
**COMPILATION AND REVIEW OF COMPLETED RESTORATION
AND MITIGATION STUDIES IN DEVELOPING AN
EVALUATION FRAMEWORK FOR ENVIRONMENTAL RESOURCES**

VOLUME II

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**COMPILATION AND REVIEW OF COMPLETED RESTORATION
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EVALUATION FRAMEWORK FOR ENVIRONMENTAL RESOURCES**

VOLUME II

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VOLUME II - OVERVIEW

A research project of this magnitude generates a tremendous volume of information. The entries in Volume II are important supplements to the comparative analysis presented in Volume I. They are valuable products/analyses on their own, but were too lengthy to be included in the comparative analysis. The contents of Volume II support the points made in the comparative analysis.

SUMMARY REPORT OF THE HEADQUARTERS WORKSHOP

The discussion of the Headquarters perspective in the comparative analysis of Volume I was based mainly on the findings of the Evaluation Framework Workshop held March 18, 1994. The objective of the workshop was to examine what is observed, explained, and desired in the review of environmental restoration project documentation based on input from selected members of the Corps, and record their recommendations for change to improve the planning and decision-making process. This report fully documents the workshop activities and provides the results and a discussion of the results. The workshop report is found in Appendix A.

INTERVIEW GUIDE INSTRUMENT

The second appendix is the interview guide instrument. This guide served the interview process very appropriately and could be used in its present form if more case study research on this EEIRP work unit is needed. As is discussed in Chapter II of Volume I, the survey instrument was designed to accommodate the EEIRP topics. The experience of the interviewers was that it not only successfully covered the EEIRP topics, but it seemed to exhaust nearly all the planning issues respondents cared to offer. Very little additional information was offered by respondents when they were asked if there was more pertinent information that was not covered in the survey guide.

Execution of the interview guide was prefaced by an introduction to the EEIRP. Interview respondents were given a description of their role in the project and how it would contribute to the development of "how-to" planning guidance for environmental mitigation and restoration projects. Figure II-3 in Volume I was used to graphically illustrate how EEIRP work units would affect the

traditional Corps planning process. Respondents were informed that the goal of the interviews was to compile lessons-learned, not to conduct an audit of the project.

Each section of the instrument was prefaced with the text in italics to explain what information would be discussed. If respondents were unable to address sections of the instrument, the questions in some sections were not asked. Questions answered by respondents as a result of previous sections were not asked again in the interests of reducing the time needed to administer the instrument. The instrument is found in Appendix B.

CASE STUDY WRITE-UPS

The case study write-ups summarize the interview activities (preparation and interviews) by case study site. These case study write-ups are a means of organizing the information for use in the comparative analysis. They are designed as stand-alone entries so that the reader could examine one without having to reference other portions of case studies of the two volume report. The case studies are not meant to be comprehensive reference documents that portray all planning activities surrounding the proposed project. Rather, they portray, in an informal way, the perspectives of those interviewed regarding planning activities of environmental projects.

The format for the case study write-ups is arranged into three primary sections: a project description, which provides the reader an introduction to the project studied; responses to the interview questions by EEIRP work unit; and a summary of major themes emphasized by the respondents. The responses by each EEIRP work unit are separated into Findings, Discussion, and Respondent Recommendations. This organization of the interview responses adequately facilitated the analysis of the volumes of data gathered during the case study process. The case study write-ups are located in Appendix C.

LIST OF REFERENCE MATERIALS

A major theme to come from this research that is presented in Volume I is the need for information exchange, especially since environmental planning is a relatively new field. To support the information exchange, this section lists the materials used, collected, or referenced to during the interviews and research.

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There was diversity among interview respondents, not only in how they responded to questions but what they used to support their statements. Some provided flyers or pamphlets, others newspaper articles. Several respondents provided videotapes that display and discuss the value of an area or promote the goals of a project or program. Further details on information in the reference list, located in Appendix D, is available through the Corps Institute for Water Resources and Waterways Experiment Station.

APPENDIX A

**WORKSHOP SUMMARY
REPORT**

Note: This is an extract from the Evaluation Framework Workshop Report presented to the Institute for Water Resources on 2 June 1994.

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I. INTRODUCTION

This report provides a review of the purpose, content, and results of a workshop of selected Corps of Engineers Headquarters personnel conducted in Fort Belvoir, Virginia on March 18, 1994. The workshop was organized at the Fusion Center, to gather information that will contribute to the final report of this task order for the Evaluation of Environmental Investments Research Program (EEIRP). EEIRP is being conducted by the Institute for Water Resources (IWR) in partnership with the Waterways Experiment Station (WES).

The objectives for the workshop were to examine what is observed, explained, and desired in the review of environmental restoration project documentation based on input from selected members of the Corps, and record their recommendations for change to improve the planning and decision-making process. The decisions being made pertain to what is commonly referred to as the site and portfolio issues.

Ten Corps personnel from Headquarters, IWR and WES attended the conference. Those selected to attend were chosen because of their involvement in reviewing environmental restoration project documentation. Planning and Management Consultants, Ltd., was contracted by IWR to provide a three-member facilitation team to assist in the execution of the workshop. A roster of those who attended is included in Exhibit A. The participant workbook that guided the activities of the workshop is located in Exhibit B.

BACKGROUND

The initial groundwork for EEIRP was created in the summer of 1991 as VEIRP (Valuation of Environmental Investments Research Program). VEIRP was also developed as a joint effort between IWR and WES. In April 1992, a workshop was conducted in Arlington, Texas to address the need for a clear understanding of the linkages between management actions, environmental impacts, and human behavior. Sixty Corps personnel attended that workshop and contributed information to these linkages and related research needs. VEIRP became EEIRP when funded.

The objectives of EEIRP are to provide an evaluation framework, techniques, and procedures to assist planners, managers, and regulators in addressing two questions:

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- 1) How can the Corps determine whether the recommended action from a range of alternatives is the most desirable in terms of the environmental objective being addressed?
- 2) How can the Corps allocate limited resources among many competing environmental investment decisions?

Currently, there is a lack of methods and processes for assessing the efficiency and effectiveness of investments in environmental restoration, protection, and mitigation. Other work units within the Evaluation of Environmental Investments Research Program (EEIRP) are developing analytical methods and models for such issues as determining objectives and measuring environmental outputs and cost-effectiveness analysis. There is still a need, however, to develop a framework to incorporate these data into the plan selection and prioritization processes. The P&G and evolving Environmental Guidance do provide a conceptual and general framework, but more operational guidance and processes are required. The main questions are: How are the developed data being communicated to the public, interest groups, sponsors and decision-makers, and even to other study members? How are we using our expertise in this area? How can the views and values of differing publics, organizations and institutions be considered? How do we incorporate trade-off analyses when we don't have a common measure for all outputs and costs including opportunity costs?

To be more specific, the objectives of the EEIRP are to study and provide guidance on the following areas: (1) to determine and communicate the significance of environmental and cultural resources, (2) identify project objectives and measure environmental output, (3) identify environmental management measures and their respective cost components, (4) formulate environmental plans, (5) use of cost effectiveness and incremental cost analyses, (6) use of monetary valuation techniques for environmental resources, (7) incorporate risk and uncertainty analysis into environmental evaluations, and (8) determine potential linkages between environmental evaluation and state of the art technology applications. the case studies will be used to identify information needs for various individuals and organizations for both the plan selection and program allocation processes.

One of the major goals of the EEIRP is to develop an operational framework that will insure the products of this program are incorporated into the site and portfolio evaluation and selection processes. More specifically, the objectives are to: (1) provide a process to systematically identify national, regional and local objectives and priorities; (2) identify information needs of the public, sponsors and decision-makers, and study participants and appropriate communication media; (3) develop and describe trade-off processes incorporating all benefits and costs including opportunity

costs; and (4) identify appropriate processes for facilitating public, organizational, and institutional involvement.

The research program has been separated into ten specific study areas, referred to as work units. These work units will examine the following issues:

- Determining and Describing Environmental Significance
- Determining Objectives and Measuring Outputs
- Objective Evaluation of Cultural Resources
- Engineering Environmental Investments
- Cost Effectiveness Analysis Techniques
- Monetary and Other Valuation Techniques
- Incorporating Risk and Uncertainty into Environmental Evaluation
- Environmental Databases and Information Management
- Evaluation Framework
- Program Management

WORKSHOP ORGANIZATION AND PROCESS

A modified nominal group process was used to conduct the workshop. This approach has an introductory session to acquaint all participants with the subject matter of the workshop, break-out sessions to focus the participants on specific areas of concern, plenary sessions to summarize session results, and a plenary session to conclude workshop activities.

The original workshop design called for dividing the participants into two groups for each breakout session. The participants would be separated in a manner that provided a mixture of disciplines and geographical areas. This would help to provide a "cross-fertilization" of capabilities and ideas, and prevent a group from being dominated by a certain train of thought they may exist in a technical group, such as biologists, economists, or engineers. Because fewer people attended the workshop than was originally intended, there was no need to split the participants into two groups. The experience and professional disciplines of those who actually participated was diverse, thus limiting professional bias.

The workshop contained four sessions. The first three sessions were used to generate ideas pertaining to decision-making. The participants were asked questions about information that is helpful, detrimental, or lacking in reports, and how that information is used in decision-making. The

fourth session had the participants populating a matrix by associating existing or needed information with the criteria that it supports. The interpretation of the point patterns in the matrix were the focus of discussion. The philosophy behind this method is that of working from general issues and honing them into specific answers that will be useful in the final analysis.

ORGANIZATION OF REPORT

This report provides a review of the workshop process and findings, and is organized into four chapters. Chapter I provides a brief introduction to EEIRP, the focus of the workshop, and the design of the workshop. Chapter II summarizes the results of the first three sessions, highlights commentary of the participants, and presents the outcome of the voting activities. Chapter III describes the matrix that was formed through the first three sessions, the significance of any interrelations among the gathered information, and the rankings of information. Chapter IV provides a summary of important participant issues and comments from the facilitation team on the overall process.

II. BREAKOUT SESSIONS

This chapter presents the information generated and pertinent discussion resulting from the breakout sessions. Each breakout session was initiated with a question which captured the theme of the intended discussion. Participants used approximately five minutes to silently generate responses to the question, writing them in the appropriate space in the participant workbook. Next, each participant was asked to provide one of their responses to the question, which were in turn posted by the facilitator on the board for the entire group to see. This process continued, in round-robin fashion, until all responses from the participants were posted. Time was then spent on any necessary clarification and review of the items posted. To this end, each participant was asked to pick the top three items by placing a "1" by the most important item listed, a "2" for the second, and a "3" for the third, in the table provided in their participant workbooks. Once the individual voting was complete, the participants were asked to place their votes on the board that had been generated during the round robin segment. Finally, the group reflected on the voting results and summarizing comments were made.

This approach to brainstorming has been applied successfully in the past. In fact, a similar approach was used at the VEIRP, which proved successful in generating and summarizing important information. The voting process typically surfaces the critical issues, but all the ideas generated, including those not receiving votes, have some value and are worthy of reporting and consideration. Note that some redundancy and overlap will exist between the items in the lists. The item that best captures the essence of the idea being presented typically receives the most voting attention. This should be considered during interpretation of the results, especially when examining those items not receiving votes. That is, they may have been absorbed by an item receiving votes.

SESSION 1 RESULTS

The task of Session 1 was aimed at examining the criteria used for making selection decisions. The specific theme of this session was phrased around the question:

What are the key criteria or issues you use to evaluate environmental studies?

The posted issues from this session are in Table II-1.

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**TABLE II-1
POSTED ISSUES-SESSION 1**

Item No.	Item	No. of Votes
A	Engineeringly Functional (Designed to meet objective)	2
B	Outputs - what are they (Precisely defined options)	2
C	Costs	
D	Linkage - Federal Interest, Corps Project	1
E	Non-Federal response/interest (Do they support the project? How much money will they put forth?)	3
F	Resources involved and significance	2
G	Benefits	
H	Does proposal make biological sense? (Feasibility)	2
I	Publicly Responsible	
J	Politically Acceptable - will they buy into it?	
K	Formulation/Alternatives	2
L	Corps Policy Requirements	3
M	Congressional interest	
N	Legal requirements/compliance	2
O	Reasonableness/rationality	1
P	Objectives - Are they clearly thought out/defined?	
Q	Does the environmental community support the proposal? (State and Federal Agencies)	1
R	Engineeringly efficient	1
S	Cost effective	
T	Are outputs habitat based?	1

**TABLE II-1 (Continued)
POSTED ISSUES-SESSION 1**

Item No.	Item	No. of Votes
U	Federal costs	1
V	Understandability by locals/environmental groups (Do locals understand their role, cost, what they bought?)	
W	Significant adverse impacts	
X	Acceptability to other agencies (State and Federal Agencies)	
Y	Justification	
Z	"What's the real objective?"	
Aa	Completeness	
Ba	Size of project/location	
Ca	Operational requirements	

Those items receiving at least one vote from the participants are listed below in descending vote order:

- Non-Federal Response/Interest (3)
- Corps Policy Requirements (3)
- *Engineeringly Functional* (2)
- *Output Options* (2)
- *Significance of Resources Involved* (2)
- *Biological Feasibility* (2)
- *Formulation of Alternatives* (2)
- Legal Requirements/Compliance (2)
- Linkage (1)
- *Reasonableness/Rationality* (1)
- Support from Environmental Community (1)
- *Engineeringly Efficient* (1)
- *Habitat Based Outputs* (1)
- *Federal Costs* (1)

The participants had no difficulty in understanding their role for this session. Upon review of the voting results, the participants were in general agreement with the importance of the criteria selections. Little discussion was required to support or oppose items that were selected. Evaluation of the 14 criteria suggests categorization into one of two groups: technical focus or policy focus. Those criteria with technical focus are shown in italics. The top vote selections have a policy focus (*Non-Federal Response/Interest* and *Corps Policy Requirements*) which could mean that in making decisions on feasibility reports the most important information relates to how well present policy is followed.

Given the 14 criteria receiving votes, the participants were asked to distribute 100 points over those criteria indicating the weight or importance they would place on each criteria. If, for example, *Non-Federal Response/Interest* is the sole criteria for approving or selecting a project, 100 points would be given to that criteria. If, on the other hand, all the criteria were considered of equal importance each would be assigned approximately 7 points. Each participant assigned their weights on an index card and the cards were collected for analysis in a later session (see table III-1).

SESSION 2 RESULTS

The task of Session 2 was aimed at examining the existing information that is useful in feasibility planning. The specific theme of this session was phrased around this question:

What information has been effective in the past in evaluating environmental studies?

The posted issues from this session are in Table II-2.

The items receiving at least one vote by the participants from the list that they generated are as follows:

- Problem Identification (5)
- Ground Truthing (3)
- Selection Criteria (3)
- Types of Outputs Generated (2)
- Personal Experience (1)
- Definition of Problem (1)
- Environmental Community Comments (1)
- Communication with Resource Agencies/Interest Groups (1)

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**TABLE II-2
POSTED ISSUES - SESSION 2**

Item No.	Item	No. of Votes
A	Personal background (in-field experience)	1
B	Alternative chosen, is it complete?	
C	Ground truthing - site visit	3
D	Quality maps	
E	Cause of problem	1
F	Specific hydrology and hydraulics information	
G	Precise nature of outputs to be produced	2
H	Identification of problem(s)	5
I	Formal comments from environmental community	1
J	Comments/letters from local sponsors supporting the project	
K	Networking/communication with resource agencies/interest groups	1
L	Documentation of selection criteria	3
M	What is the solution (i.e. land-intensive, construction)	1
N	Types of existing species and habitat	
O	Biological factors which explain changes in outputs	1
P	Severity of problem	
Q	Published scientific literature	
R	Why alternatives were not chosen	
S	Topographic maps/photos	1
T	Engineering drawings	

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**TABLE II-2 (Continued)
POSTED ISSUES - SESSION 2**

Item No.	Item	No. of Votes
U	Location of resources to be restored	1
V	Costs of habitat created	
W	Characterization of Corps linkage to degradation	
X	Area(s) affected	1
Y	Access to other disciplines in your office	
Z	MCACES	
Aa	FIS/NEPA	
Ba	Identification of other outputs/benefits	
Ca	Project makes sense in context of location	
Da	Management measures which can affect outputs	1
Ea	Frequency of problem occurrence	
Fa	Informal call to the field for questions	
Ga	What, where, why, how	1
Ha	Without project conditions	
Ia	Required maintenance for project	
Ja	Personal academic background	

- Nature of Solution (1)
- Biological Affects on Outputs (1)
- Topographical Maps/Photos (1)
- Location of Proposed Restoration (1)
- Physical Features Affected (1)
- Management Measure Affects on Outputs (1)
- What, Where, Why, How (1)

Upon review of the voting results, the participants were in general agreement with the importance of the existing supportive information. In this session over half the group voted for *Problem Identification* in their top three, suggesting a relatively high level of agreement among the participants that this information is necessary in the decision-making process. There was a distinction made between Location of *Proposed Restoration and Area(s) Affected*. The location is the geographical area where the proposed project is to take place. The area affected is a physical feature, such as a stream or a piece of farmland. Based on the items selected, the group indicated that information collected and reported in the past which is effective in the decision-making process is technical in nature. Each of the items receiving votes, with the exception of *Personal Experience*, requires a technical process or product that is common in Corps planning operations.

SESSION 3 RESULTS

The task of Session 3 was aimed at examining information that is in need of enhancement or is not currently available. The specific theme of this session was phrased around this question:

What new/additional information would be effective in evaluating environmental studies?

The posted issues from this session are in Table II-3.

The items that were selected by the participants from the list that they generated are as follows, in order of most votes received to least votes received:

- Justification Rationale (3)
- New Environmental Psychology (3)
- Output Significance (2)
- Clear, Concise, Complete, Logical, Understandable Report (2)
- Monetary/Non-monetary Benefits (2)
- Ecosystem Models (2)
- Watershed Ecosystems (2)
- Defining Monitoring (2)
- Watershed Environmental Conditions (2)

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**TABLE II-3
POSTED ISSUES - SESSION 3**

Item No.	Item	No. of Votes
A	Good topography	
B	Significance outputs	2
C	Cost effectiveness of solution(s)	1
D	Historical data	
E	Clear, concise, complete, logical, understandable report	2
F	Stronger documentation	1
G	Better description of linkage	
H	Detailed ecosystem information for study area	1
I	Species lifecycle	
J	Documentation of alternative formulation process	1
K	Discussion of trade-offs from one solution to another	
L	Documentation of OMR & R and monitoring	
M	Documentation of LEERDS	
N	Current land-use patterns and potential changes	
O	Environmental conditions in study area watershed	
P	Environmental technology available	
Q	Documentation of justification rationale	3
R	Monetary/non-monetary benefits	2
S	Documentation of project costs	
T	Documentation of environmental compliance	
U	Ecosystem models	2

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**TABLE II-3 (Continued)
POSTED ISSUES - SESSION 3**

Item No.	Item	No. of Votes
V	Environmental stability of area	
W	How long will project last?	1
X	Financial analysis	
Y	Operational guidance on sustainable development	
Z	Environmental sensitivity parameters	
Aa	Study authority	
Ba	Risk and uncertainty	
Ca	Required habitat	
Da	How do you measure the outputs?	
Ea	New environmental psychology	3
Fa	Risk and uncertainty *	
Ga	Project life - "show me guidance on this"	
Ha	Quantification of habitat (similar to HEP)	
Ia	User-friendly software linked to environment	
Ja	Documentation of ecosystems on watershed basis	2
Ka	Clear guidance on environmental acceptability	
La	Ecosystem models *	
Ma	Case studies/previous case studies	
Na	Defining monitoring (How much, how long, by whom, for what?)	2
Oa	Role of biological resources in their ecosystem	1
Pa	Potential remediation plan to ensure success	
Qa	Environmental conditions of a watershed basis	2

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- Solution(s) Cost Effectiveness (1)
- Stronger Documentation (1)
- Ecosystem Information for Study Area (1)
- Alternative Formulation Process(1)
- Project Length (1)
- Ecosystem Biological Resources (1)

In completing this task, the group struggled with differentiating new information from information that is already in existence but is not used or used poorly. (Most of the discussion was made between item Ca and Da in Table II-3.) One of the participants asked what effect the study authority would have on the study process. Other participants indicated that this information is sometimes missing from reports. This train of thought caused the participants to question whether information listed during this session was new information that was needed, and not just information that was in need of enhancement.

This issue of enhancing existing information brought out other concerns, such as reports being completed in an inadequate manner, whether it is due to poor communication skills, lack of knowledge in the field, or if it is just a "messy job". The group recognized that some of the information they were seeking may not be in existence, and that they appeared to be forming some type of "wish list", but it was expressed by more than half the group that they felt some reports were not being completed adequately. The group decided that it would be appropriate for the list to include new and enhanced information in this session. They proceeded with the listing exercise, recognizing that some redundancies would likely occur. Redundancies are marked with an asterisk in Table II-3.

The study area's ecosystem received considerable attention from the group. However, the discussion that was generated in this session indicated that even though technically-oriented information may be important, following through on existing guidance, such as Principles and Guidelines, is the greatest concern. This would lend support to the conclusions drawn from the first session that decisions regarding Corps environmental policy are important to the participants.

III. ANALYSIS

In this last session, the group was asked to determine what existing and new information would be helpful in examining criteria used to make decisions. The information was cross-referenced in matrix form. The purpose of this session was to display which decision-making criteria were in need of more supportive information, where criteria are adequately supported, and the relative importance of supportive information was most important.

PROCESS

In a separate room, the facilitation team listed vertically the criteria (session 1) selected by the participants and horizontally the existing (session 2) and new/enhanced (session 3) information to form a matrix. The group was brought to the room containing the skeleton of the matrix shown in Figure III-1. The facilitator reminded them how they generated the information from the previous sessions. Each participant was assigned two criterion and asked to do two actions:

- 1) Check the box for each category of information that supported each criterion (Supporting Information)
- 2) Circle the three most important information categories for each criterion (Crucial Supporting Information)

After they made their selections, the participants, as a group, reviewed the selections to determine if the information selected for the criteria was sufficient or if any changes were needed. The participants were then shown the results of their ranking of the criteria conducted at the end of session 1. The participants were encouraged to draw conclusions from their experience with the matrix.

MATRIX ANALYSIS

The matrix was designed to show how the information the participants selected, whether existing or new/enhanced, supported the criteria they considered important in making decisions

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regarding environmental projects. Supportive information is indicated by a hollow dot in the matrix, and information that was viewed as crucial to the criteria is indicated by a solid dot. The matrix design promoted the examination of what information was vital with reference to existing versus new/enhanced, especially with regard to the three most important information items. An intensive examination of the completed matrix would probably call for an aggregation of selected categories and raise questions as to why one type of information is related to a certain criteria and not another. The purpose of this matrix exercise, though, was to obtain a general view of the data needs for each criteria and discuss their relative importance. A more robust analysis of consistency within the matrix was not the intent of the exercise, but could be conducted at a later date. Selected general observations follow.

Output Options, Formulation of Alternatives, Legal Requirements/Compliance, and Federal Costs all received a significant amount of existing supportive information. However, for *Formulation of Alternatives*, the information deemed most important was found in the New/Enhanced Information section of the matrix. This may mean that even though there is a significant amount of information being provided, enhancements to the process are needed and should be incorporated into future reports.

Criteria that received limited information support are *Linkage, Non-Federal Response, Corps Policy Requirements, and Congressional Interest*. These criteria could be viewed as needing more research to determine what other support information is needed. However, the information that they are receiving could be adequate to support those criteria in the decision-making process.

Nine of the fourteen criteria were assigned crucial supporting information that fell in the New and Enhanced Information category. This indicates that there is crucial information in supporting the criteria that need to be developed or enhanced. These are areas appropriate for further research.

Looking down the columns of the matrix illustrates that all the data collected, whether existing or new and enhanced, supports multiple criteria. The number of criteria a data item supports varies, ranging from *Alternative Formulation Process* which supports 2 criteria, and *Basis for Solution* supports 12. Most of the data items support 7 to 10 criteria. Items that were chosen as crucial supportive information for four or more of the criteria were *Precise Nature of Produced Outputs, Identification of Problem(s), Communication with Agencies/Interest Groups, Basis for Solution, and Output Significance*.

The participants noted that the *Federal Costs* criterion had significant support, and that everything that is done will have a Federal cost attached to it. They also pointed out that costs

	Ground training - site visit In field experience	Precise nature of problem Cause of problem	Identification of problem(s) Input from env. community	Communication with agencies/interest groups Input from env. community	Selection criteria Basis for solution	Bio. factors that influence outputs Topographic map/ photos	Area of resource restoration Topographic map/ photos	Management measures effected Area(s) effected	What, where, why, how Output significance	Cost effectiveness of solutions Output significance	Complete, understandable report Cost effectiveness of solutions	Stronger documentation Ecosystem information	Alternative formulation process Ecosystem information	Monetary/non-monetary rationale Justification rationale	Documentation of watershed ecosystems Ecosystem models	New env. technology New env. technology	Defining monitoring Bb. resources in ecosystem	Env. conditions of watershed Bb. resources in ecosystem	
Engineeringly functional	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Output options	●		○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Linkage) Federal interest, Corps project		●	●	●				●	○										
Non-federal response/interest			●		●	●		○		○									
Significance of resources		○	○	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Biological feasibility		○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Formulation of alternatives	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Corps policy requirements	○		○	○				●	●	●					○				
Reasonableness/rationality					●	●	●				●								
Legal requirements/compliance	○	○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Support from environmental community			○		○	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Engineeringly efficient	○	○	○	●	●			●	○	○	○	○	○			●			
Habitat based outputs	○	○	○	●	○	○		●	○	○	○	○	○	○	○	○	○	○	○
Federal costs	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

EXISTING INFORMATION

NEW OR ENHANCED INFORMATION

○ Supporting Information ● Crucial Supporting Information

FIGURE III-1

MATRIX OF CRITERIA AND INFORMATION

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TABLE III-1

RESULTS OF CRITERIA WEIGHTING EXERCISE

Criteria	Low	High	Average	N
Biological feasibility	0	50	12.1	7
Formulation of alternatives	0	20	10.5	7
Linkage) Federal interest, corps project	0	50	10.0	5
NonFederal response/interest	0	25	9.1	7
Output options	0	20	8.7	6
Significance of resources	0	20	7.7	7
Legal requirements/compliance	0	30	7.0	6
Engineeringly functional	0	24	6.5	6
Support from environmental community	0	10	6.3	6
Corps policy requirements	0	20	5.5	6
Habitat/based outputs	0	10	4.6	5
Reasonableness/rationality	0	20	4.5	6
Engineeringly efficient	0	10	4.0	4
Federal costs	0	10	3.8	5

are the deciding factor, regardless of who you talk to in formulating the alternatives. This cost theme continued when it was mentioned that construction costs are identified in the feasibility studies, and that even though the Corps builds things for a project life, they are kept functional forever.

The results of the weighting exercise were posted along the criteria. The average weight for each criterion was assigned as indicated in the third column of Table III-1. The first two columns display the range of individual weights for each criterion. The last column indicates the number of participants who attributed points to that criterion. The range of weights, based on the average between criterion (4.0% - 12.1%) was less than anticipated. This small range could be attributed in part to the pluralism of the criteria. *Biological Feasibility* (12.1%), *Formulation of Alternatives* (10.5%), and *Linkage* (10.0%) were the top three weighted criteria. Given the participants represented a Headquarters perspective, the relative importance of these three criteria is not unexpected. *Biological Feasibility* is an obvious controlling condition of an environmental project. *Linkage* and *Formulation of Alternatives* are very important requirements for Corps involvement in a project and are integral to the Corps plan formulation process. It is not being suggested that these criteria are overlooked at the Districts and Divisions, rather it suggests that Headquarters, who cannot get involved in all the details, offers a bigger picture perspective that is represented by questions like: will it work? is it in the Federal interest? have we examined the alternatives?

Of the 14 criteria listed, nine have a technical orientation and six are policy oriented. This could be interpreted as a greater need for technical information in the decision-making process.

Another area to examine is the amount of supporting information that a criterion has versus the weight the criterion received. The crucial information needs for *Formulation of Alternatives* all fell under the new and enhanced portion of the matrix. Likewise, one crucial information need was classified as new and enhanced for *Biological Feasibility*. These could be considered as important areas of research. *Linkage*, on the other hand, appears to be sufficiently supported with existing information.

In addition to the information discussed above, it was pointed out by several participants that because of their disciplines, one individual may not view things the same way as another. For example, a biologist would be able to better address the category of *Biological Feasibility* better than an engineer, and an engineer would do a better analysis of the category of *Engineeringly Functional* than the biologist. This indicates that the criteria generated may require more examination by specialists in the areas to which they apply.

Clearly, the matrix indicates that a great deal of information is needed to support the important decision-making criteria. All the criteria are supported by some type of existing data or

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information. Thus, no existing decision making criteria is left totally unsupported at present. Note also that each information item, new or existing, supports at least one criteria. Therefore, all the information collected is or could be used to support important criteria.

IV. DISCUSSION AND WRAP-UP

There was a large amount of valuable information gathered from the insights of the workshop participants. It would appear that Session 3 generated the most discussion and created a theme: Is there a need for developing more new techniques, or do we need to improve how the existing information is communicated? This theme could also be phrased: Do we need more technology, or more policy?

An interesting comment made during the discussion of the matrix was that it was hard to keep track of all the information provided, just as if you were doing it normally in a report. The participants showed agreement with this, which could lead us to ask, do reviewers cover all the information with an equal weight, or do they try to fit it all into one examination of a report?

Session 4 showed teamwork on the part of the participants, such as when an engineer asked a biologist for input on a topic that was biologically-oriented. There were comments from all members involved that some key players were missing that would have had a greater influence on the results of the workshop. Although some comments were made about participants tiring out, they did make critical appraisals of all fourteen criterion.

Finally, as a closing comment, one of the participants asked in a humorous tone "How come everyone doesn't think like I do?" Even though this comment was made in jest, it does suggest that stronger implementation of current guidance may be what project reviewers would like to see executed.

