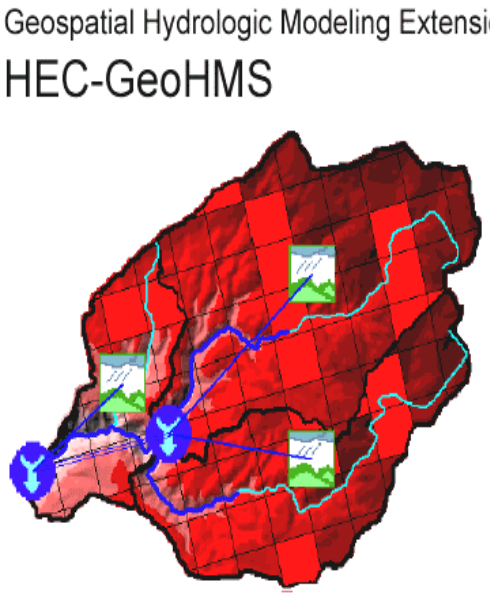
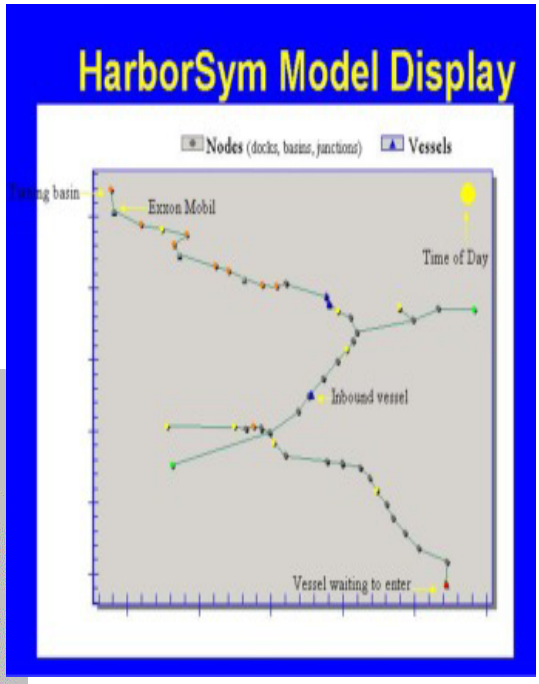
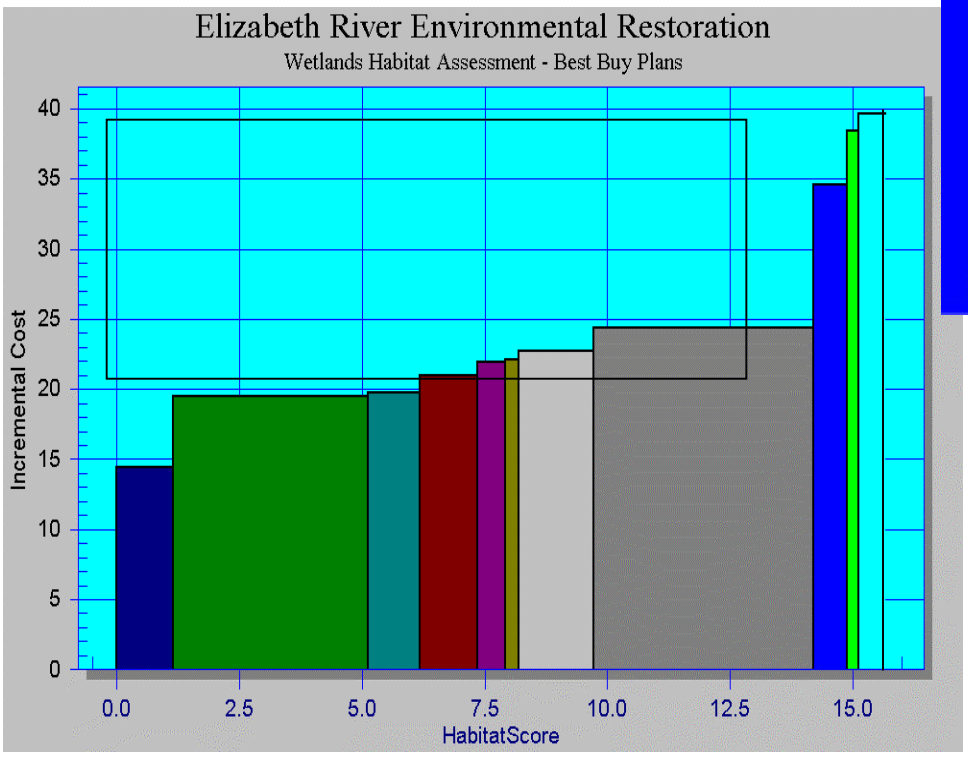
REPORT OF THE PLANNING MODELS IMPROVEMENT TASK FORCE







September 2003

U. S. Army Corps of Engineers
Planning Models Improvement Program Task Force
Final Report

Dennis D. Wagner, Co-Chairman
Northwestern Division

Kenneth D. Orth, Co-Chairman
Institute for Water Resources

Gloria R. Appell
Galveston District

Jim K. Fredericks
Northwestern Division

Linda M. Hihara-Endo
Pacific Ocean Division

William A. Hubbard
New England District

Mitchell P. Laird
Louisville District

Deborah H. Peterson
Jacksonville District

Daniel E. Sulzer
Los Angeles District

Rayford E. Wilbanks
Mississippi Valley Division

Report of the Planning Models Improvement Task Force
September 2003

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1. OVERVIEW AND RECOMMENDATIONS

In recent years, the U.S. Army Corps of Engineers has received national criticism of decisions made in recommending the expenditure of significant Federal resources. Much of the criticism has been directed not only at the recommendations themselves, but also at the models used in making the recommendations. How sound are the models? Who developed them? Have they been peer reviewed? Can they be used in different settings? The Planning Models Improvement Program was established to assess the state of planning models in the Corps, and to make recommendations to assure that high quality information is available so that informed decisions are made when investing in the Nation's water resources infrastructure and natural environment.

