Interstate Natural Gas Association of America

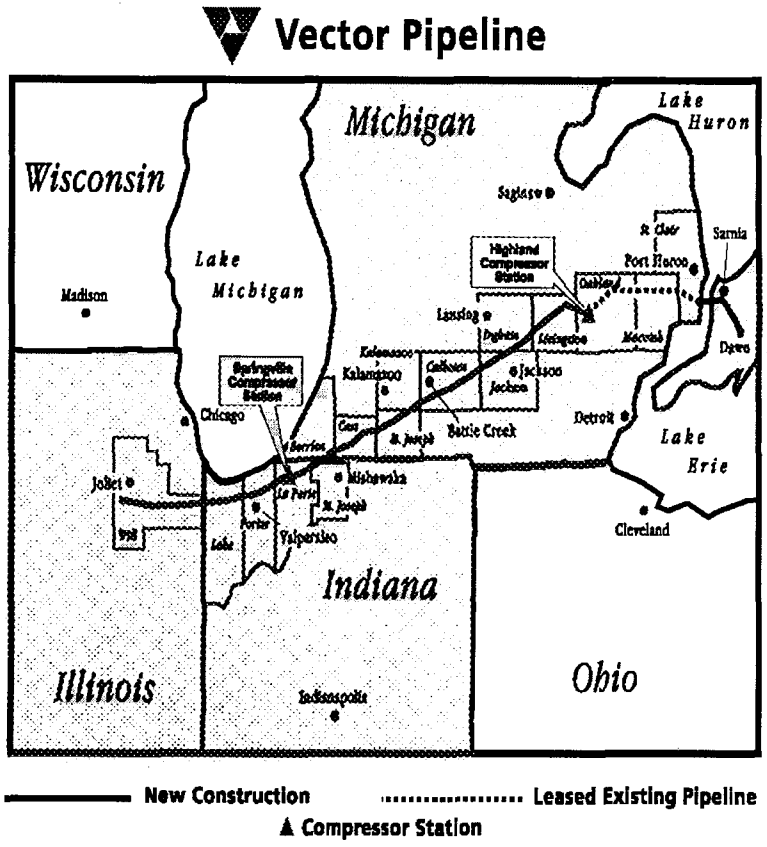
Coordinating Pipeline Permitting Process

Fundamental Problems

- Inadequate integration of NEPA compliance with NHPA and ESA compliance, and other Federal, State and local permitting;
- Inappropriate, overlapping and inconsistent Federal, State and local permitting and mitigation requirements;

Vector Natural Gas Pipeline Project

- Natural gas pipeline from the Chicago area through Indiana, Michigan and on into existing gas storage of Ontario*.
- 348-mile-long project with 274 miles of new construction in the U.S.
- 3-year project from initial consultations to beginning operations.



*Note: crosses the U.S.-Canada international border at the St. Clair River between Michigan and Ontario.

603 environmental filing requirements

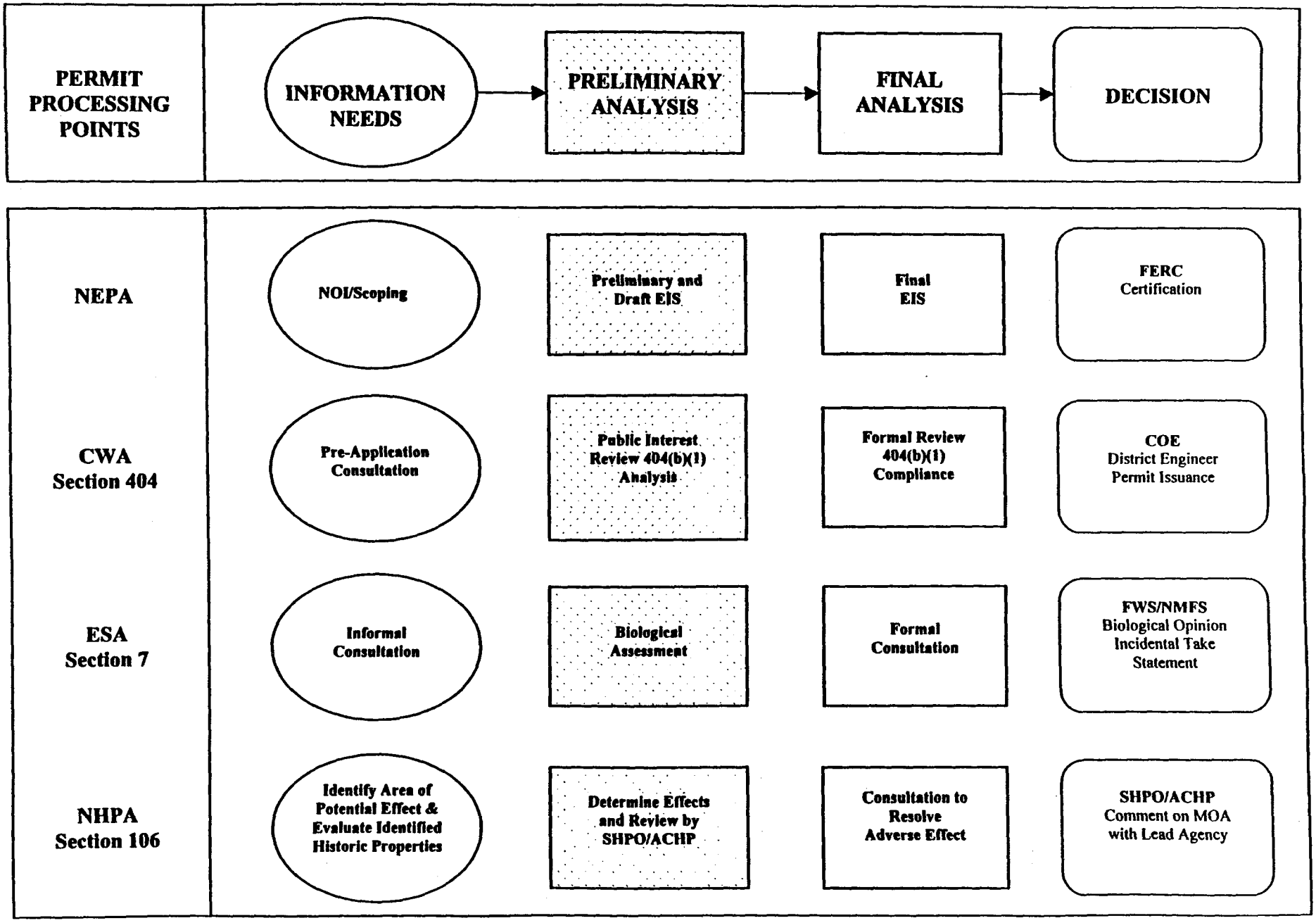
- **The Federal Energy Regulatory Commission Certificate and Environmental Impact Statement**
- **26 separate state environmental permits prior to the commencement of construction.**
- **Other Federal, State and Local permits**
  - **355 road crossing permits obtained at the local level**

- ***Environmental assessment, permitting and inspection costs for the U.S. portion of the project was approximately $20 million.***

Agency Involvement

- U.S. Fish and Wildlife
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture, National Resource Conservation Service
- National Park Service
- U.S. Coast Guard
- Presidential Permit
- Presidential International Border Crossing Permit
- Canadian Federal, Provincial and Local Permits
- Local, Township and County Permits

Figure 5: Flow Chart Relating NEPA Compliance Steps with Major Permit Processes



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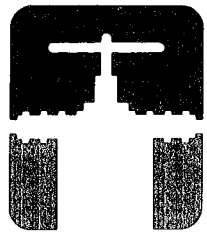

IMPROVING IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

Foundation

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IMPROVING IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

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F-2000-06

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Acronyms used in Text

ACHP – Advisory Council on Historic Preservation

ACOE – Army Corp of Engineers

AGA – American Gas Association

BA – Biological Assessment

BLM – Bureau of Land Management

BMP – Best Management Practice

BO – Biological Opinion

BTU – British Thermal Units

CEQ – Council on Environmental Quality

CEQA – California Environmental Quality Act

DOD – Department of Defense

DOE – Department of Energy

EA – Environmental Assessment

ER – Environmental Report

EIS – Environmental Impact Statement

EPRI – Electric Power Research Institute

ESA – Endangered Species Act

FERC – Federal Energy Regulatory Commission

FHWA – Federal Highway Administration

FONSI – Finding of Non-Significant Impact

GIS – Geographic information Systems

GTI – Gas Technology Institute

INGAA – Interstate Natural Gas Association of America

ISO – International Standards Organization

MOA – Memorandum of Agreement

NEPA – National Environmental Policy Act

NHPA – National Historic Preservation Act

ROW – Right of Way

SHPO – State Historic Preservation Office

SO_2 – Sulfur Dioxide

THPO – Tribal Historic Preservation Offices

USFS – U.S. Forest Service

USFWS – United States Fish and Wildlife Service

The Natural Gas Act authorizes the construction and operation of interstate natural gas pipelines, with regulatory oversight by the Federal Energy Regulatory Commission (FERC). Since these activities are performed under the authority of the Federal government, National Environmental Policy Act (NEPA) reviews are required.

Previous INGAA Foundation reports have forecast that the interstate natural gas pipeline industry will require more than $34 billion in infrastructure development through 2010 to satisfy the nation's demand for clean and dependable natural gas. This translates into approximately 2,000 miles of interstate natural gas transmission pipelines and associated facilities each year to reach a projected 30 trillion cubic foot natural gas market. Estimates are that up to 30 percent of the costs of these projects are environmentally related, and thus subject to NEPA regulations. Data requests, time delays and conflicting agency decisions contribute to the inefficient expenditure of resources and capital. Minor improvements in the NEPA process can result in significant cost savings to consumers.

This report presents the results of a study for The INGAA Foundation, Inc. by URS on NEPA implementation for interstate natural gas pipeline projects. The objective of the study is to improve the NEPA compliance process by increasing its efficiency and effectiveness. This would result in improved project implementation while providing adequate environmental protection. The specific objectives are to:

- Evaluate the legal and regulatory background of the NEPA compliance process as it relates to the natural gas pipeline industry;
- Evaluate the current NEPA compliance processes and requirements to determine their effectiveness and adequacy; and
- Develop recommendations concerning how to make the current NEPA compliance process more efficient and effective.

A variety of techniques were used to achieve these objectives, including a review of NEPA and other related major regulatory requirements, completion of two internal URS workshops involving technical and regulatory specialists and outside legal counsel, review of relevant major studies within the gas pipeline industry and completion of an extensive computer-based, key word literature search. The literature search provided substantial information, including detailed reviews of NEPA effectiveness and improvement, particularly by the Council on Environmental Quality (CEQ) and various researchers.

The study identified five major issues that exist with respect to the effectiveness of NEPA, including:

- Inadequate integration of NEPA compliance with NHPA and ESA compliance, and other Federal, State and local permitting;
- Inappropriate, overlapping and inconsistent Federal, State and local permitting and mitigation requirements;
- Inadequate interagency communication, coordination and decision-making;
- Delayed and inefficient completion of the NEPA compliance process; and
- Submittal of applications for inadequately planned and designed projects by pipeline companies.