EXHIBIT A

**EVALUATION OF ENVIRONMENTAL INVESTMENTS RESEARCH PROGRAM
WORKSHOP
Fort Belvoir, VA 18 March 1994**

PARTICIPANTS

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FACILITATION TEAM: Planning & Management Consultants, Ltd.

Dale Brown	(618) 549-2832
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EXHIBIT B

**WORKSHOP AGENDA
U.S. ARMY CORPS OF ENGINEERS**

**Compilation And Review Of Completed Restoration And Mitigation
Studies In Developing An Evaluation Framework
For Environmental Resources**

**Headquarters Perspective
March 18, 1994, Fusion Center, Fort Belvoir, VA**

0830	-	0845	Introduction/Administrative Details	Bill Hansen, Dale Brown
0845	-	0920	Overview of Environmental Evaluation Problem	Bill Hansen, Dale Brown
0920	-	1020	Breakout #1: Decision Criteria	Dale Brown, Tim Feather
1020	-	1030	Break	
1030	-	1050	Plenary #1	Dale Brown
1050	-	1135	Breakout #2: Available Information	Dale Brown, Tim Feather
1135	-	1155	Plenary #2	Dale Brown
1155	-	1245	Lunch	
1245	-	1345	Breakout #3: Needed Information	Dale Brown, Tim Feather
1345	-	1405	Plenary #3	Dale Brown
1405	-	1420	Break	

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1420	-	1450	Plenary #4: Match Information To Criteria	Dale Brown, Tim Feather
1450	-	1515	Wrap-Up, Evaluation, and Closing Remarks	Dale Brown, Bill Hansen

APPENDIX B

INTERVIEW GUIDE
INSTRUMENT

I. PROJECT DESCRIPTION

The purpose of this section is to get an overview of the project at hand. We are interested in the project's purpose, the basic design of the project, the expected results, what funding sources (e.g. outside parties, Section 1135) and support for the project were used, and the general path of approval/completion.

- 1) **I understand that the basis of this project is**

 - 2) **Was this project designed to meet specific national needs and policies?
Regional needs and policies?
Local needs and policies?
If so, what were they?**

 - 3) **Who had the study lead for this project?**

 - 4) **Who were other major players in this study? (Federal or non-Federal?)**

 - 5) **What authorities/sources funded the study?**

 - 6) **Please describe to us the general sequence of major events that occurred in this project to the completion of the report. (Supplementary, if needed: What, when, and who defined the environmental problem or opportunity in the plan formulation, evaluation, and decision making process? Was there anyone else?)**

 - 7) **How long did the feasibility/reconnaissance study take from start to completion? (What was the start and end dates for the study?) Was this time amount adequate?**

 - 8) **How helpful was Principles and Guidelines and other Corps guidance? (1-Not at all to 5-Very helpful) (Be sure to identify types of guidance) Was the analysis done to "fit" the guidance given?**
-
-

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- 9) **Is more detail necessary? (Examples: In guidance, background information, study/analysis) Why?**
- 10) **Did you feel that you were backed up by the district (division, HQ) during all stages of the project?**

II. DETERMINING AND DESCRIBING ENVIRONMENTAL SIGNIFICANCE

The purpose of this section is to find out how significant resources are identified, the reasons for identification, and examine the process or processes chosen to describe the impacts that a project will have on existing resources. This is being done to develop a better focus on what is important for decision making. An example of this would be a dredging project that substantially increases aquatic habitat (effects on the habitat), offer minor improvements in recreational opportunities (effects on area residents), and temporarily decrease the fish population (effects on area fauna).

1) How was environmental significance determined?

What factors were considered for determining and describing environmental significance at the National Scale?

Regional Scale?

Local Scale? (Technical, institutional, and public as specified in P&G)

2) Was significance considered/defined at the beginning? (If NO, Why not?) What effect did interest groups have in this process?

Was there anyone else who could have aided in this task?

Was any information missing?

Was a broader analysis done?

Were there any comparisons with past evaluations?

3) Were ranking/weighing scales used for prioritizing levels of significance? (If YES, why?)

4) How much time was spent in determining and describing environmental significance?

5) How did you communicate this information about environmental significance with the interested public groups?

Was it understood?

(For Division) How was the information for this task communicated to you? Did you understand it?

- 6) **What guidance (provided by the Corps or others) was available to help you determine environmental significance?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**
- 7) **What element of determining environmental significance do you think needs the most research attention?**
- 8) **If the study were done again, what would you do differently with regard to environmental significance?**
- 9) **Based upon your experience at {case study}, is there anything else pertaining to environmental significance that you would like to comment upon?**

III. DETERMINING OBJECTIVES AND MEASURING OUTPUTS

The purpose of this section is to examine how objectives and methods for measuring outputs were developed. An example of this would be to improve habitat for waterfowl use. This can help provide information on strategies that were particularly successful and what factors should be considered in the forming of objectives and outputs.

- 1) **How were the restoration objectives identified? (e.g., scientific, engineering, "non-technical")**

Were objectives linked to significance?

- 2) **What output measurements (i.e., success criteria) were identified in the project and how were they measured?**

Why?

What models (e.g., HEP) were selected?

Why?

How were output measurements linked to objectives?

**Were any output measurements considered but deemed not usable or understandable?
(If YES, Why?)**

- 3) **What individuals/groups were involved in determining the objectives?**

What did they do?

Was there anyone else who could have aided in this task?

- 4) **What individuals/groups were involved in identifying the outputs?**

What did they do?

Was there anyone else who could have aided in this task?

- 5) **How much time was spent in the process of determining objectives?**

What about the analytical outputs?

- 6) **How was the information for determining objectives and selecting outputs communicated to concerned locals?
Was it understood?
What worked well?**
- 7) **What guidance (provided by the Corps or others) was available to help you determine objectives and select outputs? (Differentiate between documentation and "expert opinion") How helpful was it? (1-Not at all to 5-Very Helpful) Why?**
- 8) **What information was helpful for determining the objectives?
What was missing?**
- 9) **What information was helpful in selecting the outputs?
What was missing?**
- 10) **What element of determining objectives do you think needs the most research attention?
Is there a weakness in experience and training?**
- 11) **What element of formulating outputs do you think needs the most research attention?**
- 12) **If the study were done again, what would you do differently with regard to objectives and outputs?**
- 13) **Based upon your experience with {case study}, is there anything else pertaining to determining objectives/selecting outputs that you would like to comment upon?**

IV. OBJECTIVE EVALUATION OF CULTURAL RESOURCES

The purpose of this section is to examine what steps were taken in the evaluation of the project area's cultural resources. We are looking for information on who was involved and what techniques (traditional or new) were used.

- 1) **Were cultural resources of significance in this study?**
Why?
Was the significance of the cultural resources at the local, regional, or national scales considered?

- 2) **What was the strategy used in the evaluation of cultural resources for this study? (Did you plan to bring in a contractor? Was a new test going to be used?)**
How effective was this strategy?
Why?
Was a model selected?
Why?

- 3) **(Supplementary) What individuals/groups were involved in the process of evaluating cultural resources?**
Was there anyone else who could have aided in this task?

- 4) **What resources (e.g., libraries, museums, schools) were available to help you complete this task?**
What else would have been helpful?

- 5) **How much time was spent in evaluating cultural resources?**

- 6) **How was the information on cultural resources communicated to concerned locals?**
Was it understood?

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- 7) **What guidance (provided by the Corps or others) was available to help you determine cultural resource significance?
How helpful was it? (1-Not very helpful to 5-Very Helpful) Why?**
- 8) **What element of evaluating cultural resources do you think needs the most research attention?**
- 9) **If the study were done again, what would you do differently in regard to cultural resources?**
- 10) **Based on your experience at {case study}, is there anything else pertaining to the evaluation of cultural resources that you would like to comment upon?**

V. ENGINEERING ENVIRONMENTAL INVESTMENTS - FORMULATING INPUTS AND MONITORING EFFECTIVENESS FOR IDENTIFICATION AND SELECTION OF ALTERNATIVES - RESTORATION MEASURES

The purpose of this section is examine the procedures used for identifying and formulating alternatives for environmental projects (e.g., increasing the dissolved oxygen content to improve the bluegill habitat by dredging, aeration, aquatic weed harvesting, etc).

- 1) **What process was used in formulating the alternative restoration strategies for this project?
How effective were they?
Why?
Was a model project referenced?
Why?**

 - 2) **What factors were considered in formulating the alternative restoration strategies for this project? (e.g., Costs, effectiveness, incremental nature of components?)**

 - 3) **What individuals/groups were involved in formulating the alternative restoration strategies for this project?
Was there anyone else who could have aided in this task?**

 - 4) **How much time was spent in formulating the alternative restoration strategies for this project?**

 - 5) **What was the final decision?
Why?**

 - 6) **How did you communicate this restoration alternative analysis to concerned locals?
Was it understood?
What was the initial response by those involved to the alternative chosen?
Was there any mediation or compromise in determining the alternative(s)?
Was there a lot of discussion to consider other alternatives?**
-
-

- 7) **What guidance (provided by the Corps or others) was available to help you determine alternative restoration strategies?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**

- 8) **What information was helpful in determining effective restoration strategies?
What was missing?**

- 9) **What element of formulating alternative restoration strategies do you think needs the most research attention?**

- 10) **If the study were done again, what would you do differently in regard to engineering environmental investments?**

- 11) **Based upon your experience at {case study}, is there anything else pertaining to formulation of alternative restoration strategies that you would like to comment upon?**

VI. MONETARY AND OTHER VALUATION TECHNIQUES

The purpose of this section is to examine how the value of the project was determined. In addition to the traditional monetary evaluations, we are looking for techniques that link ecological products to outputs of socioeconomic value and other uses of non-market evaluation techniques.

- 1) **What methods were used in determining the value of the benefits (ecological, monetary and others) of the project?
How effective were they?
Why?
Was a model selected?
Why?**

- 2) **What benefits were considered (e.g., monetary, ecological, aesthetic, recreation, non-use) in this project?
Were any outputs associated with environmental benefits?
How were they linked to output measures?**

- 3) **What benefits (or adverse effects) were described in non-monetary terms?
Why?
Were any benefits not included that should have been?**

- 4) **What individuals/groups were involved in determining the benefits of the project?
Was there anyone else who could have aided in this task?**

- 5) **How much time was spent in determining the benefits of this project?**

- 6) **How were the benefits for this project communicated to concerned locals?
Was it understood?**

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- 7) **What guidance (provided by the Corps or others) was available to help you determine the benefits of this project?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**

- 8) **What information was helpful in completing this task?
What was missing?**

- 9) **What element of monetary valuation techniques needs the most research attention?**

- 10) **What element of non-monetary valuation techniques needs the most research attention?**

- 11) **If the study were done again, what would you do differently in regard to valuation techniques?**

- 12) **Based upon your experience with {case study}, is there anything pertaining to monetary/non-monetary valuation that you would like to comment upon?**

VII. COST EFFECTIVENESS/INCREMENTAL ANALYSIS TECHNIQUES

The purpose of this section is to examine what was done concerning cost effectiveness and incremental analysis, how it was done, and why. For example, what will it cost for a unit of output to implement alternative A versus alternative B? How much will it cost for increased output of B over A?

- 1) **Did you conduct cost effectiveness and/or incremental analysis?
Why?
(If YES, What categories of benefits/outputs were considered for cost effectiveness/incremental analysis?)**

 - 2) **Please briefly describe the elements of the cost effectiveness/incremental analysis you used for this project.
How effective were they?
Why?**

 - 3) **What Corps elements were involved in determining the cost effectiveness/incremental analysis of the project?
Was there anyone else who could have aided in this task?**

 - 4) **How much time was spent in determining the cost effectiveness/incremental analysis of this project?
Was it sufficient?**

 - 5) **How were the results of these analyses used?
Did they influence decision making, and perhaps result in a change in the alternatives, or help influence the alternative recommended?
How did you determine how much investment (both \$ and environmental output) to make?
Were they done to meet HQUSACE instruction?**

 - 6) **Were the results for this analysis communicated to concerned locals?**
-
-

Was it understood?

- 7) **Did you have good data for costs and outputs for all your alternatives?
Was it helpful?
Why or why not?**
- 8) **What guidance (provided by the Corps or others) was available to help you determine
cost effectiveness/incremental analysis?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**
- 9) **What element of determining cost effectiveness/incremental analysis needs the most
research attention?**
- 10) **If the study were done again, what would you do differently in regard to cost
effectiveness/incremental analysis?**
- 11) **Based upon your experience with {case study}, is there anything pertaining to cost
effectiveness/incremental analysis that you would like to comment upon?**

VIII. INCORPORATING RISK AND UNCERTAINTY INTO ENVIRONMENTAL EVALUATION

The purpose of this section is to determine whether and/or how environmental aspects of the assessment of project alternatives used risk and uncertainty methodology. There are three categories of questions:

- i. Was risk and/or uncertainty methods used at all?*
- ii. If not, was it considered for use, but rejected?*
- iii. If it was used, what project questions or issues were addressed with risk and uncertainty methodology?*

i. Determine whether risk and uncertainty methodology was used.

- 1) **Was an attempt made at any level of the environmental assessment process to quantify the uncertainties associated with project results, predictions, outcomes, or alternatives?**

- 2) **Was any attempt made to a) identify and b) quantify or otherwise assess the environmental consequences of full performance, partial performance, or non-performance of project alternatives?**

ii. If project did not utilize any form of risk or uncertainty analysis, ask the following:

- 3) **Was formal assessment of risks and uncertainties ever seriously considered as part of the environmental assessment process?**
 - a. **If NO, then why not? (Examples: Was not aware it existed, project guidance did not require it, previous studies have not used it.)**

 - b. **If YES, then why was it rejected? (Examples: Lack of available guidelines, inadequate procedural methodology, too costly, inadequate time, decided it would not be useful.)**

iii. If risk and uncertainty analysis was used in the environmental assessment process, then ask the following:

4) **Was risk and uncertainty analysis a comprehensive part of the assessment process or was it used only to address a limited set of issues?**

Describe where in the process it was used. (Examples: Design of engineering features, their reliability, and costs; the evaluation of objectives; the confidence of output valuation; the probability of output measures.)

What R/U issues arise in the evaluation of Corps environmental projects?

Which are most critical?

5) **What was the motivation for using risk and uncertainty methods? (Examples: Required by guidance, followed existing precedents, recommended by resource agencies, was judged best way to address issues.)**

6) **Who performed the risk and uncertainty analyses? (Examples: In-house, college or university, consulting firm, collaborative effort.)**

7) **(Secondary) Identify the environmental issue(s) that risk and/or uncertainty analyses were used to address.**

8) **Describe the type of risk and uncertainty analysis methodology used.**

9) **Identify the information inputs and outputs associated with these analyses: Was all needed information available?**

10) **Were risk and uncertainty analyses a worthwhile investment in this project? Why/Why not?**

How much time was spent performing risk and uncertainty analyses?

- 11) How was risk and uncertainty communicated to those involved?
Was the risk and uncertainty results accepted by the environmental assessment team,
by other agencies, and by the public?
If the results were not accepted, please explain why.**

- 12) What guidance (provided by the Corps, developed from general methodology,
borrowed from previous study), if any, was available to help you consider risk and
uncertainty?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?
(Specify any borrowed or developed methods.)**

- 13) If the study were done again, what would you do differently in regard to risk and
uncertainty?**

- 14) Did you attempt to predict the success of environmental restoration?
Using what method?
If enough time has passed, has the success of the environmental restoration been
assessed/monitored?**

- 15) What element of risk and uncertainty do you think needs the most research attention?**

- 16) Based upon your experience at {case study}, is there anything else pertaining to risk
and uncertainty that you would like to comment upon?**

**IX. PROCEDURES FOR DEVELOPING AND INTEGRATING ENVIRONMENTAL
DATABASES**

The purpose of this section is to examine database linkages used in the project, understand how these environmental data were employed in the analysis, and how these results were communicated.

- 1) Were any environmental databases used? (If yes, what are they?)
Why?
Were any specific databases developed for this project?
Would you like to comment on any specific strengths or weaknesses of these environmental databases that you experienced in your evaluation?**

- 2) (Supplementary) What methods were used in developing and integrating environmental databases for the project?
How effective were they?
Why?
Was a model selected?
Why?**

- 3) What individuals/groups were involved in developing and integrating environmental databases for the project?
Was there anyone else who could have aided in this task?**

- 4) How much time was spent in developing and integrating environmental databases for this project?**

- 5) What guidance (provided by the Corps or others) was available to help you develop/integrate environmental databases and analytical models?
How helpful was it? (1-Not very helpful to 5-Very Helpful) Why?**

- 6) What element of developing and integrating environmental databases do you think needs the most research attention?**

- 7) **If the study were done again, what would you do differently in regard to environmental databases?**

- 8) **Based on your experience at {case study}, is there anything else pertaining to environmental significance that you would like to comment upon?**

X. EVALUATION PROCESS

The purpose of this section is to examine how the plan was selected for implementation and how that information is communicated to others, especially those with differing views.

- 1) **What formed the basis for your evaluation of this project?**

- 2) **Were there any unique aspects of your evaluation process? (Such as trade-off analysis, communication, consensus building, alternative dispute resolution, how the final plan was selected)
Was a model used?
Why?**

- 3) **Were there any decision support methodologies or models used? (e.g., STELLA, MATS, etc.)
Which ones?
Why?**

- 4) **What individuals/groups were involved in your evaluation process for this project?
Was there anyone else who could have aided in this task?**

- 5) **How were results communicated?
Did communication differ between Federal and non-Federal interests?
Why?
Was it understood?
Could there be any other graphic representations?**

- 6) **What guidance (provided by the Corps or others) was available to help you complete this task?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**

- 7) **What element of the evaluation process do you think needs the most research attention?**

- 8) **If the study were done again, what would you do differently in regard to the evaluation process?**

- 9) **Based upon you experience at {case study}, is there anything else pertaining to the evaluation process that you would like to comment upon?**

XI. INTERAGENCY COORDINATION AND PROGRAM MANAGEMENT

The purpose of this section is examine how interaction with other groups and agencies affected the development of the project.

- 1) **What factors influenced the coordination for this project?**

- 2) **What was done to coordinate the development of this project (e.g., safeguards, quality control)?
How effective was it?
Why?**

- 3) **Was a special interagency task force formed for this effort?
Who was on it?
How important was their input?
Did this effect the communication of information for this project?
If so, how?**

- 4) **(Secondary) How was the sponsor identified?
Did they come to the Corps, or another agency?
Did the Corps market itself?**

- 5) **What guidance (provided by the Corps or others) was available to help you complete this task?
How helpful was it? (1-Not at all to 5-Very Helpful) Why?**

- 6) **Were there any "lessons learned" from trying to develop the program coordination?**

XII. CONCLUDING REMARKS

This concludes our questions for this interview. Recognizing that this research program is aimed at developing tools for the field to aid in environmental mitigation and restoration decisions, is there anything else you would like to offer for consideration that would guide our efforts?

After we complete the evaluation of this interview, you will be sent a copy for review. Please examine it to make sure the information found in it conveys your information as you see it. Thank you for your assistance in completing this project.

(Be sure to get the address of the Project Manager!)

APPENDIX C

**CASE STUDY
WRITE-UPS**

PREFACE

This appendix contains the case study summaries. They are organized as follows:

Fern Ridge Lake Waterfowl Impoundment	C-1
Galilee Salt Marsh Restoration, Rhode Island	C-15
Homme Lake Habitat Improvement Project	C-29
Jackson Hole, Wyoming Flood Damage Reduction and Fish and Wildlife Habitat Restoration Project	C-41
Kissimmee River Restoration, Florida	C-57
La Branche Wetlands Marsh Creation	C-75
Mayfield Creek, Kentucky Project	C-87
McFaddin Ranch Wetlands Project, Texas	C-101
Pool 8 Island Restoration	C-115
Yolo Basin Wetlands Project	C-132

FERN RIDGE LAKE WATERFOWL IMPOUNDMENT

PROJECT DESCRIPTION

The Fern Ridge Lake Waterfowl Impoundment Project was a collaborative effort between the Corps, the Oregon Department of Fish and Wildlife (ODFW), and the Bureau of Land Management (BLM), all of whom played primary roles in the planning of this Section 1135 project. The project was built under the direction of the Fern Ridge Lake Master Plan. The Master Plan, developed by the Corps with assistance from ODFW, contributed a significant amount of information to aid in the completion of the feasibility study. Additional information was provided by the U.S. Fish and Wildlife Service (USFWS), the Nature Conservancy, and various university students conducting studies in the project area. Ducks Unlimited (DU) contributed funds to assist with non-Federal cost sharing.

The project is located 6 miles west of Eugene, Oregon. Although Fern Ridge Lake is located in the Pacific Flyway, there was not enough habitat to attract waterfowl for wintering and hatching purposes. This project was designed to provide some of that needed habitat. The feasibility study began in January 1991 and took 18 months to complete. It was important that project construction began before July 1993 because the local sponsor could not guarantee that it would be able to cost share in the 1993-94 fiscal budget.

One unusual aspect revealed during this study was the Corps contracting with the BLM for project construction. BLM had experience implementing environmental projects for the U.S. Forest Service and provided helpful design enhancements. Design enhancement information was also provided by Fern Ridge Lake personnel and Geotechnical Engineers, Portland District. The sum result of these design changes was a reduction in construction costs by \$220,124) nearly half of the total cost of the project. Total construction time for the project was six weeks, during which the BLM constructed approximately 8,000 linear feet of impoundments for the project area.

Presented in the remainder of this case study summary are findings and discussions relevant to those findings. The summary addresses each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program. Respondent recommendations were not made for every topic area. It is important to restate that this project has been implemented, and that the constructing group, BLM, was interviewed as part of evaluating the approved project.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The basis for environmental significance of the project was the loss of habitat acreage for waterfowl due to agricultural and urban/industrial development throughout the Willamette Valley of Oregon. The area is recognized by North American Waterfowl Management Plan (NAWMP), USFWS, and ODFW as one that will contribute significantly to the recovery efforts for waterfowl habitat.

Discussion

The Corps, ODFW, and USFWS all contributed to determining the environmental significance. Until 1971, the southern area of the Willamette Valley, which is located in the Pacific Flyway, supported 30 percent of the region's waterfowl population. Since that time, it has declined to 8 percent, which was attributed to habitat losses resulting from increases in agricultural, urban, and industrial development. Participating agencies viewed the area as contributing to the overall goals of the NAWMP, the National Marine Fisheries Program, the Strategic Plan for Migratory Birds in the Columbia River Drainage (by USFWS), and the Fern Ridge Lake Master Plan. The Master Plan was scrutinized publicly when it was developed in 1988, and it received no opposition. Any future developments for the lake are to be consistent with this plan.

Several respondents said that the determination of environmental significance should not be a difficult task for a biologist, and that a local biologist familiar with a study area should have the background knowledge to make this determination. The District biologist indicated that the guidance available for this project was adequate but it could be a cause of delays in future projects.

Respondent Recommendations

The District said there needs to be a closer examination of how environmental significance affects the selection of projects because it can differ from region to region. The District would like to know if there are criteria for prioritizing significant environmental resources in the selection process, and how much influence local significance has on project selection. Does it have to be equal to regional or national significance? For example, although mallard ducks may have stable populations elsewhere in the United States, populations in a specifically proposed project area may be deemed deficient.

Determining Objectives and Measuring Outputs

Findings

The objectives of the project were to increase the quantity and quality of wintering waterfowl habitat and waterfowl use days (WUD), to lessen the potential for disease transmittal and increase the private sector development and/or retention of wetlands, and to provide for a more equitable distribution of waterfowl in the Willamette Valley. The output measure selected was providing 200,000 WUD in the project area.

Discussion

This District took a field trip to the project area to determine what objectives and outputs could be met based on the guidelines of the Fern Ridge Lake Master Plan. WUDs were determined to be an appropriate quantifiable output because there was significant historic data for use in the calculations. WUDs refer to the sum of the number of days used by various species of waterfowl annually. In addition to goals from the Master Plan, the NAWMP, the Strategic Plan for Migratory Birds in the Columbia River Drainage, Objectives for Managing the Willamette Valley National Wildlife Refuges (by USFWS), and the Willamette Valley Waterfowl Status Report (by ODFW) provided further measurable objectives. These plans indicated that the lower end of the Willamette Valley should be able to support 250,000 puddle ducks and between 40,000-75,000 Canada geese in midwinter. The project allowed for a more equitable population distribution which will reduce the effects of disease associated with large numbers of waterfowl grouped into a small area.

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The District felt Corps guidance for this project indicated only that outputs should be measurable, not that they indicate what measurements were appropriate or acceptable. Concern was expressed that, for a project of this size, there were too many requirements for the project outputs. The amount of information requested was likened to "killing a flea with a tank," meaning that too many resources are expended for such a small a project. ODFW conducted waterfowl counts as part of the project and said quantification of outputs is necessary because the documentation helps to justify future projects.

ODFW was designated as the agency to monitor WUDs for the project. Although a cycle of monitoring was not completed, early data collection efforts indicated that implementing the project is providing anticipated results that will contribute to achieving its goals.

Respondent Recommendations

The District suggested that research be conducted to determine appropriate instruments for generating objective outputs. The District pointed out that although an experienced biologist can develop the needed information based on models like the Habitat Evaluation Procedure, there is a subjective factor in completing them. ODFW recommended the use of energy or kilocalories as a means of measuring project outputs.

Objective Evaluation of Cultural Resources

Findings

Cultural resources did not impact this project.

Discussion

A Corps archeologist conducted a standard cultural resources investigation and found no significant cultural resource sites in the project area. The Oregon State Historic Preservation Officer concurred with the findings of the Corps.

Engineering Environmental Investments

Findings

*The engineering of this project was guided by the Fern Ridge Lake Master Plan. The project design in the Master Plan was altered to avoid impacting *Lomatium bradshawii*, an endangered plant. Contracting with the BLM for the construction of this project led to improvements in the project design and a reduction of cost.*

Discussion

The alternative for this project was formulated as part of the Master Plan and resulted in a change in the original design due to the presence of *Lomatium bradshawii*. Additional design concerns were the impacts on wet prairie communities, the incremental water control structures, the ability to recycle water, the types of intake structures, and the constraints of the local sponsor in operating and maintaining the project. BLM recommended the elimination of a temporary dam during the construction phase. The dam was replaced with fill used as an earthen levee, allowing the installation of water control structure at a reduced cost. The water control structure was built on adjacent land, in the dry, which expedited construction time and provided for more sound structure. The "fill" levee was used to cover the water control structure and added to the creation of other impoundments for the project. BLM said most contractors would not have recommended this change because they are trying to make a profit and indicated that having the Corps provide equipment and supplies avoided an 18 percent administration fee assessed as part of construction costs. BLM commented that some of the Corps equipment was prone to breaking down and was in need of maintenance.

There was good cooperation between the Corps and the ODFW in developing the project design. ODFW felt the Corps biologist played a significant role in successfully developing the approved alternative and expressed pleasure in having their concerns regarding project design met by the Corps. They saw it as a nice marriage with Corps expertise. BLM said that Corps personnel were professional experts but were not consistently available at the construction site, which did not significantly affect the construction of the project but may have had a greater impact on a larger project.

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The District said the engineering guidance received from the review of the feasibility study was adequate. It was felt that a limited number of alternatives exist to meet the goal of an environmental project as opposed to projects for flood control. Several individuals felt that having someone with significant field experience who is able to adopt design to field experience and is involved in designing project alternatives is more important than having someone who relies on booklearning. The agricultural background of biologists and engineers associated with the project was considered a major plus. These personnel were results orientated-problem solving vs a typical philosophy of "lets study the problem."

Respondent Recommendations

The District indicated it would like guidance on acceptable tradeoffs for local cost sharing of projects as well as information regarding other alternatives that could be used to meet restoration objectives other than construction variations.

Monetary/Nonmonetary Valuations

Findings

The primary benefit of this project was an increase of 200,000 WUDs. Additional wildlife benefits were described qualitatively within the feasibility report. Monetary benefits were determined based on hunter and nonconsumptive user days but were considered to be secondary to the nonmonetary benefits.

Discussion

The District said there was difficulty in determining an appropriate value to represent the benefits of the project. The first guidance the District received recommended the use of a monetary value which was displayed in the form of waterfowl hunter user days (at \$15.41 per day) and nonconsumptive user days (at \$17.75 per day). These values were determined based on the 1985 National Survey of Fishing, Hunting, and Wildlife Associated Recreation by USFWS and the U.S.

Department of Commerce. The combined monetary benefits were determined to be between \$26,625 and \$53,250 for a potential overall increase of 1,595 to 3,286 user days. The benefit-to-cost ratio was determined to be 1.30-2.68 to 1.

Review comments of the feasibility study directed the District to place more emphasis on the nonmonetary benefits of the project. The projected increase of 200,000 WUDs was the principal nonmonetary benefit. Additional qualitative remarks addressed the increase of the waterfowl population, a reduction of its mortality rate, the benefits for endangered species, and benefits for nongame species that will utilize the moist soil unit. The District indicated that reduction of problem grasses in the project area was an additional benefit not assessed in the feasibility study.

The nonmonetary benefits of the project were determined partly from the goals of the Fern Ridge Lake Master Plan. The ODFW documented levels of use in the project area based on the number of permits issued. The Corps utilized people counters in some areas, but not everyone using the area can be counted) people who do not park in a parking lot, for example.

The District indicated that one of its greatest challenges was determining a benefit that was acceptable at all levels of the review process. As information travelled through the Corps hierarchy for project approval, what was acceptable appeared to differ from reviewer to reviewer. Also, the District felt that no monetary value existed that appropriately conveyed the benefits of this project. Recreation benefits related to hunting and nonconsumptive use were viewed as proxies for benefits to be derived from environmental outputs. The monetary benefits helped get the project approved even though they were considered to be secondary in the feasibility report. Respondents said it would be difficult to compare a flood control project to an environmental project based on monetary benefits. The District also felt the use of Contingent Valuation Method did not seem to capture the essence of the benefits being described. An individual's willingness to pay is based on income. The biological benefits and value of the project may be considered secondary to a dollar amount that only indicates what an individual can afford, not what the benefits may be worth.