In January 2003, the Corps' Director of Civil Works charged the Chief of Planning and Policy Division to carry out "a process to review, improve and validate analytical tools and models for USACE (U.S. Army Corps of Engineers) Civil Works business lines in coordination with HQ (Headquarters), MSCs (Major Subordinate Commands), ERDC (Engineer Research and Development Center), and IWR (Institute for Water Resources). In carrying out this initiative, we have established a Planning Model Improvement Task Force to examine planning model issues, assess the state of planning models in the Corps, and develop recommendations on improvements to planning models and related analytical tools". The Director set a milestone to complete a final report with recommendations by the end of fiscal year (FY) 2003.

The Planning Models Improvement Program Task Force ("Task Force") was assembled in January 2003 and worked as a team through the preparation of this report in September 2003. It held three meetings to hear the views of Corps' leaders and recognized technical experts, and conducted investigations and numerous discussions and debates on issues related to planning models. It identified an array of model-related problems, conducted a survey of planning models, prepared papers on model-related issues, analyzed numerous options for many issues, formulated recommendations, and wrote this final report.

Recommendations

As a result of its deliberations and work, the Task Force recommends the following to the Director of Civil Works in the interest of improving planning models:

1. The Headquarters Chief of Planning and Policy will:
    a. Publish guidance that prescribes a corporate business process and policy for development, certification, training, and on-going support for planning models. The regulation will include a process to certify planning models based on peer support and peer review.
    b. Work with the Planning Centers of Expertise to prioritize certifications, assign certification responsibility for models that are not clearly associated with any Center, and resolve other questions related to planning models.

c. Work with the Research and Development Directorate to establish a separate strategic research program for planning model needs.
d. Maintain the Planning Models Toolbox as the source of certified models.
e. Work in a timely manner with the Communities of Practice, the Planning Centers of Expertise and the Corps' research offices to field models critical to the planning process that are effective and defensible and operate seamlessly across communities of practice and business lines.
f. Conduct an annual strategic assessment of planning capability, including modeling and technology needs. Annually review model certifications issued by the Planning Centers of Expertise and Corps' research offices. Prepare an annual report to the Director of Civil Works on model certifications and audits, the strategic assessment of planning capability, and other issues related to the state of planning models.

___ APPROVED ___ DISAPPROVED ___ DISCUSS

2. The Planning Centers of Expertise are responsible for planning models that support their respective business lines. Within their business areas, the Centers will:
a. Certify planning models based on peer support and peer review in accordance with the Headquarters guidance.
b. Work with the districts and the Corps' research offices to develop, test, document, maintain, update, and provide training and ongoing support (help desk, for example) for planning models.
c. Coordinate to corporately oversee the separate strategic research program for planning model needs as well as the planning-related work in their business lines throughout the research program.
d. Work with Corps' national data collection programs, such as the Waterborne Commerce Statistics and Flood Damage Data Collection Programs, to improve the usefulness and accessibility of data for planning models.
e. Identify and reduce or otherwise resolve model redundancy among existing models.

___ APPROVED ___ DISAPPROVED ___ DISCUSS

3. District Commanders will continue to be responsible for the application of planning models to specific studies and projects. Commanders will use project management plans, independent technical reviews, and public reviews under the National Environmental Policy Act and other laws to assure the quality of:
a. Data and other model inputs.
b. Interpretations of model outputs.
c. Model users.

___ APPROVED ___ DISAPPROVED ___ DISCUSS

4. The Corps' research offices at the Engineer Research and Development Center and the Institute for Water Resources (including the Hydrologic Engineering Center) will:

a. Work with the districts and the Planning Centers of Expertise to develop, test, document, maintain, update, and provide training and ongoing support (help desk, for example) for planning models.
b. Certify planning models that they develop based on peer support and peer review in accordance with the Headquarters guidance.

 APPROVED ___ DISAPPROVED ___ DISCUSS

5. The Task Force recognizes that implementation of its recommendations will require time and funding. We recommend that the Corps' leadership consider a variety of funding sources to pay for these recommendations, and that costs be shared among these sources. Alternative sources include:

a. Research and development funds from the General Investigation account.
b. Funds from individual studies and projects for which models are being developed.
c. Funds from the General Expense account.
d. Funds raised through a models subscription service, as used by the Hydrologic Engineering Center.

The Task Force believes that, in the long-term, investments in these recommendations will save both time and funds.

 APPROVED ___ DISAPPROVED ___ DISCUSS

Situational Awareness

The Task Force acknowledges that there are several initiatives in progress at the time of this writing that may, in the near future, affect the recommendations in this report, including:

- USACE 2012, which is establishing new relationships among the Headquarters and the divisions (major subordinate commands) and is expected to begin implementation in October 2003.
- The Planning Centers of Expertise, which were designated on 25 August 2003 and are only beginning to implement their roles.
- The Strategic Engineering and Technology (SET) Initiative, which is completing a Corps-wide inventory of analytical models.
- The Federal Data Quality Management Act, for which the Corps is currently preparing guidelines.
- Congressional consideration of reviews of Corps' reports, in potential future authorization legislation.
- The Corps' budget request for fiscal year 2005, which is restructuring research and development programs and funding.

As the results of these initiatives are implemented, the Task Force recommendations should be reviewed for consistency and reconsidered as needed.

Report Content

This document includes a main report with six chapters, and five appendixes. Chapter 1 provides a report overview and the Task Force recommendations. Chapter 2 introduces the Task Force background, team composition, process, coordination, and the Task Force papers. Chapter 3 summarizes selected recent criticisms of planning models and problems identified by the Task Force. Chapter 4 presents the results of a survey of Corps' planning models. Chapter 5 summarizes options and analyses considered by the Task Force in arriving at its recommendations. Chapter 6 presents expectations regarding planning models, and lessons learned from the Task Force experience. Documentation from the three Task Force meetings is in Appendixes A, B and C. Appendix D holds papers prepared by the Task Force, and Appendix E includes the results of the planning models survey.

Appreciation

The Task Force Co-Chairs wish to thank the Task Force members for their willingness to share and be open to new ideas and their hard work, those who spoke to the Task Force for challenging us and providing seasoned advice, and those who recorded our meetings and otherwise supported the team. Everyone made generous contributions to an outstanding team effort.

2. TASK FORCE

Background and Charge

In the past few years, the Corps of Engineers has been criticized over the evaluation processes and procedures used to support recommendations for investments in water resource projects. Planning related models that support these recommendations are often highly complicated and require skilled technical staff to operate properly. As the use of models becomes more and more prevalent in aiding the development of investment recommendations, we need to ensure a consistent validation standard is in place to enhance the credibility of Corps' findings and recommendations.