For each issue, we present an overview and description, recommendations and steps to implement each recommendation. The results are summarized in the following table:

SUMMARY OF IDENTIFIED ISSUES AND RECOMMENDATIONS

Issue	Recommendations
1. Inadequate Integration of NEPA Compliance with NHPA and ESA, and Other Federal, State and Local Permitting Processes	a. Develop Improved Memoranda of Agreement (MOA) that Effectively Address: (1) Identify and Agree on Agency Jurisdiction by Cooperating Agencies (2) Use NEPA Documentation as Central Basis of Agency Decisions (3) Utilize NEPA Scoping Process as Input into Agency Decisions (4) Integrate Environmental Data Needs and Impact Assessment Methodologies (5) Identify and Agree on Review and Decision Timing of Reviews and Decisions (6) Develop a Conflict Resolution Process b. Improve the Individual NHPA, Section 106 Compliance Process c. Improve the Individual ESA, Section 7 Compliance Process
2. Inappropriate, Overlapping, Inconsistent and Inflexible Federal, State and Local Permitting and Mitigation Requirements	a. Improve Consistency and Effectiveness of Agency Completion of Reviews of Permitting and Mitigation Requirements b. Develop Improved MOAs to Minimize Overlapping and Inconsistent Federal State and Local Agency Permitting c. Utilize Updated Technical and Field Experience Data in NEPA Analysis d. Utilize Performance-Based and Industry Recommended Practices to Mitigate Effects e. Allow Broader Use of Construction and Post-Construction Inspection and Monitoring to Permit Flexibility in Mitigation Implementation
3. Inadequate Assessment of Environmental Impacts of Substituting Natural Gas for Other Fuels	a. Improve NEPA and Related Technical Analyses b. Consider Indirect Positive Air Quality Impacts in the Development of Pipeline Project Permitting and Mitigation Requirements c. Encourage Pipeline Project Applicants to Provide Information on Natural Gas Use by Facilities d. Develop Additional Data and Materials on Positive Air Quality Impacts e. Develop Workshops and Meetings with Regulatory Agency Personnel to Exchange Information and Increase Communication on Positive Air Quality Impacts
4. Inadequate Inter-Agency Communication, Coordination	a. Applicants should strongly consider collaborating with Stakeholders in the Pre-filing process

SUMMARY OF IDENTIFIED ISSUES AND RECOMMENDATIONS

Issue	Recommendations
and Decision-Making	b. Develop Improved General Operating and Project-Specific MOAs to Improve Coordination and Communication c. Applicants Should Conduct Pre-application Scoping Meetings and On-going Status Meetings with Agencies
5. Delayed and Inefficient Completion of NEPA Compliance Process	a. FERC Should Develop a Short Environmental Checklist/Assessment Instead of the Complete ER for Determination of Level of NEPA Compliance b. FERC Should Revise the ER Format to Make it More Consistent with a NEPA Document Format. c. FERC Should Prepare More EAs Instead of EISs
6. Submittal of Applications for Inadequately Planned and Designed Projects by Pipeline Companies	a. Pipeline Companies Complete Additional Project Planning and Engineering/Design in the Following Areas: (1) Applicants Should Improve the Routing Process to Avoid Sensitive Environmental Areas (2) Applicants Should Proactively Develop Feasible Alternative Routes (3) Applicants Should Develop Complete Project Descriptions Early in the Process and Identify Future Routing Changes as Routing Alternatives (4) Applicants Should Develop Alternative Construction Techniques to Achieve Acceptable Environmental Performance in Sensitive Areas (5) Applicants Should Improve Preparation of Project Permitting Requirements Analyses and Plans. (6) Applicants Should Propose Appropriate Mitigation Measures in the NEPA Document with Adequate Technical Support.

This report presents the results of a study for The INGAA Foundation, Inc. by URS on National Environmental Policy Act (NEPA) implementation for interstate natural gas pipeline projects. The industry and other groups believe that NEPA implementation by the Federal Energy Regulatory Commission (FERC) and other Federal agencies can be improved to make the process more efficient and effective. The objective of this study is to propose improvements to the NEPA compliance process that will increase its efficiency and effectiveness, resulting in improved project implementation while providing adequate environmental protection. The specific objectives of the study are:

- Evaluate the legal and regulatory background of the NEPA compliance process as it relates to the natural gas pipeline industry;
- Evaluate existing NEPA compliance processes and requirements to determine their effectiveness and adequacy; and
- Develop recommendations concerning how NEPA could be improved to become more efficient and effective.

The NEPA Implementation Study Report is organized in the following sections:

- Section One – Executive Summary
- Section Two – Introduction
- Section Three – Methods
- Section Four – Results and Discussion
- Section Five – Summary and Conclusions
- Section Six – References Cited.

The INGAA Foundation provided direction on the scope of the study. The study was completed in coordination with two additional Foundation studies, including the study of coordinating Federal agency review during the environmental approval process by Entrix, Inc. (INGAA, 1999) and an analysis of new regulations for compliance with the National Historic Preservation Act (NHPA), Section 106 completed by R. Christopher Goodwin and Associates, Inc. (INGAA, 2000).

Data and input for the study were collected by completing the following steps:

1. A review of NEPA, including the law, regulations and implementing procedures of various agencies.
2. A review of other related, major regulatory requirements, including FERC Certification requirements, Endangered Species Act (ESA) compliance requirements of the U.S. Fish and Wildlife Service (USFWS) and other agencies, and NHPA Section 106 requirements of the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Offices (SHPOs).
3. Completion of two workshops by the URS Project Team, including the Project Manager, key technical and regulatory specialists and outside legal counsel with a specialty in NEPA and related compliance (Chris Garrett, Latham and Watkins).
4. Review of recent work completed by GTI, including major studies in the areas of right-of-way (ROW) environmental Best Management Practices (BMPs), wetlands revegetation and other areas.
5. Completion of a computer-based, key word literature search. Key words included in the search included National Environmental Policy Act, NEPA, enhancement, improvement, communication, coordination, problems, efficiency, effectiveness, integration, Federal agencies, State agencies, local agencies and problems.

4.1 LEGAL AND REGULATORY BACKGROUND OF NEPA

NEPA is a key element of the Federal regulatory program. The purpose of NEPA is to establish a national environmental policy, and NEPA requires Federal agencies to:

- Act as an environmental trustee for future generations;
- Assure heartfelt, productive and aesthetically and culturally pleasing surroundings;
- Attain the widest possible range of beneficial uses of the environment without degradation or risk to health and safety;
- Achieve a balance between population and resource use; and
- Enhance the quality of renewable resources and encourage recycling of depletable resources.

The Council on Environmental Quality (CEQ) was created by the Act and was given the responsibility of providing structure and substance to the general and broad mandates of the Act. The CEQ was established to develop and recommend national environmental policies, and to promote improvement of environmental quality.

The CEQ has developed general guidelines and regulations, and required each Federal agency to adopt specific guidelines or implement procedures consistent with the overall responsibilities of the agency. CEQ regulations emphasize the goal of developing better decisions, not just NEPA documents (1500.1). The CEQ regulations include three basic themes (Freeman et al., 1992):

- Early and continuous communication with the public and agencies;
- Early consideration of significant environmental consequences; and
- Consideration of all reasonable alternatives.

Federal agencies must balance the need for the action with the impacts of the action and the costs of mitigation. Agencies are required to assess the significance of environmental impacts and consider reasonable alternatives to avoid, minimize or mitigate adverse impacts. A variety of criteria can be used to assess impact significance. A proposed alternative is generally considered reasonable unless it is not physically possible or makes an unwarranted assumption. The reasonableness of an alternative also can be evaluated on the basis of the level of technology required to implement the alternative. If the required technology is unavailable then the alternative may be considered unreasonable.

NEPA does not include any provisions for State implementation because it is directed at the actions of Federal agencies. However, there are three indirect ties between NEPA and other Federal, State and local environmental authorities (Freeman et al., 1992). First, CEQ directs Federal agencies to consult with other agency personnel who have first-hand knowledge or jurisdiction over significant environmental concerns (1501.1(b)). Second, NEPA encourages cooperation between Federal, State and local agencies concerning NEPA and similar State and local requirements (NEPA 101(a)). Third, agency NEPA regulations require that NEPA documents list the required Federal, State and local permits and approvals for the proposed action.

NEPA requires that responsible Federal officials plan for meeting requirements established by other Federal, State and local authorities. It is the intent of NEPA that compliance with all of these requirements be integrated in order to:

- "Insure appropriate consideration of NEPA policies and planning and to eliminate delay (1501.1(a));
- Identify at an early stage the significant environmental issues (1501.1(d));
- Insure that planning and decisions reflect environmental values, to avoid delays, ... and to head off potential conflicts (1501.2)."

CEQ regulations also include the following specific direction on these points:

- Integrate NEPA requirements with other environmental reviews and consultation requirements (1500.4(k), 1500.5(g), 1502.25);
- Integrate the NEPA process with other planning at the earliest possible time (1501.2);
- Eliminate duplication with State and local procedures (1506.2)
- Integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency proactively so that all procedures run concurrently rather than consecutively (1500.1(c)); and
- Reduce duplication between NEPA and State, local and other Federal procedures (1500.4(n), 1506.2, 1506.3).

The regulations also require (1502.25) integration of EIS's with the environmental impact analyses and related surveys and studies required by the Fish and Wildlife Coordination Act, NHPA and ESA.

4.2 EVALUATION OF CURRENT NEPA COMPLIANCE PROCESS

4.2.1 CEQ Evaluation

One of the responsibilities of the CEQ is to complete an annual review of the state of NEPA compliance and to recommend ways to improve NEPA compliance. The CEQ recently completed a major study of the effectiveness of NEPA (CEQ, 1997) after 25 years of implementation. This study concluded that five elements of the NEPA process are critical to its effective and efficient implementation, including:

- Strategic planning—the extent to which agencies integrate NEPA's goals into their internal planning processes at an early stage.
- Public information and input—the extent to which an agency provides information to and takes into account the views of the surrounding community and other interested members of the public during its planning and decision-making process.
- Interagency coordination—how well and how easily agencies share information and integrate planning responsibilities with other agencies.

- Interdisciplinary, place-based approach to decision-making that focuses the knowledge and values from a variety of sources on a specific place.
- Science-based and flexible management approaches once projects are approved.

Some of these areas are particularly relevant to the issues being addressed in this study, including public information and input, interagency coordination and flexible management approach. With respect to public information and input, the CEQ study concluded that Environmental Assessments (EAs) are a promising tool for maintaining public involvement while streamlining the process. Now, EAs increasingly include sufficient mitigation measures to reduce adverse effects to below significant levels. However, the preparation of an EA instead of an EIS is the most common source of conflict and litigation under NEPA. This study suggests the use of increased levels of scoping and public participation in EA preparation as a possible mechanism to reduce legal challenges.

With respect to interagency coordination, the study concluded that agencies use NEPA as a key integrating tool to consolidate and coordinate compliance with all applicable Federal, State and local environmental regulatory requirements. CEQ regulations specifically require integrating the various required analyses under different environmental laws in a single combined analysis. The specific tools for achieving this integration were considered to be as follows:

- Using scoping and tiering to prevent duplication of analyses;
- Concurrent preparation of environmental studies under NEPA and other laws;
- Combining documents under NEPA and other laws; and
- Combining public participation under NEPA and other laws.

NEPA provides a unique opportunity to streamline review and permitting efforts. However, many agencies have failed to use NEPA appropriately by becoming involved early in the process and continuing to be actively involved during the process. The study concluded that agencies often have different, and sometimes conflicting, timetables, requirements and public participation processes.

With respect to flexible management approaches, once projects are approved, the study concluded that agencies should monitor to confirm impact conclusions, ensure that mitigation measures are effective and adapt projects to account for unintended consequences. Study participants supported the use of monitoring and adaptive management to address the uncertainties of environmental impact prediction. Project permitting can be expedited by accepting more uncertainty in NEPA analyses and documents and using more flexible management approaches during project implementation. The study described this new approach as "predict, mitigate, implement, monitor and adapt," while the old approach could be considered as "predict, mitigate and implement." The new suggested components, monitor and adapt, reflect the need to monitor the accuracy of predictions and allow sufficient flexibility for mid-course (i.e., mid-project) corrections.

The results of a major 1991 CEQ workshop, *NEPA Integration: Effective, Efficient Environmental Compliance in 1990s* (CEQ, 1991) provide the following guidance with respect to a key issue in NEPA compliance-agency coordination and cooperation:

1. There is need for greater cooperation in the NEPA process within and among agencies at all levels of government. The barriers to effective, efficient cooperation are largely attitudinal. Considerable time and money are wasted arguing about the propriety of a particular agency position instead of trying to reach a reasonable accommodation, including a constructive compromise.
2. Outside assistance often is needed, but not always pursued, to resolve differences among and between agencies. Alternative means of securing such assistance might include:
   - Consultation with CEQ;
   - Compacts to facilitate integration of agency responsibilities;
   - Standardized procedures or model memoranda of agreement;
   - An administrative framework or matrix that would allow two or more agencies to share decision-making responsibilities; and
   - Alternative dispute resolution measures.
3. Frequent personnel and organizational changes within the bureaucracy require that the CEQ listing of agency contacts and areas of expertise be periodically updated to assist policy, program and project sponsors in identifying other agencies whose cooperation may be required in the early planning stages.
4. A single, reliable set of environmental indicators, comparable to economic indicators used to communicate economic trends in cost of living, national product and other areas, is needed and should be developed and made available to all agencies as quickly as possible. This measure will help to build consistency into environmental analyses under NEPA and other environmental laws. Such indicators also are essential to enable officials to assess with some degree of confidence the effectiveness of ongoing environmental policies and programs.
5. Cooperating agencies are generally reluctant to commit funds to studies in which they have been asked to participate, especially in the very early stages of development.