Respondent Recommendations

The District indicated that there is a need to develop appropriate monetary value benefits for environmental projects. They would like to have a compendium of values to determine benefits from the various agencies throughout the nation which should be organized on a region-by-region basis. It was said that some benefits can be determined as they relate to the NAWMP goals, which could

give additional justification for the project. Research is needed to determine what goals would serve as appropriate descriptions of benefits for environmental projects.

ODFW indicated that quantification of winter waterfowl populations is a difficult task and recommended measuring kilocalorie use as a benefit. This could be used as a reflection of management goals.

Cost Effectiveness/Incremental Analysis

Findings

Incremental analysis was conducted for this project as recommended in the review process.

Discussion

Incremental analysis for this project was conducted in response to comments made during the review process. It was not used to select the appropriate alternative, but it was useful for justifying the project. The incremental analysis was based on WUDs provided per impoundment. Because each additional impoundment is dependent on the one built before it, the cost per WUD decreased as more impoundments were built.

The District felt it had solid data for computing incremental analysis in the feasibility study and viewed WUDs as important in determining the project's cost effectiveness. The District team said its biologist was instrumental in defining the outputs used in the analysis. Team members indicated there was difficulty determining appropriate increments for conducting the analysis. ODFW was involved in reviewing the analysis and found it satisfactory.

The District expressed concern regarding the numbers generated in incremental analyses, particularly that they may not adequately convey what a project can provide. This District also was apprehensive that decisions will be based primarily on incremental costs and that the overall value indicated in nonmonetary terms will not be recognized.

Respondent Recommendations

The District would like to see research on determining appropriate increments for analysis. It was felt that there were many options to select and, although a successful analysis was completed, there was apprehension of the chosen increments.

Incorporating Risk and Uncertainty

Findings

Risk analysis was not performed for this project.

Discussion

Risk and uncertainty were not examined in this study because the District was not required to conduct such an examination.

Developing and Integrating Environmental Databases

Findings

The District used waterfowl count data collected by ODFW.

Discussion

The District indicated some historic information was used, but formal databases were not accessed. Data used from waterfowl counts were taken by ODFW, who said that some of the

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information pertaining to botanical information came from local university student studies and The Nature Conservancy.

ODFW said it was monitoring the plant community, reptiles, amphibians, shorebird surveys, recreational use, wintering waterfowl, and bald eagles. Additional information could be obtained from a WUD time series database. The Corps supports ODFW in monitoring the lake stage gauging stations. Although ODFW information was not used in the feasibility study, it will be helpful in completing future environmental projects for Fern Ridge Lake. BLM indicated it has biologists who conduct species surveys for some of their projects.

The District felt it had enough data to complete the analysis for this feasibility study. Needs for data must be evaluated on a project-by-project basis, depending on the size, complexity, and research/planning funds available.

Respondent Recommendations

ODFW noted it would appreciate more access to Corps data pertaining to hydrology, habitat monitoring, and lake levels for the project area.

Evaluation Process

Findings

The selected alternative met the goals designated in the Fern Ridge Lake Master Plan.

Discussion

The alternative constructed for this project was created from the Fern Ridge Lake Master Plan. The original seven impoundment design was changed to avoid impacting an endangered plant species. It was determined that building four impoundments would be more cost effective than building six or seven.

Interagency Coordination and Program Management

Findings

The successful completion of the project was a result of strong ties between the biology personnel of the involved agencies, the existence of the Fern Ridge Lake Master Plan, a strong District team, and access to the reviewer of this project by the District.

Discussion

All agencies interviewed indicated they cooperated well with each other throughout project planning and construction. Some of this cooperation was the result of strong working relationships that existed among each agency's biologists well before the beginning of this project. Inclusion of the biologists, especially those in the field, reduced the time normally spent on interagency approval. ODFW was especially pleased its suggestions were incorporated into the project plan by the Corps. The District felt the key in working with the other agencies was an open exchange of information which does not guarantee success every time but assures that more is gained than lost. BLM said the cooperation in this project was high but members of the Corps were frequently unavailable during construction of the project.

The Fern Ridge Lake Master Plan provided some efficiencies in time and resources since it provided a tentative design and purpose for the project area. Because the proposed project was aligned with the Master Plan, the only major planning tasks to be completed were the new "Finding Of No Significant Impact" document and an updated biological assessment from USFWS. This reduction of steps in the feasibility study help reduce costs.

The District said its team worked well together. When the District first became involved in environmental projects, the initial team experienced difficulty in completing tasks because of personality conflicts and poor management skills. The current team was hand-picked and appeared to be working well, according to its members. They recognized that a successful team does not form in a short time, and that each member must develop a clear understanding of his or her role and level of involvement for each project.

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The District had limited time to gain approval for this project because the local sponsor could not guarantee that the allocated state money for cost sharing would be available after June 1993. Even though DU was able to contribute some of the funding through ODFW, it was not enough to meet the cost-sharing needs. The District was able to meet directly with a member of the Washington Level Review Committee to get immediate guidance on approval requirements, and indicated that the guidance at the time of this project was general enough to gain approval. The District also said the existing guidance for Section 1135 projects is adequate, but guidance for larger projects outside 1135 authorization is much more difficult to follow. It felt the existing policy was inadequate for proposing or implementing an environmental project under General Investigations authorizations.

Even though the project was completed, the District felt the approval process was too long. There were times when the District felt it was struggling with Headquarters to get review information. The District's assessment of the comments from Headquarters was that Headquarters does not understand the basis of environmental projects. Reviewer comments did not provide further guidance on the biological aspects of the project.

Respondent Recommendations

ODFW indicated the Corps does not maintain environmental projects but recommended more Corps involvement by committing personnel to monitor some of the biological aspects of a project or to provide financial support to the agencies that are required to do so.

The District said it would like to have more autonomy in making decisions for Section 1135 projects because of its knowledge of the area biology. A more efficient review process was advocated.

SUMMARY OF THEMES

The Master Plan which was completed in 1988 as a joint effort between the Corps and ODFW, made the largest contribution toward completion of the Fern Ridge Lake Waterfowl Impoundment. It provided an initial development plan for the Fern Ridge Lake area. In this project, little additional investigation was required because it had already been done. By having a pre-selected design, the study group spent more time on improving it rather than identifying alternatives.

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This case study showed a remarkable amount of cooperation between all of the involved agencies. It is important to note this cooperation was strongly influenced by the personal relationships that existed between the biology personnel for each agency. These groups were able to work together and complete the study on time.

The District indicated the presence of a Washington level reviewer was important in getting the feasibility report approved and into the construction phase. On-site review provides timely comments without delays.

The District expressed concern about the amount of information required for the completion of this Section 1135 feasibility study. Even though the Master Plan saved time, excessive work was needed to complete the study. There should be clear and efficient guidance to optimize the amount of information required for Section 1135 projects.

BLM has experience in constructing impoundments similar to the one in this project. Because they are not profit oriented, they should be considered for use in the future.

GALILEE SALT MARSH RESTORATION, RHODE ISLAND

PROJECT DESCRIPTION

Originally, the project area was a salt marsh. It changed to a combination of freshwater, brackish, and salt marsh because an emergency evacuation road was constructed across its opening and dredged material eroded into the channel from a disposal area, preventing the tides from bringing saltwater into the marsh. This caused the decline of most saltwater dependent plant and animal species. This project was designed to restore tidal flows into the marsh and associated needed salinity levels to restore the estuarine-salt marsh community. This restoration was designed so that increases in flooding potential for the project area would not occur.

The agencies involved with planning the Galilee Salt Marsh Restoration were the New England Division Corps of Engineers, the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), the Rhode Island Department of Environmental Management, Division of Fish, Wildlife, and Estuarine Resources (RIDEM), Rhode Island Department of Transportation (RIDOT), the University of Rhode Island (URI), the Town of Narragansett and Ducks Unlimited. All of the agencies except for RIDOT, the Town of Narragansett, Ducks Unlimited, and URI were interviewed. The study was conducted under Section 1135 of the Water Resources Development Act of 1986; the projected cost was \$2.5 million. At the time the case studies were conducted, the feasibility report was in Washington for approval.

Several unique funding components were illustrated during project formulation of the Galilee Salt Marsh Restoration effort in Rhode Island. The project area has been identified as a restoration site for the Atlantic Coast Joint Venture of the North American Waterfowl Management Plan (NAWMP). Funding was originally sought through Coastal America, which is a joint venture among seven federal agencies directed at restoring coastal resources. In this case, estuarine habitat will be restored in the northeast region. The project construction was to be provided by Coastal America because the project was identified as a priority by the Coastal America Regional Implementation Team and three federal agencies were involved in the project development. Unfortunately, Coastal America was not funded by Congress. Section 1135 authorization was found to be applicable, however, because modification of the existing Corps dredged material disposal could contribute to restoration of the marsh.

Another funding mechanism used was incorporating mitigation effort for a highway project constructed by RIDOT. RIDOT requested involvement in the project to meet mitigation banking

requirements related to wetlands that were altered in a bridge construction project. Additionally, Ducks Unlimited contributed funding to the local sponsor as part of this effort. The local sponsor is cost sharing 25% of the project and USFWS may provide some additional funding.

In the remainder of this summary paper, findings, discussion relevant to the findings, and lists of respondent recommendations for improvement are presented. The summary is organized to address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The environmental significance of the project area was the ecological significance of salt marsh embedded in both the Coastal America Plan and NAWMP. The local public views the environmental attributes of the project as significant for ecological, aesthetic, educational, and recreational reasons.

Discussion

Significance was identified by the Division in relation to laws that protect wetlands and saltwater marshes and the ecological value of estuarine habitat. Rhode Island has few opportunities for this type of restoration, which was viewed as environmentally significant to both Coastal America and NAWMP restoration efforts.

Interview respondents indicated that the Corps did an acceptable job of describing the environmental significance of the project. The educational and recreational benefits related to environmental improvements provided by the sanctuary were especially important. Waterfowl and other migratory birds will have a resting area, which the public will be able to view in an aesthetically pleasing environment. The USFWS respondent said there will be many benefits for the black duck,

in addition to many other animal species after the project is completed. One respondent noted that this type of coastal wetland is an endangered and declining resource in its own right.

Determining Objectives and Measuring Outputs

Findings

The objective of the project was to restore estuarine habitat without impacting flooding potential. The primary output measure was restored acres.

Discussion

Division respondents felt the project objectives were straightforward. Originally, the Corps was only required to restore ten acres, but additional data were acquired that indicated the dredged material could have degraded as much as seventy acres.

Tidal flows will be monitored to determine if they are sufficient to bring saltwater into the marsh. Division respondents indicated that, although increases in estuarine aquatic productivity will result from the project, quantifying projected outputs as a result of the project would be difficult.

Presently, the study area is thick with vegetation but not diverse enough according to RIDEM respondents. It is believed that saltwater plant species will return as a result of restoration efforts, but will take between five to ten years. RIDEM was pleased that URI will be involved with some long-term monitoring and hoped it would continue so data could be used in later projects.

Guidance for determining objectives and measuring outputs was open to many options. Acreage was specifically identified and used in the feasibility report.

Respondent Recommendations

Division respondents indicated they would support research to develop improved techniques for predicting habitat changes. The USFWS suggested that more quantification of the impacts of birds species of proposed restoration projects be carried out. RIDEM would have liked more information on water levels and how it would affect the use of the gated culverts.

Objective Evaluation of Cultural Resources

Findings

Cultural resources had no effect on planning this project.

Discussion

The Division said there were no problems planning this project relative to cultural resources. The Corps archeologist indicated no presence of cultural resources in the project area, and the Rhode Island State Historic Preservation officer concurred.

All other respondents said there were no problems with regard to cultural resources and that the Corps handled the examination adequately. Cultural resources receive significant protection under the law and if challenged, rulings most often are in favor of protecting the resources.

Engineering Environmental Investments

Findings

The alternative proposed for implementation was the installation of automatic tide gates-culverts and the dredging of the channel in the marsh to allow for saltwater flow.

Discussion

The Division said the original size of the project changed. The Corps initially intended to restore ten acres of filled salt marsh. Further research and data from aerial photography indicated that approximately seventy acres could have been affected by an unconfined disposal site. The increase in acres necessitated a new approach in engineering the project. The predominant design concern was the potential for flooding and how to avoid it.

WES was consulted about developing a two-dimensional model for the area, but it was not completed in time for evaluation of the project. WES had originally intended on providing two-dimensional hydrological modeling for the project areas as part of their research program, but the efforts failed since time and funding were limited. Non-Corps participants in the study area were not pleased with this outcome, and hoped WES would still become involved in the project because it could provide information to give the feasibility study more scientific credibility. Nevertheless, the hydrology was examined by the Division using less sophisticated hydrology-hydraulics modeling procedures.

The approach to this project differs from traditional Corps projects in that water is to be brought into the marsh instead of kept out. Concerns for mosquito abatement due to increased areas of tidal marsh were considered.

A number of alternatives were considered. One alternative was a pump station to bring saltwater into the marsh. This was rejected because of high electricity and maintenance costs.

The interagency work group developed biological goals for culvert openings in the road to allow saltwater flow from the tide. It was recognized that the cost of multiple culverts would be high. The key to project success is maximizing tidal flows into the area. The RIDEM respondent shared that similar culverts were being successfully used at a Connecticut site that suggested the present proposal for the Galilee project could be adjusted to utilize smaller culverts. Exact sizing will occur after more detailed surveys are performed and ditching schemes are determined.

Respondent Recommendations

All respondents would like to see additional hydrological modeling for this and other similar projects to better understand the dynamics of the system being examined. Non-Corps respondents

expressed the importance of on-site Corps construction supervisors during construction with regards to biological concerns. Preventing error during construction even if it is dredging only an inch too deep or too shallow is very important to the success of a project.

Monetary and Other Valuation Techniques

Findings

Monetary values were not assessed for this project, although as a general finding, some non-Corps respondents would have liked monetary benefits included, envisioning this would satisfy Washington reviewers. Nonmonetary values were described within the Environmental Assessment (EA) for the feasibility study.

Discussion

Monetary values were not required for this project, relieving planners from justifying monetary benefits and draining study resources. However, some recreation benefits that could be quantified will be realized from the project. Examination of nonmonetary benefits provided useful qualitative information and data for comparing alternatives, but it was viewed as inappropriate to attribute dollar values to them. Actual dollars contributed by an individual or group were perceived as more appropriate justification than amounts hypothetically given as generated using contingent valuation. Although the cost per acre may be higher than some other projects, Division respondents felt this project will provide more than adequate benefits.

RIDEM respondents thought there was too much emphasis in the EA regarding gains, and there was not enough documentation of losses if the project was not implemented. Significant effort was used in preparing the EA, and Division personnel were satisfied with the results. RIDEM respondents felt the EA was quite acceptable.

The EPA respondent said the environmental project must adequately describe the benefits to be accepted by the public. Many people and agencies regard waterfowl as being in a favored position over other species. In spite of this favored status, people still become concerned that their property will be adversely impacted by this type of project. Economic benefits can be realized and

should be mentioned from environmental projects in the areas of education, hunting, water quality, fishing, and air quality. Aesthetics are difficult to describe, but they have a place in the benefit category.

As another benefit category, respondents agreed there will be long-term restoration benefits based on the increase of acres in the project.

Respondent Recommendations

Most recommendations for research on this topic suggested development of more reliable quantification tools for assessing project benefits. Another recommendation made for research was to list measureables that are justifiable to the Washington office. Some indicated that benefits vary from region to region and that a comparison among projects cannot be made at a national level. The USFWS respondent said a National Resources Damage Assessment is used for placing values on environmental features in cases of contamination (e.g., oil spills), and this could be a starting point for placing values on environmental projects.

Some non-Corps respondents emphasized a desire to assess the project with predominantly monetary benefits, perceiving it would provide better justification for the project. The use of existing contingent valuation methods was considered acceptable at this time, especially regarding recreation values.

More information regarding benefits should be obtained from public surveys. School systems realize educational benefits from environmental projects if they have access to those areas. If a project's value to a community were generated in addition to those of conservation organizations, it would be of great importance in feasibility studies.

The USFWS respondent recommended conducting research to determine regional values for environmental projects. The information could be compiled at a centralized location, such as WES, for use in future projects. Also, consideration should be given to the existence value of a project which is the value of just knowing that a resource is in place. Research should be conducted to determine which valuation measures are appropriate.

Cost-Effectiveness/Incremental Analysis

Findings

The incremental analysis for this project was conducted during the feasibility stage for the optimization of the design.

Discussion

Division respondents said incremental analysis was conducted to determine the optimal design of the recommended alternative. The grading requirements, culvert placement, and the number of culverts to be used were taken into account. The project economist, biologist, hydraulic engineer, and manager were involved in conducting the analysis. This combination of disciplines was viewed as an appropriate balance that led to better definition of the involved elements.

Division respondents perceived that an unwritten rule of thumb existed indicating a cost of more than \$100,000 per acre would be considered unacceptable without significant justification. They felt that implementation costs for low-acreage projects easily could exceed this financial limit.

Challenges existed in adapting incremental analysis to environmental projects. Division respondents indicated that slight changes in the guidance could be made for restoration projects as opposed to mitigation projects. The Division recognized the need for more information on how incremental analysis is conducted for other environmental projects.

Non-Corps respondents shared mixed comments about the results of this analysis. RIDEM said the results were confusing but impressive, and they acknowledged the analysis assists in determining the most effective way to use financial resources for the project. However, they felt that justification of financial resources was not required because all participants approved of the plan. RIDEM was cost sharing the project, and felt they functioned as another safeguard against improper spending of project funds.

A general comment, not with context to the Galilee study, made by some non-Corps respondents was that incremental analysis could be used as a way to reduce costs. This type of

analysis was seen as unnecessary and leading to a reduction in the amount of area to be restored, in turn reducing the success of the project. Several respondents were resistant to a detailed economically-based evaluation. Although numbers provide decision makers with quantitative information, the values attributed to environmental resources are disputed.

Respondent Recommendations

Division respondents would like to view more case studies on incremental analysis for environmental projects to learn about other approaches to this challenge, which they would use as standard guidance for ease of implementation, especially for Section 1135 projects. It was also suggested that a preliminary incremental analysis be conducted during the study process to refine alternatives and design, which will require that extra money be appropriated.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty were not formally assess for this project.

Discussion

The Division said risk and uncertainty were not quantified for this project and noted that this type of analysis is typically done informally throughout project planning. Consideration was given to the possibility of flooding, but minimal risk analysis was required. The Division said it may be useful to indicate uncertainty in these types of projects but it would drain existing resources that are already scarce. It did not seem cost-effective to conduct an analysis on this size of the project because the threat to people is not significant.

Other respondents recognized the value of such an analysis but felt the informal approach was the best course. Many respondents did not have great confidence in using a formal assessment of risk and uncertainty because of the dynamic nature of environmental projects and the lack of knowledge regarding biological responses. One respondent said that if WES was involved in developing the project, general uncertainty about the hydrological scheme and its effects on the proposed alternative would have been reduced. The Corps utilized computer models for hydrologic and hydraulic design. Some of the state participants were unfamiliar with this technology and viewed it suspiciously. They felt only a research organization was capable of this “magic” technology.

Developing and Integrating Environmental Databases

Findings

A Geographic Information System (GIS) was used as part of the examination of the area. URI was found to be a valuable source for data collection in this project.

Discussion

URI submitted a research proposal to RIDEM for conducting baseline studies in the project area. They conducted habitat mapping, in-field analysis, and avian studies. All respondents were pleased with the involvement of URI. Information regarding bird counts, vegetation, and salinity were important to the agencies involved in the study. Other useful sources of data were tidal data from the Coast Guard and elevation surveys provided by RIDOT. RIDEM indicated additional historical data were available from the 1940s recorded in a birdwatcher’s notebook.

A sixty-meter grid was used to collect baseline data for the project, and it continues to be supported through monitoring efforts. Although this level of data collected supports many of the project’s analytical needs, it does not meet all the monitoring needs for this project, such as hydrologic data and analysis.

Respondent Recommendations

Some respondents recommended a long-term monitoring plan of selected ecological and hydrological indicators to use for tracking after the project is implemented, as it will take several years for restoration to occur.

The non-Corps respondents said using local universities should be considered for gathering data because they would be more cost-effective for long-term monitoring. Also, local professors should have a good understanding of the local ecosystem, and their involvement could help reduce data inconsistency that can result from personnel turnover in other agencies.

A recommendation was made to centralize data collected for these projects, especially for the development of a GIS. WES was suggested as an appropriate site.

Evaluation Process

Findings

The selected alternative was chosen because of its cost-effectiveness and its ability to provide the needed tidal flow without increasing flooding potential in the project area.

Discussion

The agencies met to discuss the appropriateness of the recommended alternatives. Representatives understood the basic engineering for supplying saltwater to the area. The cost per gated culvert was an important part of their decision. A flow control gates culvert design was selected because it will close the opening to prevent flooding when water levels in the marsh reach a critical height.

Interagency Coordination and Program Management

Findings

Generally, respondents felt that the coordination for this project was adequate. However, there was strong sentiment expressed for more interaction among agencies.

Discussion

Project coordination was influenced by the involvement of Coastal America. Since it formed partnerships between the involved federal agencies, some lines of communication were already in place. RIDOT was looking to pay its “debt” by mitigation from a previously constructed bridge. RIDEM saw the involvement of RIDOT as a means of reducing the department’s costs of the project. The EPA expressed the only complaint indicating that it has been three years since bridge construction was completed and the mitigation should have been achieved by now.

A great deal of effort was put forth to reduce concerns about hydrological impacts of the project. Original expectations of non-Corps participants were high at the beginning given WES was involved. But when WES fell out, expectations were somewhat reduced although the final analysis was considered satisfactory. Several respondents indicated that the Corps did a satisfactory job of reducing the public’s fear of flooding.

Respondents agreed that coordination efforts by the Corps were timely and continuous, but that there is always room for improvement. Because some regulatory agencies were not involved at the beginning of the study process for whatever reasons, a need was expressed to make it convenient for regulatory agency personnel to attend these meetings. Enhancing coordination was seen as helpful to increasing the efficiency of the study process. Frustration was expressed by several respondents at the amount of time required for reports to be reviewed in Washington, and at the overall length of the process.

Respondent Recommendations

Recommendations were made to include all regulatory agencies at the start of the study process and to keep them involved to its conclusion. It was noted that most of the participating agencies have contact personnel for coordination purposes. One respondent recommended that agency interaction, project goals, purposes, and justification be better documented.

SUMMARY OF THEMES

The primary theme of this case study is project coordination. The consensus was that overall coordination was adequate. Involvement from all agencies at the beginning of the project should be a high priority.

Many respondents requested more data for most of the interview topics. URI played a significant role in data collection for this project and will continue to monitor it after construction has been completed. Consideration should be given to involving colleges and universities in data collection for environmental projects, and criteria should be established to determine their capability to conduct ecosystem research in the project area.

It appeared there was some confusion among respondents as to how much quantification should be used in environmental projects. In general, the attitude toward quantifying benefits was favorable, even in monetary form, if possible, and there was resistance to extended usage of incremental analysis techniques. A better balance should be developed between quantitative and qualitative evaluation, and a better definition of the role of incremental analysis in project analysis and review should be provided for future projects.

The project was a straightforward restoration effort. Coastal America's involvement gave the project more visibility, which got it moving.

HOMME LAKE HABITAT IMPROVEMENT PROJECT

PROJECT DESCRIPTION

The Homme Lake Habitat Improvement Project, located in eastern North Dakota, was one of the first projects planned under Section 1135 guidelines. The project was designed to increase brooding, nesting, and feeding habitat for waterfowl. The improvement goals contributed to the advancement of the Prairie Pothole Joint Venture (PPJV) as part of the North American Waterfowl Management Plan (NAWMP). All applicable laws and regulations that pertain to environmental projects were fully met. The Corps worked with the North Dakota Department of Game and Fish (NDGF), the U.S. Fish and Wildlife Service (USFWS), and Ducks Unlimited (DU) to complete the planning of this project.

In 1989, the St. Paul District approached a nearby town as a potential local sponsor for the project. The town was interested in expanding the capacity of Homme Reservoir, but they could not afford to participate in cost sharing. The District then approached NDGF in as a possible local sponsor. NDGF expressed their interest in participating in an improvement project for the area. In 1990, representatives from the Corps and NDGF met at the project site to determine possible alternatives. The planning process took approximately one year to complete, with the feasibility study being submitted for approval on July 1991. The project was approved for construction in the summer of 1992. Construction was preferred in the winter when site accessibility would be maximized and waterfowl disturbance would be minimized. After some start-up difficulties with the contractor, construction was completed in the spring of 1994.

The area that was chosen for improvement had a two problems to address. The first was a high level of siltation in the backwaters, which had increased cattail growth and reduced the amount of habitat that could be used by waterfowl. The second was the inability to maintain water levels in an oxbow that could provide additional waterfowl habitat. It was decided that the overabundant cattail stands would be reduced by strategic removal in designated areas. Four potholes were to be created to provide more brooding area, and seven nesting culverts were placed in the appropriate cattail areas. Water retention in the oxbow was achieved through the use of a gated culvert.

The remainder of this summary paper presents findings, provides discussion relevant to the findings, and lists respondent recommendations for improvement. The summary is organized to

address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program. Respondent recommendations were not made for every area.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The environmental significance of the area was based on its location in the PPJV region as associated with the NAWMP.

Discussion

The project area is located in the PPJV region, which is part of the NAWMP. The lake is viewed as an "environmental jewel" in the middle of agricultural development. The drainage area above the reservoir is approximately 300 square miles in area, and of that, 88% is used for agriculture and 7% for pasture and livestock. Several respondents indicated that determining the environmental significance for an area is a judgement that can be made by field biologists.

NDGF contributed one percent of their operating budget to this project. All respondents said that the willingness of an agency to cost-share on a project should indicate that agency's view of an area's environmental significance.

Determining Objectives and Measuring Outputs

Findings

The objective of the project was to increase waterfowl production. This objective was to be met through maintaining water levels in the oxbow, and increases in breeding and nesting habitat.

Discussion

The objectives for the area were to increase waterfowl production through maintenance of water levels in the oxbow, and increasing waterfowl breeding and nesting habitat. There were no specific goals for fisheries, but it was expressed that as part of achieving the goal for waterfowl, fisheries would not be impacted.

There were not any quantified outputs for this project. One respondent said that it would have been difficult to determine quantified outputs for the amount of waterfowl that would use the area. Basic numbers from a vegetation survey were used to determine the amount of acres to be enhanced. Many of the project outputs were described in qualitative terms. Several respondents indicated that the approach for this project was "If you build it, they will come." Early informal surveys of the project area indicate that there is a 200% increase in use by waterfowl.

Respondent Recommendations

All respondents indicated that there is a need for developing a system-wide model, something that goes beyond measuring a single-species. This would provide a better picture of the outputs of a project, such as if there will be enough food to sustain an increased population of waterfowl.

Objective Evaluation of Cultural Resources

Findings

The evaluation of cultural resources did not make an impact on the planning of the project. The Corps followed the steps provided for in Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G).

Discussion

The Homme Lake project was not affected by the evaluation of cultural resources. The evaluation was based on information from past surveys that were conducted in the area. The District was in charge of the mandatory coordination issues.

Respondents from the Corps said that although most projects are not impacted by cultural resource examinations, it is treated very seriously because of the potential problems that can develop from a discovery. A project design can change drastically if a historic site is discovered that must be avoided.

Engineering Environmental Investments

Findings

The project design was developed through a joint effort between the District and NDGF. Effects of predation strongly influenced the final design. Culverts were used to provided needed nesting habitat for waterfowl.

Discussion

The design of alternatives for this project started out as an informal brainstorming session at the project site. The District and NDGF proposed a variety of ideas, including potential channel configurations and island formations. Factors that were considered in this process were the existing water depth, the desired water depth, effects of predation, types of nesting structures, island heights and shapes, and methods of maintaining water in the oxbow. DU contributed information for possible island designs.

The lead biologist for NDGF brought some innovative design ideas using culverts for nesting habitat. Most man made designs require a significant amount of maintenance, but the existing design acts like a planter in which grasses can grow. It was expressed that although NEPA guidelines indicate that all reasonable alternatives must be listed, the appropriate choice for meeting the objectives of this project should be simple to determine because of its size.

There was concern with regard to meeting objectives based on output limits related to amounts of brood and feeding habitat. You don't want to design a project that will accommodate 50 ducks for brood habitat, but only has enough feeding habitat to support ten. There were some alterations to the projects design, but the majority of it was intact after review. A small dam for wood ducks was eliminated from the original design because it restricted fish movement. A zig-zag pattern for the removal of cattails was eliminated due to potential negative impacts on mink habitat and an increased predation rate.

There was a problem getting construction started for the project. The only time that the project could be practically constructed was during the winter months because the water levels were low and there would not be a disturbance of waterfowl in the area. Nothing was accomplished during the first winter, so the District asserted, in the opinion of NDGF, an appropriate amount of control over the situation to get the project underway. NDGF was pleased that the Corps was working patiently with the local contractor. This was seen as a means for developing support for future environmental projects.

The Division voiced concern regarding the amount of money a cost sharing partner should provide. The contribution of the local sponsor for this project, although small, was one percent of their operating budget. After securing an initial financial commitment, they felt there should be a limit as to how much money the local sponsor should contribute if costs go far beyond their initial projection.

Monetary/Non-monetary Valuations

Findings

Monetary values were not examined for this project. Benefits were measured through increases in habitat units and waterfowl use.

Discussion

An Habitat Suitability Index for wood ducks was developed in response to a review request for a Habitat Evaluation Procedure (HEP) analysis. Wood ducks were selected because the existing habitat was forested riverain. The District felt that the model used was too complex. They indicated that there is a draft model for blue-wing teal that is simpler to use, yet conveys the needed information. One respondent said that most state agencies are not comfortable using HEP for project justification.