In July 2002, the Director of Civil Works expressed concern that the Corps' planning capabilities and expertise had declined to an unacceptable level. He indicated that the lack of depth in planning organizations has limited the Corps' ability to provide professional staff development, continuity, mentoring, peer consultation, and advanced modeling techniques. In addition, and more fundamentally, he stated that the long-term ability to produce high-quality investment decision documents is at risk.

As part of the Corps' commitment to improve the overall quality of planning products, the Director of Civil Works established a Planning Model Improvement Program Task Force. In his 20 January 2003 message to Division Commanders, the Director defined his charge to the Task Force:

> **"**As part of a USACE commitment to improve planning products, the Planning and Policy Division is carrying out a process to review, improve and validate analytical tools and models for USACE Civil Works business lines in coordination with HQ, MSCs, ERDC, and IWR. In carrying out this initiative, we have established a Planning Model Improvement Task Force to examine planning model issues, assess the state of planning models in the Corps, and develop recommendations on improvements to planning models and related analytical tools."
>
> "The Planning Model Improvement Task Force is co-chaired by Dennis Wagner of NWD and Ken Orth of IWR, and will involve MSC and district participation in order to assure its success. The final selection of Task Force participants will be made in early February. A Project Management Plan will also be developed in February to delineate the scope, tasks, milestones, peer review, and a completion schedule of this effort. At this time we hope to have a final report with recommendations competed by the end of FY 2003".

This report is the final report of the Planning Models Improvement Program Task Force.

Team Composition

The Task Force that was established to conduct this review was comprised of a broad multi-disciplinary group of individuals representing the districts, the divisions, Headquarters and the Institute for Water Resources. The Task Force was very diverse in areas of expertise, covering the disciplines of economics, environmental sciences, plan formulation, civil engineering, and others. In addition, many individuals had extensive experience in the use and application of various planning models. The Task Force composition was as follows (Co-Chairs and field representatives noted by an asterisk):

Name	**Office**
Gloria Appell*	Galveston District
Bruce Carlson	Headquarters
Chris Dunn	Hydrologic Engineering Center
Susan Durden	Institute for Water Resources
Jim Fredericks*	Northwestern Division
Rich Fristik	Institute for Water Resources
Dr. Linda Hihara-Endo*	Pacific Ocean Division
Keith Hofseth	Institute for Water Resources
William Hubbard*	New England District
Harry Kitch	Headquarters
Mitch Laird*	Louisville District
Dr. David Moser	Institute for Water Resources
Darrell Nolton	Institute for Water Resources
Ken Orth, Co-Chair*	Institute for Water Resources
Debbie Peterson*	Jacksonville District
Dan Sulzer*	Los Angeles District
Dennis Wagner, Co-Chair*	Northwestern Division
Rich Whittington	Institute for Water Resources
Rayford Wilbanks*	Mississippi Valley Division

The Task Force heard advice, comments and ideas from a variety of leaders and technical experts during its three meetings, including:

Name	**Office**
Donald Basham	Corps' Headquarters
William Dawson	Corps' Headquarters
Dr. Mark Dunning	Institute for Water Resources
MG Robert Griffin	Corps' Headquarters
Dr. Tom Hart	Corps' Science and Engineering Technology (SET) Initiative
Dr. Jeff Jacobs	National Research Council, National Academy of Sciences
Dr. Richard Males	RMM Technical Services
Dr. Jean O'Neill	Engineer Research and Development Center
David Richards	Engineer Research and Development Center
Dr. Peter Rogers	Harvard University
Jim Smyth	Office of the Assistant Secretary of the Army (Civil Works)
Dr. Charles Yoe	College of Notre Dame at Baltimore

The Task Force was also ably assisted with record keeping by Sharon McHale of the Sacramento District (June meeting), and Ernie Clark of the Jacksonville District (August meeting).

Process

Following creation of the Task Force, three meetings were subsequently conducted in Alexandria, Virginia. The initial session held 15-17 April 2003 facilitated the identification of the scope of issues to be addressed, and the development of a Project Management Plan which would lead to the completion of a final report with recommendations. In addition, supplemental background information was provided by a variety of speakers. A second meeting was held 17-19 June 2003, and the final team meeting was conducted 19-20 August 2003. These working sessions provided further refinements and shaping to the scope and content of the final report. The Task Force continued to obtain input from invited speakers at each meeting. Documentation from the three Task Force meetings is in Appendixes A, B and C.

The three meetings were supplemented with frequent conference calls throughout the work effort, and considerable electronic exchanges of information and draft products. In addition to a review of the draft report by Task Force members, a small group of Division and District planners provided an independent review.

Coordination

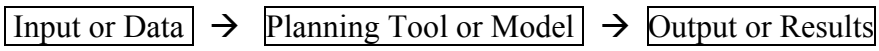
The basic framework of recommendations contained in this report was developed from discussions with several internal and external sources, including the Director of Civil Works and representatives from the Assistant Secretary of the Army (Civil Works), the Corps' Headquarters, and others as listed above. Task Force members were encouraged to seek information and advice on a full range of issues related to planning models from peers, the Corps' leadership, and others who had an interest in this effort. Articles in Planning Ahead, which is distributed throughout the Corps' planning community of practice, provided information on the Planning Model Improvement Program and sought input. A member of the Task Force worked closely with the Headquarters' Science and Engineering Technology initiative, which is developing an inventory of models used for science and technology applications in the Corps. Information obtained through this process provided a basis to develop an effective concept plan that would improve planning-related analytical tools and models. Although the coordination effort did not have broad involvement with other Federal agencies, academic interests, or stakeholders, this report recommends a long-term business process to fully engage these entities and others to ensure collaboration in the determination of research and development needs and priorities for planning.

Summary of Task Force Papers

A number of papers were written by Task Force members to help improve the collective understanding of the application and problems associated with planning related models. As presented in Appendix D, prepared papers address:

- What's a Planning Model?
- Frameworks for Organizing Models
- Planning Model Problems
- Criteria for Good Models
- Mandatory or Not
- Peer Support and Peer Review Process/Certification
- User Support
- Data Sources and Input for Planning Tools and Models.

