated with the wetland's surrounding environs that influence delivery of floodwaters to the wetland. Some examples include size of the watershed, permeability of watershed soils, and watershed land cover characteristics. In order for the wetland to have an opportunity to alter floodflows, a significant input of surface water must occur. The effectiveness of a wetland in performing this function will largely depend upon characteristics associated with the wetland itself, such as floodwater storage capacity, presence or absence of constricted inlets and outlets, wetland hydroperiod, and water-velocity reduction capability. To be effective, the wetland must be able to retain or retard surface flows. Assessment of social significance of the wetland for floodflow alteration would be influenced primarily by factors downstream of the wetland, such as the presence of a town. This function may have social significance if damage is reduced or prevented downstream. Brief descriptions of these analyses are presented below.

Social significance

Social significance is evaluated at two levels. Level 1 consists of 31 questions designed to determine whether the wetland has specific characteristics that indicate it may be performing functions and values beneficial to society. A Level 1 assessment can be completed in 1-2 hours using information resources typically found in one's office, such as US Geological Survey (USGS) quadrangle maps, regional atlases, and lists of national historical locations. Level 2 is an optional step to refine the probability rating for the uniqueness/heritage function.

Effectiveness and opportunity

The effectiveness and opportunity of a wetland to provide functions and values is analyzed by addressing a series of questions designed to characterize the wetland and surrounding area. This evaluation has three assessment levels with each successive level building a more detailed characterization of the wetland and surrounding area and consequently providing increased confidence in probability ratings resulting from the assessment.

The first level of analysis for effectiveness and opportunity can be conducted in the office using information found on USGS quadrangle maps, Soil

Conservation Service soil survey maps, National Wetlands Inventory maps, and other data sources that indicate wetland size, configuration, slope, and juxtaposition relative to surrounding environs. The analysis can generally be performed in an hour or less and does not require a site visit.

The second level of assessment requires visiting the wetland area for observation and data collection. This level of analysis will take approximately 1-3 hours to complete.

The third level of assessment requires detailed (and in some situations, long-term) physical, chemical, and biological monitoring data from the wetland. For example, data obtained from water table wells would be used, if available, at this level of analysis to indicate groundwater relationships to the wetland. The time required to conduct this level of analysis varies depending upon the size and complexity of the wetland being evaluated.

Data analysis

Data can be analyzed either manually or electronically with a computer program. Manual analysis is performed by physically comparing question responses to required responses in the interpretation keys. One to several hours would be required to conduct an analysis manually, depending upon the type of evaluation performed and the level of analysis for each type.

Data analysis using the computer software requires less than 15 minutes regardless of the level of analysis performed. Results are obtained instantly upon completion of data input. Substantially revised from an earlier version (Clairain 1986), the WET computer program version 2.0 is written in C language and compiled. It will run on any IBM or true IBM-compatible microcomputer, operating under MS-DOS version 2.0 or later. WET requires less than 256 kb of storage on a double-sided, double-density diskette and will run from a floppy or hard disk. The program is menu driven and provides the user with options to input data, edit existing files, analyze data, print data files or results of data analyses, or exit the program. Data results are presented in the format displayed in Figure 1.

Evaluation Site: Hypothetical Wetland Site

Wetland Functions and Values

	Social Significance	Effectiveness	Opportunity
Groundwater recharge	L	U	*
Groundwater discharge	M	H	*
Floodflow alteration	M	H	M
Sediment stabilization	M	H	*
Sediment toxicant retention	H	L	M
Nutrient removal transform	M	L	M
Production export	*	M	*
Wildlife diversity/abundance	M	*	*
Breeding	*	L	*
Migration	*	H	*
Wintering	*	H	*
Aquatic diversity/abundance	H	H	*
Uniqueness/heritage	H	*	*
Recreation	L	*	*

An asterisk indicates functions and values not evaluated by WET; H = high, M = moderate, L = low, and U = uncertain.

Figure 1. Example of an evaluation summary sheet for a hypothetical wetland

Future Directions

WET version 2.0 has been published as an operational draft but will undergo considerable review and refinement during the next several years before it will be published as the next operational draft. The technique will be tested by the Corps of Engineers and other Federal and state agencies for an 18-month period with revisions consolidated into the next operational draft (version 3.0). During this testing period several other tasks will also be conducted to enhance the technical accuracy of WET and make the software more user friendly. Field research in bottomland hardwood forests in the southeastern United States is underway by WES to enhance WET's ability to assess these complex wetland systems. This study will be conducted over the next three years, although field research in other wetland systems will be conducted according to priorities established in the Wetlands Functions and Values Study Plan (Clairain 1985 and Clairain et al. 1985) as funds are available. Interpretation keys will also be refined based on results of field research studies and published information. Although WET currently provides an analysis for many different fish and wildlife species, additional

species-specific interpretation keys will be developed and integrated into future versions of WET. Also several important wetland functions and values, such as hunting and fishing, which are not available in version 2.0, will be developed for future versions of WET. Expert systems will be examined to evaluate the potential applicability of this new technology to implementation of WET. Training courses will also be provided each year to train potential users and assure consistency in results.

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