Respondents expressed doubt toward placing a monetary benefit on all aspects of a project. This viewpoint extends from the belief that some benefits of environmental projects are not adequately described by a dollar value. NDGF said that their contribution to the project was well worth the returns they are starting to get in the form of increased waterfowl use. Several respondents indicated that if the local sponsor endorses a project based on non-monetary benefits, such as an increase in waterfowl use, it is enough to justify the project. The Division expressed concern toward being able to successfully compare monetary land values to habitat types and increases in animal populations.

Respondent Recommendations

The District would like to see information and models developed pertaining to riverine restoration. They said having good models will provide good valuations for projects.

Cost Effectiveness/Incremental Analysis

Findings

Incremental analysis was conducted in response to review commentary. Incremental analysis was viewed as useful by the respondents, but all expressed reservation of its use for small projects.

Discussion

Incremental analysis for this project was done in response to review commentary. Although respondents saw value in the use of incremental analysis as a planning tool, there was concern expressed that there is too much weight placed on incremental analysis as a means of project justification for environmental projects, especially with regard to cost-effectiveness. An alternative that appears to be more cost effective per acre than another may not provide the needed enhancements for an area. The District mentioned that there is a computer program that can assist in screening out irrational alternatives, but expressed caution in total reliance on such tools for decision making.

The District indicated that at times there is too much analysis. The analysis should be simple, especially for small projects. Sometimes the analysis is redundant when there are a limited amount of alternatives, and it is like restating the obvious choice. This can make the analysis more effort than it is worth, and at times overkill.

The Division pointed out that use of incremental analysis for environmental projects often leads to clashes between biologists and economists, due to differences in their training. Neither group usually agrees on what the values and costs of a project are.

Respondent Recommendations

The District said that they would like some latitude in deciding when to use incremental analysis for small 1135 projects.

Incorporating Risk and Uncertainty

Findings

A formal risk analysis was not assessed for this project.

Discussion

Risk and uncertainty was not determined for this project. All respondents said that the project is too small to make a risk assessment worth while. The only risk that this project could examine is of whether it will increase the number of waterfowl that will use the area. This is extremely difficult to do for environmental projects because it is an inexact science, as opposed to what has been done with flood control. Several respondents said that if a local sponsor is willing to cost-share, it is an indicator of willingness to take a risk on the project. This was attributed to the notion that most local sponsors have limited budgets and cannot afford to spend money carelessly.

Developing and Integrating Environmental Databases

Findings

A GIS was used to integrate the data for this project.

Discussion

The District used a GIS for the project area. Its primary use was to display vegetation information for the project area. In addition to the vegetation information, the District also used hydrologic data and aerial photographs for designing the project. All of the respondents were very pleased with the information that the GIS provided. The District recognized that they are fortunate

to have a GIS in their office and they use it to its fullest potential. They also felt that the data that was available for this project was sufficient because the project was approved for construction.

Respondent Recommendations

The Division recommended that it is important to develop large monitoring systems for large project areas, like the Great Lakes or the Mississippi, but that smaller projects do not necessarily require as intensive examination of data.

Evaluation Process

Findings

The selected plan was agreed upon by all the involved members. Special attention was given to effects of predation, fish mobility, and waterfowl habitat supportability in the development of the selected alternative for this project.

Interagency Coordination and Program Management

Findings

The coordination between the local agencies was considered good by all respondents. There was a need to streamline procedures for projects under a certain dollar value.

Discussion

All respondents indicated that the communication between the involved agencies was good. Most of the coordination occurred between the Corps and NDGF. NDGF was very impressed by the District's attentiveness to the coordination of the project, especially since the project was small in size

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and cost. They would like more involvement in 1135 projects, especially with the other District in the state, because there are many that could be done. USFWS participated in the review of the feasibility study.

Both the District and Division indicated that the present draft guidance for 1135 projects has some valuable information, but that it needs to be finalized. It was indicated that some of the requirements, such as incremental analysis, can be useful in project planning, but for a small project it can be very labor intensive and draining on resources, especially if the local sponsor has a limited budget. They would like to see review for 1135 projects of small size stop at the Division, and that for projects under a set dollar amount, the reports should be fairly short and not require extensive detail. The rationale for this is if a local sponsor is willing to commit dollars to a project, that should be enough for the justification of the project, especially since the environmental science is not as structured as others, like lock and dam construction.

The respondents said that the review process was lengthy, but recognized that part of it was related to the infancy of 1135 authorization. They did feel that, recognizing the newness of 1135 authorization, the year that the report was in Washington for review was too long. It was expressed that the farther away a feasibility report gets from a District, the less reasonable the requests become during the review process. This in turn raises the costs of the preparation of the report, which seems to be unnecessary for a small project. In some cases, the preparation of the cost sharing agreement costs more than the amount of the local sponsor's contribution.

There was concern that although the Corps is becoming more involved in environmental projects, there isn't as much financial commitment compared to other types of projects. The budget for environmental projects is very small compared to others. Environmental projects do provide benefits, but there are not enough means for measuring the financial values as compared to lock and dam or navigation projects.

Respondent Recommendations

The District recommended the development of a streamlined reporting process for projects that fall under a certain dollar value. They indicated that a report for a \$100,000 project should be 20 pages in length. The Division suggested that having another Federal agency as a sponsor may be useful for project justification.

SUMMARY OF THEMES

This case study dealt with a very small project, both in terms of size and cost. However, the theme that brought the Homme Lake project together was its coordination between the Corps and NDGF. Both agencies felt that they paid much attention to the examination of the project, and that there was a good working relationship which only enhanced the development of the project. Unlike other case studies that had good coordination due to prior working relationships, the principle players did not have a prior history. This would indicate that the Corps and NDGF approached this project without any significant preconceived attitudes about how the players would perform.

All respondents felt that the feasibility report for Homme Lake was had more than enough information to justify the construction of this project. Respondents from the Corps were displeased with the fact that the planning costs exceeded the costs for project construction. There should be consideration given to streamlining the study process for projects that are under a set dollar and acre amount.

In conjunction with the request for streamlining the report process, respondents indicated simplistic versions of HEP models would be appropriate for planning small projects. If streamlining of small projects will occur, simplistic HEP models should be developed for use. In addition to this, it may be appropriate to allow the Division to approve 1135 projects that fall under a certain dollar amount. The reason for this is that the Division should have a better understanding of the project area than reviewers in Washington, and it would reduce the overall costs of the planning process.

The Corps respondents frequently indicated that a local sponsor's willingness to support a project should have a significant impact on the justification of a project. The review of these projects should give considerable weight to this suggestion, because as mentioned earlier, local sponsors are careful when spending due to limited budgets.

JACKSON HOLE, WYOMING FLOOD DAMAGE REDUCTION AND FISH AND WILDLIFE HABITAT RESTORATION PROJECT

PROJECT DESCRIPTION

The Flood Damage Reduction and Fish and Wildlife Habitat Restoration Plan for Jackson Hole, Wyoming is a distinctive case study in this project. Case study interviews were based on the formulation of the project's reconnaissance study. At the time of the interviews, the project was recently approved to enter the feasibility study phase. This multipurpose project placed equal emphasis on reducing flood damage and providing environmental restoration. The study area received significant national recognition because lies in both Yellowstone and Grand Teton national parks, which are world-class tourism sites.

Problems in the project area are related to the levees currently located along 20 miles of the Snake River. Historically, the Snake River was considered to be a braided stream that meandered throughout the flood plain. As levees were built to provide flood protection, the area in the flood plain in which the Snake River could meander was reduced, eventually causing the river flow to increase in velocity and to become channelized. Riparian habitat along the river is decreasing because needed amounts of water are not getting behind the levees to maintain it. Where there are no levees, the force of the water in flood stage erodes the habitat. Fishery habitat in the river is being destroyed because of the flow velocity, and tributary streams are not getting adequate amounts of water for good self-maintenance. These conditions are also leading to avulsion, which causes a major river channel to shift into a minor river channel, resulting in overbank flooding and erosion.

Residents of the area are sensitive to environmental concerns. Many would like to see the restoration of the riparian areas along the Snake River, while others are concerned that flood control will be compromised if water is allowed to flow behind the levees. A parcel of land will increase in value if a stream runs through it, but some land owners fear that avulsion may occur on their property if water is channelled away from the Snake River.

This is a unique project because it is large in size and will be significantly exposed to the vacationing public. The engineering involved in altering the fast-flowing Snake River will be challenging. Some new design alternatives will be considered and, in some cases, tested as the project continues through the feasibility study stage. The District is taking a holistic view of the project area for determining the potential impacts of these designs.

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The project was approved to enter the feasibility study phase in April 1994. Examination of the Snake River area is being conducted under the continuing authority of the March 1954 resolution of the U.S. Senate Committee on Public Works and the 12 June 1990 U.S. Senate Committee on Environment and Public Works Study Resolution.

Seven interviews were conducted for this case study. Represented were the North Pacific Division, the Walla Walla District, the Wyoming Game and Fish Department (WGFD), the Teton County Commissioners (County), the Jackson Hole Alliance (Alliance), Trout Unlimited (TU), and private landowners. Each of these groups has been part of a steering committee that examined the problems of this study. Other agencies involved who were mentioned during the interview process were the U.S. Fish and Wildlife Service (USFWS), the Environmental Protection Agency (EPA), the Soil Conservation Service (SCS), the Grand Teton National Park, the Bureau of Land Management (BLM), the U.S. Bureau of Reclamation, the University of Idaho, the National Ecology Lab, and the Yellowstone Commission.

Presented in the remainder of this summary paper are findings, discussion relevant to the findings, and respondent recommendations for improvement. Each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program is addressed; however, respondent recommendations were not made for every topic area.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The determination of environmental significance was based on the Economic and Environmental Principles and Guidelines for Water and Related Land Resources (P&G), which included preservation of endangered species and national parks.

Discussion

Residents of the study area are attuned to the environmental significance of the Snake River flood plain. The project will affect parts of Yellowstone National Park and Grand Teton National Park both of which are heavily used by tourists and are well known throughout the United States. Such use can be considered as public recognition according to P&G. The residents indicated that the pristine beauty in this area cannot be found anywhere else in the country. Values of land have reached as much as \$40,000 an acre. In one case, an individual purchased 300 acres of land for \$6 million, the high cost reflecting the fact that there is an eagle's nest on the property.

The Wyoming area has a shortage of gravel, due partially to the residents' desire to preserve the natural beauty of the area. Excavation of gravel from the hills would blemish the landscape. Some gravel may be extracted from the river in this project, which would be of value to Teton County for road maintenance.

This project is aimed at protecting the endangered bald eagle through habitat improvement of its primary food source in the region, the cutthroat trout. This can be viewed as supporting technical recognition as defined by P&G.

Most respondents indicated that, for this level of study, the amount of information provided for environmental significance was adequate but not technically detailed enough to properly convey the significance for the feasibility study. The District felt that even with the lack of technical details, conveying significance to the community was a tremendous challenge. The Alliance respondent indicated that community members want to know the environmental significance of the project, but that information is sometimes too detailed or technical for them to understand.

Respondent Recommendations

Both the Corps and other respondents indicated that there is a need for methods to communicate a project's environmental significance. The District said P&G provided an outline as to what was significant but no guidance on how to share that information with the public.

Determining Objectives and Measuring Outputs

Findings

The primary objective of this project is to return the study area to the conditions that existed in 1956. This objective will be measured through implementing the Habitat Suitability Index (HSI) for cutthroat trout and gauging the velocity of flow in the Snake River.

Discussion

The restoration objective for this project was based on the conditions of the area in 1956 because habitat data were available for that time period. A HSI was used in conjunction with a Geographic Information System (GIS) and aerial photography to develop a model of the area for determining 1956 conditions.

The District contracted with the University of Idaho to develop databases for the GIS. The habitat classification was based on Classifications of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979), which is considered to be a standard and widely accepted source for riverine and wetlands areas. Species examined for the HSI were the cutthroat trout and the bald eagle. The steering committee worked with the Corps to form these objectives while WGFD provided data on cutthroat trout and indicated that the HEP model for the Snake River flood plain was developed with assistance from the National Ecology Lab. WGFD was unsure if the model had been tested at the time of the interview and a desire to see restoration of the pioneer habitat communities in this area. WGFD indicated that this study received more analysis in determining habitat loss than most reconnaissance studies because of USFWS requirements.

Stream flow velocity is one of the primary means of measuring the output of this project. Project implementation will have an immediate impact on the flow velocity of the Snake River, but the regeneration of habitat areas will require more time. Another quantifiable output will be the amount of gravel removed from the project area. More precise output measures for the project will be developed in the feasibility study stage.

A respondent for the Alliance said the public is interested in project objectives and outputs but that the level of detail for this information does not have to be high. The Alliance is willing to be

an intermediary between the Corps and the general populace in this endeavor. County representatives indicated that it does rely on local agencies to evaluate the technical information regarding project objectives and outputs.

Respondent Recommendations

The District would like to have information pertaining to avulsion, erosion, land loss, and energy transfers in ecosystems as well as observable changes of physical features and their effects, which would provide better information for the formulation of objectives and outputs.

Objective Evaluation of Cultural Resources

Findings

At the completion of the reconnaissance study, the Corps had conducted no field investigations within the project area. Based on a file search and past Corps cultural surveys within the project area, potential sites of significance that do exist will be fully addressed during the feasibility study.

Discussion

Past surveys conducted in the area indicated that most native Americans did not build dwellings in the flood plain. Respondents who were aware of the examination of cultural resources felt the Corps was investigating this aspect of the study thoroughly.

Engineering Environmental Investments

Findings

An interagency team was assembled to brainstorm alternatives for this project. Some small-scale experimentation with proposed alternatives will be conducted during the feasibility study.

Discussion

Design alternatives for this study were formulated during a field reconnaissance of the Snake River by the Corps, USFWS, WGF, and the Alliance. Trout Unlimited and a local dude ranch contributed suggestions after the field reconnaissance. Factors that influenced the decisions made in this process were flow velocity, availability of funding for cost sharing from the local sponsor, the excavation of gravel, provisions for flood protection, and the need to develop riparian areas. All respondents indicated that there appear to be some potential alternatives, but that they need to be tested during the feasibility study.

Keeping in mind that the project is intended to restore habitat for wildlife as well as provide flood protection, the proposed options from the reconnaissance study were to construct training fences and spur dikes consisting of rock and wood, strategic boulder and root ball placement, channel restoration, and sediment redistribution. These alternatives are to receive further examination during the feasibility study stage. The District pointed out that projects are engineered and built for endurance, but in this study some designs will only be required to last for a limited number of years.

Much of the standard guidance for civil engineering is not applicable to this project due to the uniqueness of the situation. The local sponsor was pleased that the Corps was striving for a holistic view of the area because sponsor representatives do not believe there is a blanket policy that can be applied through the examination of segments of the river factors the local sponsor see as influencing the alternatives for the project are the overall cost and the scarcity of available rock for reinforcing levees. One respondent pointed out that residents are very sensitive to anything affecting the natural beauty of the area and that some innovative ways to develop and maintain this project must be established. All respondents thought the District was very cooperative, and that alternatives proposed for the project were appropriate.

Respondent Recommendations

The District would like research information regarding the use of in-water structures for habitat creation and their duration, especially in streams with a high flow velocity. The District also said there should be more time spent by the Corps on site for ground truthing and for gathering information from those involved in the study area. All respondents indicated that a need exists for experimentation with new alternatives during the feasibility study. One respondent remarked there should be more information regarding gravel extraction and habitat restoration techniques behind levees.

Monetary and Other Valuation Techniques

Findings

The focus of this project is on nonmonetary valuation through HSI. Most respondents indicated a reluctance to place monetary values on nature, although the extremely high property values in the study area are worthy of consideration in the analysis.

Discussion

The District said it views HSI as the primary means of determining the benefits of the project. A benefit-to-cost ratio was not sought because it was not required. The District thought flood protection benefits should have been considered for this project because they would have provided monetary benefit justification. The District indicated an interest in including recreation benefits, which are not being considered because of policy conflicts within the Corps and the project area.

The WGFD considered the largest monetary value in this project to be the value of homes behind the levees. The WGFD also determined values for trout based on the amount of money an angler spent to catch the trout and the number of spawning sites. The WGFD representative regarded the dollar value as inadequate for describing a fish's worth, and indicated that the species and habitats

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in the study area are vital or irreplaceable according to the WGFD mitigation policy. They also see these habitats as having high social and ecological significance.

One respondent said recreation should have been evaluated for this study. The significant real estate costs and easements in the area were recognized, and it was understood that improving a trout stream will substantially raise the value of the real estate through which it runs. Special attention should be given to real estate and political issues that are inherent to the region during the valuation process.

Respondent Recommendations

The District wanted research on determining monetary values for fish, wildlife, and habitat. Although people may be resistant to such measures, it must be done, providing the generated values accurately measure what is being described. The District also would appreciate more information on determining aesthetic and recreation values.

Cost Effectiveness/Incremental Analysis

Findings

Incremental analysis was conducted for this study based on information from the HSI. All respondents questioned the results of the analysis and indicated some level of apprehension in conducting such an examination.

Discussion

The District conducted incremental analysis based on output units from the HSI in response to review comments on the draft reconnaissance study. It was felt that the data was insufficient to complete an accurate analysis. The District noted that Headquarters found the information useful but that preparation consumed valuable time and manpower resources, which locals perceived as less

important compared to other planning needs. District respondents also stated that determining appropriate increments is initially a guessing game.

One respondent indicated there is a value to conducting incremental analysis, but felt the Corps needs to examine the legitimacy of the results. Project justification is often based on dollar estimates and approved by individuals who lack awareness of natural resources. The respondent also questioned the cost effectiveness of any research that generates significant amounts of paperwork and consumes significant amounts of time but does not get anything under construction.

Another respondent was concerned that determining benefits by standard or "cookbook" methods may not accurately portray the values of the proposed environmental enhancement. In conveying results, the information needs to be user friendly for lay persons receiving it. County representatives were concerned that the costs of such an analysis would hurt the financial commitment they could provide. Both groups were concerned about the overall costs of the project and what the community would be able to afford without raising taxes. The TU respondent viewed incremental analysis as a necessary evil, and noted that it is influenced by the biases of those conducting it.

A landowner indicated that some of the assumptions made in the incremental analysis are unreasonable or illogically defined. He expressed concern that undeveloped lands were not examined as well as were developed lands. His perception was, if restoration is to be based on property value, the project is bound to be counterproductive; the analysis should be conducted for the whole river. Many respondents indicated they will examine the results of the analysis in the future.

Respondent Recommendations

The District indicated that incremental analysis should have a common-sense base in its application. The process was more challenging and time consuming than originally perceived. Based on the experience of the respondents, one of the largest challenges is the formation of meaningful alternatives and increments. A need exists for determining what the appropriate increments are. The District also said such an analysis should be proportionate to the money available so the analysis is cost effective. WGFD would like to see research determining the legitimacy of incremental analysis results.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty will be examined in the feasibility study.

Discussion

The District will be conducting risk analysis during the feasibility study as directed by Headquarters. One of the landowners said risk analysis will be needed in this study because of the experimentation that will be conducted in developing alternatives for the project. The experimentation will provide some of the information needed for conducting such an analysis. It is problematic to determine risk if data are not available, such as that pertaining to island protection in the Snake River. One respondent indicated the County will probably resist conducting extensive risk analysis because it would significantly increase their portion of the cost sharing agreement.

Respondent Recommendations

One respondent indicated that intensive risk analysis should not be conducted for types of projects that are well documented or do not have any performance documentation. Examination of risk should be conducted only if enough data are collected. The Corps should consider reserving risk analysis for experimental projects versus examining elements that will function with a known high certainty.

Developing and Integrating Environmental Databases

Findings

A significant amount of information was generated to create a GIS for the study area.

Discussion

A concerted effort was made by the District to develop a GIS for this project. The Corps contracted with the University of Idaho to develop and populate the GIS. Information used in constructing the GIS included vegetation cover types, topography, land uses, and hydraulic information. Other information used in the completion of the reconnaissance study were bald eagle nesting maps, land values, and in-stream characteristics such as spawning areas and trout per section of stream.

The GIS has been used very effectively in graphically comparing the vegetation and land uses for 1956 and 1986, although continued development and maintenance of the GIS is being seriously questioned by the District as costs increase. An extreme increase in costs has occurred since the responsibility for maintaining the GIS shifted from the University of Idaho to the District. It also was suggested that more analytical utility be realized if the GIS is to be considered cost effective. At this stage, its main use has been to create the two vegetation maps.

The District indicated that TU has volunteered to monitor stream conditions. The challenge is that present Corps policy prohibits the loan of equipment, but the District felt allowing groups such as TU to monitor conditions would help to maintain local interest in the project.

Respondent Recommendations

The Alliance said it has public interest data for the Corps to use, and it would be willing to assist in gathering more. One respondent thought the GIS information would be useful to the County because many organizations are moving to incorporate GIS systems in their planning processes.

Evaluation Process

Findings

The project has entered the feasibility study stage. No other recommendations were made regarding the selection of alternatives because of the need to field test them.

Discussion

Based on the information gathered in this reconnaissance study, the study team recommended that the project enter the feasibility study stage. Although there are some preliminary recommendations for alternatives, none have been put forward because it was inappropriate for a reconnaissance study. A landowner indicated he would like to have a greater level of involvement in the evaluation of the feasibility study because many private properties are to be affected by this project. Some of the landowners are willing to make some trade-offs with regard to easements but on a case-by-case basis.

This project will result in the excavation of gravel from some portions of the Snake River. There are several groups interested in what will be done with the gravel after it is removed. The County would like to use it for road maintenance, which could affect the amount of money the local sponsor can contribute, if the cost of the gravel and its transport is less than normal.

The TU respondent indicated that selecting among competing projects should be based on the determined measure of success, the location, benefits to the public, and the Corps linkage to the problem.

Respondent Recommendations

It was recommended that the Corps meet with landowners on an individual basis. Each landowner would trade off different items for the project, some more than others which would give a greater sense of what could be done in the project area.

Interagency Coordination and Program Management

Findings

A Steering Committee was formed to coordinate this study. Overall, the participants involved had a favorable response for assembling such a group but felt the Corps needs to improve the process of getting information to the group members in a reasonable amount of time.

Discussion

A Steering Committee was formed for this project, with which the County was satisfied. The County also was pleased with the interagency meeting that was held at the Division office. District respondents indicated that a Steering Committee was necessary to improve the Corps communication with the public. The District felt that communication issues were so significant that a public relations course was held for District personnel.

Throughout the reconnaissance study, the County looked to other local agencies that had the technical expertise to advise them of the environmental soundness of proposed alternatives. They were satisfied with the information provided to them in this manner, but they had difficulty understanding Corps policy and acronyms.

The Alliance, which is pleased to be a part of the Steering Committee, performs a watchdog role for the Jackson area to ensure that development is compatible with its natural and cultural resources. The purpose is to keep the community informed for their decision making.

Many respondents were frustrated with the amount of time required for approval of decisions and study reports within the Corps chain of command. Several agencies indicated an urgency to get the project started because of the powerful force of the river and the dwindling amount of habitat.

Division respondents indicated a need for more interaction at all level of the Corps, from the District to Headquarters, which would help speed the process of evaluating reports. Thus, the project could proceed at a rapid rate and help maintain positive local interest. The Division said continuity of personnel in the study process is needed. The Division also noted that project and technical study

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managers basically perform the same functions but was not sure if a single individual could perform both roles throughout the process.

The District indicated that the study required a significant amount of shaping during the planning process because of the lack of experience and training of the team. It also said that new environmental projects will have changing specifications, and at better and more communication will be needed throughout all elements of the Corps for these specifications to be understood and met.

WGFD felt the coordination between the District and the local office was adequate, but the headquarters of WGFD did not believe they were receiving sufficient attention from the Corps, often getting short or no notice of meetings to be held. WGFD thought that general coordination was poor and the overall project development process was cumbersome and unfruitful but hoped it would change. Another respondent said the District is attentive to everyone involved. However, there is uncertainty regarding money needed from the local sponsor to construct the project after the feasibility study is completed.

One respondent indicated that the higher one rises in the Corps chain of command, the more removed one is from what is happening in the field. There is concern that these projects are not viewed as high priorities because of the time it takes to get them moving. The Corps does provide an impetus for getting environmental projects started, but the momentum slows because of the length of time Corps studies require.

Respondent Recommendations

The District said a working group needs to be of a manageable size, and should consist of individuals who know each other by name and can be held accountable to the committee.

Several respondents indicated a need for better notification of meetings being conducted by the Corps. One respondent suggested a standardized mailing list as a means of notifying involved parties of meetings. Another respondent recommended having a local Corps representative because coordinating with the personnel in Walla Walla can take valuable time and delay the completion and approval of the study.

SUMMARY OF THEMES

This case study examined a project that completed the reconnaissance phase. Two significant aspects of the agencies and area residents were considered in this case study. First, they have increased sensitivity to the environment and place a high value on the aesthetic beauty of the area. Therefore, alternatives generated for this study must minimize damages resulting from construction or excavation. Second, area agencies and residents recognize the destructive power of the Snake River and would like to have something done immediately to prevent it from destroying anything else. In examining these challenges, the District is taking a holistic view of the study area, which pleases all interests involved.

The District recognized the uniqueness of the problems in trying to restore the area, and it appears to have made some significant steps in developing agreeable alternatives for this project. However, alternatives need to be tested during the feasibility study, which will help determine the overall success of the project by providing data on the performance level of the proposed structures.

All of the respondents, including the Corps, indicated a need for improved communication among all agencies to reduce the time needed in the approval process. All are frustrated that the extreme velocity of the Snake River will destroy much of the habitat before construction proceeds.

Another concern regarding communication was how information was conveyed to area agencies and residents. Some of the information was considered to be too technical for lay persons to understand. In other cases, the rationale for decisions or courses of action determined by the Corps were construed as being illogical or confusing. Information needs to be made understandable to those affected by a project.

Many respondents approved development of the GIS because it presented a visual image that conveyed changes in the project area. It was more cost effective to have an outside group construct the GIS than to do it inhouse. Since the GIS was viewed favorably by those interviewed, a closer examination should be conducted to make the GIS more cost effective in its development.

Some respondents in this case study felt monetary values needed to be attached to wildlife and habitat. Support for such an effort was not overwhelming, but it could provide a means for the justification of a project. The greatest concern of all those involved was that this type of valuation would not adequately indicate the worth of a species.

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All local residents and agencies would like to see something under construction. They have expressed frustration at the amount of time and effort spent proposing alternatives and getting them approved so the feasibility study could begin. Although these people remain hopeful, they are afraid that more time and habitat will be lost unless attempts are made to experiment in the Snake River with some of the proposed structures.

One other area that suggests further review is the use of volunteers in the project area for data collection. Such participation would be an effective means for gathering needed information in a manner that is extremely cost effective. It is advisable to develop a method for loaning out gauging equipment to volunteers who are willing to donate time for a project.

KISSIMMEE RIVER RESTORATION, FLORIDA

PROJECT DESCRIPTION

Navigation and flood control were the primary water resource developments on the Kissimmee River in the early part of the 1900s. Many smaller-scale projects were built, but major hydrologic events like the flooding created by the hurricane of 1947 caused the state of Florida and the Corps to consider major channelization of the river. The channelization was eventually approved and completed in 1971 and has since provided adequate flood control and navigation. The channel, referred to as C-38, reduced the natural river length from 103 to 56 miles.

Since the completion of C-38, there have been numerous studies indicating that channel flows have been depositing significant nutrient loads into Lake Okeechobee, causing accelerated eutrophication. However, the most significant water quality issue in the channelized system is low dissolved oxygen regimes, which has been identified as the primary contributor to the degrading of habitat along the lower section of the Kissimmee River. Florida placed the Kissimmee on its Save Our Rivers Program, and as of 1991 acquired 27,300 acres of the basin for restoration efforts.

This restoration effort has received a considerable amount of political attention, which led to congressional support authorized under Section 116(h) of the Water Resources Development Act of 1990. The South Florida Water Management District (SFWMD) dedicated a considerable amount of resources to evaluate restoration alternatives for the Kissimmee River basin. The SFWMD proposal was submitted to the Corps and was adopted with strong approval from the Assistant Secretary of the Army and Congress. SFWMD is the local sponsor of this project.

Five interviews were conducted for this case study: the Corps Jacksonville District, the South Atlantic Division, the SFWMD, the Sierra Club, and the Realist Opposing Alleged Restoration group (ROAR). ROAR is a group of county commissioners and residents within the project area opposed to the implementation of the recommended plan. The U.S. Fish and Wildlife Service and the Florida Game and Fresh Water Fish Commission were also identified as playing supporting roles in the study but were not interviewed. SFWMD indicated their perceptions of these agencies' roles in the project.

The remainder of this summary paper presents findings, provides discussion relevant to the findings, and lists respondent recommendations for improvement. The summary is organized to

address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

Environmental significance for this project was based on issues of water quality and declining acres of wetland habitat. There are several endangered species that would be affected by the project.

Discussion

The primary emphasis of this project is to restore the integrity of the Kissimmee River ecosystem. There has been a series of reports published by the Corps (1978 to 1985) and SFWMD (1984 to 1990) that have documented the degradation of the Kissimmee's water quality, wetlands, and ecosystem. The channelization of the Kissimmee caused substantial changes in land use, including drainage of about half of the wetlands in the basin. These habitat changes in the basin have impacted significantly the type and quantity of fish and wildlife in the region.

Water quality in the Kissimmee River has steadily degraded due to agricultural and urban development in the basin. The channelization of the river restricts the natural cleansing function of a meandering river and the wetland-rich basin. Consequently, the channelized form of the river contributes to the declining water quality. The Kissimmee is the largest basin draining into Lake Okeechobee, which is also undergoing steady water quality degradation. The Kissimmee River and Lake Okeechobee are significant hydrological contributors to the Everglades National Park. This tie with the Everglades National Park is of great environmental concern and brings heightened political attention to the restoration of the Kissimmee.

Recognizing the environmental sensitivity of the Kissimmee basin, the state of Florida's Save Our Rivers Program was used to acquire selected parcels in the basin that are set aside for purposes of environmental restoration. These land purchases began in the Kissimmee basin in 1984.