The *What's a Planning Model?* paper provides a discussion of models in general, and how models used in the planning process assist in providing a sense of logic or rationale to problem solving and decision-making. The *Framework for Organizing Models* paper suggests a two-dimensional approach to organize water resources planning models using categories and components that could also be termed model attributes. The seven categories include the following: 1) business programs; 2) communities of practice; 3) six steps of the planning process; 4) civil works planning phases; 5) civil works planning scale; 6) geographic applicability; and 7) model types. The report on *Planning Model Problems* provides a discussion of a variety of modeling problems identified by the Task Force, as well as those reported by interest groups external to the Corps. The report on *Criteria for Good Models* provides criteria for selecting a model for use in the planning process that is acceptable, efficient, effective, and complete. The *Mandatory or Not* paper discusses the positive and negative aspects of establishing requirements for using specific models in evaluating water resource problems. The paper on *Peer Support and Peer Review Process/Certification* provides proposed criteria for the appropriate level of review needed for use of a planning related model based on a number of defined factors. The *User Support* paper recognizes the importance of having competent and knowledgeable model users. It provides a discussion on the problems with model users, good user attributes, and recommendations to improving model user capabilities. The paper on *Data Sources and Input for Planning Tools and Models* describes the process of obtaining results from planning tools or models as presented below.



A brief discussion of these topics can be found in Chapter 5, and the complete text of the papers can be found in Appendix D of this report.

3. PROBLEM IDENTIFICATION

Over the past several years Corps planning analysis has been criticized by a number of nationally respected sources. A committee of the National Research Council of the National Academy of Sciences reviewed the Upper Mississippi River- Illinois Waterway System Navigation Study and found "flawed assumptions and data" that were used as input to a barge traffic model (NRC 2001). Another Council committee reviewed the Florida Keys Carrying Capacity Study, where it found the study model to "project an unrealistic understanding of complicated environmental issues" (NRC 2002b). A General Accounting Office report on the Delaware River navigation project found "miscalculations, invalid assumptions, and outdated information" in the economic analysis (GAO 2002). More generally, Mr. James T.B. Tripp, of Environmental Defense, challenged Corps' leaders to "use nationally respected economic models to restore credibility to Corps economic analyses" (Tripp 2002). Most recently, in response to a Congressional charge to investigate review of Corps' planning reports, the National Academy recommended, "reviews [of Corps' reports] should be conducted to…evaluate the soundness of models and planning methods" (NRC 2002a).

During the first Task Force meeting (15-17 April 2003), members brainstormed and discussed a variety of potential issues related to planning models, and models in general; and as a result, identified a wide variety of modeling problems. These were reviewed and grouped into the following major categories:

Causes of Problems – Why? The Task Force noted a wide range of conditions that have cumulatively contributed to problems with planning models, including: lack of review, changing planning capability, a focus on project delivery at the expense of adequate analysis, lack of a coherent model development process, and attitudes about models, such as "not invented here" and cost sharing which has caused model development to occur during project development.

Model Input. Inputs are the empirical data and assumptions that fuel a model. Models may be selected without enough attention to what it will take to use them. Some models require seemingly infinite amounts of input. The question "Can we afford to care for and feed the model?" should, but may not, be answered after considering the financial cost, time, and expertise to develop the proper quality of input required by the model. Poor quality data, often due to time and funding constraints, may result in poor quality outputs and decisions.

Model Structure. Models themselves may suffer from a host of problems, including being incomplete or based on inappropriate scientific theory, having incorrect computational routines, lacking sensitivity to the scale of the problem at hand, lacking spatial and temporal flexibility, being too complex or oversimplified, being expensive to develop and unreliable in getting the job done, being a "black box" that is not easy to understand or is too hard to use, not fitting well with other models, and being developed too late to be useful.

Model Gaps. Some models don't exist; others do exist but the Corps doesn't use them. General categories of model gaps identified by the Task Force include:

- Environmental/ecosystem restoration analysis.
- Monetary valuation of environmental benefits.
- Plan formulation.
- Trade-off analysis, including NED-NER trade-offs.
- Public involvement.
- Forecasting future conditions.
- Models for large-scale watershed studies.
- Deep-draft navigation economic model.

Model Users. People who use models may be limited by their basic qualifications, and may not understand model results. Analyses may suffer from unintended human error or mis-use. Turnover in personnel may limit effective model applications. Some users may depend too heavily on models as substitutes for good clear thinking.

Model Results. The output results of models may not be understandable, believable, or useful for decision-making. Results can also be misinterpreted.

Model Support. It is difficult to exchange information about models. Many models lack adequate documentation and training support. Few models receive adequate ongoing maintenance and rehabilitation, including user-friendly technical support.

Effects of Problems – So What? Many of the above listed problems with models, including their inputs, results, users and support, have led to unintended and undesirable consequences. Many models are ad hoc and unique to local problems and situations, have limited application and may not be portable from place to place. Study-specific models and a lack of awareness about existing models have resulted in some duplication. Few models are recognized and used nationwide, and currently there are no mandatory planning models. This unavoidably leads to inconsistency in formulation, evaluation, policy application, and decision-making. In some cases, different model users or reviewers may not be able to replicate model results due to poor documentation, user error, or other factors. Some models are outdated and do not reflect the state of the art or best practices. Other models and their results may not be useful in informing and advising decision-making, and meeting requirements of law or regulations.

The holistic result of these problems and other factors is that the credibility of Corps' planning analyses has suffered and recommendations are not necessarily accepted as being based on good science. We have seen a loss of trust in, and acceptability of, Corps' planning modeling and its results, and a sense that models may not withstand professional and public scrutiny.

4. SURVEY OF PLANNING MODELS

Discussions at the first Task Force meeting and subsequent research confirmed that a consolidated source of information on what planning models are available or used for Corps' planning studies does not exist. In addition, senior Corps' leaders who attended the three Task Force meetings asked various basic questions about the universe of planning models. In order to begin building a useful source of information about planning models and to respond to questions about planning models, the Task Force undertook a survey of Corps' planning models. The purpose of the survey was to: (1) identify what planning models are available and what they do; (2) identify redundancies in models; and (3) identify gaps where new tools are needed.