The 1991 CEQ workshop also identified the following as action items for Federal agencies concerning NEPA implementation:

1. All agencies of the Federal government should conduct a thorough ongoing review of, and periodically re-examine, existing authorizations, policies and procedures to assure that NEPA is being implemented and administered to fullest advantage, not only in terms of achieving the act's objectives, but also for purposes of satisfying other important requirements of the NEPA process, such as reducing paperwork and administrative delay.
2. Federal agencies must look beyond the EIS component of NEPA in fashioning effective, efficient environmental management programs. In addition to fully implementing the mandates of NEPA, including section 102(2)(B), Federal agencies should boldly exercise their discretion, responding imaginatively and resourcefully to the present-day planning and management challenges of integrating environmental and non-environmental policies. All provisions of NEPA and its special process as well as other coordinative management techniques, including the use of memoranda of agreement for policy and program implementation, should be creatively exploited.

3. Federal agency officials should consult with CEQ, not just when crises are imminent or in the context of formal agency proceedings, but early and informally in any program effort where questions concerning approaches to environmental quality issues are presented. CEQ is empowered to assist Federal agencies and departments in appraising the effectiveness of existing and proposed facilities, programs, policies and activities and in coordinating efforts within the Federal family to protect and improve environmental quality. However, individual departments and agencies must actively seek the assistance of CEQ, which lacks the resources to monitor all Federal government programs and activities.

4.2.2 Other Studies on NEPA Implementation

The literature review identified a number of other papers that addressed improving the efficiency and efficacy of NEPA. In addition to the CEQ analysis, there are three notable recent Federal efforts involving improving NEPA efficiency:

1. The Federal Highway Administration (FHWA) has developed an Environmental Streamlining National Action Plan and Status Report (FHWA 2000), which has numerous recommended actions, some of which are applicable to other types of activities. This plan is currently in draft form, and FHWA is developing numerous related documents and efforts which are described on their website. Current practice for FHWA is four to six years to prepare an average EIS, and 18 months to prepare an EA.
2. The Green River Advisory Committee was convened by Interior Secretary Babbitt, and was comprised of environmental, oil and gas industry, private landowner, State and local government and Federal agency representatives. The Committee was formed to address perceived conflicts between natural gas development and protection of environmental values in southwest Wyoming and northeast Colorado. Their objective was to streamline the NEPA process by achieving 50 percent reductions in time and paperwork. Their recommendations were presented in Green River Advisory Committee (1996).
3. The House of Representatives (Committee on Resources, 1998), held hearings on NEPA in 1998, which included testimony by industry representatives. The most useful suggestions were provided by Randy Allen, Rivergas Corporation; Rocky Mountain Oil and Gas Association; American Petroleum Institute and Dan Chu, Wyoming Wildlife Federation.

The other papers reviewed were mostly presented in professional meetings or publications. Most of them were written from the point of view of the Federal agency or environmental consultant, with industry viewpoints rarely addressed. Many appear to be written for Department of Energy (DOE) or Department of Defense (DOD) facility compliance, and include recommendations that are not applicable to linear projects involving multiple agencies. Many include practical recommendations that are helpful to NEPA document preparers or agency managers, but of limited value to pipeline companies. Documents reviewed include Blaug (1993); Thompson (1982); Reed et al. (1991); Koo (1984); Lee and Russell (1999); Jenson (1998); Salk et al. (1999); Hansen and Wolff (1998); Federal Highway Administration (2000); Ensminger and McLean (1993); Conley and Odegard (1992); Herson and Bass (1998); Canter and Clark (1997); Wilkinson (1998); Smillie and Swartz (1997); Eccleston (1998); CEQ (1991); McCormick, Taylor and Associates (1995); and Bell (1998).

Collectively, these papers make the following recommendations:

Interagency Coordination

- Integrate the NEPA process with other environmental compliance and review processes; establish timely, and where feasible, concurrent project reviews;
- Ensure early, sustained and continuous involvement of Federal and State resource agencies;
- Negotiate formal agreements among Federal and State partners;
- Develop timeframes for individual project review;
- Use Section 404, Section 106 and Section 7 consultations and coordination to identify project measures that will reduce impacts;
- Establish an integrated review and permitting process that identifies key decision points and potential conflicts as soon as possible;
- Create dispute resolution processes to provide mechanisms to address unresolved issues; outside assistance may be needed to resolve differences among and between agencies;
- Provide oversight to ensure accountability of local agency staff;
- EPA should be involved earlier than review of Draft EISs;
- Proponents should provide "aggressive support" for interagency coordination through frequent meetings and communications; and
- Agencies should reduce institutional barriers to cumulative impact analyses.

Management/Planning

- Incorporate NEPA into early project planning, when decisions are being made;
- Accelerate the decision time for determining the appropriate level of NEPA documentation (EIS/EA/CATX);
- Use more tiering and policy/program level EISs in NEPA documentation; group small projects in one NEPA document;
- Facilitate communication among proponents, stakeholders, and NEPA document preparers;
- Use a NEPA facilitator to increase government agency personnel involvement and NEPA team building, instead of delegating most of the work to a third-party consultant;
- Improve definition of purpose and need, define alternatives based on purpose and need, eliminate inappropriate or nonviable alternatives;
- Minimize environmental impacts, use area-wide mitigations, keep projects on schedule through the use of conflict avoidance and resolution processes;
- Improve coordination among proponents, agencies and third-party contractors; and
- Improve proponent applications, applicants submit conceptual project plans with standard operating procedures and preferred mitigation to help resolve issues early, diffuse controversy, reduce environmental impacts, and minimize appeals.

Scoping/Public Involvement

- Conduct early and thorough internal scoping; plan the work as early as possible to reduce delay and paperwork;
- Use public scoping processes that are participatory rather than confrontational; and
- Agencies should be more willing to dismiss frivolous or ideological public comments that are not focused on project-specific issues.

Baseline Data

- Maintain an up-to-date compendium of environmental baseline information, identify and use existing information to reduce documentation and enhance confidence in the environmental analysis; and
- Improve quality of agency field data, consolidate agency databases, develop reliable and complete biological databases; implement preventative monitoring and mitigation.

Impact Analysis

- Increase monitoring to provide a baseline for more accurate impact assessment in the future (not learning enough from large numbers of EISs prepared); use adaptive management techniques and ISO 14000;
- Measure continuous improvement through best practices and evaluation techniques such as performance standards;
- Develop guidelines or standards;
- Focus on significant issues (those affecting decision); screen out peripheral matters and previously resolved issues; level of analysis should be consistent with the weight of impacts; and
- Improve consistency of cumulative impact assessment.

Document Preparation

- Prepare annotated outlines that serve as a road map for EA or EIS preparation;
- Decrease the length and complexity of highly technical portions of NEPA documents;
- Work diligently to prepare better organized, shorter, more readable NEPA documents; create effective, inviting documents that will be easy for decision makers and the public to use;
- Focus assessments to address issues of concern, facilitate clarity of thought, and hone presentation of information;
- Adhere to page limitations;
- Prepare decision paper for the non-technical public;
- Limit documents to include only information useful to the decision makers and the public; and
- Use appendices, technical reports and incorporation by reference to limit size of NEPA documents.

Agency Management of NEPA

- Increase and improve NEPA training for agency personnel;
- Increase agency budgets to free up personnel for NEPA compliance;
- Install NEPA coordinators in agencies to coordinate NEPA compliance efforts;
- Allocate resources to allow adequate staffing;
- Increase internal agency support for NEPA compliance; and
- Agencies begin NEPA process in early project planning.

Mitigation/Monitoring

- Establish controls and agreements to ensure compliance with the conditions upon which approvals are based;
- Increase oversight and monitoring of mitigation implementation, complete audits of implementation; and
- Increase use of mitigation MOUs.

CEQ Guidance/Agency Regulations

- Provide more guidance on scoping and public involvement;
- CEQ update regulations to reflect the current agency use of EAs and mitigated FONSIs;
- CEQ should provide time limit guidance for private actions subject to Federal approvals;
- Institute Federal agency accountability in the NEPA process;
- Increase use of categorical exclusions;
- Provide guidance on definition of significance;
- CEQ should require greater consistency in agency regulations;
- CEQ should provide minimum monitoring and reporting requirements for EISs and EA/FONSI actions; and
- CEQ/agencies develop good practice guides for mitigation planning and implementation.

Most of these recommendations focus on improving NEPA practices, although some cover improvement of NEPA regulations and guidance. Some obviously either are not applicable to interstate natural gas pipeline projects, or are beyond the ability and authority of pipeline companies.

4.2.3 Interstate Natural Gas Pipeline Industry Evaluation

Our experience indicates that the interstate natural gas pipeline industry, including pipeline companies, construction contractors, environmental consultants and other groups, and some regulatory and resource management agency staff, believe that NEPA and related Federal, State and local environmental regulatory requirements could be implemented more effectively, resulting in improved project implementation while still avoiding significant environmental

impacts and meeting regulatory requirements. More specifically, we suggest that the major deficiencies exist with respect to implementation of NEPA are as follows:

- Inadequate integration of NEPA compliance with NHPA and ESA compliance, and other Federal, State and local permitting;
- Inappropriate, overlapping and inconsistent Federal, State and local permitting, and mitigation requirements;
- Inadequate inter-agency communication, coordination and decision-making;
- Delayed and inefficient completion of the NEPA compliance process; and
- Submittal of applications for inadequately planned and designed projects by pipeline companies.

4.3 RECOMMENDATIONS FOR IMPROVEMENT OF CURRENT NEPA COMPLIANCE PROCESS

We have developed several recommendations for addressing each of the five key issues identified in Section 4.2.3. The recommendations presented here by URS build on certain of the recommendations that have been made in the past by CEQ and other recommendations included in the substantial technical literature reviewed as part of this study, as influenced by our experience, our assessment of the experience of the interstate natural gas pipeline industry and regulatory agencies, and the specific characteristics of natural gas pipeline projects.

4.3.1 Issue 1 – Inadequate Integration of NEPA Compliance with NHPA and ESA Compliance, and Other Federal, State and Local Permitting

4.3.1.1 Introduction

It is clearly the intent of NEPA and CEQ regulations that NEPA should be the central point of integration and coordination of required Federal, State and local compliance and permitting, and that duplication of State and local procedures should be eliminated or reduced, and that all Federal, State and local procedures be completed concurrently. The other major Federal compliance and permitting areas include the NHPA and ESA compliance, U.S. Army Corps of Engineers (USACOE) Section 404 permitting and NEPA compliance by all involved Federal agencies, including the FERC, Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Department of Defense (DOD) and other agencies. Figure 2 presents a flow chart showing a summary of the relationships among the major Federal requirements. Typical State permitting requirements include those related to wetlands, river and stream crossings, hydrostatic test water intake and discharge, compressor station air discharges, erosion and sediment control, vegetation and wildlife, endangered species, land use, cultural resources and other areas. Typical local permitting is related to wetlands, land use, soils, erosion and sediment control, road crossings and other areas.

However, there is clearly a need to increase the early integration of NEPA compliance with NHPA and ESA compliance, and other Federal, State and local permitting. On many pipeline projects, the various Federal, State and local compliance efforts are completed too separately or

independently, resulting in inconsistent conclusions and requirements, schedule delays, cost increases and inefficiency. With respect to NHPA and ESA compliance, the typical problem is that the major conclusions and decisions made in these two processes are not available at the appropriate time in the NEPA compliance process and that these conclusions may be inconsistent with the conclusions of NEPA assessment. For example, the assessments leading to compliance with the NHPA and ESA may lead to a requirement to use a particular proposed or alternative pipeline route while the NEPA compliance assessment, if not integrated with NHPA and ESA compliance, could lead to a different agency conclusion regarding preferred pipeline routing. Similar potential problems exist with respect to other Federal, State and local compliance efforts.