Between the state of Florida's considerable amount of political and financial attention given to the Kissimmee River and the past technical studies conducted on the river, a great deal of evidence for determining and describing environmental significance was available for the Corps as it developed the feasibility report. Note also that there are six endangered species residing in the study area, three of which will benefit from the project and three that will not be affected.

Corps and SFWMD respondents said that the project was not originally designed to meet environmental significance policy. The District identified factors of environmental significance that are related to state and Federal environmental acts as part of their assessment of the proposed alternatives, including the modification of the Level II Backfilling plan. Some of those mentioned were the Water Resources Development Act of 1990, the Clean Water Act of 1977, and the National Environmental Policy Act of 1969.

A Habitat Evaluation Procedure (HEP) was conducted by USFWS to determine the numbers of species that were impacted by the channelization of the project. The District felt the results were useful for describing the environmental significance of the project. Other respondents felt the HEP results would change the focus of the project, or that the results were not representative of the diversification of the species present.

Respondent Recommendations

The District said the availability of more information for determining project justification with regard to environmental significance would be helpful in formulating feasibility reports, since they found this task challenging for the project. Both Division and District respondents would like the development of methods for quantifying of this type of information for use in future projects.

Determining Objectives and Measuring Outputs

Findings

The chief objective of this project is to restore the ecological integrity of the Kissimmee River. The measurement of objectives was accomplished by a number of means to include acres of ecosystem and wetlands, fish biomass, individual waterfowl and wading bird species, and habitat units. Physical hydrologic characteristics were also measured and compared to historic and existing conditions.

Discussion

The development of the objectives was an extensive process, beginning with a Corps study that started in November 1978, which incorporated information from various public agencies, groups, and individuals. A special review committee was developed to work with state agencies during this process. This committee developed five hydrologic criteria that were developed from prechannelization records within the floodplain. These criteria were: continuous flow with duration and variability characteristics; average flow velocities between 0.8-1.8 feet per second when flows are contained within the channel banks; a stage-discharge relationship that results in overbank flow along most of the floodplain when discharges exceed 1,400 - 2,000 cubic feet per second; stage recession rates on the floodplain that typically do not exceed 1 foot per month; and stage hydrographs that result in floodplain inundation frequencies comparable to prechannelization hydroperiods, including seasonal and long-term variability characteristics.

The hydrologic criteria were recognized as the means to achieve ecological integrity, since improvements in water resources would improve habitat conditions. In addition to these criteria, five additional determinants of ecological integrity were incorporated to monitor the outputs of the project. The five determinants are food (energy) base, water quality, habitat quality, biotic interaction, and ecosystem properties. There were numbers generated regarding acres of restored habitat and wildlife population increases, but these were viewed as potential output goals, not actual goals.

The District said the justification of a project, in their experience, needs to be of a measurable nature. Therefore, quantifying the amount of wetland acres lost seemed to be the logical approach. Several studies have been conducted, including one in a Florida Governor's Report, that quantify species and their increases and declines.

District respondents said that many environmental projects done in the past were based on restoring habitat for waterfowl or several target species of fish. In those cases, it was easier to measure potential outputs, and at a lesser cost. Although a holistic approach was desired for this project, District respondents recognized that a holistic approach was not refined enough to produce quantifiable outputs. The District insisted on having discreet, measurable outputs for the feasibility study report. Eventually, some outputs were used as acceptable proxies for the ecosystem perspective.

The USFWS conducted a HEP for 17 vegetative cover types and 25 animal species. This information was used to develop a Habitat Suitability Index. Habitat types were measured and incorporated into a Geographic Information System to portray historic conditions. As indicated earlier, the use of HEP received mixed responses. Respondents against its use said it does not generate an optimal habitat for a wide range of species.

SFWMD viewed HEP as a means to supplement information regarding the views of an ecosystem. However, the results are based on an individual species' optimum condition. Since more than 300 species were recognized as being affected by the project, there is no way to create an optimum condition for each species in the ecosystem. HEP is useful for gathering data on endangered species, but it does not develop a holistic view of an ecosystem that contributes to an adaptive management strategy.

ROAR respondents perceived an inaccurate balance in the study of species because four-fifths of the indicator species are wetland dependant, but wetlands make up only one-third of the area. Concern was also voiced that although upland species may migrate, there is significant housing development occurring in the upland areas. This could endanger the survival of some upland species.

Restoration of the area to historic hydrologic conditions was acceptable to all the respondents but ROAR. ROAR said the people living on the river do not want to go back to the past conditions and felt that the historic conditions were less beneficial than existing conditions regarding evapotranspiration and potential drought effects in the area. SFWMD felt this would not be a problem, based on their analysis.

SFWMD indicated a project's goals and benefits need to be viewed in comparison, not just one aspect such as cost per acre. The goal of the project is more than outputs. The politics and local sponsors will definitely affect selection order of objectives and outputs.

Respondent Recommendations

Both the District and ROAR would like to have clear, measurable outputs for determining project success. This test should be measurable and attainable. District respondents wanted better definitions for outputs that are not monetarily based. These outputs need to have an appropriate quantification for use in determining benefits.

The Sierra Club respondent said attention should be given to determining where a project fits in the ecosystem. SFWMD echoed this request, saying someone needs to pull the "big picture" together, and eliminate segmented structuring. There needs to be more attentiveness on developing environmental projects instead of merely fixing them.

The Division respondent requested research on developing correlations between hydrological data and biological responses. At present there are no predictors for determining rates of habitat return or means of explaining it to the public. Along with this development, research was requested regarding modeling efforts that explain ecosystem interaction, and how those interactions should be weighed for evaluating projects. The Division respondent also said research should be conducted to determine techniques for quantifying all the outputs of a project.

Both District and SFWMD respondents wanted to see more training of biological personnel in ecosystem management, with an emphasis on the holistic aspects of the project. They would also like to see more biological personnel involved in these projects.

Objective Evaluation of Cultural Resources

Findings

Cultural resources did not have a significant impact on the design of this project.

Discussion

Much of the project area was frequently covered by water before the river was channelized. The channelization process uncovered some sites, and those areas were avoided in the present design. Based on these two facts, it is unlikely that other resources will be found in the project area. If resources are found, they will be avoided until a decision is made by the State Historic Preservation Officer regarding what should be done. All of the non-Corps respondents felt the Corps was handling this portion of the study properly.

The Division respondent said some cultural resources may have been buried during the channelization project. A plan is in place for dealing with the recovery of cultural resources if any are found.

Respondent Recommendations

The District said that existing guidance does not address policy regarding the reflooding of an area that implemented flood control measures. They felt that research should be conducted for this issue. The Division respondent indicated that there may be a need to examine how highly perishable cultural resources are extracted, especially when discovered during excavation.

Engineering Environmental Investments

Findings

The selected alternative proposed by SFWMD was identified in the first Corps study. The recommendations presented were evaluated and modified by the Corps, as indicated in the authorization. Factors affecting the selection of alternatives were cost-effectiveness, dissolved oxygen levels, acres of wetland restored, area hydrology, navigation, aesthetics, and restoration to historic qualities.

Discussion

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The legislation for this project stated the Corps was to evaluate the proposed plans and select the best alternative. They were not required to develop other alternatives for the project. SFWMD performed much of the work and research in their feasibility study, which incorporated information from the past Corps studies for the area. As noted earlier, the selected alternative was originally proposed in the first Corps environmental feasibility study conducted for the area.

One interesting development in this project is that the success of any of the proposed alternatives is dependent on an ongoing headwaters study. The headwaters of the Kissimmee may require some regulation to successfully implement any alternative. It was recognized during the planning process that restoring the Kissimmee to a meandering river would require significant amounts of water as a result of increasing its length.

The District said some refinements were made to the selected alternative, but no major changes or new alternatives were proposed. There was some reservation by SFWMD regarding Corps in-house expertise to formulate a proper range of alternatives for environmental projects, in both plan formulation and management structure. SFWMD saw the Corps biologists as having a mitigation focus, as opposed to development.

Thirteen alternatives were proposed in the first Corps study. The SFWMD examined some additional alternatives as part of their study and constructed a test plug as a pilot for this project. Four approaches were proposed by SFWMD that the Corps evaluated. These approaches were strategic installation of weirs, plugging the canal with material dredged from the flood control project, backfilling segments of the channel located adjacent to abandoned river bends, and the backfilling of 25-30 miles of the channel between pools B through D. The final selection was a modification of backfilling 25-30 miles of the channel, which was one of the recommended options in the first Corps study.

The channel backfilling plan was selected because it provides river velocities that improve river channel habitat, and it is more conducive to biological functions such as feeding and reproduction. Navigation would be possible 24 hours a day because locks would be removed. However, in dry seasons, some areas will not be navigable because areas utilizing natural grade control for river flows will become too shallow for watercraft.

District respondents said flood control was not to be impacted. To do this, some land was bought to avoid affecting homes in the future. The original plan would have required the taking of 356 homes. With some alterations, that number is down to "a handful." The SFWMD took the lead in examining these requirements for the project.

Efforts to implement best-management farming practices to reduce the amount of non-point pollution entering the Kissimmee River have been undertaken. Local residents opposed to the project believe that these practices, in conjunction with the placement of weirs to wet the old meanders, made significant changes that improved the quality of the water in the river. They said the issue of phosphorous effects on water quality was difficult to interpret because there are naturally high levels of phosphorus in Florida.

There was some concern about amounts of mercury in the soil and water if the existing soil was used to build the plugs. ROAR said they conducted a study on the possibility of mercury entering the water supply. The Sierra Club respondent noted surprise that there was not a mercury warning on fisheries resources.

In addition to concerns about mercury, ROAR proposed a ten-point program to address possible goals for attaining environmental restoration in the area, including the development of new wetlands. They felt these recommendations were ignored.

Respondent Recommendations

The District recommended research on setting design standards for environmental projects. They also recognized that there is a need to modify engineering requirements for environmental projects to avoid overengineering.

ROAR respondents recommended that soil boring samples be computer modeled to determine how sedimentation and stratification will affect the project area.

Monetary and Other Valuation Techniques

Findings

Benefits for this project were based on nonmonetary values. Increases were indicated for various species of wildlife dependent on riverine habitat and the amount of acres of restored land. A benefit/cost analysis was not conducted for the project.

Discussion

The benefits described for this project were a reflection of how well the project would restore the historic biological conditions of the project area. Benefits were based on improved hydrologic conditions, increases in acres of wetlands, greater diversification of wildlife, greater carrying capacity for waterfowl, improved water quality, and increased recreational opportunities.

Quantification of benefits was commented on by many of the respondents. SFWMD respondents were resistant to placing any quantitative values (monetary or otherwise) on the ecological benefits of this project, fearing numerical analysis would undermine the overall ecological goal of the project. They wanted to maintain a focus on the entire ecosystem and to prevent overemphasis on any particular species that will benefit from the project. The Division respondent said this is a high-visibility project and felt that the numbers used for indicating benefits were extremely conservative. ROAR respondents said the description of the project benefits seemed to place a weighted value on wetland-dependant species. For example, they were resistant to accepting the fact that a duck was worth more than a turkey.

Many respondents questioned the lack of monetary benefits for the project, especially because economic impacts are considered as part of the study. The Division respondent said the inclusion of monetary values would show significant project benefits. The Sierra Club respondent indicated that they had made an attempt to incorporate recreation benefits as part of the value of this project and had conducted a study that critiqued the benefit/cost analysis of a 1985 feasibility study of the Kissimmee River conducted by the Corps. SFWMD indicated there should have been more discussion about intangible benefits, as well as developing monetary benefits pertaining to recreation. They also wanted to develop more values regarding the educational benefits that could be derived as a result of the project. SFWMD said that it is difficult to determine a dollar value for an animal, and questioned the appropriateness of such an attempt.

The District noted that some recreational value would have been lost in the original project design because it did not take into account the effect on boat ramps in the project area. They said there is a danger in using recreation benefits for restoration projects because the focus can shift to recreation from the restoration. The local population relates well to recreation values, but recreation benefits have no worth when the study report reaches Headquarters based on current policy. Using contingent valuation demand curves was not considered an effective approach for determining ecosystem benefits because of the challenge of gaining acceptance of someone's willingness to pay. Most of the public does not understand the basis of ecosystem restoration beyond the provision of recreation benefits.

ROAR respondents were concerned the taking of land would affect the property value of the surrounding homes. More than 50 percent of the land in Florida is owned by the state and Federal government. Because land is often taken, it has negatively affected the ability of residents to procure insurance for their homes, especially near swamps or the river. This has put more pressure on local government, which feels left out of all these proceedings, yet has to deal with those they represent.

Respondent Recommendations

Division, District, and ROAR respondents agreed that human links to the ecosystem should be examined, and more consideration should be given to discussing the benefits that humans can derive from these projects.

If the eventual intent is to compare the merits of projects nationwide, the District was interested in knowing if there is a nationally equal value for acres of land. For example, does 50,000 acres of wetland in California equal 50,000 acres of wetland in Florida?

Cost-Effectiveness/Incremental Analysis

Findings

Incremental analysis was conducted for this project. The units considered for the analysis were habitat types, acres restored, and average annual habitat units.

Discussion

The analysis for this project was based on the costs of the acres of AAHU relative to the miles of intended backfilling. Costs were categorized as fixed or variable for each alternative examined. Lengths of fifteen miles, twenty-nine miles, and forty-eight miles were the determined increments, with twenty-nine miles found to provide the most cost-effective approach.

The respondents indicated there is value to using incremental analysis for determining the economically efficient alternative. However, there were varying opinions as to the value of the analysis for this project. ROAR said there should be a stronger focus on benefit/cost ratios, and there should have been more analysis for other incremental alternatives. SFWMD indicated an analysis of this type can be manipulated based on the factors chosen for determining the analysis. SFWMD said the analysis justified the recommended alternative.

Both the District and SFWMD agreed the results of the analysis were not used for selecting an alternative, just to meet the requirements of project authorization. The District said the results generated were good, but the analysis was not as detailed as they would have liked. Part of the problem was the lack of data to conduct the analysis. Division said it determined the amount of backfilling to be done, since a seven-mile stretch of homes to be taken was eliminated from the initial plan after conducting a first analysis.

Incorporating Risk and Uncertainty

Findings

A formal risk and uncertainty analysis was not conducted for this project. Studies were conducted to either reduce uncertainties with physical aspects or include uncertainties through professional judgement.

Discussion

The Corps did not conduct a formal risk analysis of the project. However, several other agencies conducted some studies. SFWMD contracted the University of California at Berkeley to develop hydrologic modeling for the project to reduce the uncertainties associated with project effects.

District respondents said conducting risk analysis requires an understanding of what outputs will be developed and what effects they will have on the system. Adaptive management with constant monitoring was viewed as the means of conducting and developing measurement techniques for assessing risk and uncertainty. Most environmental projects do not have a negative impact on people

or their property. The Division respondent indicated that risk analysis is often done informally to examine the alternatives.

Developing and Integrating Environmental Databases

Findings

Respondents did not identify the use or development of any particular databases. Historic information from past studies was used. Significant biological information was drawn upon to accommodate the data needs for HEP, since it was used to examine 25 vegetation types and 17 animal species.

Discussion

Much of the information used came from past studies of the Kissimmee River. SFWMD is in favor of monitoring the project after construction but said the Corps planning process does not accommodate for it. SFWMD respondents felt that it might be conducted by one of the state agencies. The Division respondent said that future projects in Florida will be designed based on the success of this project.

Respondent Recommendations

The Corps should consider developing partnerships with other agencies for sharing data on a regional basis. Most ecosystems do not have enough historic data. Exchanging information helps to determine the form and function of the system and how alternatives will affect that system.

Evaluation Process

Findings

The selection of the alternative for this project was based primarily on its ability to restore the Kissimmee to its historic conditions before channelization occurred. Several other criteria based on Corps policy were incorporated.

Discussion

The Corps requirement in this project was to examine the project proposal by SFWMD and determine the appropriate alternative. The major criteria that guided the evaluation were Section 122 of the 1970 River and Harbors and Flood Control Act, Principles and Guidelines Effects, Evaluation Accounts, Determinants of Ecological Integrity, Environmental Outputs, Planning Criteria, Environmental Compliance, and Public Views. In addition, the criteria that were developed by the interagency committee were used as part of the evaluation process to indicate the alternative most likely to return the project area to historic conditions without causing water to exceed the floodplain region.

ROAR respondents, which included county commissioners from the project area, said they were not invited to many of the public meetings or any of the planning meetings. They felt this lack of representation for the local communities' leaders was inappropriate, since the locals will be directly affected by this project. ROAR felt the Corps did good work with what they had, and that the politics involved with this project has not allowed them to adequately examine the river system. There is a feeling that the environmental groups are now more powerful than public officials, and ROAR respondents viewed this as threatening the economic development of Florida.

ROAR respondents felt the Corps should have requested more current analysis to assist them in evaluating the proposal, especially because this system is so dynamic. They felt SFWMD did not have to comply with permitting standards regarding wetlands in the way the public is required when making alterations to property. The ROAR group said the river has historically experienced some drought conditions due to evapotranspiration, as indicated in the 1947 Corps report on the Kissimmee River, and they are concerned these conditions may return if the proposed project is implemented. It was their belief that although it is claimed the ecosystem is being examined, there is too great a

trade-off between wetland and upland habitat. ROAR would have preferred more peer review of the study by others in the biological and hydrological fields to validate the results.

According to SFWMD, taxonomic aspects, referent conditions, and postrestoration goals were all part of the evaluation of alternatives. Some of this information is still being developed.

Respondent Recommendations

The District said research should be conducted to determine when success is achieved, and what is appropriate for consideration during the evaluation process.

Interagency Coordination and Program Management

Findings

The coordination of this project was not strong initially, but did improve significantly throughout the study process. The Corps role as the lead agency was somewhat blurred. It also appeared that SFWMD had direct coordination with key personnel in Washington, D.C.

Discussion

Several of the problems associated with the project relate to issues of coordination. The District indicated that the timeline they were given under this legislation did not facilitate a massive public involvement effort, leading to some difficulties associated with Corps communication with the public. Public meetings that were held did result in a reduction in the amount backfill to reduce the extent of impacting residents.

There were conflicting reports regarding the format of local meetings. SFWMD was viewed as not contacting all the required people for these meetings according to the District and ROAR. The District was viewed by SFWMD as not effectively communicating the project goals to the public. The Division indicated there was somewhat of a "sibling rivalry" that resulted from SFWMD not being familiar with the Corps process. Once this was understood, coordination and communication improved.

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One unique aspect of coordination was that SFWMD appeared to be able to directly coordinate planning issues with key personnel in Washington. It appeared as if much of the policy requirements for this project were the result of requests to U.S. Army Corps of Engineers Headquarters or members of Congress. These connections had a significant influence on the coordination of this study, especially with regard to the time required to review the study. This aspect is more unique when you recognize that personnel from the Corps and SFWMD shared working quarters during the formulation of the feasibility study.

The Division respondent said, in addition to these problems, traditional adversarial relationships with USFWS have not improved among field-level personnel, and this caused some problems in completing the feasibility study. This adversarial relationship has been reduced through the development of personnel exchanges at the District. On a new project, representatives from all the involved agencies are working together at the District office. This approach appears to have reduced tensions between the involved agencies.

ROAR respondents said they want to prevent mistakes from being made in the future. The project objectives were seen as shifting throughout the study process, and were unaware of its cause. They understood the original impetus for the project to be water quality. The study emphasis has been shifted to wildlife conservation. Part of the confusion was attributed to the blurred role of the Corps in the study process, since SFWMD appeared to be directing the project. They felt there were enough examples to compare the costs of environmental projects on a relative basis, preferably through costs per acre restored.

The other respondents felt that coordination improved throughout the development of the project. Some of the improvement was credited to steady communication between the Corps and SFWMD. The legislation for the project was viewed as useful for getting review of the report completed in an expedient fashion. It helped to bring the reviewer from Washington to the District to assist in the completion of the project review.

Respondent Recommendations

All the respondents said consideration should be given to how local sponsors are selected. Each organization presented its own bias, but all agreed that this is an area worthy of consideration based on what they can offer.

The District said if property may be impacted by a project, the owners need to be notified early in the study process.

The District also recommended bringing specialists from other agencies posted in project areas on staff to assist in the planning of projects, such as local biologists familiar with the ecosystem. This would enhance the quality of the planning process so a project could be better tailored to its area.

The Division recommended making the biological terminology understandable to lay persons so that problems can be resolved early in the study process.

SUMMARY OF THEMES

There were many unique aspects to this study, but the overriding theme was the amount of political influence over this project. Special legislation was passed to authorize the Corps to examine what SFWMD developed in their feasibility study, apparently due to the connections SFWMD had in Washington. This was viewed as good because the legislation put the review of the study on a strict timetable that was met. The project also received high visibility as a result. However, the legislation prohibited the examination of other potential alternatives and the study of more recent data from the river system. If more current data were examined in this process, this may have created a better relationship with the ROAR group.

Special note should be given to the large commitment of resources by the state of Florida. In addition to the financial resources that have been dedicated to this project, the state has legislation regarding the importance of the restoration of wetlands. The energy and dedication of Florida to the issue of wetland preservation is unique in comparison to other states throughout the United States.

Reference was made often by many respondents requesting the development of more quantitative measures for environmental projects. Although it is important to examine ecosystems holistically, until acceptable methods are developed the quantification of outputs is necessary to convey information in a manner most of the people can understand, especially for the local participants.

Several of the respondents said that Corps personnel were lacking in experience for developing and planning environmental projects. The District respondents requested more personnel training with regard to evaluating ecosystem restoration projects. If the Corps is going to pursue

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more environmental projects, then more biological and environmental personnel should be recruited for future endeavors.

As mentioned earlier, the District has developed an interagency team that works together out of the District office. The preliminary results of this arrangement appear to be favorable, especially for reducing past adversarial roles. This approach is worthy of consideration for use by other Districts, especially for large projects.

The planning effort for this project was completed in one year. This was attributed to the deadlines placed on the agencies involved in reviewing the project and the availability of past reports. However, it was thought that it would be difficult to repeat this feat if the headwaters study were part of the original study.

Ecosystem restoration is a new mission for the Corps. Additional training and guidance for evaluating ecosystem restoration projects should be a high priority.

LA BRANCHE WETLANDS MARSH CREATION

PROJECT DESCRIPTION

The La Branche Wetlands Marsh Creation Project was constructed under Section 303(a) of the Coastal Wetland Planning, Protection, and Restoration Act of 1990 (CWPPRA). The majority of this legislation is directed at restoring and protecting coastal Louisiana. The Secretary of the Army is authorized to meet with the Administrator of the Environmental Protection Agency, the Governor of the state of Louisiana, the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce to form a Task Force for prioritizing wetland restoration projects in coastal Louisiana. The state of Louisiana was designated as the nonFederal sponsor for all projects under this legislation. At the time of the interview, the Task Force was developing its fourth project priority list for CWPPRA and had completed six projects.

The La Branche Project was designed to create 254 acres of intermediate marsh. The Corps and the Louisiana Department of Natural Resources (LDNR) were the primary agencies involved with the La Branche Project. Creation of the marsh was achieved by dredging sediment from Lake Pontchartrain and pumping it into the development area. Approximately 70 percent of the area was designated to hold sediment, which was kept in place with retention dikes. The project required eighteen months to complete, and initially, it has been viewed as successful.

The remainder of this summary paper presents findings, provides discussion relevant to the findings, and lists respondent recommendations for improvement. The summary is organized to address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The significance of this project was established through CWPPRA legislation and the prioritization procedure used by the Task Force that manages the authorized funds.

Discussion

The CWPPRA was developed to combat the rapid deterioration of the nation's coastal wetlands, of which 40 percent are in Louisiana. The Task Force that manages the implementation of the CWPPRA legislation identified the La Branche Project as significant in its first priority list produced in 1991. In developing the priority lists, the Task Force considers actions such as the charge offered by the legislation, the likelihood of project completion, type of wetland, other projects in the basin, and the cost per unit output estimated for the proposed project. The cost-effectiveness criterion, which is measured in dollars per average annual habitat unit (\$/AAHU), is relied on extensively by the Task Force in creating the priority list rankings.

The LDNR respondent said the residents of Louisiana are extremely environmentally conscious and recognize what is important for preserving and restoring habitat. Residents view the La Branche area as especially important in providing habitat for waterfowl. Public support and the high visibility of the project (which is located adjacent to Interstate 10) were perceived as propelling the project forward. LDNR said that this project is significant not only because it will restore this marsh, but because it will also prevent further intrusion of Lake Pontchartrain into other marshes located behind the La Branche Project.

Determining Objectives and Measuring Outputs

Findings

The objective of the project is to create new vegetated wetlands and restore and nourish deteriorated marshes in the La Branche area. Outputs of the project were measured in AAHU and percent of marshland created.

Discussion

The Wetlands Valuation Assessment (WVA) is a technique developed specifically for the prioritization and evaluation needs of the CWPPRA Task Force. It is a quantitative-based technique that assesses the changes in wetland quality and quantity resulting from a proposed project. WVA is related in concept and structure to the HEP developed by U.S. Fish and Wildlife Service (USFWS). One noted difference is that WVA is a community-based approach and HEP is species-based.

Key parameters of the WVA are ingress/egress capacity for aquatic species, utilization by wildlife, land-versus-water ratio, and vegetation surveys. Determination of the AAHU was calculated from the results of the WVA, which is a direct input for the cost-effectiveness analysis considered in ranking proposed projects.

The WVA is the analytical measure of output of the project. The land use and design-related output are a combination of marsh and water. The La Branche project design called for development of 70 percent wetland creation by using nearby sediment, and leaving the remaining 30 percent water.

Respondent Recommendations

Though development of the WVA received input from many disciplines, it is still characterized by rather broad assumptions. No one suggested it not be used in the evaluative process, but it was indicated the WVA required improvements to narrow some of the assumptions.

Objective Evaluation of Cultural Resources

Findings

Cultural resources had a minimal impact on the design of this project.

Discussion

Some sensitive areas were identified during a review of potential cultural resource sites. These sites, mostly related to navigation, were avoided as part of the planning process. The District indicated these discoveries slowed the NEPA documentation process, but there were no other difficulties associated with cultural resources.

LDNR commented that the District handled the issue of cultural resources well. The State Historic Preservation Officer was included early in the process and agreed with the approach proposed by the Corps.

Engineering Environmental Investments

Findings

The design for this project was introduced as part of the original proposal to the Task Force. Minor adjustments were made to the alternative after authorization was granted.

Discussion

All the respondents felt that the engineering approach for this project was evident. There was a narrow fringe of marsh in the estuary that was being lost at a rapid rate. Soil had to be placed in the area for growing plant species that would support various animal species, primarily waterfowl,

and a means to retain the soil had to be designed as well. The optimum conditions for the marsh were determined to be 70 percent marshland and 30 percent water.

The Corps took the lead in engineering the project. Factors that affected project engineering were access to the marsh by duck clubs, dike placement in relation to the highway, the location of an appropriate borrow area for dredging, the size of the dredge, and the amount of ingress/egress available to marine organisms.

An airplane successfully seeded the area with Japanese millet. An evaluation by members of the project team will determine if the dikes should receive more openings to improve the ingress/egress for marine organisms and the effectiveness of the land-to-water distribution.

Respondent Recommendations

The District recommended researching less expensive approaches for preventing shore erosion. In Louisiana there is not a large quantity of available rock because of its geological makeup. Dramatic cost increases for projects occur when rock has to be shipped from elsewhere.

Monetary and Other Valuation Techniques

Findings

An economic valuation was conducted for the project. The primary benefits were based on the acres the project restored. Benefits were perceived as being validated by public support for the project.

Discussion

Economic values could have been associated with this project in areas of recreation and commercial estuaries, and were viewed as necessary because project costs versus economic benefits are the "bottom line" for decision making. The District said there is a problem determining

benefit/cost ratios for environmental projects because each agency has a different value for benefits, based on its mission. For example, the National Marine Fisheries Service (NMFS) may place a higher value on a saltwater species of fish than the USFWS does.

Other values, such as acres of habitat restored, were viewed as important but difficult to quantify with a dollar value. Both the District and LDNR agreed that these values have a significant worth, but most often what drives congressional authorization of projects is the costs and the monetary benefits the projects can provide. One District respondent said they were attempting to develop a model for the economic development of an area as a means for project justification.

Public support was considered to be an indicator of project benefits. The respondents said the public only supports those projects that will be beneficial to them. Although there is not an economic value that can be attributed to public support, this support is important for justification of the project.

Cost-Effectiveness/Incremental Analysis

Findings

Cost-effectiveness of each proposed project was examined based on the \$/AAHU. Formal incremental analysis was not conducted for La Branche because of the limited amount of time for preparing the first priority list.

Discussion

Cost-effectiveness is an important parameter in the prioritization process for CWPPRA candidate projects. This appears to have been used effectively by the Task Force, though the accuracy of both the cost and output values are sometimes questioned.

The respondents said that while incremental analysis can be a useful tool, it is often a cumbersome requirement. They indicated that this type of analysis should not be required for all projects because many of the proposed projects have limited alternatives and usually require complete implementation for success. There have been projects where incremental analysis has been useful,

such as determining the amounts of material needed for canal bank stabilization. The District is developing a cost-effectiveness model for barrier islands used for marsh protection. One respondent noted that this is the type of project where cost-effectiveness techniques are most appropriately applied.

Respondent Recommendations

LDNR recommended that incremental analysis be optional for evaluating environmental projects. This would make more resources available for other areas of project design or be of use for completing another project.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty were not formally assessed for this project.

Discussion

The respondents indicated that although formal risk analysis was not conducted, elements of risk are considered when the alternatives are examined. One example is the quality of the mineral content of the dredged material used for supporting plant growth. Respondents said that the potential for negative effects on human life in case of a failure are extremely low. The restoration of the area to obtain the desired results is characterized by uncertainty because these approaches are new and untested. Quite often, there is no impact or effect. The District will be conducting a meeting to address the issue of risk analysis and its impacts on future projects.