The Task Force designed a three-part survey of planning models which was fielded using a web-based platform on 17 July 2003. When the survey closed on 12 August 2003, a total of 123 responses were received. Responses were received from every Corps district. The full results of the survey are in Appendix E and are summarized as follows:

Part 1. This part of the survey focused on planning models commonly used on a national basis. Respondents indicated that the most frequently used models are HEC-FDA, @RISK (add-in to Excel), HEP and IWR-PLAN. Comments on these models were generally positive.

Part 2. This part focused on other models. Forty responses were received regarding other models; and removing duplicates resulted in a list of 36 models. Some, but not all, of these models were "home-grown". Models were identified almost evenly among the economic, environmental, and plan formulation communities of practice. Twenty-one were noted as used by more than one community of practice.

Part 3. This part of the survey asked about new models that are needed now or will be needed in the future. The most commonly identified needs were: to improve existing flood damage models (HEC-FDA, for example), to develop a coastal storm damage model, and to develop more ecosystem restoration and watershed tools. In addition to needs for specific models, several overarching themes appeared in the comments: need for information on what models are available; GIS based or compatible models; scaleable models; and greater attention to maintenance and updating.

Based on the survey responses, and the experiences and discussions among its members, the Task Force offers the following answers to the questions that led to our survey:

How many planning models are there? Based on our limited efforts we do not have a good estimate for the total number of planning models in use. The Task Force identified 91 different planning models. We believe there are many more planning models in use.

What planning models are being used? Planning models in use today include nationally used models developed by Corps' research offices (for example: HEC-FDA, IWR-PLAN), locally developed models (for example: Charleston Beach Model, deep-

draft navigation spreadsheets), and models developed outside the Corps (for example: HEP, @RISK).

What do planning models analyze? The models listed in Appendix E conduct a variety of planning-related tasks. The most commonly listed tasks were forecasting future conditions, calculating benefits and economic and environmental impact evaluation of alternatives. One of the things we learned is that we do not have a standard list of discrete planning tasks.

How many Districts use planning models? Based on receiving at least one response to the survey from every Corps district and the Task Force's experience, we believe that every Corps district uses various planning models in its study and project analyses.

Are any planning models nationally applicable? The Task Force identified 26 planning models that are commonly used on a national basis. The Task Force believes that there may be several more planning models used on a national basis.

Has anyone else done a survey earlier that we can compare this survey to? The Headquarters' Strategic Engineering and Technology (SET) initiative identified 507 models used agency-wide across the Corps of Engineers, including 17 that the Task Force considers to be planning models. The information collected in this survey has been shared with SET team.

Are there any redundant planning models? The survey did identify some redundancy at a general level. Based on the Task Force's experience, there are probably other redundancies among locally developed models that accomplish routine common tasks, such as calculating interest during construction.

Where are the planning model gaps? Survey respondents identified the following model gaps and other needs:

- Increased technology transfer is needed so people can find out what models are available: link on Planner's web site; CD; periodic articles in ***Planning Ahead***.
- Improving the HEC-FDA model is a priority need.
- A corporately approved coastal storm damage model needs to be completed.
- Adequate models for ecosystem restoration analysis and watershed planning are not commonly available. We need a model with greater scientific rigor that ties physical changes to service outputs.
- New models should incorporate risk and uncertainty. Existing models should be updated to add capabilities to address risk and uncertainty.

It should be noted that there are ongoing efforts in some of the areas identified above that should fill some of the planning model gaps.

5. OPTIONS AND ANALYSIS

The Task Force considered the problems related to Corps' planning models and identified topics for further analysis. These topics were debated during the Task Force meetings (see Appendixes A, B and C), investigated and documented in papers (see Appendix D) and explored through the planning models survey (see Appendix E). Task Force members worked individually, in sub-teams and as the full team to identify and analyze various options related to planning models. This chapter summarizes options and analyses considered by the Task Force in arriving at its recommendations.

Roles

Defining appropriate roles and responsibilities associated with implementing actions to improve analytical tools and models used in the planning process are critical to the success of this effort. A variety of options to provide broad oversight for implementation of the recommendations in this report were considered by the Task Force. Some options considered include: (1) delegating planning model responsibilities to the divisions; (2) centralizing responsibilities at the Headquarters, (3) establishing a Planning Model Clearinghouse at the Headquarters; (4) delegating responsibilities by business line to the recently designated Planning Centers of Expertise; and (5) various combinations of district, division, and Headquarters involvement.

Key to the Task Force's final decision was the establishment of Planning Centers of Expertise for the Corps' water resources business lines. The Centers will maintain high skills and capabilities to support national planning needs for specific mission business lines. Such capabilities would extend to providing effective guidance in the development, validation, utilization, and necessary training of the analytical tools and models used as part of the planning process. As such, this option was determined to be the best approach to ensure effective implementation of the report recommendations. In addition, it was determined that some form of broad oversight would be needed at the national level to ensure consistency in the development and application of guidance, supporting research and development needs, and providing coordination with other Federal agencies, industry, special interest organizations, stakeholders, and others. These functions, and others as presented in this report, would best be accomplished at the Headquarters.

Business Process

The Task Force believes that a corporate business process is needed to implement the recommendations presented in this report, especially those pertaining to the newer ideas for peer support and review and the roles of the Planning Centers of Expertise. The Task Force recommends that this process be established in guidance on planning models to be issued by the Headquarters.

The Task Force recognizes that there are differences in the technical requirements for peer support and review for the Corps' different business lines. However, we do not believe that this is a reason for variation in the basic business process among the Planning Centers of Expertise. Because the districts will be working with multiple Centers, absolute consistency is paramount for efficiency and effectiveness. It is critical that the Headquarters' corporate guidance be consistently applied across the Centers, and that the Centers do not establish independent supplemental guidance for certifying planning models.

Certification Through Peer Support and Peer Review

The Task Force devoted substantial thought and debate to the ideas of "peer review" and model "certification" (or "validation"). In considering these ideas, the Task Force developed the idea of "peer support" as a complement to peer review. As a result, the Task Force recommends that (1) new models be developed through a peer support process; (2) existing models be critiqued through a peer review process; (3) models that successfully go through one of these processes be certified for national use; (4) all certified models be placed in a readily accessible Planning Models Toolbox; and (5) certification be reviewed annually. The following paragraphs summarize how the Task Force defined these ideas and considered options for carrying them out in the Corps. See Appendix D-6 for additional information.