4.3.1.2 Recommendations

We have developed recommendations in three categories to address the issue, increasing the early integration of NEPA compliance with other permitting, including Memoranda of Agreement (MOAs), the NHPA, Section 106 compliance process and the ESA, Section 7 compliance process. With respect to MOAs, we suggest that development of improved MOAs or other similar agreement documents could significantly improve the integration of NEPA, NHPA, ESA and other Federal, State and local compliance efforts. More specifically, we suggest that MOAs or other agreement documents could be significantly improved in the following areas:

- Cooperating agency identification;
- Agreement on agency jurisdiction;
- Identification of agency decisions to be made using NEPA documents;
- Scoping;
- Environmental data needs;
- Environmental impact assessment methodologies;
- Timing of reviews and decisions; and
- Conflict resolution.

Such MOAs could include general operating MOAs or project-specific MOAs. General operating MOAs would be signed by two or more agencies to address how certain elements of their respective compliance responsibilities will be completed over the long term on specific projects. These types of agreements have been signed in the past, generally between two agencies, with some success. We believe that this approach could be used more broadly in the future to address a variety of issues identified in this report. General operating MOAs probably would focus on issues such as agency jurisdiction and conflict resolution and possibly the timing of reviews and decisions. General operating MOAs also could form a "shell or umbrella agreement" under which more detailed project-specific agreements could be developed. Project-specific MOAs probably would focus on issues such as scoping, cooperating agency identification, identification of agency decisions to be made using the NEPA document, environmental data needs, impact assessment methodologies, timing of reviews and decisions and conflict resolution. It would be most effective to use a combination of general operating MOAs and project-specific MOAs.

Memoranda of Agreement

Identify and Agree on Agency Jurisdiction by Cooperating Agencies

The initial step in improved MOA development is to ensure that all Federal, State and local agencies with jurisdiction and permitting responsibilities are identified and made part of the NEPA compliance process. This step should include using a more proactive and direct approach to ensure that all appropriate agencies are made a part of the MOA process. We also recommend that in the case of overlapping agency jurisdiction, which is quite common and potentially problematic, agreements should be developed to facilitate the process of effectively making decisions on permitting and mitigation responsibilities. One option includes one agency taking primary or lead responsibility but obtaining input from other agencies with overlapping jurisdiction. Recommended lead and supporting agencies for some key resource areas and related regulatory areas are listed below in Table 1.

Table 1

RECOMMENDED LEAD AND SUPPORTING AGENCY RESPONSIBILITIES FOR KEY RESOURCE/REGULATORY AREAS

Resource/ Regulatory Area	Agency or Other Group Responsibility	
	Lead	Support
Soils	Natural Resource Conservation Service (NRCS) (private lands), BLM and USFS (Federal lands, as appropriate)	State and local agencies, FERC
Water Resources (Stream and River Crossings)	ACOE (overall), State agencies (State and private lands), BLM and USFS (Federal lands, as appropriate)	FERC, local agencies
Biological Resources		
– Endangered Species	Federal – USFWS	--
	State – State agencies	--
– Wetlands	ACOE (overall), State agencies (State and private lands), BLM and USFS (Federal lands, as appropriate)	FERC, local agencies
– Other Resources	State agencies (State and private lands), BLM and USFS (Federal lands, as appropriate)	FERC, USFWS
Agriculture	Landowner	State and local agencies, FERC, NRCS

A second, less desirable, option would include not having one agency take lead responsibility, but facilitating the process of obtaining input from the jurisdictional agencies and making the required decisions. To be effective, this option would include improved communication, coordination, decision-making and conflict resolution procedures as part of the process.

Use NEPA Documentation as Central Basis of Agency Decisions

It also would be helpful to specifically identify in the MOA the agency decisions that will be made using the NEPA compliance document and to explicitly agree in the MOA that the NEPA document will be used as the central basis for all significant decision-making by the involved agencies. We believe that this early action would help ensure that all issues of importance to the involved agencies are identified and addressed in the NEPA document, that the NEPA document includes all of the information and analyses required by each agency to make its decisions and that NEPA is used as the central basis for agency decision-making, as intended.

Utilize NEPA Scoping Process as Input into Agency Decisions

In the area of scoping, the critical issue is ensuring that all involved agencies use the NEPA scoping process as an opportunity to provide early input on their jurisdiction, responsibilities, policies, procedures, issues of concern, requirements for review and analysis, and mitigation requirements. Such early actions by NEPA lead agencies and project proponents will ensure that this includes oral and written input in scoping meetings, other project meetings, correspondence and telephone communication. All input should be eventually provided in written form. Lead agencies should consider using standardized forms to collect all required information. A recommended agency scoping input form is shown in Table 2. Aggressive follow-up should be completed with agencies that do not respond to initial requests for scoping input and meeting participation.

Table 2

RECOMMENDED AGENCY SCOPING INPUT FORM

Agency:
Lead Agency Representative (Name, Title, Telephone, Fax, Email, Address):
Project:
Required Permit(s) or Approvals:
Key Issues of Concern:
Applicable Regulatory Requirements and Standards:
Required or Recommended Technical Analyses:
Required, Recommended or Potential Mitigation Measures:
Agreement to Use NEPA Document for Decision-Making (Yes/No):
Signature of Designated Agency Representative:

Integrate Environmental Data Needs and Impact Assessment Methodologies

Two additional areas should be specifically addressed during scoping, including agency environmental data needs and suggested or required environmental impact assessment methodologies. Specific agency requirements or suggestions in these areas must be identified during scoping to satisfy all NEPA technical requirements. In addition, a comprehensive environmental database should be developed to meet all agency requirements at one time and to ensure that the project schedule is achieved.

Identify and Agree on Review and Decision Timing

An additional critical element to address in MOAs or other project agreements is the timing of agency and proponent reviews and decisions. MOAs should specifically identify and agree to the timing of all required agency and proponent input, reviews and decisions, including starting points, durations and ending points. This would assist in the development of compliance and review processes and schedules that provide the required information at the required times and the allocation of agency and proponent attention and resources at the required times to make the necessary decisions.

Develop a Conflict Resolution Process

Finally, MOAs should specifically identify the process by which potential disputes or significant differences of opinion among agencies, proponents and other possible groups are to be resolved. Potential dispute resolution procedures could include the use of outside facilitators, agency management review boards and other similar actions. We suggest that this type of approach will save time and achieve better project results.

Improve the Individual NHPA, Section 106 Compliance Process

In the area of NHPA, Section 106 compliance as an individual process, we support the recommendations made by Goodwin and Associates (2000) in the report, *"Analysis of Regulations for Compliance with Section 106 of the National Historic Preservation Act of 1966, as Amended."* Goodwin's suggestions that are relevant to this study include:

- Industry should encourage FERC to:
  - Recognize NEPA as an alternative process in meeting NHPA requirements;
  - Develop standard protocols for identifying and qualifying consulting parties to the process;
  - Develop standard protocols for authorizing the applicant to initiate and proceed with the Section 106 process; and
  - Consider negotiation of a Programmatic Agreement among the Tribal Historic Preservation Offices (THPOs), Advisory Council, and FERC to empower authorized applicants to consult with THPOs in the process.

We also recommend completing the following actions:

- Industry should work closely with FERC and other involved groups during the implementation phase of the revised requirements to ensure that their interests are represented;

- Industry and FERC should work closely with the Advisory Council to establish standard methods for treatment of recurring situations;
- Industry should work closely with FERC and the Advisory Council to develop more flexible responses for post-review discovery situations; and
- Industry should take full advantage of opportunities to direct and control the compliance process, such as early consultation with SHPOs and THPOs. FERC should be requested by industry to authorize this applicant participation.

Improve the Individual ESA, Section 7 Compliance Process

In the area of ESA, Section 7 compliance as an individual process, we have the following recommendations:

- Project proponents should optimize the new requirement included in FERC Order 603 (Section 380.13) to act as FERC's non-Federal representative for ESA compliance. This process includes the proponent completing informal consultation with USFWS, including all required scoping, discussion and negotiation, and preparing the Biological Assessment (BA). This new requirement allows the proponent to direct the process and expedite permitting.
- Agencies and proponents should ensure that an early BA prepared by the NEPA Lead Agency or proponent covers the proposed action and alternatives. This will ensure that the final selected alternative for the project has adequate ESA compliance, and that schedule delays do not occur as a result of having insufficient biological survey results and assessment for the agency-approved pipeline route, compressor station site or other project facility.
- Consider using the actual NEPA document as the BA. This would reduce the time and effort needed to prepare a separate BA document, even though some technical appendices may be needed to support conclusions presented in the NEPA document.
- Ensure that an early BA is available at the time of the Draft EIS. This allows adequate time for agency, particularly USFWS, review of the BA and preparation of the USFWS Biological Opinion (BO) in time for inclusion in the Final EIS and agency decision documents.
- Ensure that biological field surveys are completed at the appropriate time in the project schedule. We strongly recommend that project proponents complete all required biological field surveys at a time that allows the results to be included in the Certificate application Environmental Report. This would allow the previous recommendations to be completed.

Applicants can expedite the NEPA, ESA and NHPA compliance processes by maximizing their direct participation in these processes. More specifically, whenever field or other data collection or analysis can be completed by the applicant, we strongly suggest that the applicant complete this work to avoid problems related to lack of personnel, budget and other resources that regulatory agencies often have. Specific areas where applicants can complete field and other data collection and analysis include endangered species, wetlands, vegetation, wildlife, aquatic resources, archaeological resources and land use. FERC requires that applicants collect this information but other agencies that may be cooperating NEPA agencies often have assumed responsibility for this work, although they typically use third-party contractors to complete the work.

Other participation by applicants in these processes should include scoping, development of assessment approaches and methods, providing substantial input to development of the purpose and need and project description sections, project progress meetings, review of preliminary draft document materials, and discussion of preliminary impact conclusions and development of mitigation measures.

4.3.1.3 Implementation Steps

With respect to the development of improved MOAs, we recommend that INGAA review the model Interagency Agreement recently developed by Entrix (INGAA, 1999) to determine if INGAA wants to make any modifications of the model agreement to incorporate the suggestions made in Section 4.3.1.2. We suggest that the model agreement could be improved by adding language to cover the following areas addressed in our recommendations:

- Cooperating agency identification;
- Agreement on agency jurisdiction and responsibility; and
- Identification of agency decisions to be made using the NEPA document.

We recommend that INGAA work closely with the relevant agencies and industry to develop and sign general operating MOAs or similar agreements. INGAA also should encourage pipeline companies to develop good project-specific MOAs.

With respect to improving the individual NHPA and ESA compliance processes, we recommend that project proponents work to ensure that the recommended actions identified in this report are completed on their individual projects, as appropriate. This would involve project proponents working closely with the involved agencies to ensure that these issues are addressed and these actions taken, as appropriate.

4.3.2 Issue 2 – Inappropriate, Overlapping, Inconsistent and Inflexible Federal, State and Local Permitting and Mitigation Requirements

4.3.2.1 Introduction

In addition to insufficient integration of NEPA and other Federal, State and local permitting and decision-making, we also suggest that some specific inappropriate, overlapping, inconsistent and inflexible permitting and mitigation requirements exist at the Federal, State and local levels.

We have separated this issue from Issue 1 even though they are clearly related. Issue 2 covers specific project-related permitting and mitigation requirements while Issue 1 covers the broader topic of integrated NEPA compliance. In our experience, the key resource and regulatory areas with these types of requirements are as follows:

- River and stream crossings/surface water quality standards;
- Erosion and sediment control;
- Wetlands; and
- Other biological resources.

Again, it is clearly the intent of NEPA to integrate NEPA requirements with other Federal, State and local reviews and requirements, and CEQ regulations on NEPA compliance require the elimination of duplication with State and local procedures.

4.3.2.2 Recommendations

We have developed a set of recommendations to address this issue, including recommendations in the following categories:

- Agency reviews of permitting and mitigation requirements to improve consistency and effectiveness;
- Development of improved MOAs to reduce overlap and inconsistency;
- Completion of improved NEPA and related technical analyses to better define impacts and required mitigation;
- Broader use of industry and agency Best Management Practices (BMPs) and performance-based measures to select mitigation; and
- Broader use of construction and post-construction inspection and monitoring to allow flexibility in mitigation implementation.