The Corps has constructed one project under this legislation, and the other agencies have constructed at least two. This was viewed by the District as a disparate ratio and was attributed to the extra costs associated with extensive analysis and overengineering for Corps restoration projects.

Since the other agencies' projects have lesser costs, they are likely to receive authorization for more of them. This is tied to the emphasis of cost-effectiveness in the priority list.

Respondent Recommendations

District respondents indicated a need to relax the engineering design against failure for environmental projects. The Corps traditionally builds projects to withstand significant hydrological events because human life and property are typically at stake. Using these same design parameters makes environmental projects extremely costly, especially in this region where rock is scarce. It was suggested that a new perspective be developed by engineers for designing environmental projects that is more tolerant of the risk of failure. This perspective should be willing to test new options, since most functions of environmental projects are not well understood.

LDNR recommended the development of more demonstration projects. This allows for more experimentation as well as the completion of some projects in a short time to continue public support. The public likes to see things being built, or else they become skeptical of what is being attempted.

Developing and Integrating Environmental Databases

Findings

LDNR maintains a database that provided a considerable amount of baseline information for the project. The U.S. Geological Survey (USGS) and local universities contributed additional information and comments throughout the project. The area will be monitored by LDNR throughout the twenty-year life of the project.

Discussion

A significant amount of environmental data was available for this project. Data came from geotechnical investigations, vegetation maps, wetland loss rates, aerial photography, and elevation

maps. Permanent boundary markers were placed to form a transect that will be used as part of the monitoring process. Professors and graduate students were involved with some monitoring, but they also formed a committee of academic advisors that were involved in all areas of project development, including review.

One respondent said that a recent bird survey of the area indicated there is a significant increase in the bird populations indigenous to the marsh, especially for waterfowl.

Evaluation Process

Findings

The project was selected as part of the ranking process by the CWPPRA Task Force.

Discussion

The Task Force has several subgroups that examine project proposals. The subgroups are composed of members from the Federal and state agencies, local university professors and students, and public-interest groups. Input from the public occurs during public meetings throughout the evaluation process. Examination is based on average annual habitat units (AAHU) and the cost analysis for completing it. Other factors can influence the selection of projects, such as distribution among parishes, but AAHU and the cost analysis are the primary components. Once projects have been ranked and approved by the various subgroups, money is authorized for as many projects as possible. After money is authorized, any alterations to the project design cannot exceed the funds available for it because no additional monies can be added for extra costs. All projects are designed with a twenty-year project life. It should be mentioned that this project did not follow the traditional Corps planning process. Most of the data and examinations submitted for ranking are, at most, reconnaissance-level investigations.

Two issues of special concern for the CWPPRA Program are state water bottom rights and oyster bed permits. State water bottom rights are a problem because of the wording of the law for Louisiana. The law concerns who has the mineral rights for water bottoms, depending on how the water bottom exists. Some interpretations of this law could give private property to the state, and

this has caused hesitation among some private landowners in granting easements for wetland development. Rights for oyster bed permits can significantly affect the cost of takings, because areas with these leases could be argued as providing millions of dollars that become lost revenue as a result of a project.

LDNR indicated the responsibility of handling these issues often falls on the local sponsor. These legal issues are costly, and LDNR said they should be handled by the agency originally responsible for the problem.

Interagency Coordination and Program Management

Findings

The District and LDNR worked together effectively on the project. The ranking process appears to accommodate input from any individual or group that may be impacted by a proposed project.

Discussion

Respondents identified factors that influenced the project coordination as permitting requirements, the Fish and Wildlife Coordination Act, and CWPPRA legislation. Both the District and LDNR felt the coordination overall was good because everyone that could be affected by the project was included early in the ranking process. The greatest challenge the ranking process faces is satisfying the differing agendas of the agencies and individual participants.

The District said that although the Corps was designated as the organization to monitor the funding for all CWPPRA projects, there are differences in the disbursement procedure that could alter how projects are completed. Organizations like NMFS have grant programs in place to allow more participation in environmental projects by state and local government agencies. Because of its invoice process, the Corps is not able to distribute funding that would be of use to non-Federal agencies. If there were a means to get money to more non-Federal agencies, as the NMFS is able to do, the Corps could have more options for involvement in environmental projects.

SUMMARY OF THEMES

Many of the responses for the areas of research are short and simple. They are indicative of the predominant theme in this case study: Keep the projects simple and solve the problem. Respondents felt that until enough postmonitoring data are gathered, there is not a need for extensively analyzing alternatives during the planning process. The respondents felt the problem areas are easily identified, and the alternatives for solving them are straightforward.

La Branche was viewed as a successful demonstration project. This success was attributed to the speed of completing the project and to the positive voice of public support. The respondents said public support would have dwindled if any more time would have been required to study the project. Respondents said the data gathered from this and future projects will direct future projects and approaches to solving them. Until that time, simple projects like this should be pursued to preserve existing habitat before more loss occurs.

Plan formulation dictated by CWPPRA legislation deviates somewhat from traditional Corps planning. This authorization brings together a number of agencies and involves them throughout the planning process. There is a specific format to follow based on what information is required for fact sheets, how the projects are to be evaluated, and what the criteria for project priority are. The respondents viewed the present guidelines as adequate, requiring only minor revisions. This format should be examined for applicability of Corps environmental projects nationally.

The respondents were pleased that new approaches were tried in the La Branche Project, but felt there was a need for more experimentation and acceptance of marginal loss in the design of future projects. There are concerns that some of the costs associated with standard Corps designs will jeopardize the reauthorization of the CWPPRA Program. Experimentation with new approaches in environmental engineering should be considered, especially because it appears all other persons and agencies are willing to accept the risks in order to get more projects completed.

MAYFIELD CREEK, KENTUCKY PROJECT

PROJECT DESCRIPTION

The Mayfield Creek Project design was one of the first U.S. Army Corps of Engineer's projects to utilize the Stream Obstruction Removal Guidelines (SORG), which was designed by the American Fisheries Society. The origins for this study began in 1983 when the SORG was first conducted. The SORG classifies a stream into one of five categories and then uses environmentally sensitive alternatives to remove the obstructions.

The Memphis District and the Lower Mississippi Valley Division worked together to face the challenge of providing flood control and habitat for waterfowl travelling the Mississippi Flyway. The study was funded as part of the continuing authorities program in Section 208 of the 1965 Flood Control Act and Section 205 of the 1948 Flood Control Act. The project has been designed to comply with National Economic Development (NED) goals, the Endangered Species Act, Section 404 guidelines for the disposal of dredged material, and goals provided by the U.S. Fish and Wildlife Service.

The Corps worked with eleven other agencies that are discussed in this Mayfield Creek study. The Mayfield Creek Compact, which is the local sponsor, is a coalition of three counties (Ballard, Carlisle, and McCracken) that will directly benefit from the execution of the project. The other participants had varying levels of involvement, from reviewing information to providing technical support, and included the Kentucky Department of Fish and Wildlife Resources (KY F&W), the U.S. Fish and Wildlife Service (USFWS), the Kentucky Division of Water Resources, the Purchase Development Agency, the Environmental Protection Agency (EPA), the Kentucky Historic Preservation Officer, the Historic Preservation Associates, Ducks Unlimited (DU), a timber company, and private land owners.

In 1937, the WPA performed cleanout and channel modifications in a 16-mile reach of Mayfield Creek, beginning about 3.8 miles from the mouth and proceeding upstream. The Flood Control Act of 1937 provided authority for the Corps to perform stream clearance work on navigable streams and tributaries. Under this authority, drifts, snags, and other debris were removed from about mile 3.8 on Mayfield Creek and proceeding upstream for a distance of about 5 miles.

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Due to improvements in agricultural technology, more land was cleared for farming, which led to increased siltation in both the natural meandering creek and the modified channel. The accumulation of sediment was accelerated by the formation of log jams and increased beaver activity in the basin. A recommendation was made in 1972 for channel enlargement that was subject to further study and review until 1979. Stream conditions became so obstructed that they contributed to a major flood in 1983.

The original purpose of the Mayfield Creek project was to provide flood control, but the environmental features became increasingly important and resulted in disagreements about the design of the project. Within the Corps itself, the evolving nature of the project presented challenges as to how it should be justified. The farming interests wanted better flood control so they could farm acres that were presently unproductive due to existing flood conditions. Other private landowners were interested in maintaining wetlands habitat for waterfowl, primarily for fishing and hunting.

The feasibility study for this project was completed in December 1990. It was recommended that project modifications be executed through a combination of snagging and clearing, and minimal dredging of severely blocked spots. The recommended SORG actions will not significantly reduce flood levels but will provide for better drainage and runoff of affected areas. Maintenance of wetlands and fisheries will be achieved through the strategic placement of a weir on Mayfield Creek near the mouth of Wilson Creek. Wilson Creek is a major tributary which empties into Mayfield Creek near the mid-point of the project. The project is in the construction phase.

In the remainder of this case study summary, findings are presented, discussion relevant to the findings is provided, and respondents' recommendations for improvement are listed. The summary is organized so that each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program is addressed. Respondent recommendations were not made for every topic area.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The determination of environmental significance for this project was developed from the Economic and Environmental Principles and Guidelines for Water and Related Land Resources (P&G). Emphasis was placed on the restoration of bottomland hardwoods; the enhancement of waterfowl, wetlands, and endangered species; are compliance with the Clean Water Act and the North American Waterfowl Management Plan (NAWMP).

Discussion

Documentation of environmental significance was fairly straightforward following the P&G. Even though some parties were not seeking environmental benefits from the project, no one denied the improved environmental value of the SORG-based project. The District said the P&G acts as a "cookbook" with descriptions of what local people view as significant. Letters indicating an organization's support of the study area's environmental significance came from the USFWS, timber interests, and hunting groups.

Respondent Recommendations

The District indicated that the only change it would have made in the feasibility report for this project would have been to add neotropical migrant birds under environmental significance because of recent data developments in that area. It also was suggested that P&G be followed since it covers the topic adequately.

Determining Objectives and Measuring Outputs

Findings

There were two primary objectives for this project. The first objective was to restore the project area to the conditions that existed in the 1950s and 1960s based on land mapping of that time period and measurement of change in habitat units. Second, the project was to improve existing flood control. Predicted measurement conditions for the objectives were accomplished by the SORG evaluation of the project area. Output measures identified for the project were based on restored acres, habitat units, waterfowl use days, and hunting days.

Discussion

Instruments used for measuring the outputs for this project came from the Habitat Evaluation Procedure (HEP), and the Habitat Evaluation System (HES). The SORG was used to classify stream obstructions and to provide means of mitigating the obstructions. The HEP analysis was used to determine demand for hunting days based on habitat output. The HES was used to determine the types of habitat that would exist as a result of implementing the project.

The SORG team was composed of members of the Corps, the USFWS, EPA and the KY F&W. The USFWS conducted the species-based HEP analysis, and the Corps conducted the habitat-based HES. Information from these two methods generally allow for validation of their respective results. Data for hunter information were provided by the KY F&W.

Outputs of the project were based on estimates of land types that would evolve in 50 years. It was projected that bottomland hardwoods would increase from 5,855 to 13,870 acres; dead and dying timber, and shrub swamp would decrease from 1,248 to 332 acres and 4,816 to 332 acres respectively. Acres of forested swamp and marshes will be slightly affected, yet will remain at 267 and 850 acres respectively.

Examination by the KY F&W of the area showed it to be capable of providing viable habitat for waterfowl that travel the Mississippi Flyway. Fish and wildlife within the project area over the 50-year period were estimated to be sustained at current levels. The USFWS indicated that a holistic

examination of flora and fauna in the area was not conducted because private property access needed to conduct a thorough examination of the environment was not practical.

The project will not have a significant effect on the reduction of flood stages in the project area. However, the time required for drainage and runoff is expected to significantly decrease as a result of project implementation. In fact, in the reaches of the creek where construction has begun, enhanced runoff already has been realized.

Respondent Recommendations

The District and Division indicated a greater need for examining wetland functions and their output values. An examination would provide a working model that would assist in reaching an agency consensus. Every model has its flaws, but a group working together can make a reasonable assessment with it.

There is a need for developing appropriate means of quantifying environmental outputs for these types of projects. Respondents stated that although the measures assist in the evaluation of a project, they do not necessarily portray what is being examined accurately. They also recommended an enhanced analysis of flood duration changes for the project area.

Objective Evaluation of Cultural Resources

Findings

Cultural resources were examined and found to have no significant impact on the project design. Six potential cultural resource sites were avoided in the project design.

Discussion

Examination of cultural resources was conducted in accordance with Corps Engineering Regulation 1105-2-100. The primary research was conducted by an outside agency. Six sites that

had potential cultural resource value were identified at the lower end of the project area. These sites were avoided in the planning process and subsequent project design.

Engineering Environmental Investments

Findings

This project considered alternatives that could provide flood control as well as habitat for fish and waterfowl. The selected alternative was chosen because of its environmental sensitivity and NED benefits through the reduction of flood losses (proposed by the SORG team).

Discussion

The design considerations for this project were to provide flood control, to maintain the meandering creek at low flow, and to be environmentally sensitive. The local sponsors needed a project that would be inexpensive because they had a small budget to contribute to cost sharing. To maintain environmental sensitivity, there was no work in the project area during April and May to prevent disturbing the spawning, hatching, or birthing of fish and wildlife.

The SORG team determined the course of action for project construction. Team members were from the Corps District, the USFWS, EPA, and the KY F&W. They determined the types of blockage that existed in the project area as indicated by the SORG classification system. Three stream classification examinations were conducted between 1983 and 1990. The study in 1983 examined the entire project area. Because of the dynamic conditions of the stream, studies were conducted at the lower eight miles of Mayfield Creek in 1989, and in 1990 at the middle section of the project area. The interdisciplinary team classified the entire project area based on SORG guidelines. Most of the work would be done based on snag-and-clear techniques, with a minimal amount of dredging to be done in several silted areas.

Mayfield Creek Compact members have been working to involve local landowners in assisting with maintaining the project after its completion. This would include removing downed trees that have fallen into the stream. One landowner indicated that maintenance will not be a problem until the people are too old to continue or cannot afford to have someone do it.

Several respondents indicated that the design of these environmental projects often go against natural laws. Instead of working with natural environmental forces, design attempts often try to force natural features, such as a stream, to do something it normally would not do. This typically results in a failed effort because, "If you design projects to fight the environment, you will lose." The SORG was viewed as an approach that worked with the environment.

Respondent Recommendations

One respondent said that the Corps has some of the best planning ability, but it needs to channel those efforts into environmental planning. Moreover, the Corps should not be apprehensive in experimenting with new techniques.

Another respondent indicated that utilizing helicopters would help in mapping channels, especially at high flows. Although there may be extra associated costs, a helicopter can significantly reduce the amount of groundwork time.

Monetary and Other Valuation Techniques

Findings

The primary benefits of this project are reductions in flood damage, an increase in bottomland hardwood acres and recreation benefits, and the maintenance of existing habitat for various wildlife species.

Discussion

A considerable amount of historical data were used to determine project benefits. Monetary benefits for this project were determined using NED accounting for the benefit/cost ratio based on a 50-year project life. The benefits that contributed to this ratio were the reduction of crop-road inundation, land use intensification, recreation values, decreased risks to public health and safety, and

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enhanced land values. Some other monetary benefits would be realized in the areas of trapping and commercial fishing.

Nonmonetary benefits that were considered include waterfowl use days and the continuance of existing habitat for waterfowl and fisheries. One unique benefit mentioned that was not considered was the educational and interactive value of an individual's first experience with a type of habitat, such as a child playing in a stream or forest. Some of the benefits that are considered in more recent Corps environmental projects are not found in this planning study simply because the guidance was not available at the time. Local residents were interested primarily in the costs for the project.

Benefits to wildlife will vary: Populations associated with bottomland hardwoods will increase and populations associated with shrub swamps will decrease.

Respondent Recommendations

The District indicated the need for techniques to estimate benefits that are independent of water levels in a project area.

Cost Effectiveness/Incremental Analysis

Findings

The cost effectiveness of the project was determined by a benefit/cost ratio based on NED accounting techniques. Incremental analysis was not conducted for this project.

Discussion

The benefit/cost ratio for this project was determined to be 1.07, which was adequate to justify the project; formal incremental analysis was not conducted by the Corps. Respondents indicated that incremental analysis can be extremely cumbersome to use and difficult to explain, especially to some of the individuals representing local interests. According to the respondents, little

is gained with incremental analysis for this type of project because all the obstructions need to be removed or the project will not provide any benefits.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty were not considered for this project.

Discussion

Risk and uncertainty for environmental projects differ from flood control projects. The District said there is confusion as to what should be done for determining risk. It was also indicated that, in the District's assessment, costs for conducting a risk analysis are excessive compared to the cost of replacing a physical failure after the project is completed.

Respondent Recommendations

Some technical issues were raised with regard to risk analysis. For example, if risk is to be examined for a project, should risk be assessed for every year of the project life, or should it concentrate on the potential for overall loss for the entire 50-year period? These issues as well as others should be addressed as the Corps enhances its techniques of risk analysis.

Developing and Integrating Environmental Databases

Findings

This project incorporated database information from the USGS, baseline data for the HES and HEP from KY F&W, and the EPA water database.

Discussion

Information used in determining the hydrological aspects of the project area was derived from the USGS, hydraulic gauge information, and the EPA water database. Information used to determine project outputs was provided by KY F&W, and a timber company. KY F&W supplied the baseline information for the HES, HEP, and hunter data; the timber company provided data on tree planting and dead timber areas.

Respondent Recommendations

Several areas for planning, modeling, and analysis require additional data collection efforts for changes in flood duration and land use. These data should be compiled into databases regularly and used to update existing models.

Evaluation Process

Findings

The primary reasons for selecting the proposed alternative were based on flood control, economic feasibility, and environmental sensitivity.

Discussion

The project formulation drew upon intensive use of written and oral historical data. The SORG team influenced the configuration of the project because its analysis was sensitive to the small-stream environment. The local sponsor viewed the project as economically feasible for cost-sharing purposes. According to the District, the evaluation of this project's alternatives would have been different if it had been initiated as an environmental restoration project. Although there will be some

benefits for wildlife, the emphasis of this project is to provide improved drainage for land uses such as farming and timbering.

Respondent Recommendations

The District expressed the need for environmental projects within the Corps to be evaluated on a regional basis similar to the design of the NAWMP.

Interagency Coordination and Program Management

Findings

An interagency team was formed to conduct the SORG assessment. Team participants viewed the SORG as an effective alternative for the project and felt that this was a progressive attempt by the Corps with regard to evaluating environmental projects.

Discussion

All of the respondents indicated that the most important element in any environmental project is to maintain the continuity of participants from all involved agencies. If the experts from each agency can work together without changes in personnel, an agreeable plan most likely can be formulated. The interdisciplinary team moved the project to its present status. In general, outside interests were pleased with the performance of District personnel but were displeased with the amount of time required to get information from the reviewers in Washington. Landowners were concerned that the longer it would take to complete the project, the more land and money would be lost.

The local sponsor, the Mayfield Creek Compact, indicated that there are many single-purpose organizations involved in the project. They felt that, if the Corps is in charge of a project, they need to be able to coordinate all the involved interests. Mayfield Creek Compact members were concerned that the USFWS was going to demand that another feasibility study be done and that the

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plan would then change. They indicated that there were too many changes in agency personnel involved in the project. Farming interests expressed concern about the amount of power that environmental groups, such as USFWS and DU, had over projects and that not enough attention was being paid to the concerns of farmers. It appears that the objectives of environmental projects are not always in accordance with the needs of those who will be affected.

One farming interest noted that some areas have been under water for so long that the land will not be cultivable. Though the Mayfield Creek Compact was construed as a representative of the local land owners, including farmers, a point was made that the Corps should have spent more time discussing and formulating project details with the farmers.

Several respondents felt the Corps was reluctant to share preliminary planning. Time could be saved by involving the necessary agencies early in the planning process. They indicated that the field-level working group was very good but problems existed because the field people could not make final decisions. One of the landowner interests would have liked documentation regarding agreements made during the planning process as a means of avoiding deviations from consensus determined during the feasibility study.

Directions from other agencies that the District was required to follow as part of the planning process were from the Fish and Wildlife Coordination Act, EIS requirements, the National Register of Historic Places, and NEPA guidelines. The District indicated that after integrating the information from the various agencies involved in a project, one cannot be sure how reviewers at Headquarters are going to interpret the information. Although the project was approved, District personnel thought there should be better definitions of what is required and how things should be completed.

Respondent Recommendations

The District indicated that there is a need for expanding and defining P&G framework. This would provide a clearer set of standards to follow for restoration projects and a better understanding of information presented in feasibility reports throughout the Corps.

One respondent noted that the Corps should develop more partnerships with other agencies, e.g., USDA, for example, to enhance working relations. It was also indicated that the EPA and the State Water Bureau should be more involved in the planning process.

One other recommendation was the need for members of the interdisciplinary team to be involved throughout the construction of the project to alleviate problems that may result from field adjustment during construction.

SUMMARY OF THEMES

Many aspects of this project were successful. The Corps, through application of the SORG at Mayfield Creek, has shown an environmentally sensitive approach to flood control. SORG improved the Corps relationship with environmental groups. The method is accepted by most environmental agencies as environmentally sensitive and shows that the Corps is attempting to incorporate new strategies in its planning and design process.

Another dominant theme observed in this case study is that an interagency work group was instrumental in the successful completion of the feasibility study. Formulation of the SORG team allowed the primary environmental agencies to formulate an alternative that was acceptable to all respective agencies.

This project did not start out with a primary environmental emphasis. This is evident not only in respondents' statements but in the consideration of project benefits as well. Because of the changing design of the project, it caused some cumbersomeness in the plan formulation. The recommended alternative was environmentally sensitive, but its main emphasis was for flood reduction, not habitat increases.

MCFADDIN RANCH WETLANDS PROJECT, TEXAS

PROJECT DESCRIPTION

The McFaddin Ranch Wetlands Project, located in Jefferson County, Texas, was designed to reduce saltwater intrusion into a freshwater marsh from the Gulf Intracoastal Waterway (GIWW). Saltwater intrusion has occurred because the channel created for the GIWW subverted the natural salinity gradient of the area. This project was proposed by the Texas Parks and Wildlife Department (TPWD), and it corresponded with the goals of the North American Waterfowl Management Plan (NAWMP) and the Coastal America plan. The other agencies that participated in the development of this project were the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Soil Conservation Service (SCS), Louisiana State University (LSU), Ducks Unlimited (DU), Texas Department of Transportation, and Environmental Protection Agency.

The authorization for this project was under Section 1135(b) of the Water Resources Act of 1986. In 1988, the Corps held a meeting of environmental agencies at the Galveston District to brainstorm ideas for projects that fell under Section 1135 authorization and the Coastal America plan. Field trips were conducted to sites that were determined to have a high priority for the area, and this project was ranked as the number one priority for the NAWMP for the state of Texas.

Originally, the project area was a private ranch and oil field. As structures on the property fell into disrepair, parcels of land were sold to the government. Eventually, all the purchased property was converted to wildlife refuges. In time, much of the freshwater marsh was affected by saltwater intrusion due to navigation channels that were cut through the area as early as 1933. A comparison of area photography from the 1930s with the present day clearly displayed the effects of the saltwater intrusion on the area. TPWD developed a management plan for the area, which was first viewed by the Corps at a NAWMP meeting held August 1990.

The feasibility study began in April 1991, which examined the area as a part of the Salt Bayou drainage system. The USFWS operates a control structure at one end of this drainage system, and any type of project would have a direct effect on that structure. The study was completed in March 1992, and it recommended the construction of a gated water control structure to regulate salinity and provide fish and wildlife management opportunities. After a year of review, the District received the money for plans and specifications in March 1993. The District anticipated that the

construction contract would be awarded shortly, and that construction would be completed by July 1995.

The total project cost was projected to be \$2 million. TPWD, as the local sponsor, was required to provide \$500,000. The sale of state duck stamps generated \$400,000, and DU contributed \$100,000. If this Section 1135 project is determined to be a successful means of pursuing environmental projects, the District and other environmental agencies plan to create more proposals under this authorization.

The remainder of this summary paper presents findings, provides discussion relevant to the findings, and lists respondent recommendations for improvement. The summary is organized to address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The environmental significance of this project is its location on 60,000 acres of publicly owned land and the restoration of the area to a freshwater marsh, thus advancing the goals of the NAWMP to preserve and increase waterfowl populations.

Discussion

The District said that based on the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), the area has institutional significance because the project area contains 60,000 acres of publicly owned land in the form of parks and refuges. Significance was also based on Executive Order 11990, which designated the protection of wetlands wherever possible.

The area was formerly a large freshwater marsh that has deteriorated for the last forty years because of the construction and frequent use of the GIWW. Returning the marsh to its former state will enhance habitat for waterfowl, which is significant to the goals of the NAWMP. The study area is important to migratory waterfowl that winter here from both the Central and Mississippi flyways. Prior to the increase of salinity in the area, there was a diversity of fresh- and saltwater species of plants and animals in the marsh. Since the increase, most of the freshwater habitat has disappeared. Many animal species were dependent on the freshwater plant species for food, especially waterfowl. Without that food, they cannot exist in the area.

The District said that describing the environmental significance of this project was not difficult to do. TPWD was able to provide solid historical data about the refuge's biological aspects and presented this information in the form of a videotape. They felt having that information available made a good narrative that was easy to understand. The TPWD respondent felt fortunate that this District had good biologists on staff, because very often Corps biology staffs are small in number and limited in their understanding of the environmental aspects of an area. This respondent also indicated that conveying environmental significance to nonbiologists can be difficult due to their limited knowledge in the area.

Respondent Recommendations

The District said the P&G needs to provide information that assists in the determination of the biological significance of marshlands.

Determining Objectives and Measuring Outputs

Findings

The goal of the project was to reduce saltwater intrusion into the marsh to improve the habitat quality for freshwater dependent species. A Habitat Suitability Index (HSI) for the mottled duck was selected as the measure of habitat improvement. TPWD will monitor plant and animal species as well as the salinity level of the marsh.

Discussion

The objectives of this project were to improve habitat quality for freshwater fish and wildlife by reducing the saltwater intrusion into the area. The HSI for the mottled duck was selected as the indicator species because it is a year-round resident of the area and is well documented. The mallard duck is a very common selection for indicator species, which is not necessarily the best choice, according to the TPWD respondent. Mallard ducks are not year-round residents of the area, so their habitat needs are short-term.

Strong consideration was given to using fish production, shrimp production, recreation, hunting, fishing, and monetary increases for furriers as possible output measures for the project. These were not selected because they were not reflective of the project goals and would have required significant effort for accurate quantification. The use of the HSI was the only method that was acceptable for all the participants. The model covers the life requisites of the mottled duck, which are food, cover, and reproduction.

Several respondents commented on the shortcomings of the HSI model. Though it is a fair indicator, HSI cannot account for natural events, such as a hurricane or a drought. The best measure is based on opinion from a refuge manager who has spent significant time monitoring the area, just as a farmer can determine what will happen in a planted field. TPWD offers week-long training sessions to educate attendees on marsh management strategies. According to the TPWD respondent, very few Federal agencies send representatives to these sessions.

The TPWD respondent said "short-stopping" is one aspect sometimes not factored into the determination of outputs in attracting migratory birds. This occurs if an area along a migration route provides large amounts of habitat to support a large amount of birds. This can either delay or eliminate the need for further travel for migratory animals, which can make a significant impact on waterfowl counts if you are surveying an area at the end of a flyway.

Respondent Recommendations

The NMFS respondent said that there is a method that has been designed for estuarine coastal evaluations, known as the Wetland Value Assessment. This may warrant further research to determine its use in measuring project outputs. Other information that may be reviewed for future

use includes A Study of Marsh Management Practice in Coastal Louisiana and Community Structure and Dynamics of Fishes and Crustaceans in a Southeast Texas Estuary.

It was suggested that universities can be a source for research assistance. However, in soliciting such assistance, there is a strong chance that students who participate in such studies may not have enough training to accurately assess biological conditions. TPWD recommended that money should be spent developing personnel so they can make better field assessments. TPWD said their marsh management course would benefit the Corps and other agencies' personnel in the development and evaluation of environmental projects.

Objective Evaluation of Cultural Resources

Findings

Cultural resources did not have an effect on the planning of this project.

Discussion

The District used their in-house library to conduct the initial survey of the project area. A site containing shell fragments from prehistoric hunting-and-gathering tribes was determined to be within the project area. A field reconnaissance was conducted, and based on the field survey, it was determined that the project would have no impacts on the resource. A letter was sent to the State Historic Preservation Officer (SHPO) for Texas stating there would be no impact, and they concurred with the District's findings.

The District archeologist was satisfied with the planning guidance for evaluating cultural resources from the Advisory Committee on Cultural Resources and the P&G. The archeologist indicated that SHPO records and assistance can vary from state to state, so it is important to maintain a good rapport with them to help speed things along. The other agencies interviewed said they were satisfied with the Corps examination of cultural resources.

Engineering Environmental Investments

Findings

The design for this project was based on existing plans for similar water control structures that were designed and built by the SCS.

Discussion

The engineering for this project was influenced by design plans from the SCS for a water control structure in Louisiana. The District took two field trips to examine similar structures in Texas. Factors that affected the design of the structure for this project were a need for vandal-resistant materials, parts that could be moved and replaced without machinery, low maintenance, ability to control water levels, allowance for the ingress of photoplankton and saltwater when desired, and the minimization of erosion.

There were several studies conducted by LSU, USFWS, and TPWD that recommended various options for the project. The primary issue was determining what species was going to be managed at what time of year. The goal was to reduce saltwater intrusion, but if the system was closed in the spring, shrimp that use the area for spawning would not be able to get in or out. The final design eliminated a dam because it would not allow control of water levels. Using gates allows for a quick response to adjust water levels, especially if there are excessive rains that would require some drainage of the marsh to prevent the drowning of plant species. It will also facilitate an influx of saltwater when needed in the marsh. A roller ramp for small boats will be installed to provide access to the marsh for TPWD.