Peer Review. In the context of planning models, peer review is a review of an existing model by independent peers knowledgeable of the particular subject area. Peer reviewers may be internal or external to the Corps. Reviewers critique a model against a set of criteria that define quality standards for a model's structural and performance characteristics. See Appendix D-4 for a discussion of potential "criteria for a good model" (such as technical soundness, computational correctness, and usability) considered by the Task Force.

The Task Force recommends that the Planning Centers of Expertise be responsible for planning models that support their respective business lines. Within their business areas, the Centers will certify planning models based on peer support and peer review in accordance with the Headquarters guidance. In conducting peer review, we recommend that the Centers use three different levels of peer review. The level of review for a given model is dictated by the complexity, controversy, cost and risk associated with that model or the study in which it is to be used. The level of review in turn dictates the number and mix of reviewers internal and external to the Corps.

- Level 1 is the most detailed review, and will be required for complex, controversial, costly or high-risk studies or models where a wrong investment decision would have serious undesirable consequences.
- Level 2 review is for studies and models of normal complexity and where the risk of using a model could lead to the wrong investment decision resulting in minimum impacts.
- Level 3 review has two basic purposes: (1) review of new, routine and non-complex models that have a minor impact on decision making, and, (2) review of

existing, frequently-used models that were developed by Corps, other agencies, universities and contractors and that have withstood historical formal and informal reviews. The review of a frequently used existing model will include an examination of any previous informal or formal reviews, model documentation, and the extent and success of previous uses to determine if it warrants certification without a Level 1 or 2 peer review.

A suggested process for peer review using the framework of these three review levels is presented in Appendix D-6.

Peer review will not take the place of the districts' independent technical review (ITR) which will continue to be necessary to assure that model users are qualified and that the model fits the requirement, appropriate data are used, and results interpreted correctly. Rather, peer review leads to a corporate "seal of approval" that eliminates the need for a district-level review of a certified model.

Peer Support. Peer support is a complement to peer review. The purpose of peer support is to provide districts with early and seamless advice, assistance, and review from experts in the development and initial application of new models. Modified and new models will be developed such that they will meet quality standards for a model's structural and performance characteristics. Because of the early involvement of experts it is expected that models developed through the peer support process will be "certified" upon completion of model development and documentation and that a formal peer review will not be required.

Peer support will be initiated, for example, when a district approaches a Planning Center of Expertise with a request to identify a model to evaluate a problem. If the Center identifies an existing model that will meet the district's needs, it will provide the district with the expert support needed to use it (training workshop, for example). If, however, the Center determines that no existing model is appropriate, it will coordinate with the Corps' research offices to develop a team of expert peers, internal and external, who will work to modify an existing model or develop a new model that will meet the district's needs. The district, the Center, the research offices and others on the team of expert peers will work together to develop, test, document, maintain, update, train and otherwise support the modeling process.

Certification. Certification means that the Corps' has corporately approved the model for nation-wide use and there is no additional need for review of the model. Certification is a corporate "seal of approval" that the model is technically sound and otherwise meets quality standards for a model's structural and performance characteristics. The Task Force recommends that the Planning Centers of Expertise certify planning models that have successfully completed either a peer review process or been developed through a peer support process, and that the Corps' research offices certify models that they develop through the research program. The Task Force believes that planning models with a history of common use on a national basis, such as HEC-FDA, IWR-PLAN, HEP and @RISK, should be considered among the first to be certified.

Toolbox. The Task Force recommends that certified planning models be placed in a "toolbox" that is readily accessible to all users and others with an interest in the Corps' business processes and decision making. Planning Centers of Expertise will submit profiles of certified models to the Headquarters where they will be maintained most likely on the ***Planning Resource*** website located at http://www.iwr.usace.army.mil/iwr/plannersweb/. The types of profile information that the toolbox may include about each model include:

- Name of model.
- Point of contact (office, email address, phone number).
- Applicable business lines (ecosystem restoration, flood damage reduction, navigation, etc.).
- Applicable communities of practice (formulation, environmental sciences, economics, other social sciences, public involvement).
- Applicable steps in the planning process.
- Applicable planning tasks (forecasting, benefit evaluation, habitat impact assessment, trade-off analysis, etc.)
- Applicable study phase (reconnaissance, feasibility, preconstruction, post construction).
- Model operating system.
- Availability of users manual.
- Availability of training opportunities.

Annual Review. The Task Force recommends that the Headquarters annually review model certifications. The review will include an audit of at least two model certifications issued by each Planning Center of Expertise and each Corps' research office to assure adherence to the corporate business process and policy prescribed in the Headquarters' guidance. The review will also search for lessons learned that would provide a foundation for improving how we provide peer support, conduct peer review and certify models. The Headquarters will prepare an annual report summarizing the year's certification activities, including such information as the number completed, what models were involved, description of findings, and who participated in the support and reviews. The report will also provide a brief assessment of "state of the technology" issues to ensure Corps' planning models are using best business practices. The annual report will serve as the Corps' corporate record of peer support and peer review of planning models.

Process Options. The Task Force analyzed numerous issues and related options for peer support and review and certification. Two of the issues were whether expert peers should be internal or external to the Corps, and what office should actually conduct peer support, peer review, and certification.

The Task Force considered three options for internal and external peer support and peer review. First, a national review center, similar to the defunct Board of Engineers for Rivers and Harbors or the Washington-Level Review Center, could probably provide focused and efficient service. However, funding constraints and concerns of independence moved the Task Force away from recommending the creation of an internal

national review center. Second, an option to use only experts from outside the Corps would ensure the independence of support and reviews. However, given a need for review flexibility with the wide range of study and model complexity and the desire to take advantage of the Corps' considerable on-board expertise, the Task Force did not adopt the idea of having all model reviews being conducted solely by outside experts. Rather, the Task Force favored a third option to conduct peer support and peer review with a mix of external and internal peers depending on the rigor and independence dictated by the level of review needed.

Although the Headquarters' Chief of Planning and Policy would have ultimate oversight responsibilities, the Task Force explored options for what office should administer and conduct the day-to-day operation of peer support, peer review, and certification. Options included assigning responsibilities to: (1) the Headquarters (for example, assign responsibilities to the newly created Business Line Managers); (2) the Institute for Water Resources; or (3) the newly established Planning Centers of Expertise. The Planning Centers of Expertise have compatible roles and responsibilities desirable for peer support and review. In the Director of Civil Works letter of 25 August 2003 designating the Centers, they are charged to provide consulting services or accomplish "key analytical components of very costly, highly complex and controversial studies", and to provide "independent review support". These compatible roles and responsibilities motivated the Task Force to recommend that the Centers be designated as the offices to conduct peer support and review and to certify models.