Improve Consistency and Effectiveness of Agency Reviews of Permitting and Mitigation Requirements

An example of an inconsistent requirement that could be addressed using this approach is that FERC currently uses the 1989 wetlands manual while ACOE and other agencies use the 1987 manual. In order to maximize inter-agency consistency and stay current with advances in environmental, pipeline design and pipeline construction technologies, we recommend that Federal, State and local agencies complete annual or bi-annual reviews of their requirements and guidelines, evaluate potentially required changes and implement appropriate changes. This effort could also be helpful in reducing overlaps of different agency requirements, especially if agencies completed such reviews in a coordinated way involving discussion and group decision-making. Suggestions also could be solicited from non-agency groups such as GTI, INGAA, pipeline companies, individual experts, construction contractors, pipeline design engineering firms and environmental consultants.

Develop Improved MOAs to Minimize Overlapping and Inconsistent Federal, State and Local Agency Permitting

In Section 4.3.1, we recommended that the MOA development process could be improved in several ways to address inadequate integration of NEPA, NHPA and ESA compliance, and other Federal, State and local permitting. We also suggest that MOA development could be improved to address the issue of overlapping and inconsistent Federal, State and local agency permitting and mitigation requirements. This approach could include the use of both general operating MOAs and project-specific MOAs. As noted in Section 4.3.1, general operating MOAs probably would focus on agency jurisdiction and conflict resolution. Project-specific MOAs would cover a broader set of topics.

We suggest that if general operating MOAs or project-specific MOAs were used to reduce overlap of agency jurisdiction using a division of resource area responsibilities similar to that presented in Table 1, along with implementing other recommendations made in this report, there would be significant reduction of overlapping and inconsistent requirements.

Utilize Updated Technical and Field Experience Data in NEPA Analysis

We believe that the quality and accuracy of NEPA compliance documents and related technical analyses could be significantly improved by using the available technical and scientific literature and the results of construction and post-construction monitoring programs completed for previous interstate natural gas pipeline projects. We believe that many recent NEPA compliance documents prepared for projects largely repeat the same assessment without using information that is currently available from the sources listed above. In the case of monitoring program reports, the magnitude and quality of the available information is increasing substantially every year. This information is valuable because it provides accurate information on actual, on-the-ground impacts that result from pipeline project implementation. This monitoring information also provides substantial, practical data on the effectiveness of many types of pre-construction, construction, post-construction and operational mitigation measures required by agencies or otherwise used by pipeline companies or construction contractors. There is no substitute for this type of information on the actual impacts of pipeline project implementation.

The available technical and scientific literature includes significant and directly relevant information developed by GTI, Electric Power Research Institute (EPRI), American Gas Association (AGA), Southern Gas Association (SGA), INGAA and other groups and researchers that could make NEPA analyses much more focused on the real issues of concern and more accurate with respect to impact conclusions, and allow them to present more effective and practical mitigation measures. We suggest that the technical resource areas where these suggestions are most relevant include erosion and sediment control, river and stream crossings, habitat fragmentation, revegetation, wetland crossings and revegetation, and other biological resources.

Utilize Performance-Based and Industry Recommended Practices to Mitigate Effects

Mitigation technology in several resource areas, including erosion and sediment control, river and stream crossings, wetland crossings and revegetation, is rapidly evolving and many new techniques are being developed that are cost-effective, flexible and feasible in one or more environmental settings. These new technologies and applications are being developed by researchers, product vendors, pipeline companies, groups such as GTI and INGAA, regulatory and resource management agencies, environmental consultants, pipeline design engineering firms and other groups.

We believe that there is an emerging trend toward combining these new technologies into individual or categories of Best Management Practices (BMPs) that represent the state of the art in mitigation of impacts in selected environmental resource areas. BMPs have been developed for many different types of activities and impacts related to the pre-construction, construction, post-construction, operation and abandonment phases of pipeline projects.

At the same time, the natural gas pipeline industry has expressed an interest in establishing appropriate performance-based standards for mitigation that involve the development of

appropriate impact level standards to be met for their projects in selected environmental resource areas, such as erosion and sediment discharge from disturbed areas and as a result of river or stream crossings, and revegetation of disturbed areas. This approach also could be used in a variety of other resource and regulatory areas.

We suggest that the concepts of BMPs and performance-based standards for impact mitigation could be combined to form an approach to mitigation of pipeline impacts that would be effective in mitigating impacts, allowing more flexibility for pipeline companies, construction contractors and other groups, and reducing project costs and schedules.

Allow Broader Use of Construction and Post-Construction Inspection and Monitoring to Permit Flexibility in Mitigation Implementation

In Section 4.2.1, we described the results of a major study of NEPA effectiveness completed by CEQ (CEQ, 1997). In this study, CEQ concluded that project permitting can be expedited by accepting more uncertainty in NEPA analyses and using monitoring to ensure that mitigation is effective and adapting projects to account for unintended consequences. We suggest that this approach is a good one and could be extended to allow more flexibility in the selection and implementation of environmental mitigation measures for natural gas pipeline projects.

Based on FERC and other agency requirements, there is substantial pre-construction, construction and post-construction environmental inspection and monitoring on interstate natural gas pipeline projects. We believe that this inspection and monitoring has resulted in increased levels of effective mitigation measure implementation and compliance with FERC Certificate conditions and other permit requirements. We also believe that this high level of required inspection and monitoring could be used more broadly to make real-time, in-the-field decisions regarding the specific implementation of proposed or required mitigation, to make required changes in proposed or required mitigation and possibly to implement different mitigation entirely on the basis of specific, actual conditions encountered in the field during construction. These types of in-the-field changes during construction would be facilitated by the availability of a suite of candidate BMPs of the type previously discussed for specific types of impacts.

We believe that recent changes to third-party monitoring by the FERC included in Order 609, including establishing Level 1, 2, and 3 variances, are a positive step and that the recommendations included in this report are a logical extension of these improvements in the FERC environmental monitoring requirements. We also believe that this recommended approach is consistent with the requirements of adaptive management and ISO 14001. Adaptive management involves the continuous modification of management practices to achieve both project objectives and environmental protection (CEQ, 1997). It moves iteratively toward these goals in the face of uncertainty by including feedback loops, including use of monitoring results, to change future implementation methods. The International Standards Organization (ISO) released the standard ISO 14001 in 1996, which provides specifications for an Environmental Management System (EMS). ISO 14001 is based on the concept of total quality management, emphasizes continual improvement, and also has strong feedback loops for monitoring and improvement (Wilkinson, 1998). The comparative stages of project implementation for ISO 14001, NEPA, and NEPA adaptive management are provided in Table 3. For use of either technique to be effective, the results of inspection and monitoring must be documented in reports that are made available to industry and agency decision-makers.

Table 3

COMPARISON OF MANAGEMENT SYSTEMS FRAMEWORK: ISO 14001 AND NEPA

ISO 14001	NEPA	NEPA Adaptive Management
Policy	Establish purpose and need for action	Predict
Planning	Develop proposed action and alternatives	
	Conduct interdisciplinary impact assessment	
	Plan mitigation measures	Mitigate
Implementation	Implement decision	Implement
Checking and Corrective Action	Mitigation and monitoring	Monitor
Continuous Improvement		Adapt

Source: Wilkinson (1998).

4.3.2.3 Implementation Steps

To implement the recommendations made in this report, we suggest that INGAA complete the following:

- Make formal recommendations to selected Federal and State agencies that they complete coordinated reviews of their requirements and guidelines to improve consistency and effectiveness. Key Federal agencies include FERC, ACOE, Advisory Council on Historic Preservation (ACHP), USFWS, EPA, BLM and USFS.
- Compile and publish information on significant inconsistencies in permitting and mitigation requirements.
- Review the draft Interagency Agreement developed for INGAA by Entrix and make potential modifications to address issues identified in this report. Make formal recommendations to selected Federal and State agencies that they develop and use general operating and project-specific MOAs. Key Federal agencies are the same as those listed above.
- Make formal recommendations to selected Federal agencies to improve NEPA and related technical analyses. Key Federal agencies are the same as those listed above.
- Actively encourage and support the development of industry and agency BMPs for impact mitigation. Actively encourage and support the development of performance-based mitigation standards. In addition, make formal recommendations to selected Federal and State agencies to use performance-based measures to select mitigation. Actively encourage and support agency and industry workshops to present, discuss and develop BMPs.

- Make formal recommendations to selected Federal and State agencies to more broadly use construction and post-construction inspection and monitoring to support flexibility in mitigation implementation.
- Encourage development and distribution of monitoring reports to evaluate the effectiveness of BMPs and other mitigation. Develop a clearinghouse or distribution system for these reports so that they are easily available for active use.

4.3.3 Issue 3 – Inadequate Assessment of the Environmental Impacts of Substituting Natural Gas for Other Fuels

4.3.3.1 Introduction

NEPA clearly requires that the indirect and cumulative impacts of projects be evaluated in addition to direct and project-specific impacts. One of the major consequences of constructing new natural gas pipelines is to facilitate the substitution of natural gas for other fuels, primarily including coal and fuel oil, used in existing and new electrical generation and other types of facilities. The combustion of natural gas as compared to these solid and liquid fossil fuels results in substantially lower combustion-related air emissions, including SO_2, particulates, and hazardous air pollutants, including heavy metals, as measured on a consistent unit basis (e.g., emissions per BTU of energy produced).

Direct conversion of gas to heat in industrial or residential use in place of electrical energy also represents conservation of our non-renewable resources. Direct use of the heat energy avoids the significant energy losses experienced with converting the heat energy into electrical form and then back to provide heat. For example, the overall efficiency of electrical energy from coal combustion is only approximately 30 percent. Increasing the efficiency of our energy use is a good way to reduce carbon dioxide and other greenhouse gas emissions.

GTI (1998) completed a life cycle assessment of the production and use of natural gas compared to other fuels and showed that centralized natural gas-fired power plants are significantly better than coal-fired plants in terms of global warming and acidification potential.

INGAA (1999) concluded that the demand for natural gas in the U.S. by 2010 could be as high as 30 Tcf, depending on the rate of economic growth and the rate of nuclear and coal-fueled power plant retirement. The power generation and industrial market sectors were identified as the key sectors supporting the potential growth. The INGAA study also concluded that an average of approximately 2,000 to –2,100 miles of new natural gas transmission pipeline would be needed to support this potential level of natural gas demand. Substantial additional storage capacity also would be required.

However, in our experience, at least in the past, most NEPA documents prepared by FERC and other agencies do not adequately address this positive, beneficial impact of fuel conversion resulting from additional natural gas pipeline construction to meet market demand. Further, we suggest that, in the past, FERC has not adequately considered this type of impact when making Certificate application decisions. However, in the recent past, we believe that both FERC and some pipeline companies have started to address this issue in a meaningful way. We believe that this issue should receive significant additional emphasis in environmental reviews and Certificate application decisions. More specifically, we suggest that when making decisions on

Certificate applications, FERC and other agencies should balance the adverse impacts of project construction with the beneficial impacts of fuel conversion that may result from pipeline project implementation and the resulting increased availability of natural gas.

4.3.3.2 Recommendations

We have the following recommendations to address this issue:

- Completion of improved NEPA and related technical analyses;
- Regulatory agency consideration of indirect positive air quality impacts in the development of pipeline project permitting and mitigation requirements;
- Encouragement of pipeline project applicants to provide information on natural gas use by facilities;
- Development of additional data and materials to support pipeline project Certificate applications; and
- Completion of workshops and meetings with regulatory agency personnel to exchange information and increase communication.

Improve NEPA and Related Technical Analyses

We recommend that NEPA and related technical analyses could be improved to more effectively address the issue of indirect air quality impacts of pipeline project implementation resulting from potential fuel conversion at power plants and industrial facilities. This type of conversion would typically be from coal and fuel oil to natural gas. Potential new facilities also could use natural gas instead of these other fuels.

This type of improved assessment generally would involve comparing the current air quality impacts of confirmed or potential existing facilities that use coal, fuel oil or other fuels with the air quality impacts that would result from use of natural gas in those facilities. Proposed facilities could be evaluated in the same way. In addition, local or regional analyses and studies may be available to provide a more general indication of these comparative impacts.

The result of this type of assessment would show that, on an equivalent basis, the combustion of natural gas as compared to coal and fuel oil would result in lower air emissions and impacts.

Consider Indirect Positive Air Quality Impacts in the Development of Pipeline Project Permitting and Mitigation Requirements

We suggest that it is appropriate for regulatory agencies to consider the indirect positive air quality impacts of potential fuel conversion in the development of pipeline project permitting and mitigation requirements. This type of approach would be based on considering the net environmental impacts of project implementation and not only the direct impacts of pipeline project construction, operation and abandonment.