There will be special consideration to using local agencies to assist in the construction of the project, such as the local oil emergency response team because of their equipment availability. In addition, the design will attempt to use material stripped from site, such as grass seed, and to use dredge spoil as top soil when preparing to seed an area. Respondents said that regardless of how well a project is planned to incorporate such ideas, a field engineer who is not aware of a project's environmental significance can make field decisions that will cause the design to be less effective than originally anticipated.

Non-Corps respondents voiced some concerns about the development of the project design. The first concern was that the engineers do not appear to be as attuned to environmental concerns as other Corps personnel regarding environmental project. Very few are able to leave the "cookbook" of design options out when developing a project. Local sponsors will not settle for a standardized design project because of their marsh management needs. Another concern was the rate of turnover that occurs at District offices. Most Corps personnel do not spend as much time in an area as state conservation agency personnel who have resided in a state most of their life. Because of this, state personnel usually have a better understanding of the local ecological system and need to be included in the engineering of environmental projects.

Respondent Recommendations

Respondents recommended consulting the SCS about these types of projects because they have experience in their design and construction. They also said that biologists should sit down with the engineers who will develop the project and explain what the biological goal is, why they need to meet that goal, and define what the maintenance and financial constraints are. It was also suggested that computer enhancement should always be considered for refining the project design.

The District said that although there is a formulation process to follow for planning projects, there is a need for specific guidance for the biological preservation of marshlands.

Monetary and Other Valuation Techniques

Findings

The benefits for this project were the increase in the HSI for mottled ducks from 0.36 to 0.79 and an expected increase in habitat for other animals located in the area.

Discussion

The increase in freshwater vegetation will increase the wildlife population. The available habitat will increase for the mottled duck and other species, including mink, coyote, otter, muskrat, and nutria. The District was not required to conduct a benefit/cost ratio. They were pleased with this because they felt it would be challenging to determine monetary benefits for this project.

The TPWD respondent suggested that economic benefits could be assigned to livestock grazing, trapping, and duck hunting. TPWD collects a percentage of money from trapping and gator hunting when it is permitted on the refuge. NMFS provided data regarding potential benefits for commercial fisheries.

The NMFS respondent said determining the benefits for estuarine restoration has been frustrating. There have been major conferences held to make improvements in benefit determination, but it is difficult to find a model that describes all of a project benefit. Presently, it seems necessary to use several models.

Respondent Recommendations

The District recommended that qualitative descriptions of benefits be used in environmental project reports because they provide a detailed view of a project area and what will be gained.

Cost-Effectiveness/Incremental Analysis

Findings

Incremental analysis was used to analyze the impacts of the project alternatives.

Discussion

The District conducted incremental analysis based on the cost of the implementation of each alternative and the change in HSI each alternative would provide. The District said incremental analysis creates challenges in planning because it assumes a wide array of alternatives require examination. It is difficult to generate a variety of choices for mitigation projects of this nature. Technically, saltwater estuaries and cypress swamps cannot be restored or created because little is known about their complex natures, and they have taken hundreds of years to evolve and mature.

When incremental analysis is used in these projects, some agencies view it as a way for the Corps to avoid full mitigation. Nine Easy Steps for incremental analysis was not perceived as applicable to projects that are designated to provide 100 percent mitigation.

District respondents said incremental analysis is economically based and deals with quantifiable units. Its application for environmental projects is difficult because there are factors that are not readily quantifiable. The TPWD respondent felt that there are too many variables involved in these types of projects to produce a number that accurately reflects its goals and values. Respondents agreed that cost-effectiveness of projects needs to be considered, but a high level of subjectivity underlies the analysis.

Respondent Recommendations

The District would like to be empowered to make more field decisions. The respondents said they lose credibility with the other agencies when changes are requested from the Washington Level Review Committee (WLRC). Many of the decisions regarding environmental projects require field observations that cannot be made from Washington.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty were not formally considered for this project.

Discussion

The respondents did not see a practical means of assessing risk for environmental projects. Marsh management was described as an art rather than a science. The TPWD respondent indicated that some of the best marsh managers based part of an area's assessment by the taste of the water, instead of using calibrated instruments. There are many factors that can influence the results of a project, including plants that are in competition with each other. Completing such an in-depth examination would require a large amount of money, and it still might not provide an accurate assessment. The best means of determining project risk is to get an informal assessment from the manager of the area.

One respondent made the point that risk depends on who is viewing it. NMFS would like more saltwater for spawning shrimp. TPWD is interested in increasing waterfowl habitat for the area. Although one group may consider a project a failure, another may see it as a success for meeting their agency's goals. Trade-offs occur in the development of projects, but each agency has its own interests they would like to see met.

Respondent Recommendations

The District said there needs to be a means of quantifying all of the elements that would be involved in the calculations if a formal risk analysis is going to be required for future projects. They would prefer an analysis that was an informal assessment from field experts.

Developing and Integrating Environmental Databases

Findings

Databases that were used in this project contained weather bureau information, storm search data, wave height data, tidal conditions, historical information, and hydrological data. The Texas National Research Database was used to locate engineering information.

Discussion

The District said that much of the relevant information was found through personal searches and readings, although some database information was used in this project. Every environmental area has unique characteristics, and this information was available through the TPWD. Information that was examined came from archeological records, Corps correspondence, riprap designs, engineering records, Civil War records, aerial maps, and parks and wildlife population surveys. The U.S. Geological Survey and LSU provided some information, but much of it was incomplete.

District respondents said there are appropriate databases available, similar to the Texas National Research Database; the difficulty is locating them.

Respondent Recommendations

Respondents said the Coast Guard may have additional hydrologic information that can be used in future projects.

The District would like to see compilations of existing designs, individuals, and resources that would assist in the development of environmental projects.

Evaluation Process

Findings

The alternatives for this project were evaluated with regard to their ability to return the marsh to its historic conditions before the construction of the GIWW.

Discussion

Proposed project alternatives needed to restore the marsh to conditions before construction of the GIWW. Although the reduction of saltwater into the marsh will meet this goal, NMFS said alternatives had to allow for the passage of marine organisms, such as shrimp, in and out of the marsh. Original maps and photographs of the area were used as part of the determination of those historic conditions. TPWD was pleased with the selection of the proposed alternative. They would like to see more projects examined in this manner.

Interagency Coordination and Program Management

Findings

The Corps and TPWD worked closely on almost all aspects of this project. All respondents felt there was good coordination between the agencies involved in the project.

Discussion

The District said they followed the steps provided in the P&G. This helped to get the project through the review process in Washington. They attributed the success of completing the feasibility study to the enthusiasm and assistance of the local sponsor and the Division office. The TPWD indicated the Corps study manager helped to maintain that enthusiasm throughout the project. Respondents said the open exchange of information between the involved agencies helped to enhance each others' credibility, and that allowed the feasibility study to be completed in less than a year. There was some initial resistance from local environmental groups and a saltwater fisherman. Presentation of the alternatives helped to reduce their uncertainty of project outputs.

District respondents were concerned that some aspects of the feasibility study report were being overexamined at Headquarters. The Division spent two months in its review of the study, and the WLRC required eight months to examine the document. There were technical comments from WLRC that were viewed as unnecessary because the District had already dealt with them in their in-house review. The District made many telephone calls to Washington; however, there was no

feedback during this stage. In the end, no changes were made to the feasibility study. All agencies involved felt there was an inordinate amount of review for a document that required no changes.

All respondents indicated there are many environmental projects that could be pursued, but there are not enough local sponsors to participate in cost sharing.

Respondent Recommendations

Several respondents recommended that environmental projects should be managed by individuals with a strong environmental background. A biologist with the proper training can guide an environmental project to its completion easier than other personnel because of the required interaction with other environmental agencies.

The District said there should be more weight given to field assessments during project review. Many of the biological decisions are made and approved by the District and the environmental agencies involved in the study.

District respondents said there needs to be a difference in how small and large projects are reviewed, and that different formats for the reports may require development. They asked if there are any guidelines for determining when a project is too small to pursue. They also would like deadlines adopted for the review of projects to encourage timely turnaround.

The NMFS said there are multi-agency task forces set up in Louisiana that evaluate and select environmental projects, with each agency getting one vote. This should be examined for possible state-by-state implementation.

SUMMARY OF THEMES

The theme that seemed to permeate all of the interviews in this study was the need to be conscious of the environmental aspects of projects and how to manage for them. The non-Corps respondents indicated that having a biologist as the study manager contributed greatly to the completion of the feasibility study. The manager's background encouraged more efficient communication with the other environmental agencies involved in this project. Because of the manager's sensitivity to environmental concerns, it helped to develop a solid working relationship.

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In developing the project design, consideration had to be given to how the marsh would be managed. There was some controversy with regard to how much the saltwater intrusion needed to be reduced, since each agency has its own objectives. The study manager appeared to help develop trade-offs between agencies, which reduced tensions enough to have them sign off on the proposal.

This project dealt with marsh restoration. The District could have used guidance on developing a statement of environmental significance for marshlands. The interviews with the local environmental agencies indicate that they have a considerable amount of information in this area.

The engineering of this project incorporated water control structure designs from the SCS. It appears that in addition to the SCS there may be other agencies that have valuable design information. Efforts should be made to locate where this information can be found and assemble it into a database that could be accessed for use in project designs. The Corps also should consider sending biological and engineering personnel to marsh management courses to improve their knowledge of planning and designing environmental projects.

There was considerable discussion pertaining to empowering the District to make more plan formulation decisions. Many of the decisions that the District would like to make require firsthand knowledge of the site, and conveying information in the form of a memorandum can be challenging and time-consuming, especially if the information is biologically oriented and the receiver of the information is not. Also, limits should be set on the review time of a feasibility report. This will expedite the process and limit frustration, especially from local sponsors, that often occurs in the plan formulation process.

POOL 8 ISLAND CONSTRUCTION

PROJECT DESCRIPTION

The Pool 8 Island Construction project was the first case study that was part of an overall management system for a geographic region, the Upper Mississippi River. Authorization for the system management approach was provided under Section 1103 of the Water Resources Development Act of 1986, referred to as the Upper Mississippi River System Environmental Management Program (EMP). The participants for this program were made up of the Corps, the U.S. Fish and Wildlife Service (USFWS), and the states along the Upper Mississippi River. These states are Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Projects for this program can be presented by any agency, and each after the island was seeded the Flood of 1993 hit the area. The island withstood the 1993 flood on the Mississippi River, which would indicate the hydraulic design is effective.

The remainder of this summary paper presents findings, provides discussion relevant to the findings, and lists respondent recommendations for improvement. The summary is organized to address each of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program. Respondent recommendations were not made for every area.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The environmental significance for this project was based on goals of the North American Waterfowl Management Plan (NAWMP), it will help waterfowl species of concern, and the project location is within a national wildlife refuge.

Discussion

Many of the factors for significance were derived from the goals of the EMP. The Upper Mississippi River is viewed as a contributing factor to the significance of this project. Respondents said one of the benefits of the EMP program is if a project is selected for study and construction, that indicates the project has significance because of the multiagency consensus required. Additional significance exists because the project area is located within the Upper Mississippi River Wildlife and Fish Refuge, as well as being indicated within the Master Plan for that refuge. There is also significance within the confines of the NAWMP because the project area is situated along the Mississippi Flyway, and waterfowl species of concern such as the canvasback duck use the refuge as one of their staging areas for fall migration.

There is a significance for fisheries, but it did not receive a great emphasis to avoid attracting additional people who would want to fish in this closed area of the refuge. A later project in the lower Pool 8 area will be emphasizing fisheries benefits. The constructed islands provide a visual barrier for resting waterfowl in addition to reducing wave action and turbidity. Public meetings were held that discussed the environmental significance of the project, but some respondents felt that there was a need for more of these meetings.

One respondent indicated that the fact there has been money legislated for these projects as part of the EMP should indicate a high enough level of significance. Members of the Washington Level Review Committee were given a boat tour of the Upper Mississippi region by the Division in 1993 to help show the significance of the project area.

The Division said Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) is not used as a checklist for evaluating the environmental significance of a project because much of the information required is developed in the initial proposal for the Rivers Resources Forum. The description was not perfect, but it did convey the needed information to justify the project. The other agencies involved felt the Corps adequately described the environmental significance of the project.

Concern was expressed about perceptions of local significance at the Washington level. The bluegill may be determined to be a significant species in a project area. Bluegill may be a prominent species in most areas of the United States, but if they are determined to be important to the local community, is that important to the reviewers?

Respondent Recommendations

More emphasis should be placed on the field biologist's determination of environmental significance because of their daily exposure to the area's ecosystem.

Determining Objectives and Measuring Outputs

Findings

The primary objective of the habitat restoration was to maintain aquatic plant beds over a set amount of acres. This restoration would contribute to maintaining critical migration habitat for waterfowl and maintaining fisheries habitat.

Discussion

The District said there was difficulty in forming this section of the feasibility study. There was inadequate data to determine any numbers for increases in fish and waterfowl populations. Both the Habitat Evaluation Procedure (HEP) and Wetland Habitat Assessment Guidelines (WHAG) were conducted to provide some quantitative information as requested based on the review of the feasibility study. This information was used to illustrate the potential outputs in a measurable manner. Engineers require specific information to assist them in designing a project, and providing them this information has, to a certain extent, helped the formulation process.

District respondents felt present models for determining migratory waterfowl benefits were not appropriate for this region. They did view the models as useful for planning assistance, but that they should not be used as a means of evaluating one project against another. Many of the other respondents strongly discouraged extensive reliance on tools such as HEP because of their subjectivity and the lack of a system-wide view of a project's effects. The respondents acknowledged that although community modeling and ecosystem management is being developed, it is not far enough along to supplant single-species models. One respondent said if you are going to use subjective modeling, why not go back to the old survey methods that were rich in qualitative

information. Another respondent noted there will always be a need for single-species indicator models to monitor endangered and threatened species.

Respondents all appeared to be in general agreement that it would be difficult to develop quantifiable goals for the biological aspects of the project. Several recommended setting up broad management objectives because the site in question is an open system subject to many effects beyond the project area. The respondents indicated there was difficulty in making sure the qualitative information properly expressed project goals and outputs.

One representative for USFWS commented that their organization has had difficulty in determining appropriate quantifications for biological resources for the last fifty years. The respondent said that using quantifiable outputs does not provide the proper perception for an environmental project.

Respondent Recommendations

District respondents suggested research be conducted for determining acceptable aquatic measures, more data developed for exotic plant and animal species, and developing models that reflect the biological diversity of an area. Biologists indicated a need for more models for waterfowl and shorebirds, but expressed concern that if biologically diverse models are developed, the single-species models will be of little use. If single-species models are going to continue to be used, one respondent indicated a need for models that determine appropriate migration habitat.

Many of the respondents said there should be more reliance on qualitative information for environmental projects. One respondent suggested that quantifiable objectives and outputs should be based on physically or chemically measurable features. At the present time, it is difficult and risky to evaluate biological systems based on present modeling techniques.

All respondents said the GIS is important for future determinations, and it should continue to be maintained with new data because of its continued value to the Upper Mississippi region.

Objective Evaluation of Cultural Resources

Findings

Cultural resources did not have an impact on the planning of this project.

Discussion

The Corps cultural resource staff conducted a historical review of the project area. They were very attentive to the potential of ship wreckage and native american artifacts. A letter was sent to the State Historic Preservation Officer indicating a lack of cultural significance in the project area, and the officer concurred.

The District archeologist said cultural resources located along the Mississippi River are becoming very important to people for its historic data. Even though there are standard ways to examine cultural resources, careful attention is given to thoroughly research each area. The agencies involved in this project agreed the Corps handled the examination properly. To avoid conflicts between agencies when a project is located on Federal land, the Corps and USFWS have agreed the cultural resource assessments will be handled by the Corps.

The District archeologist expressed concern toward having adequate resources for conducting cultural resource mitigation. For EMP projects the available funding is based on one percent of the total project cost. There are times when this amount is inadequate because of what needs to be done, such as ripraping a burial ground that is eroding from the raising of the river. Requesting additional money and resources for this type of mitigation can be a very difficult process.

Engineering Environmental Investments

Findings

Alternatives for this project were developed through brainstorming. Special consideration was given to orientating the project toward waterfowl. The River Resources Forum was useful in gaining cooperation from the state of Wisconsin over some design issues.

Discussion

Initially, members of each agency met to brainstorm alternatives that would combat the increased sedimentation and turbidity in the pool, which was caused by wave action from navigation and wind fetch. The measure of turbidity in the pool was considered to be very important in the formulation of alternatives.

Development of island configurations and their composition was an important consideration during the alternative formulation process. If the goal of the project was to provide a breakwater, only rock would be required to fulfill the task. Since the islands were going to provide habitat for waterfowl in addition to reducing turbidity in the pool, it was necessary to consider what type of substrate (e.g., sand, silt, clay) would allow vegetation to grow but not be impacted by wave action and flooding. Although using a larger amount of dredged fines as part of the island composition would have allowed for a more rapid development of vegetation, they may not have withstood the dynamic hydraulic conditions of the Mississippi River.

The laws of Wisconsin posed a challenge to the engineering of this project. Wisconsin has very strict policies regarding flood control and use of dredge spoil. The issue of dredge spoil was especially challenging because Wisconsin law prohibits placing any dredge spoil into the Mississippi River. The endorsement of this project by the River Resources Forum helped to gain approval from the state. When decisions were made on how many paths the water should have for circulation in the pool, it was determined to keep the number of openings small because it would be easier both legally and physically to remove more soil to increase flow rather than add more for flow reduction.

All of the respondents were pleased with the experimentation the engineers incorporated into the design of the project. Riprap was used to armor the main island against the flows of the Mississippi, and on one island groins were added to prevent its erosion. Willows were planted in staggered rows along the shores of the islands to guard against erosion from wave action. Waterways Experiment Station has been examining varieties of plant life in the area that may be useful as protection for future projects.

District respondents indicated there were some problems with the Definite Project Report cost estimate for the project it was based on low unit prices received on other dredging contracts from a local contractor who subsequently retired. During preparation of plans and specifications it was recognized the project construction costs would be substantially higher than originally estimated so additional money had to be appropriated. There were also concerns that there would not be

enough money allotted for operation and maintenance of the project once it was complete. According to several respondents, this is often a major concern.

A USFWS respondent recognized there are challenges in conveying biological concerns to engineers, but there is a greater difficulty in getting biologists to agree on an alternative because of the orientation of an agency. In this case, some agencies were trying to develop the project for waterfowl while others wanted more for fisheries. Since there are going to be additional projects planned for this pool, trade-offs were arranged so this project emphasized more benefits for waterfowl. The next project to be constructed in this pool will emphasize fisheries.

Respondent Recommendations

Several respondents said there should be more consideration given to utilizing the energy of the river as a means for constructing future projects. There is already some experimentation with placing a structure in the river to form an island, and respondents thought this should continue. One respondent even indicated the river forces can work better than a backhoe, but recognized that navigation needs would not make it a viable option at this time.

A representative from USFWS recommended more collaborative efforts between the Corps and USFWS in developing master plans, such as the one that exists for the Upper Mississippi Fish and Wildlife Refuge. The current situation between the two agencies is the Corps building the projects and USFWS maintaining them. Joint development of master plans would only enhance relations between the two agencies.

One respondent said there are moist soil units that can be used to feed dabbling ducks, but these do not help diving ducks. There should be more research to determine how to provide vegetation for them.

Monetary/Non-monetary Valuations

Findings

Non-monetary benefits were used to describe the values of the project. These benefits include reduced sedimentation, and increases in habitat for waterfowl and fisheries. No monetary benefits were calculated.

Discussion

District respondents said monetary benefits were not determined because it was not required. The non-monetary benefits of the project were described as a narrative based on the goals of the EMP. The respondents felt there were not adequate means for determining values, and professional judgement needs to be relied upon for determining the benefits of a project.

Many respondents referred to the selection process for EMP projects as an indicator of high benefit and justification. A ranking system is used that is based on the breadth of species benefit, project size, and potential of success. All involved agencies have an equal vote in determining the most beneficial projects as they see it. There is a lot of detail that goes into the preparation of these proposals for the River Resources Forum. Because the members are familiar with the environmental conditions of the Mississippi River, they have solid background knowledge regarding where benefits can be gained and are most needed.

All the respondents saw a need for more qualitative descriptions of both the project area and the benefits achieved by project implementation. The descriptions can illustrate project benefits to a reviewer who is unfamiliar with the project area. It is necessary to explain differences in restoration rates, such as the reason songbirds may recover at a faster rate than waterfowl is that waterfowl are hunted and the songbirds are not.

There were mixed reactions to the effects of recreation on a project. Some respondents wanted to incorporate recreation benefits into the feasibility report because there are definitive monetary values that can be determined. Those opposed to recreation values assumed that position because there are consumable benefits associated with recreation. Some agencies view consumable benefits as contrary to the goals of restoration programs. Concern was also expressed that the public

will perceive improved fisheries as improved access to fishing. USFWS respondents wanted this benefit underemphasized to avoid the disturbance of nesting ducks within the refuge area. Other projects to be conducted in Pool 8 will have a greater emphasis on fisheries for this reason.

The involved agencies view this project as a type of experiment, and therefore felt unable to determine many of the benefits the project could provide. However, as long-term monitoring continues, this project will help to determine more benefits for similar projects based on the biological responses.

One District respondent said states have lists that assess monetary values to animals. These lists do not necessarily match from state to state. Respondents recognized that there is a need to integrate economic development with environmental sensitivity in these projects. The challenge is getting everyone to agree on common values.

Respondent Recommendations

All respondents recommended more acceptance of qualitative professional opinions in determining project benefits. Until more information is gathered, there is no way to account for project benefits.

Division respondents would like to see more research done for determining values of aquatic systems.

Cost Effectiveness/Incremental Analysis

Findings

The cost effectiveness of the project was examined in response to questions from the Division during preparation of plans and specifications.

Discussion

Incremental analysis was conducted during the plans and specifications project phase. The District respondents noted there were a small number of alternatives to compare. HEP was used in the analysis. District respondents indicated if there are a limited number of acres being improved by a project, using incremental analysis does not help justify the benefits a project can provide. Determining increments for this project was not a problem based on the goals that were developed. The lengthiest part was the actual cost estimation of the project due to the amount of detail required.

A Division respondent said following Nine Easy Steps for incremental analysis may be too excessive, depending on the project size. Based on EMP projects, they would prefer to spend more time examining qualitative information pertaining to these projects. Money not spent on incremental analysis could be used for developing other projects. The Division is attempting to have a workshop for all its Districts to reduce inconsistencies in how this information is presented. Other agencies involved in EMP projects will be invited to attend.

Several respondents expressed concern in using cost-effectiveness as a means to justify projects. One reason for this is some justifications for environmental projects do not have quantifiable values. Another was certain models attribute different values to fishery and wildlife habitats. Excessive cost restrictions could cause scaling down of many projects, which in turn could negatively affect restoration efforts.

Respondent Recommendations

The District said projects should not be compared simply by cost and/or incremental analysis. Incremental analysis should be used to determine levels of engineering effectiveness.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty was not considered for this project.

Discussion

The District said there were some failure considerations, but they were based on professional judgement. There is a commitment among all agencies to develop more environmental projects, and there is a willingness to take more risks in their design. They indicated the challenge lies in getting engineers willing to risk potential failure of the designs because of the lack of solid data available on environmental structures. If an assessment is to be done, develop the worst case scenario. Currently, there is not enough information to determine varying levels of success for environmental projects.

Other respondents were not sure there is a means to quantify risk for environmental projects, primarily because many of these projects have just been constructed or have never been done before. New information is being gathered every day for future application, such as the knowledge that it is easier to maintain shallow water islands than deep water islands within the confines of the Mississippi River. All respondents wanted this type of information chronicled for future use.

USFWS respondents indicated there is difficulty in determining all the variables involved. An earlier island project saw a high mortality rate among some birds caused by bacterium, but was viewed as a temporary setback. Success for environmental projects does not necessarily occur overnight.

Developing and Integrating Environmental Databases

Findings

There was an interagency effort to provide some of the data used in this project. Some information was gathered as part of the Long Term River Monitoring (LTRM) for the EMP program. The data was incorporated into a Geographic Information System (GIS).

Discussion

The LTRM yielded some data useful for this project, but MDNR and USGS provided significant information regarding vegetative mapping and water quality. Aerial photography, duck counts, and mussel survey information came as part of the interagency coordination. Some of the information has been digitized for use on a GIS. Eventually the information gathered will be made accessible to other interested agencies.

The District said the maps of vegetation versus water depth were helpful in the planning process, as opposed to receiving the information in written form. Information generated from the GIS has proved valuable as a means of presenting aspects of the project to the public and decision makers.

USFWS is pleased to see this type of monitoring occurring for the Upper Mississippi River because it will provide useful information for future projects. The respondents indicated they look forward to the accessibility to LTRM data, and hope the monitoring for these projects will continue long after they are constructed.

Evaluation Process

Findings

Island designs were examined to determine what would best achieve the project objectives.

Discussion

The objective of the project was to construct islands to provide habitat for waterfowl and fisheries. The evaluation required determining what island designs would be most effective and what steps needed to be taken to prevent erosion of those islands. Several respondents indicated that sometimes the evaluation of alternatives is too extensive, especially when options are limited.

Many respondents noted the environmental projects for the Upper Mississippi River are approved on a consensus basis. This was seen as an indicator of approval of the project by the involved agencies, and it should have some bearing on the justification of the project.

Respondent Recommendations

Many of the respondents said incorporating more qualitative information into feasibility reports would be useful in making evaluations of proposed alternatives.

Interagency Coordination and Program Management

Findings

All involved agencies felt the cooperation between themselves was good. The formation of the EMP provides a good medium to settle disagreements among agencies. There was disagreement as to how effective communication was with the public.

Discussion

The agencies in this project felt the Corps did a good job in coordinating this project. Several respondents said the frequency of information was very good. Credit was given to the EMP for being used as a means for distributing information. Agencies were able to voice their positions in an open forum. Disagreements and arguments still existed, but it was viewed as part of the process in getting the project moving.

There was disagreement as to how effective communication was with the public in the review of the project. The public supported the use of dredged materials for the islands, which was helpful in negotiations with Wisconsin. Some of the other recommendations were incorporated into the design. It was stated that the earlier the public is brought into these projects, the sooner issues of public significance can be addressed. There are times that people will talk excessively, but it is an important part of the process. Generally, the respondents felt the Corps did a good job incorporating

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other agencies' comments on environmental significance, but the public should be brought in earlier. After the public was informed of the project and its goals, they were supportive to the point that an overlook is being developed for the area.

District respondents said they followed the six step planning process for project formulation, and some of the state agencies had difficulty in understanding why it was done in this manner. Everyone involved had an idea of how this project should be formulated. Again, the EMP was credited as providing a middle ground for the agencies to meet. District respondents felt there was adequate existing guidance for developing projects, but sometimes there needs to be a way to convince partner agencies the process we are following will work. The state agencies would like to see the overall process move more quickly so more projects can be built.

The District and Division respondents expressed frustration with the review process of the feasibility report. The Washington Level Review Committee (WLRC) provided some good functional suggestions, but they do not appear to understand the systems approach being developed for the Upper Mississippi River. Members of WLRC were taken on a tour of the region as a way of introducing them to the area and what the EMP would provide the Mississippi River.

Division respondents said they look for the Districts to elaborate more or think things through when there is a problem in a report. Regionalized reports make it easier for the Division to examine the meat of the interview. When a report gets to higher levels of review, the value of regional knowledge is lost on someone not familiar with it. There never seems to be consistency in the review of documents by WLRC. A standard format does not seem to exist.

Respondent Recommendations

One of the respondents said there should be better documentation of what is being done in the groups. There were times when it seemed the project was going backward. The documentation was suggested as a way to keep the group focused and on track. Some of the agencies have an above average rate of turnover, and documentation could help bring new personnel up to speed. In conjunction with this, agencies should also sign off on what has been agreed upon to enhance the group focus.

It was suggested that when multi-agency teams are meeting with the public, they should all sit together at the front of the room. This would be a visible sign of unity among all agencies and should reduce the amount of attacks the public tends to direct at the Corps.

Division respondents recommended the inclusion of WLRC at the draft stage of reviewing study reports if they are going to be involved in the process. This should help them develop a better understanding of the project, and they can see how it evolves as studies are completed. The Division also recommended the development of EMPs for the major rivers in the United States. Several other Divisions have expressed an interest in developing such a program for their region. This type of plan provides a sense of ownership to the agencies involved and flexibility to adjust to specific regional needs.

SUMMARY OF THEMES

The EMP provided an arena for the needed interaction between the agencies involved in this project. The projects are selected through a ranking process where everyone gets a vote. The River Resources Forum attempts to allot projects as equally as possible among all the involved states. This system does appear to enhance the rate of development of environmental projects, and this type of system should be considered for other areas with major river systems. Long-term monitoring is being conducted for the project area, as well as other areas of the Upper Mississippi River. The data is viewed as vital by all respondents to the design of future projects. More strides should be taken to conduct such measuring on a system-wide basis.

All respondents strongly emphasized the need for more qualitative information throughout reports, and that it should have more influence on the evaluation of the feasibility study. By adding more qualitative information, it should provide better descriptions of the project area and a better explanation about the significance of the resources located there.

There were some significant trade-offs involved in the development of this project between the USFWS and the WDNR. This was accommodated through the phasing of projects to be completed in Pool 8. This project was the first phase for the pool, and its emphasis was on waterfowl restoration. The WDNR wanted more fisheries developed, and this will be accommodated in the second phase. Although there are concerns that phasing the project area may affect species enhancement due to the amount of time involved for implementation, this method allows construction to occur more quickly because of Division authorization for EMP projects under \$2 million.

Incremental analysis was seen as a useful planning tool in project development, but Corps respondents felt there was over emphasis on its importance for justification. It appears there were limited alternatives for designing this project, and that an in-depth analysis would have been an unnecessary expenditure of resources.