Users and Data

The Task Force recognized that more than "good" models are needed to improve the foundations for decision-making. Quality model users and quality model input data are also necessary, and the Task Force addressed these issues in its early discussions. See Appendixes D-7 and D-8 for additional information.

The Task Force considered various measures that could be used to ensure the proper use of models or to identify specific qualifications for the use of different models. As models could be certified, so too could model users be certified as qualified to apply given models. While it was recognized that model certification is essential, it was agreed that individual "drivers' licenses" or "certification of individuals" would not be practical nor would it necessarily ensure that models are appropriately applied. The term "good model users" was emphasized. It was noted that a good user will understand the theoretical basis for the model; will recognize model specific limitations, applicability, and difficulties; will run independent checks of model outputs; and will recognize the data needs for specific models and the limitations generated from using inadequate data. Continuous access to training workshops, web-based training, mentoring, and informal networking will be necessary to ensure that model users are knowledgeable and competent and have access to model support.

Similarly, the Task Force discussed the relationship of good data to good modeling. The importance of data in modeling cannot be overemphasized. Again, however, the Task Force believes that "certification of data" would not be practical at a national level.

The Task Force recommends that the districts continue to be responsible for the application of planning models to specific studies and projects. They should use training, project management plans, independent technical reviews, and public reviews under the National Environmental Policy Act and other laws to assure the quality of data and other model inputs as well as model users, including how they interpret model outputs. We also recommend that the Planning Centers of Expertise work with Corps' national data collection programs, such as the Waterborne Commerce Statistics and Flood Damage Data Collection Programs, to improve the usefulness and accessibility of data for planning models.

Mandatory

During its three meetings, the Task Force heard from senior Corps' leaders about the desirability of mandating the nation-wide use of certain planning models. The Task Force considered the question of "Should models be mandatory?" and examined the advantages and disadvantages of mandating specific models to be used in planning studies. See Appendix D-5 for additional information.

Mandating certain models could ease review time because models would be more familiar and widely accepted. Another advantage of mandating certain models would be that resources could be concentrated on maintaining and updating a smaller and more manageable set of models. Also a smaller set of mandated models could be standardized to some extent. Standardization would enable users to more easily use any of the mandated models as they all would be formatted similarly. Finally, mandated models could improve the confidence and comfort of model users and decision makers alike, knowing that recommendations are founded in a consistently-used tool.

Conversely, mandating certain models would discourage innovation or development of new models. Certain models may not fit every application, and mandated models could inhibit some planners from modeling unique issues and concerns when it would be proper to do so. During its second meeting the Task Force heard from a panel of distinguished scientists expert in various aspects of planning modeling, and they were unanimous in discouraging mandated models.

Rather than mandating the use of specific models, the Task Force recommends that models used in Corps planning be certified based on peer review or peer support (as described in earlier sections of this report). The Task Force expects that, over time, requiring the process of certification will create an incentive for using fewer models, thus essentially meeting the intent of mandating specific models while allowing for flexibility and creativity in solving problems.

Redundancy

Another concern expressed to the Task Force by senior Corps' leaders was the need to reduce redundant models, that is, models that do the same thing. The survey of planning models did not reveal redundancy to be a significant problem. However, the experiences of Task Force members suggest that there are some tasks for which there are more than one model in use (for example: calculating interest during construction).

The Task Force examined the advantages and disadvantages of reducing the number of redundant models and how that might be achieved. By requiring that all planning models go through a process of peer support or peer review for certification, the Task Force expects that users will gravitate toward the fewer certified models. Reducing redundant models will free up more resources for improvements and maintenance. Fewer models will also create a greater body of knowledge about the certified models among users and reviewers. However, by reducing the number of redundant models, some users will initially have to learn to use unfamiliar models. Also, the flexibility to adapt models to local conditions may be more difficult with fewer models. The Task Force recommends that the Planning Centers of Expertise identify and reduce or otherwise resolve model redundancy as a part of their technical mission.

Research and Development

The Task Force discussed several options regarding how to better meet planning model needs through the Corps' research and development program.

Currently, most research for planning models is conducted through the Integrated Technologies for Decision Making (ITDM) research area, which has three subprograms: Navigation Economic Technologies (covering models for inland and deep-draft navigation and coastal analysis), Risk Analysis for Water Resources (covering risk models across business lines), and Investment and Management Decision Making (covering all other planning models across business lines, such as IWR-PLAN). The ITDM Area focuses on strategic research that largely cuts across business lines. It receives about 10 percent of the annual $20 million in planning funds (general investigation account) invested in water resources research. The Headquarters recently dispersed the ITDM work among four new research areas for navigation, flood and coastal, environment, and system-wide analysis beginning in fiscal year 2005.

The Task Force believes that the planning community of practice continues to need a mechanism and a champion to coordinate and shepherd its interests and needs, and it considered several options to that end. One option is to task the Planning Centers of Expertise to oversee planning-related research within their assigned business lines regardless of how the research programs are organized. This would give the Centers a clear picture of both tactical peer support-related research as well as the more strategic and cross-business line research in the traditional research programs. The Centers could take a much more proactive role in directing the types and priorities of planning-funded research and ensure that it meets national strategic modeling needs. They could develop

a strategic ongoing research business plan that actively engages a field review group with representation from the districts, Centers, sponsors, Corps' research offices, academic interests, critics, and other stakeholders outside the Corps in identifying and prioritizing new planning model needs. The Centers could also provide regular and ongoing opportunities for these interests to review and provide advice on planning-related research throughout the course of the year.

Another option is to establish a separate research area to address the unique needs of the planning community of practice. These unique needs, such as forecasting future conditions, formulation at the project and watershed scales, risk and uncertainty analysis, and trade-off analysis, cut across and support all of the Corps' business lines. Forcing these needs to compete for funding and talent within the limited concerns of business line programs puts special planning problems at risk and further jeopardizes an already eroded Corps' planning capability. A separate planning research area will facilitate opportunities for integrated, multipurpose and multiobjective water resources planning that balance the full range of water resource needs.