Encourage Pipeline Project Applicants to Provide Information on Natural Gas Use by Facilities

To successfully implement the previous two recommendations, it would be important for pipeline companies to provide appropriate information that they have to regulatory agencies on the fuel-consuming facilities that may substitute natural gas for other fuels currently being used or that will use natural gas in the future in the case of new facilities. This type of information would include facility name, type, location, current fuel type and usage rate, proposed fuel type and usage rate, and other similar information. In our experience, pipeline companies would need to work closely with shippers and gas users to develop this information.

Develop Additional Data and Materials on Positive Air Quality Impacts to Support Pipeline Project Certificate Applications

We believe that it would be helpful if INGAA, GTI or other similar groups completed additional technical analyses of the environmental impacts, particularly air quality, of this type of fuel conversion to provide improved support for project permitting. It also would be helpful to have standard information packages available to pipeline companies for use on specific proposed projects. Additional technical analyses could include local or regional analyses of the air emissions reductions and impacts that would result from various levels of conversion to natural gas from other, more polluting fuels. Standard information packages could include summaries of available research and guidance concerning the completion of project-specific technical analyses.

Develop Workshops and Meetings With Regulatory Agency Personnel to Exchange Information and Increase Communication on Positive Air Quality Impacts

We suggest that it would be beneficial for INGAA or other similar groups to hold a series of workshops and/or meetings with FERC and other appropriate regulatory agency personnel to discuss the issue of the assessment of environmental impacts of substituting natural gas for other fuels. Relevant data and information could be presented and discussed. In addition, general approaches and specific technical techniques for completing improved NEPA assessments of this issue could be discussed.

4.3.3.3 Implementation Steps

We suggest that INGAA complete the following steps to implement these recommendations:

- Make formal recommendations to FERC and other agencies to implement these recommendations for improved NEPA and related technical analyses.
- Make formal recommendations to FERC and other agencies to consider indirect positive air quality impacts in the development of pipeline project permitting and mitigation requirements. Applicants should complete similar actions with regard to specific projects during NEPA scoping and in providing comments on Draft NEPA compliance documents.
- Formally encourage applicants to provide information on natural gas use by facilities.
- Develop or support the development by other groups such as GRI of additional data and materials to support pipeline project Certificate applications.

- Complete or support the completion of workshops and meetings with appropriate regulatory agency personnel to exchange information and increase communication on this issue.

4.3.4 Issue 4 – Inadequate Inter-Agency Communication, Coordination and Decision-Making

4.3.4.1 Introduction

In our literature review, and in our experience and that of natural gas pipeline companies, inadequate inter-agency communication, coordination and decision-making are major causes of inefficient and ineffective NEPA compliance. Conley and Odegard (1992) correctly note that long-distance linear projects, including major pipeline projects, have a high level of NEPA complexity because of the relatively large number of jurisdictional agencies.

4.3.4.2 Recommendations

Many of the component problems involved in this issue have been previously addressed and therefore are not addressed again in this section. However, one of the major mechanisms for addressing the first two issues also is relevant for this issue, including MOA improvement. In this section, we make additional suggestions for MOA improvement that are directly related to the issue of inadequate inter-agency communication, coordination and decision-making.

The recommendations are:

- Applicants should strongly consider collaborating with stakeholders during the pre-filing process;
- Develop improved general operating and project-specific MOAs; and
- Applicants should conduct planned, thorough and coordinated pre-application scoping meetings and on-going status meetings with agencies.

Applicants Should Strongly Consider Collaborating with Stakeholders in the Pre-filing Process

Particularly on significant projects applicants should use a collaborative process involving the company, FERC, other involved Federal, State and local agencies, and landowners to achieve project compliance and permitting. The collaborative process is intended to be completed prior to Certificate application filing. The intent of the process is to identify as many of the controversial issues as possible. Ideally it would be beneficial if the collaborative process permits the parties to eliminate submittal of the Environmental Report and proceed directly to applicant preparation of the draft NEPA document.

Use of a collaborative process tailored to the specific facts of the proposed project could be an effective way to solve many problems related to inadequate interagency communication, coordination and decision-making. However, the needs for agency communication and coordination remain the same in this instance, but the applicant has the opportunity and responsibility for driving the process.

We have the following suggestions for applicants who choose to use a collaborative process:

- Develop a complete list of involved Federal, State and local agencies;
- Develop a preliminary project description to support initial contacts with these agencies;
- Work closely with the agencies to define areas of jurisdiction and minimize overlaps of jurisdiction;
- Strongly consider the use of project-specific MOAs or other agreements as discussed in this report to address all relevant issues;
- Consider combined agency scoping meetings using an outside facilitator and formal consensus-building and decision-making techniques;
- Use a modified collaborative process to collect input to complete pipeline routing, other facility design, development of construction plans, and development of operations plans (see Section 4.3.6 for a further discussion of this suggestion); and
- Consider developing and implementing an expanded project public information and participation program designed to identify interested parties; describe the company and project; identify public issues and concerns; collect input on project routing, design, construction and operation; and answer questions. Considering developing a project website as part of this effort.

Develop Improved General Operating and Project-Specific MOAs to Improve Coordination and Communication

We earlier described an approach based on the use of enhanced MOAs to better integrate NEPA, ESA and NHPA compliance, and other permitting, and to minimize overlapping and inconsistent permitting and mitigation requirements. We also recommend developing and using enhanced MOAs or other agreements to improve inter-agency communication, coordination and decision-making. We recommend that the previously described types of improved MOAs should include the following components to address this issue:

- General operating MOAs among two or more agencies to facilitate project reviews and decisions to address the following issues:
  - General areas of jurisdiction and responsibility;
  - General review processes;
  - General communication and coordination protocols;
  - General decision-making processes; and
  - General conflict resolution protocols.
- Project-specific MOAs (tiered-off general operating MOAs, as appropriate) to address the following issues:
  - Involved agencies and their project-specific areas of jurisdiction and responsibility;
  - Responsible agency individuals;
  - Specific review and decision processes;

- Specific review and decision schedules;
- Specific communication and coordination protocols;
- Specific conflict resolution and problem-resolution protocols
- Agency budget and staff resource allocation plans or requirements; and
- Applicant funding plans, if appropriate.

Applicants Should Conduct Pre-Application Scoping Meetings and On-Going Status Meetings with Agencies

Much of the agency review and decision process is out of the control of the applicant. However, there are early actions that applicants should take to influence the process as much as possible. Initially, the applicant should complete at least one pre-application scoping meeting with all of the major Federal, State and local regulatory and resource management agencies involved in the project. The objectives of pre-application scoping meetings are:

- Description of the applicant and project;
- Identification of key agency and applicant personnel;
- Initiation of communication and coordination;
- Development of communication and coordination procedures;
- Identification of agency and applicant concerns and issues;
- Identification of agency data and information needs;
- Identification of agency permitting and mitigation requirements;
- Discussion of project schedule;
- Identification of potentially required alternatives; and
- Potential inter-agency MOA development.

In addition to scoping meetings, regular project progress meetings involving the applicant and agencies must be held to:

- Measure progress;
- Discuss analyses and conclusions;
- Anticipate, identify and solve problems;
- Discuss and agree on mitigation;
- Discuss potential modification of project location, design, construction and operation.

Applicants also should provide aggressive support to agencies to ensure that questions are answered, work is completed and schedules are achieved.

4.3.4.3 Implementation Steps

We suggest that INGAA complete the following steps to implement these recommendations:

- Encourage interstate natural gas pipeline companies to use a pre-filing collaborative process for significant projects, including following our specific recommendations on how to improve the process.
- Implement recommendations made in other sections with regard to MOA development and use, and include suggestions made in this section responding to specific problems with inter-agency communication, coordination and decision-making.

4.3.5 Issue 5 – Delayed and Inefficient Completion of the NEPA Compliance Process

4.3.5.1 Introduction

Until issuance of Order 608 and FERC's recognition of the benefits of a pre-filing collaborative process, the FERC Certification and NEPA compliance process required a significantly longer and less efficient process than is necessary to comply with NEPA. For a major project 7(c) filing, the process has included preparation of the Environmental Report (ER) (Resource Reports 1-12 or 13), evaluation of the ER by FERC, development of the decision by FERC concerning the appropriate level of NEPA compliance (EA or EIS), and then completion of the NEPA document. As discussed in the previous section, the option to use a pre-filing collaborative process avoids this lengthy and, we suggest, inefficient process. However, this improvement must be compared with the extensive upfront effort of the pre-filing collaborative effort. Because of this, not all applicants may choose to use a collaborative process and, thus, we have developed some recommendations to shorten the "normal" process and make it more efficient.

4.3.5.2 Recommendations

We have developed three recommendations to shorten and make more efficient the NEPA compliance process for applicants who do not use a pre-filing collaborative process (two recommendations) and for applicants who do use the process (one recommendation). These recommendations are:

- FERC require applicants to prepare a short environmental checklist/assessment instead of the complete ER;
- FERC revise the ER format to make it more consistent with a NEPA document format; and
- FERC prepare more EAs instead of EISs.

FERC Should Develop a Short Environmental Checklist/Assessment Instead of Complete ER for Determination of Level of NEPA Compliance

Much of the information and analysis presented in the ER is similar to that included in the NEPA document. Further, we suggest that less information than is currently required in the ER is needed for FERC and potential cooperating NEPA agencies to decide on the appropriate level of NEPA compliance (EA or EIS), given the substantial existing knowledge about pipeline impacts.

The Environmental Checklist/Assessment would provide adequate information for FERC and other agencies to review and understand the project, adequately estimate project impacts and potentially required mitigation, identify potential problem areas and issues, develop data requests for the applicant, decide on the appropriate level of NEPA compliance, and initiate NEPA compliance. The Environmental Checklist/Assessment would be a form or structured report organized as presented in Table 4. This approach is successfully used in California as part of the California Environmental Quality Act (CEQA) compliance process through use of the Environmental Checklist/Initial Study. This checklist is a short, form-based assessment used by CEQA lead agencies to decide whether to prepare a Negative Declaration (ND) or Environmental Impact Report (EIR). NDs are prepared for actions with no or only minor impacts and EIRs are prepared for projects with potentially significant impacts. A copy of the CEQA Environmental Checklist form is included in Appendix A.

Table 4

RECOMMENDED FERC ENVIRONMENTAL CHECKLIST/ASSESSMENT FORM

Company:
Project Name:
Project Need and Purpose:
Project Description (proposed action and alternatives) (location, facilities, design, construction, operation, abandonment): (appropriate text, tables and figures) – maximum 10 pages
Summary of Affected Environment, Environmental Consequences and Applicant-Proposed Mitigation Measures (in each Resource Category included in the ER guidelines): (appropriate text, tables and figures) – maximum 10 pages

FERC Should Revise the ER Format to Make More Consistent with NEPA Document Format

Where complete ERs continue to be submitted, we suggested that the required ER format be modified to be similar to the standard EIS or EA format, as appropriate for the specific project. We believe that this can be easily accomplished given the high similarity of the technical content of the two types of documents. We also suggest that this action would greatly facilitate preparation of the NEPA document by FERC.

FERC Should Prepare More EAs Instead of EISs

As noted previously, preparation of EAs instead of EISs by lead Federal agencies is the source of more legal challenges than any other action. Thus, this suggested approach would be undertaken with considerable evaluation. However, we do suggest that, for some relatively low impact and less controversial projects, preparation of EAs, especially with good project design, public and agency scoping, preparation of Draft and Final documents, public and agency review of Draft EAs, sufficient evaluation of alternatives, particularly route alternatives and adequate mitigation,

would be compliant with NEPA and reduce the time periods for NEPA compliance for these projects.

4.3.5.3 Implementation Steps

We recommend completion of the following steps to implement these recommendations:

- Make a formal recommendation to FERC to revise their requirements to substitute a short environmental checklist/assessment for the currently required ER (when the collaborative process is not used).
- Make a formal recommendation to FERC to revise their current ER format requirements to make the format more consistent with NEPA compliance document (EA or EIS) outlines (if the previous recommendation is not implemented).
- Encourage FERC to prepare more EAs instead of EISs for selected projects that have characteristics noted in this report.