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The engineering of this project involved a significant amount of risk taking. New ideas were being applied to island construction and protection in a dynamic river system. The approach appears to have been successful because the islands survived a flood one week after construction was completed. There are waterfowl using the islands for nesting, which shows the design is apparently meeting project goals for waterfowl.

There was a lot of concern expressed toward what type of modeling should be developed for these projects. The long-term monitoring will help provide information in developing a systems approach, but respondents indicated it will be some time before dependence on single- species modeling no longer exists. This area requires further research, especially because several respondents recognized the value of the single-species approach, mostly for monitoring endangered species.

Modeling is very important in the planning process, but, as most respondents indicated, most techniques are extremely subjective. The information generated from these techniques should not be used in comparison to other projects because the subjectivity inherent in these models has a wide range of error, depending on how the user interprets its use.

YOLO BASIN WETLANDS PROJECT, CALIFORNIA

PROJECT DESCRIPTION

The Yolo Basin Wetlands Project, located in the Yolo Basin drainage area, is aimed at restoring wetlands within a flood control area without compromising existing flood protection. Migratory waterfowl in the Pacific Flyway will be the primary beneficiaries of the wetlands development. Funding for the project is through an 1135(b) authorization for the Yolo Bypass of the Sacramento River Flood Control Project. The project will comply with the Clean Water Act, the North American Waterfowl Management Plan, Executive Order 1190--Wetlands, the Endangered Species Act, the National Historic Preservation Act, and the Yolo County General Plan.

In addition to the Corps eleven other agencies were identified during the interviews. Some of these agencies served in a highly visible, technical capacities, while others played minor supporting roles. They are Waterways Experiment Station (WES); the California Department of Fish and Game (CDFG); the U.S. Fish and Wildlife Service (USFWS); the city of Davis, California; the California Central Valley Habitat Joint Venture (CVHJV); the Yolo Basin Foundation; Ducks Unlimited; the Soil Conservation Service (SCS); the Water Reclamation Board; the California Transportation System (CALTRANS); and the Mosquito Abatement Agency. Others listed in the feasibility study but not discussed during the interviews were the Environmental Protection Agency, the National Marine Fisheries Service, the State Regional Water Quality Control Board, the Far Western Anthropological Group, and the State Historic Preservation Office.

The Yolo Basin site had received the attention of CDFG for many years. The North American Waterfowl Management Plan (NAWMP) and the CVHJV led to the formation of the Yolo Basin Working Group in 1989 which targeted the study site. The group was very active and provided significant information and support throughout the planning process, meeting monthly to discuss issues pertinent to this project. The Sacramento District became an active member of this group in January 1991 when the Corps was identified as a potential funding source for the project. The feasibility study was released in June 1992.

Strong local support for this and other wildlife projects exists as many residents of the area are highly sensitive to environmental issues. Local environmental groups (CVHJV, Yolo Basin Foundation) are aligned with their congressman, who exerted significant influence in the project formulation process. In addition to local political support, the state of California has several

propositions signed into law that allow for the acquisition of lands for environmental concerns. It appears that these factors provided the direction followed throughout this project.

Three areas for construction were proposed in the feasibility study; Putah Creek Sinks, Yolo Causeway, and the Davis site. At the time of the interviews for this study, the Davis site required further examination while the other two sites were accepted for initiation of construction as proposed in the feasibility study. The Davis site was receiving further study because of the possible need for improving water quality with a water treatment station.

In the remainder of this summary paper, findings are presented, discussions relevant to the findings are provided, and respondents' recommendations for improvement are listed. The summary is organized so that of the ten research areas of interest associated with the Evaluation of Environmental Investments Research Program is addressed. The summary concludes with a review of the major themes gleaned from the interview process.

PLAN FORMULATION ACTIVITIES

Determining and Describing Environmental Significance

Findings

The determination of environmental significance for this project was developed based upon Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). The NAWMP, CVHJV and associated agencies offered important substance to the statement of environmental significance.

Discussion

Outside interests involved in this project provided a majority of the information used to determine environmental significance. Based on the content of Economic and Environmental Principles and Guidelines for Water and Related Land Resources (P&G) for determining environmental significance, there were grounds for justification of environmental significance at every

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level based on institutional, public, and technical recognition. The goal of the NAWMP is to restore and maintain the diversity, abundance, and distribution of waterfowl that occurred from 1970 through 1979. The NAWMP was referenced often because the Central Valley of California is one of the seven high priorities identified for restoration enhancement. In fact, the District found that much of the information provided by outside interests was readily adapted for use in stating the environmental significance of this study.

The Yolo Basin Working Group defined two major factors that contributed to the environmental significance of this project. First, the project area was formerly a freshwater marsh until the Bureau of Reclamation constructed a dam in 1957. The project area has lost over 90 percent of the marshlands since that time. The second factor is that the project area is located in the Pacific Flyway, which links with the NAWMP. Improvements provided by this project would be a benefit not only to waterfowl but to various shore birds, fish, and small mammals.

Other organizations contributed to the description of environmental significance. An environmental consulting firm conducted a review of birds residing in the project area. The USFWS conducted a Habitat Evaluation Procedure (HEP) analysis, and the CDFG contributed additional information to emphasize significant threatened or endangered species within the project area according to the California Environmental Quality Act. CDFG also applied a predictive computer model (Wildlife Habitat Relationship) to determine what animals might use this habitat. The collective effort by all the groups involved helped the District to satisfy the information needs for determining environmental significance.

Determining Objectives and Measuring Outputs

Findings

The objective of this project was to increase wetlands habitat through restoration enhancement of three sites in the Yolo Basin area. Restoration would provide more wintering and birthing areas for migratory waterfowl in the Pacific Flyway, which could lead to an increase in the waterfowl population. The outputs will be measured according waterfowl counts and calculation of the percent of habitat converted to wetlands and riparian woodland.

Discussion

Determining project objectives and measuring project outputs began with local environmental groups. The CVHJV formulated the Central Valley Plan, which is a component of the NAWMP, and identified the Yolo Basin as its first priority area. The goal of this plan is to restore 10,000 acres of wetlands. In addition, the CDFG developed the Yolo Bypass Wildlife Area Management Plan (YBWAMP). The YBWAMP targets four habitat types, with specific measurements for operation and maintenance of these habitats.

Through a series of field trips, the Yolo Basin Working Group compared the project site to several other restoration areas as a means of generating possible project goals. HEP was used as a way of presenting a with and without accounting of the expected project effects. However, any suggested objectives had to preserve the existing flood control function in the area.

To better understand the flood flows in the basin, special funding was acquired to update computer generated flood routing models (RMA-2V). Special analysis of field conditions were conducted to determine accurate values for Manning's "n" which impacts the hydraulic flows. Representatives from WES and the SCS were involved in these hydraulic analyses.

There was concern that the results generated by HEP (and similar single-species measuring instruments) need to be streamlined to be understood by all members of the Corps at various stages of review. Respondents felt that using a HEP does not create a holistic view of the ecosystem, and that the significance of an area may not be fully understood by reviewers. This, in turn, could underestimate the benefits associated with a project and might threaten its funding.

Several respondents indicated that even though there was great public interest in the project, the details of the HEP analysis were too technical to be understood by lay persons. Members of the public wanted to know what would be done and what the effects would be, monetarily as well as environmentally. However, some members of the Yolo Basin Foundation did examine the HEP results as possible outputs for this project. Respondents voiced concern about the use of HEP and other similar techniques as appropriate means to determine the outputs of a project because of the subjectivity used in applying them.

Respondent Recommendations

Respondents indicated that they would like to see methods developed that would provide a more holistic view of the ecosystem, as opposed to the present methods that examine a limited section of the ecosystem. One of the respondents noted that there is a need for research in the area of hydrologic modeling and that there should be more ground surveying and truthing conducted to improve the geographical depiction of the area.

Objective Evaluation of Cultural Resources

Findings

Cultural resources were examined and found to have no significant impact on the project design. All respondents interviewed felt that the examination of cultural significance, as currently prescribed by the Corps, was handled properly.

Discussion

Examination of cultural resources was conducted in accordance with the National Historic Preservation Act of 1966 and Policy and Planning Guidance for Conducting Civil Works Planning Studies. An outside agency conducted the cultural resource evaluation, which coordinated with the Corps regarding archeological impacts. A prehistoric site of archeological debris was identified in the Putah Creek Sinks area. The agency that conducted the review recommended that the site of significance be avoided to prevent further degradation of those resources, and was indicated in the report. The rest of the Putah area could be developed for wetlands restoration.

Engineering Environmental Investments

Findings

Three design alternatives that could provide the wetlands habitat needed for the area were considered. The selected alternative which was chosen because it was the only one that would not compromise existing flood control for the area.

Discussion

Original designs for this project by the District's civil design branch were considered to be too expensive, mainly because they required that a significant amount of fill dirt be transported to the project site. The design choice could not reduce existing flood protection. Traditional Corps specifications were not compatible with designing environmental structures, and many individuals recognized the need for new methods of engineering these projects. The challenge was to find new designs for the Corps engineering portfolio. Several recommendations addressed methods of developing these designs, such as working with farmers and duck clubs who have expertise in this area.

Field trips were made by the Yolo Basin Working Group to duck clubs to examine their pumping systems and maintenance plans. This information provided improved techniques for engineering environmental projects to add to the Corps traditional design portfolio. In addition, the USFWS provided valuable design guidance and information for the project. Although some of the suggestions would compromise existing flood control. After the field trips were completed, three plans were offered as alternatives in the feasibility report. Only one of which was acceptable because the others compromised the present flood control function for the area. The selected alternative did meet the goals developed by CVHJV. The recommended modification for the project included constructing seasonal wetlands ponds, permanent wetlands, shorebird foraging areas, riparian forests, and grasslands. The wetlands were designed with irrigation and drainage systems for effective operation and maintenance. The design also allowed for appropriate drainage and fill rates for the wetland cells to accommodate the concerns of mosquito abatement.

One respondent stated that the cost of Corps projects are sometimes high because of the detail and intensity of Corps performance specifications that must be met to achieve construction

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standards. Generally, more flexibility is needed so that field adjustments in the design can be made. For example, a high level of risk is involved in successfully growing and maintaining swamp timothy grass. Specifications would require that the swamp timothy must grow within a certain time frame, or the contractor will be required to do it again without financial compensation. Most commercial operators will not bid on this type of job because they cannot be certain it will work. If the specification standards were not so rigid, it might be possible to attract more locals to bid on these types of projects.

One criticism of the alternative design process was the time needed to approve the project modifications through the Corps hierarchy. One respondent indicated that the approval process for the project was excessive, and that construction should have already been initiated. If the Corps was able to approve the project more quickly, less tension would have arisen between the Corps and the other project participants who would like to see restoration actions undertaken immediately. The respondent also said that timely approval of this project also would invite positive media coverage, which could assist in expediting future environmental projects initiated by the Corps.

Respondent Recommendations

Several respondents indicated that the Corps needs to allow for technology transfer from local environmental experts, nonprofit groups, and farmers. These groups have significant experience in designing environmental projects, especially the farmers who develop wetlands areas to aid in irrigation of their crops. It also was recommended that the Corps delegate decision authority to the District in order to reduce processing time and expedite construction.

The District said that the U.S.D.A. Soil Conservation Service has significant expertise in developing wetland projects, and that consulting with it could reduce construction costs. It was also recommended that there needs to be experimentation on wetland development in conjunction with the California State Conservation Corps.

Monetary and Other Valuation Techniques

Findings

The primary beneficiaries of this project are fish and wildlife, especially waterfowl and other water birds. Monetary values examined for this project were potential spillover benefits from recreation. The other benefits identified were Average Annual Habitat Units (generated by HEP), improved water quality, sediment stabilization, an increase in waterfowl species counts, benefits for threatened and endangered species, and educational programs for the area.

Discussion

Information about wetlands functions (developed at the Waterways Experiment Station and by other scientists) were used to determine some of the benefits for this project. The basis for determining benefits was returning the fish and wildlife habitat conditions to levels similar to recent historic conditions. The USFWS determined peak potential increases in winter waterfowl use days (WWUD) and the average annual number of fledglings (AANF) for each site. The total increase for all sites regarding WWUD was 281,530 days and for AANF, 2,660. The Yolo Basin Working Group identified many of the nonmonetary values associated with the selected alternatives and were important components of the feasibility report. Additionally, farmers are likely to benefit from this project because waterfowl are expected to be redirected to the new wetlands to feed, as opposed to feeding on the farmers' crops.

Many respondents were resistant to habitat quantification of a limited scope as provided by traditional HEP analysis. They would have preferred a system that would have provided a holistic view of the ecosystem, but they did view HEP as an appropriate relative measure for habitat. HEP alone, however, significantly underestimates the many other benefits a restoration project provides, such as those to invertebrates.

A resistance to placing a dollar value on a habitat or an animal species also existed. Some suggested that it was not possible, and others advocated a thorough examination by taking a holistic view of the ecosystem. The holistic, systems-based view examines not only the waterfowl or migratory residents, but, for example, other year-round residents of the project area.

Respondent Recommendations

It was recommended that the Corps continue research toward determining adequate and appropriate means benefit estimation. Instead of targeting a few species in an evaluation, an examination of the entire ecosystem would provide a better representation of the restoration benefits.

Cost Effectiveness/Incremental Analysis

Findings

The cost effectiveness for this project was based on the dollar value per acre of a riparian area. The USFWS conducted an incremental on the project alternatives.

Discussion

Incremental analysis was conducted by the USFWS with input from the Corps. The results of incremental analysis were not crucial to the final plan selection because two of the three alternatives did not meet the criteria on impacting flood control. Creating additional flood control levees would have driven the up costs causing these alternatives to be economically unacceptable.

District personnel expressed caution in the use of incremental analysis. They were concerned that engineering and habitat issues would not be addressed adequately if they were based primarily on incremental analysis. However, one Division-level respondent indicated that incremental analysis is much simpler to use than most people think. In most cases, it is an issue of communication of the operations of incremental analysis that "loses the audience". Thus very few planners within the Corps understand it or use it.

Much concern was voiced regarding the general process for determining the cost effectiveness of a project. The question was raised if benefits are to be measured, but a benefit-cost ratio is not required, why be required to do incremental analysis?

Respondent Recommendations

The Division felt that the guidance for this area is inadequate, and that there needs to be a familiarity with procedures for determining cost effectiveness and incremental analysis that does not currently exist among Corps personnel. In fact, if incremental analysis was used in this project, one of the adopted sites might have been excluded from the project.

Incorporating Risk and Uncertainty

Findings

Risk and uncertainty were not considered for this project.

Discussion

A risk analysis was not conducted for this project. District personnel indicated that there is not enough data regarding environmental projects to conduct such an analysis. They said that it will take some time to collect enough data to make an appropriate risk assessment.

Respondent Recommendations

Respondents suggested areas for future research, including financial risk, ability to restore habitat, mosquito development, and the safety risk the waterfowl and people due to waterfowl flying across the highway, because one habitat area will be located immediately next to a well-traveled state highway.

Developing and Integrating Environmental Databases

Findings

This project incorporated a number of databases, including HEP information, Natural Diversity Database for California, hydrologic, and the Wildlife Habitat Relationship model.

Discussion

CDFG said that a database for agriculture was available for use, but at the time of the Yolo study, it was incomplete. They also noted that a GIS was conducted after the decision-making process was completed. This information may be useful for future projects.

Respondent Recommendations

Although some areas should be explored for further research in the development of databases, respondents expressed the need for better coordination of existing information. Enough information already may be available, but it must be accessible (is a matter of knowing where to find it). Participants favored information coordination because developing more databases during the feasibility study process can exhaust valuable time and resources.

Evaluation Process

Findings

The proposed alternative was selected primarily because it provided the wetlands and did not compromise the flood control of the area.

Discussion

The alternative recommended met the goals of the Central Valley Plan as developed by the CVHJV, and the YBWAMP as put forth by CDFG. The USFWS offered a Wetlands Enhancement Plan and an Optimization Plan as possible options for the project. These plans were designed to maximize habitat benefits for waterfowl, but neither were accepted because they compromised existing flood protection.

Interagency Coordination and Program Management

Findings

A working group was formed for this project before the Corps became involved with planning and design. This group met at least once a month during the plan formulation process.

Discussion

The Yolo Basin Working Group was originally formed to provide a means for only the key representatives of all agencies to meet. There was no definitive leader of this group and, at times, someone was needed to take charge, even an outside facilitator.

Comments from organizations outside of the Corps noted that the Corps should become an early active participant and learn from the dialogue. The Corps did have good rapport with the CDFG, which provided significant environmental information for the Corps to utilize.

The organizations at times were severely limited by their own rules. It was recommended that establishing some best management agreements with other organizations that interacted regularly could have increased the efficiency of the planning process by reducing the number of steps normally required to secure permission from other government agencies. It also was recommended that communication with the U.S. Army Corps of Engineers be limited to contact persons.

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All of the interviewed respondents felt that the earlier groups affected by a project are involved, the easier it is to gain their cooperation in the planning process. Including the Mosquito Abatement Agency at the beginning saved a lot of time and avoided the notion that the working group was excluding them and considered them a lesser player in the development of the project.

The Division noted that some study proposals are poorly developed and observed that, in general, Districts know the reports will be intensively reviewed. The Division asserted that, some cases, Districts tend to be lax in reporting detail because they know someone will eventually identify what needs to be added or revised.

Participants indicated that there appear to be varying standards for different groups in the eyes of the reclamation board. The Corps was required to go through a lengthy permit and review process, while others that live in the area, referred to as "pirates," seem to build whatever type of structure they want in the flood control area without a permit.

Respondent Recommendations

One respondent recommended that the Corps coordinate with others who are experts in the field of environmental restoration so it can learn how these projects should be executed. The Corps should consider assigning study managers with environmental backgrounds to better interact with the environmental experts and issues.

One of the outside organizations asked for a less constrained flow of information from the Corps to the other organizations. In the eyes of the respondent, part of this is a result of the chain of command to be followed for approval to disperse information. This respondent said that this could be alleviated by allowing greater autonomy to the District offices in the Corps.

Another respondent noted that different organizations have different names for projects. It was recommended that there be a single labeling system so everyone involved knows to which project someone is referring, especially if several projects are being conducted in an area.

SUMMARY OF THEMES

The interview process and subsequent examination of plan formulation activities discussed above suggest eight themes from the Yolo Basin Case Study. The overriding theme observed in this case study is the need to organize a working group at the beginning of the planning process that includes the Corps. In this instance, the Corps came into the picture after a local environmental group took the lead on the project. Having the Corps as a part of this group would help to expedite some segments of the planning process, by assisting as a mediator in the dispute resolution process.

Some opportunities arose for the Corps to gain a favorable view from the locals that could lead to good publicity in other projects. There were times that District members felt as if their hands were tied when working with the group because of Corps policy and guidance. If District personnel were allowed to make some field decisions, it may help to promote cohesiveness with local groups.

The Corps is relatively new to the field of environmental restoration. All of the respondents indicated, to some degree, that the Corps needs to learn how to develop environmental projects by learning from others. The Corps does have a good ability to complete projects once the construction phase starts. The problems occur because methods that are traditionally used often do not lend themselves to practical maintenance of this type of project. The effects of environmental projects generally are not understood as well as other engineering efforts (e.g. structural design), so the Corps again has an opportunity to take the lead in the area research, and to experiment with new designs for environmental restoration. The limiting factor is funding for such an effort.

It appears that several databases were available for this project. As indicated previously, the problem is knowing what is available and how it can be accessed. Developing a comprehensive listing of databases available to Corps personnel would reduce the amount of time needed to determine if a database needs to be created.

In this case study, the Corps appears to have handled the issue of cultural resources well. Even though there may be a cultural resource site, an alternative could be reached to prevent degrading the resource, while at the same time allowing for the construction of the project.

All respondents indicated a resistance to placing dollar values on wildlife and expressed a need for a holistic view of the ecosystem examined. Although this view would make a more complete picture for developing alternatives in the plan formulation process, it generally was understood by those interviewed that it would be extremely costly and impractical for a small project. A possible alternative would be to increase the number of species to be examined, which, although not entirely

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holistic it would allow for wider assessment of the effects of the project. Another alternative would be to develop further the Wildlife Habitat Relationship model to help provide a more holistic view of ecosystems.

One theme of note is the efficiency of Corps planning activities. Respondents aligned on all sides of this issue possibly because they were reacting to issues that particularly affected them. Some individuals wanted something constructed immediately. Others wanted more careful examination of certain issues they felt were not adequately addressed. One way to meet these needs was suggested in the study: to separate the project into three smaller projects. This would support two objectives: first, it would prevent a project from being stopped because one section needs to be revised; second, provide the opportunity to collect data that can help improve other projects in need of revision.

APPENDIX D
REFERENCE LIST

REFERENCES

- American Fishery Society. 1983. Stream Obstruction Removal Guidelines. 5410 Grosrenor Lane, Bethesda, MD.
- Ball, I. J., and S. K. Ball. "Earth-filled Culverts as Nest Sites for Waterfowl." Prairie Naturalist 23 (1991): 85-88.
- Cahoon, D. R., and C. G. Groat, eds. 1990. A Study of Marsh Management Practice in Coastal Louisiana, Vol. 1: Executive Summary. Final report submitted to Minerals Management Service, New Orleans, LA. OCS Study/MMS 90-0075.
- California Department of Fish and Game, Natural Heritage Division. Natural Diversity Database (Brochure). Sacramento, CA.
- Coastal America. Coastal America: A Partnership for Action (Booklet). Washington, D.C.
- Concrete Culvert Handling and Installation Preliminary Guidelines. Acquired during interview with St. Paul District, 12 July 1994.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Fish and Wildlife Service. FWS/OBS - 79-31. 131 pp.
- Excerpt from magazine regarding nesting structures. Publisher unknown. Acquired during interview with St. Paul District, 12 July 1994.
- Feather, T. D., J. F. Langowski Jr., E. M. Pettit, K. L. O'Grady, and F. D. Brown. April 1992. Valuation of Environmental Investments Research Program Workshop. Submitted to United States Army Corps of Engineers, Institute for Water Resources, Fort Belvoir, VA.
- Fishery Monitoring Subcommittee. "Assessment of CWPPRA Project Impacts on Fishery Resources."

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*

- Golet, F. C., and W. R. Eddleman. "Baseline Ecological Survey of the Galilee Bird Sanctuary, Galilee, Rhode Island." Research proposal submitted to the Rhode Island Department of Environmental Management, Division of Fish and Wildlife, 1 July 1991.
- Hartman, R. D., C. F. Bryan, and J. W. Korth. "Community Structure and Dynamics of Fishes and Crustaceans in a Southeast Texas Estuary." Paper submitted to the United States Fish and Wildlife Service Regional Office, Albuquerque, 30 September 1987.
- Higgins, K. F., H. W. Miller, and L. M. Kirsch. "Waterfowl Nesting on an Earth-Filled Cement Culvert." Prairie Naturalist 18 (1986): 115-116.
- Hill, Brian J. "Wilderness Valuation." Parks and Recreation (August 1994): 29-31.
- Interagency Working Group on the Dredging Process. May 1994. (Draft report). Washington, D.C.
- LaBounty, Michele. "Corps would rather switch than fight." Jackson Hole News, 13 March 1991, 6A.
- Louisiana Coastal Wetlands Conservation and Restoration Task Force. 18 November 1991. Coastal Wetlands Planning, Protection, and Restoration Act: Priority Project List Report. Louisiana.
- Louisiana Coastal Wetlands Conservation and Restoration Task Force. November 1992. Coastal Wetlands Planning, Protection, and Restoration Act: 2nd Priority Project List Report. Louisiana.
- Louisiana Coastal Wetlands Conservation and Restoration Task Force. November 1993. Coastal Wetlands Planning, Protection, and Restoration Act: 3rd Priority Project List Report. Louisiana.
- Management Agreement Among the California Department of Fish and Game, California Department of Water Resources, and the Reclamation Board of the State of California Regarding Yolo Basin Wetlands. February 1994.
- Maryland Department of Natural Resources, Nontidal Wetlands Division. "Nontidal Wetlands Documents." Annapolis, MD.

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*

Maryland Department of Natural Resources, Wetlands and Waterways Division. Nontidal Wetland Consultant List. Annapolis, MD.

Memorandum of Understanding Regarding Threatened and Endangered Species in the Yolo Basin Wetlands Project. March 1994.

National Biological Survey, Onalaska Office. 10 August 1994. Bibliographical listing of Reports Published by the National Biological Survey Environmental Management Technical Center, Onalaska, WI.

National Marine Fisheries Service, Galveston Field Branch. Mission statement flyer. Galveston, TX.

Oregon Department of Fish and Wildlife. December 1993. Fern Ridge Wildlife Area Long Range Management Plan. Portland, OR.

Puotinen, Marjetta. "A decision support tool for ecosystem management." Duke Environment (Spring 1994): 15-32.

Realist Opposed to Alleged Restoration. 10 February 1994. "Risk Analysis of Potential for Mercury Mobilization and Bioaccumulation Through Food Chains Following Reflooding of the Kissimmee River Valley." Winter Park, Florida.

Realist Opposed to Alleged Restoration. 7 October 1992 (Rev: 28 January 1993). "Utilization of Variable Flow Control Structures for Restoration of Natural Flows to Oxbows in the Kissimmee River." Okeechobee, FL.

Realist Opposed to Alleged Restoration. "Draft Summary of Alternative Restoration of the Kissimmee River." Okeechobee, FL.

Realist Opposed to Alleged Restoration. "ROAR Summary of the Kissimmee River Restoration Project Proposal." Okeechobee, FL.

Sierra Club. 15 April 1988. "A Critique and Reestimation of the Benefit/Cost Analysis Performed by the Army Corps of Engineers for its Restudy of the Kissimmee River Restoration Alternatives." Tallahassee, FL.

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*

- Shabman, Leonard. 1993 Environmental Activities in the Corps of Engineers Water Resources Program: Charting a New Direction. United States Army Corps of Engineers, Institute for Water Resources, Alexandria, VA. IWR Policy Study 93-PS-1.
- Texas Parks and Wildlife Department. A case history for management of public wetlands in Southeast Texas. Videotape.
- Texas Parks and Wildlife Department, and United States Fish and Wildlife Service. August 1990. Salt Bayou Project: Joint Water Management Plan for Sea Rim State Park, McFaddin National Wildlife Refuge and Murphree Wildlife Management Area.
- Thullbery, Carolyn. Letter to authors regarding ROAR positions, 2 October 1994.
- United States Army Corps of Engineers, Galveston District. March 1992. Final Project Modification Report: Salt Bayou, McFaddin Ranch Wetlands, Texas. Galveston, TX.
- United States Army Corps of Engineers, Jacksonville District. December 1991. Central and Southern Florida Project, Environmental Restoration of the Kissimmee River, Florida: Final Integrated Feasibility Report and Environmental Impact Statement. Jacksonville, FL.
- United States Army Corps of Engineers, Memphis District. December 1990. Mayfield Creek, Kentucky Final Definite Project Report/FEIS. Memphis, TN.
- United States Army Corps of Engineers, New England Division. April 1994. Galilee Salt Marsh Restoration Narragansett, Rhode Island: Feasibility (Section 1135) Report and Environmental Assessment. Waltham, MA.
- United States Army Corps of Engineers, North Central Division. August 1992. Upper Mississippi River System Environmental Management Program: Midterm Evaluation Report. Chicago, IL.
- United States Army Corps of Engineers, North Central Division. May 1991. Upper Mississippi River System Environmental Management Program: Sixth Annual Addendum. Chicago, IL.
- United States Army Corps of Engineers, Portland District. October 1992. Fern Ridge Lake, Long Tom River OR; Project Modification for Improvement of Environment; Fisher Butte Waterfowl Impoundments, Section 1135(b) (Draft). Portland, OR.

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*

United States Army Corps of Engineers, St. Paul District. July 1991. Section 1135 Feasibility Report and Environmental Assessment for Homme Reservoir, Walsh County, North Dakota. St. Paul, MN.

United States Army Corps of Engineers, St. Paul District. June 1989. Upper Mississippi River System Environmental Management Program Definite Project Report/Environmental Assessment (SP-4): Pool 8 Island Construction - Phase I Habitat Rehabilitation and Enhancement Project, Pool 8, Upper Mississippi River, Vernon County, Wisconsin. St. Paul, MN.

United States Army Corps of Engineers, St. Paul District, et. al. Past Cultures of the Upper Mississippi River (Brochure). St. Paul, MN.

United States Army Corps of Engineers, Sacramento District. April 1992. Yolo Basin Wetlands, Sacramento River, California: Project Modification Report. Sacramento, CA.

United States Army Corps of Engineers, Walla Walla District. March 1994. Jackson Hole, Wyoming - Flood Damage Reduction, Fish and Wildlife Habitat Restoration: Pre-Reconnaissance Review Conference Documentation. Walla Walla, WA.

United States Army Corps of Engineers, Walla Walla District. June 1993. Jackson Hole, Wyoming - Flood Damage Reduction and Fish and Wildlife Habitat Restoration Reconnaissance Report. Walla Walla, WA.

United States Army Corps of Engineers, Waterways Experiment Station. Engineering Solutions For Heritage Preservation. Videotape.

United States Army Corps of Engineers, Waterways Experiment Station. Support to Cultural Resources Management/Historic Preservation: Expertise, Facilities, Equipment (Booklet). Vicksburg, MS.

United States Department of the Interior, and Environment Canada. May 1986. North American Waterfowl Management Plan: A Strategy for Cooperation.

United States Fish and Wildlife Service. June 1978. Draft Habitat Suitability Index Guidelines for the Blue-Winged Teal.

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*

United States Water Resources Council. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington: Government Printing Office, 10 March 1983.

Upper Mississippi River Basin Association. Meeting the Challenge: The Upper Mississippi River System Environmental Management Program (Booklet). St. Paul, MN.

Yolo Basin Foundation. A million ducks can't be wrong. (Brochure). Davis, CA.

Yolo Flyway (3), (Winter 1994). (Newsletter). Davis, CA.

*Compilation and Review of Completed
Restoration and Mitigation Studies in Developing an
Evaluation Framework for Environmental Resources) Volume II*