The Task Force believes that a focused and fully funded planning-related research area is an essential component of the planning capability that the Corps has worked so hard to maintain and improve over the past several years. Therefore, we recommend that Headquarters establish a separate research area for planning model needs, and the Centers of Expertise oversee both that separate planning area as well as the planning-related work in their business lines throughout the Civil Works research program.

Funding

The Task Force recognizes that implementation of its recommendations will require time and funding. Resources must be provided to conduct the peer support and peer review processes, to maintain the planning models toolbox, to prepare certification audits and an annual report, and to accomplish other new activities. We considered using a number of alternative sources to fund these activities, including:

- Research and development funds from the General Investigation account. Costs for peer support and peer review are as necessary to doing good professional business as are costs for model building and data collection. A substantial portion of annual research and development funds should be reserved for these purposes.
- Funds from individual studies and projects for which models are being developed. If a study or project poses questions that can only be answered by a new or modified model, then, following the "user pays" principle, it should bear a substantial portion or all of the costs involved. The Task Force recognizes that smaller studies and projects may not be able to bear such costs and that funds from other sources may be needed. Alternatively, peer support and peer review of models could be a new "remaining items" line item in the General Investigations funding account.

- Funds from the General Expense account. It may be appropriate to fund peer support and peer review for nationally applicable models from this funding account that is not designated for specific studies and projects.
- Funds raised through a models subscription service, as used by the Hydrologic Engineering Center. This approach has been successful in funding limited "help desk" type of advice and activities for the Hydrologic Engineering Center's suite of models. A similar service could be established for planning models.

The Task Force does not recommend that any one of these funding sources alone be used to support its recommendations. Rather, we recommend that the Corps' leadership consider a variety of funding sources to pay for these recommendations. We also recommend that modeling costs be shared among these sources. For example, the cost of developing a new model for a specific local planning study should be shared between the Corps' district that needs the model and the Corps' research office and Planning Center of Expertise providing peer support in developing the model. The Task Force believes that, in the long-term, investments in the Task Force recommendations will save both time and funds.

Annual Strategic Capability Assessment

Creating planning models and other analytical tools on demand and often in isolation is not an efficient investment and can lead to major long-term problems in both modeling and capability. The Corps' must do a better job of developing models based on a strategic look at its future functions and capabilities.

How will we know what models the Corps will need in the future? While we can never have a complete answer to that question, the Task Force recommends that the Headquarters conduct an annual strategic capability assessment as a positive step in identifying future modeling needs. The annual assessment would identify the implications of recurring forces that drive future needs in order to identify gaps in capability. It would, as a minimum, review the previous year's Water Resources Development Act for authorizations (when applicable) and the previous year's Energy and Water Development Act for appropriations and, for every study and project listed, ask: "What models and technology are needed to accomplish this work? Are they available, or are new models and technology needed?" The assessment should also look beyond modeling needs and ask similar questions regarding:

- Expertise – What types of expertise are needed? Do we have the expertise internally, or should (and could) it be obtained through contractors?
- Training – What training is needed? Is it available, or is new training needed?
- Law – Is current Federal law adequate? Are there any impediments in current law? Is new legislation needed?
- Policy – Is existing policy adequate? Are there any conflicts with existing policy? Are policy changes or new policies needed?
- Funds – How would this be funded? Is current funding adequate?

In addition to authorization and appropriations acts, the annual assessment should also review the implications of other current initiatives that are likely to drive future needs for modeling, and technology and other resources. For example, at this time other initiatives with future implications include the Civil Works Strategic Plan, the Environmental Operating Principles, USACE 2012, the Planning Centers of Expertise, and the revision of the FY05 budget request around business lines. What do these mean to our modeling and technology over the next ten years? An annual strategic assessment will help us develop a thoughtful response.

6. EXPECTATIONS AND LESSONS LEARNED

In addition to its recommendations, the Task Force offers the following expectations regarding planning models, and lessons learned from the Task Force experience.

Expectations

Fundamental planning concepts in the ***Principles and Guidelines***, the National Environmental Policy Act, and other Federal requirements drive the need for and use of planning models. Many previous studies and reports have called for reviews of these requirements, and the Task Force encourages the Corps to support such reviews in the interest of incorporating new technologies and our society's changing values. The Task Force notes that changes in Federal planning requirements could dramatically change the need for and use of models in the Corps' planning.

Models are intended to help decision makers and others make more informed decisions, and the Task Force expects that neither model users nor decision makers will mis-use modeling procedures, including model assumptions, inputs and outputs, to arrive at preconceived results.

Models are not substitutes for thinking and do not obviate responsibility for professional judgment. Further, the Corps' Districts are problem-solving laboratories, and the leadership must encourage and expect creative thinking in modeling and other aspects of planning.

The Task Force expects that the Corps will take full advantage of evolving website technology in communicating the planning models toolbox, guidance, expertise and other information necessary and helpful to improved decision making.

Lessons Learned

At the last meeting of the Task Force participants were asked three questions: "What went well?", "What did not go well?", and "What lessons learned would you pass on to similar groups?" A summary of their responses follows. Overall, the Task Force members were very positive about their experience.

What went well? Answers to this question had three themes: people, communication and leadership support. The comments about the Task Force members included: very good mix of people; open-minded; knowledgeable; good ideas; excellent discussions and interactions; committed; enthusiastic; did assignments. The usefulness of the conference calls to stay in touch and keep focused was mentioned by many of the participants and their particular importance for a group as geographically diverse as this one. Several felt that having three meetings off site was an important advantage for the group. The third item mentioned often was appreciation for the support shown by senior Corps' leaders

such as Major General Griffin, Jim Smyth, Bill Dawson, Don Basham and Harry Kitch. Their personal involvement made the importance of this mission unmistakable.

What did not go well? Comments on what did not go well were limited. The item of most concern was that some Task Force members did not attend all of the meetings. Other comments were: spent too much time on some points-beat to death; not sure all understood the goal; would have liked more feedback from Task Force members on papers which groups developed.

What lessons learned would you pass on to similar groups? The two most common lessons learned were: state the mission/objective clearly and early, and a diverse group of knowledgeable, open-minded, driven people is essential to success. Multiple participants also listed establishing the importance of the task by the participation of senior leaders and sticking to a schedule for a short time frame project.

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