4.3.6 Issue 6 – Submittal of Applications for Inadequately Planned and Designed Projects by Pipeline Companies

4.3.6.1 Introduction

Our experience suggests that the NEPA compliance process and related Federal, State and local project permitting could be substantially more efficient if pipeline companies completed better preliminary project planning and engineering/design prior to the preparation and submittal of permit applications to regulatory agencies.

4.3.6.2 Recommendations

We suggest that additional preliminary planning and engineering/design in the following areas would be particularly effective:

- Pipeline routing to avoid sensitive environmental and other areas to the maximum practicable extent where significant permitting and mitigation requirements may be imposed;
- Applicant development of feasible alternative routes when permitting issues, constraints or problems may exist for the proposed route;
- Applicant development of complete project descriptions early in the process and minimizing subsequent changes;
- Applicant development of appropriate construction techniques to cross sensitive areas, particularly rivers and streams, wetlands, residential areas, and other sensitive areas;
- Applicant preparation of project permitting requirements analyses and plans; and
- Applicant development of appropriate mitigation measures with adequate technical support.

Applicants Should Improve Routing Process to Avoid Sensitive Environmental Areas

We strongly believe that many issues, requirements and problems associated with NEPA compliance and other permitting of natural gas pipeline projects and associated permitting schedules and completing better pipeline routing could significantly reduce costs. In our experience, improved pipeline routing could avoid some sensitive resources and locations, reduce associated permitting requirements and time, reduce mitigation requirements, and still meet project cost requirements.

The electric power industry has a long history of completing detailed electric transmission line routing studies to select proposed and alternative routes. Most of these studies have been based on mapping of routing constraints and opportunities in a wide corridor located between the origin and termination points of the transmission line, developing alternative routes designed to avoid or minimize crossings of constraints or higher impact areas and maximize following of routing opportunities, selecting a proposed route that best achieves project goals while minimizing impacts, and possibly also identifying alternative routes. An example of typical transmission line routing opportunity and constraints map developed using this approach is included in Figure 1. This detailed approach has been used in this industry because electric transmission line projects have been fairly controversial, primarily because of their presence above ground.

Various Geographic Information Systems (GISs) have been used to complete many of these assessments, including Arc/Info, Arc/View and others. This approach is based on the use of digitized map data and can be used to complete a variety of detailed impact analyses and comparisons of alternative routes. Arc/Info also can be used to calculate the least impact route and also can take into account project costs and other considerations in addition to environmental impacts. Weighting also can be used to establish priority levels for various types of resources, impacts or other factors. A copy of a paper describing the use of this approach is included in Appendix B.

We believe that this approach is very cost-effective and could be used widely and successfully in the interstate natural gas pipeline industry to facilitate the NEPA process and other Federal, State and local permitting, reduce impacts and mitigation requirements, reduce project costs and shorten project schedules.

Applicants Should Proactively Develop Feasible Alternative Routes

We recommend that applicants take a strong role in the development of alternative pipeline routes in cases where there may be significant permitting issues, constraints or problems associated with their proposed route, or when they are unable to make a decision on route preference because of insufficient information being available. Alternative routes identified by applicants should be feasible from their point of view and applicants should be prepared to use any alternative routes that they identify. Applicants must be proactive in identifying alternative routes to minimize the possibility of having agencies identify or permit alternatives that are unacceptable to the applicant.

Applicants Should Develop Complete Project Descriptions Early in Process and Identify Future Changes as Alternatives

In our experience and in the experience of many regulatory agencies, one of the most significant problems in NEPA compliance and other project permitting is not having sufficient project description information available early in the NEPA compliance and permitting process, and having project descriptions change significantly during the process. Both issues can delay the project schedule. Applicants must adequately define projects early in the process, including describing need and purpose; overall project layout; locations and major characteristics of all proposed and alternative facilities, construction procedures, project schedule, project workforce requirements, operational procedures and abandonment plans. If all information is not available, the possible plans should be described as alternatives.

Applicants Should Develop Alternative Construction Techniques to Achieve Environmental Performance in Sensitive Areas

FERC and other Federal, State and local agencies involved in pipeline permitting are clearly emphasizing evaluation of proposed construction procedures for crossings of rivers and streams, wetlands, residential areas and other sensitive areas. Related issues include construction right-of-way, locations and sizes of temporary use areas, soil segregation requirements and procedures, and other constructed related issues. Our experience suggests that pipeline companies, construction contractors, regulatory agency personnel, environmental consultants and others have substantial knowledge and experience with these issues, and also have strong preferences that significantly differ in some cases. Pipeline companies must carefully consider their proposed construction technique alternatives in these types of areas, select a proposed technique, and then develop technical support for their proposals to use in discussions with agencies. We also suggest that companies have alternative construction plans available to use if proposed techniques are not approved by agencies.

We also recommend that applicants use the river and stream crossing evaluation model (Crossings™) recently developed by Golder Associates for GTI as a tool to evaluate the potential effects of open cut (trenched) crossings of rivers and streams prior to making construction decisions.

Applicants Should Improve Preparation of Project Permitting Requirements Analyses and Plans

One of the most effective tools for facilitating project planning and permitting is completion of a permitting requirements analysis and plan for a proposed natural gas pipeline project. This type of report presents a listing, description and analysis of each Federal, State and local permit, review or approval required for project implementation. Project construction, operation and abandonment are covered. Required permits are evaluated by agency. For each required permit, the following information is provided:

- Agency;
- Permit/approval name;
- Action/facility requiring permit/approval;

- Information/analysis requirements for permit application;
- Application form information;
- Permit fees or costs;
- Scheduling requirements;
- Contact individuals (name, position, telephone number, email address, mailing address); and
- Potential problems/issues.

This information is provided in text and tabular form.

In addition to the assessment of permitting requirements, these documents are most effective when they include a recommended permitting strategy and plan. This element should include a description of each potential issue, constraint or problem that may exist for the project, along with a strategy and plan for successfully addressing the issue. The strategy and plan should identify the overall actions that need to be taken to address the issue, the responsible individual or group, and specific implementation steps that must be completed.

The permitting strategy and plan also should include a detailed permitting cost estimate and permitting schedule. The cost estimate should include pipeline company, consultant, agency and permit (as appropriate) costs for each permit and in total. The schedule should include starting points, durations and ending points of key activities for each permit. Key activities should include scoping, permit application preparation, agency completeness review, agency review and decision, and other tasks, as appropriate.

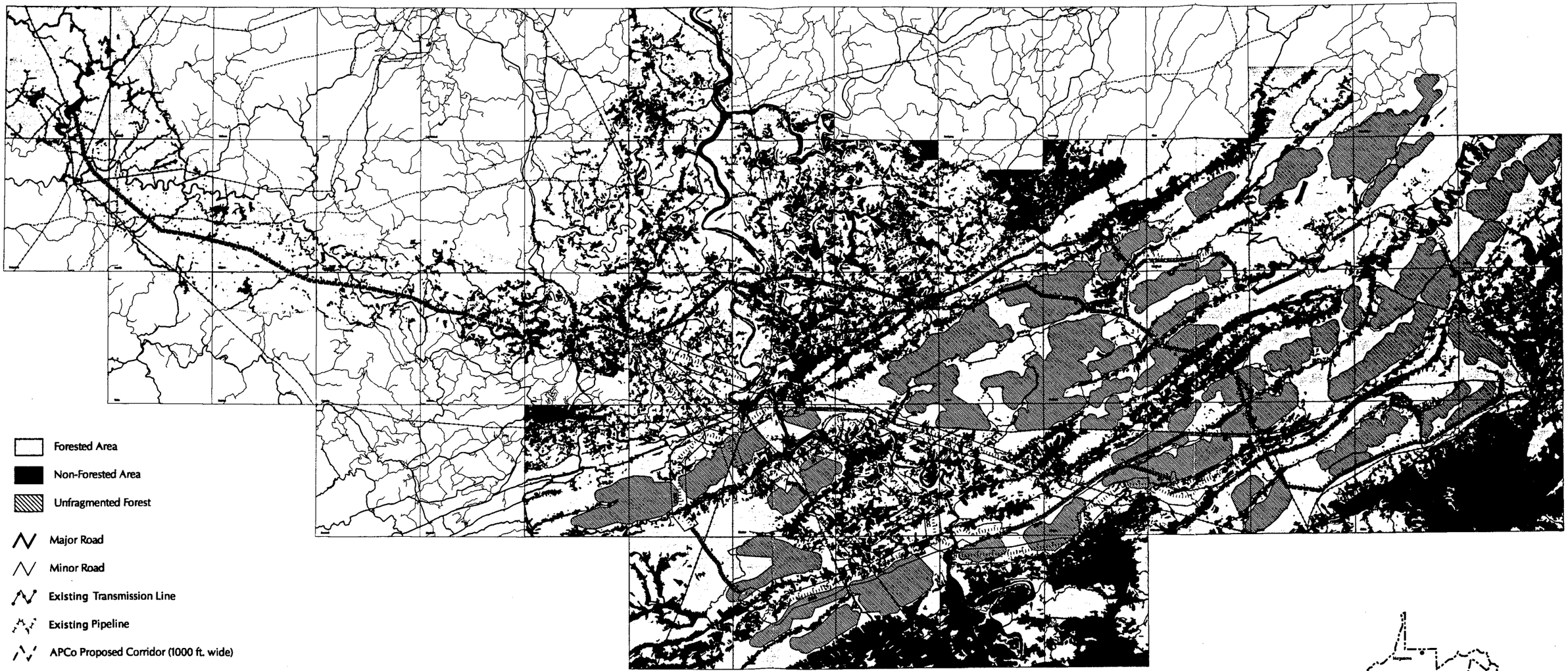
Applicants Should Propose Appropriate Mitigation Measures in the NEPA Document

The NEPA compliance process and other Federal, State and local project permitting can be substantially facilitated by applicant's proposing adequate mitigation for all anticipated major project impacts. This results in the impact assessment and mitigation discussions proceeding more efficiently. If possible, mitigation should be included as part of the proposed action. In NEPA compliance, this is especially effective because no additional mitigation must be considered if the proposed mitigation is deemed adequate. If necessary, alternative mitigation measures should be proposed. Mitigation measures can be discussed with agencies prior to the submittal of permit applications or during the review process. It is most effective to propose and agree on mitigation as early as possible in the permitting process. Adequate technical support should be provided for all mitigation, especially if it varies from stated agency requirements. BMPs should be used, where possible, to facilitate agency review and approval.

4.3.6.3 Implementation Steps

We recommend that INGAA sponsor one or more workshops involving appropriate pipeline company staff on the topic of using GIS technology to assist in improved pipeline routing and permitting in order to implement the first recommendation on this issue.

UNFRAGMENTED FOREST EVALUATION
APCo 765 KV Electric Transmission Line Project



Forested Area

Non-Forested Area

Unfragmented Forest

Major Road

Minor Road

Existing Transmission Line

Existing Pipeline

APCo Proposed Corridor (1000 ft. wide)

1000 ft. wide Corridor

1 mile wide Corridor

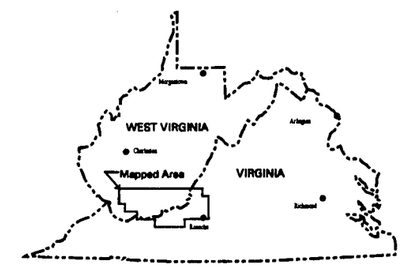
APCo Proposed Corridor Centerline

APCo Alternative Corridor Segment Centerline

SCC Alternative Corridor Segment Centerline

Alternative Corridor Segment Centerline on Federal Land

Center of 1 Mile Wide Corridors on Non-Federal Land. Shown to Identify Segments, does not Represent Location of Potential Transmission Line.



SCALE 1:100,000

0 5000 10,000 15,000 20,000 METERS

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 FEET

0 2 4 6 8 10 12 MILES

Figure 1
EXAMPLE OF FACILITY ROUTING ANALYSIS USING GIS

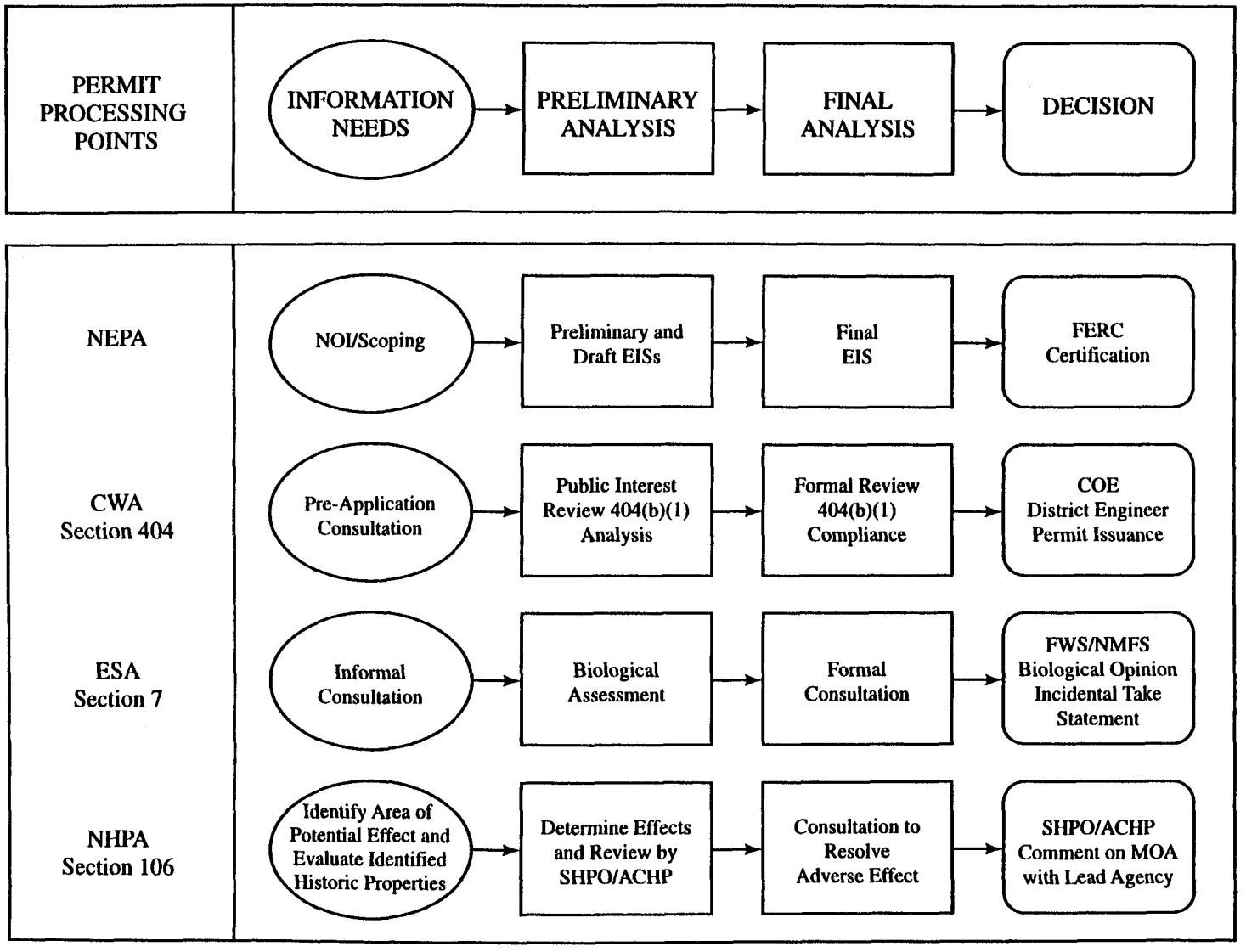


Figure 2
Flow Chart Relating NEPA Compliance Steps with Other Major Federal Reviews (From INGAA Foundation 1999)

This report presents the results of a study completed for The INGAA Foundation, Inc. by URS on implementing NEPA for interstate natural gas pipeline projects. The objective of the study is to improve the NEPA compliance process by increasing its efficiency and effectiveness, resulting in improved project implementation while providing adequate environmental protection. The specific objectives of the study were to:

- Evaluate the legal and regulatory background of the NEPA compliance process as it relates to the natural gas pipeline industry;
- Evaluate the current NEPA compliance processes and requirements to determine their effectiveness and adequacy; and
- Develop recommendations concerning how the current NEPA compliance process could be improved to make it more efficient and effective.

Several techniques were used to achieve these objectives, including a review of NEPA and other related major regulatory requirements, completion of two internal URS workshops involving technical and regulatory specialists and outside legal counsel, review of relevant major studies within the gas pipeline industry and completion of an extensive computer-based, key word literature search. The literature search provided substantial information, including detailed reviews of NEPA effectiveness and improvement, particularly by CEQ and various researchers.

The study identified five major issues that exist with respect to the effectiveness of NEPA, including the following:

- Inadequate integration of NEPA compliance with NHPA and ESA compliance, and other Federal, State and local permitting;
- Inappropriate, overlapping and inconsistent Federal, State and local permitting and mitigation requirements;
- Inadequate interagency communication, coordination and decision-making;
- Delayed and inefficient completion of the NEPA compliance process; and
- Submittal of applications for inadequately planned and designed projects by pipeline companies.

For each issue, we presented an overview and description, recommendations and steps to implement each recommendation. The following table presents a summary of the identified issues and recommendations.

SUMMARY OF IDENTIFIED ISSUES AND RECOMMENDATIONS

Issue	Recommendations
1. Inadequate Integration of NEPA Compliance with NHPA and ESA Compliance, and Other Federal, State and Local Permitting	a. Develop Improved Memoranda of Agreement that Effectively Address: (1) Identify and Agree on Agency Jurisdiction by Cooperating Agencies (2) Use NEPA Documentation as Central Basis of Agency Decisions (3) Utilize NEPA Scoping Process as INPUT into Agency Decisions (4) Integrate Environmental Data Needs and Impact Assessment Methodologies (5) Identify and Agree on Review and Decision Timing of Reviews and Decisions (6) Develop a Conflict Resolution Process b. Improve the Individual NHPA, Section 106 Compliance Process c. Improve the Individual ESA, Section 7 Compliance Process
2. Inappropriate, Overlapping, Inconsistent and Inflexible Federal, State and Local Permitting and Mitigation Requirements	a. Improve Consistency and Effectiveness of Agency Completion of Reviews of Permitting and Mitigation Requirements b. Develop Improved MOAs to Minimize Overlapping and Inconsistent Federal State and Local Agency Permitting c. Utilize Updated Technical and Field Experience Data in NEPA Analysis d. Utilize Performance-Based and Industry Recommended Practices to Mitigate. e. Allow Broader Use of Construction and Post-construction Inspection and Monitoring to Permit Flexibility in Mitigation Implementation.
3. Inadequate Assessment of Environmental Impacts of Substituting Natural Gas for Other Fuels	a. Improve NEPA and Related Technical Analyses b. Consider Indirect Positive Air Quality Impacts in the Development of Pipeline Project Permitting and Mitigation Requirements. c. Encourage of Pipeline Project Applicants to Provide Information on Natural Gas Use by Facilities. d. Develop Additional Data and Materials on Positive Air Quality Impacts e. Develop Workshops and Meetings with Regulatory Agency Personnel to Exchange Information and Increase Communication Positive Air Quality Impacts
4. Inadequate Inter-Agency Communication, Coordination and Decision-Making	a. Applicants Should Strongly Consider collaborating with stakeholders in the Pre-filing Process. b. Develop Improved General Operating and Project-Specific MOAs to Improve Coordination and Communications c. Applicants Should Conduct Pre-application Scoping Meetings and On-going Status Meetings with Agencies

SUMMARY OF IDENTIFIED ISSUES AND RECOMMENDATIONS

Issue	Recommendations
5. Delayed and Inefficient Completion of NEPA Compliance Process	a. FERC Should Develop a Short Environmental Checklist/Assessment Instead of the Complete ER for Determination of Level of NEPA Compliance b. FERC Should Revise the ER Format to Make it More Consistent with a NEPA Document Format. c. FERC Should Prepare More EAs Instead of EISs.
6. Submittal of Applications for Inadequately Planned and Designed Projects by Pipeline Companies	a. Pipeline Companies Complete Additional Project Planning and Engineering/Design in the Following Areas: (1) Applicants Should Improve the Routing Process to Avoid Sensitive Environmental Areas (2) Applicants Should Proactively Develop Feasible Alternative Routes (3) Applicants Should Develop Complete Project Descriptions Early in the Process and Identify Future Routing Changes as Routing Alternatives (4) Applicants Should Develop Alternative Construction Techniques to Achieve Acceptable Environmental Performance in Sensitive Areas (5) Applicants Should Improve Preparation of Project Permitting Requirements, Analyses and Plans (6) Applicants Should Propose Development of Appropriate Mitigation Measures in the NEPA Document with Adequate Technical Support.

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Appendix A

CEQA Environmental Checklist Form

1. Project title: _____

2. Lead agency name and address:

_____
_____
_____

3. Contact person and phone number: _____

4. Project location: _____

5. Project sponsor's name and address:

_____
_____
_____

6. General plan designation:_____ 7. Zoning: _____

8. Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)

_____
_____
_____
_____

9. Surrounding land uses and setting: Briefly describe the project's surroundings:

_____
_____
_____
_____

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)

_____
_____
_____
_____

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture Resources	☐ Air Quality
☐ Biological Resources	☐ Cultural Resources	☐ Geology /Soils
☐ Hazards & Hazardous Materials	☐ Hydrology / Water Quality	☐ Land Use / Planning

☐ Mineral Resources ☐ Noise ☐ Population / Housing

☐ Public Services ☐ Recreation ☐ Transportation/Traffic

☐ Utilities / Service Systems ☐ Mandatory Findings of Significance

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

_____ _____

Signature Date

_____ _____

Printed name For

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose

sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, "Earlier Analyses," may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

   a) Earlier Analysis Used. Identify and state where they are available for review.

   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:
   a) the significance criteria or threshold, if any, used to evaluate each question; and
   b) the mitigation measure identified, if any, to reduce the impact to less than significance

SAMPLE QUESTION

Issues:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less Than Significant Impact	No Impact
I. AESTHETICS – Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☐
II. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☐
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☐
III. AIR QUALITY – Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				

a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☐
IV. BIOLOGICAL RESOURCES – Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☐

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☐
V. CULTURAL RESOURCES – Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☐
VI. GEOLOGY AND SOILS – Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☐
ii) Strong seismic ground shaking?	☐	☐	☐	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☐
iv) Landslides?	☐	☐	☐	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☐

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☐
VII. HAZARDS AND HAZARDOUS MATERIALS				
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☐
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☐
VIII. HYDROLOGY AND WATER QUALITY – Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☐

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☐
f) Otherwise substantially degrade water quality?	☐	☐	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☐
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☐
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☐
IX. LAND USE AND PLANNING - Would the project:				
a) Physically divide an established community?	☐	☐	☐	☐
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☐

X. MINERAL RESOURCES – Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☐
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☐

XI. NOISE –

Would the project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐

XII. POPULATION AND HOUSING – Would the project:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☐
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☐

XIII. PUBLIC SERVICES

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

Fire protection?

Police protection?

Schools?

Parks?

Other public facilities?

XIV. RECREATION –

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

XV. TRANSPORTATION/TRAFFIC – Would the project:

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?

b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

e) Result in inadequate emergency access?

f) Result in inadequate parking capacity?

g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☐

XVI. UTILITIES AND SERVICE SYSTEMS –

Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☐
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☐

XVII. MANDATORY FINDINGS OF SIGNIFICANCE –	Potentially Significant Impact	Less than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☐

Appendix B
GIS Papers

Site Selection of Petroleum Pipelines: A GIS Approach to Minimize Environmental Impacts and Liabilities

Russell Jones and Mace Barron

Site selection of petroleum pipelines has historically focused on lessening the cost of construction and increasing the efficiency of transport. This paper demonstrates how GIS can be used in the site location process to minimize impacts to the environment during construction and from accidental release, as well as to lessen the costs of permits and liability risks associated with accidental releases. Ecological variables developed from publicly available spatial data sets are utilized in this process.

Introduction

The oil and gas industry is increasingly using GIS technology in siting new pipelines as a tool to lessen both construction and operational costs (Hicken et al., 1998). The themes and variables used as input in this process mainly address direct construction costs and pipeline efficiency once the pipeline has been completed. Some of the variables examined include:

- shortest distance from source to market
- least grading (removal of trees, etc.)
- costs associated with right of way
- slope of terrain
- number of stream, road, and railroad crossings
- substrate (rock, soils, etc., associated with burial)
- existing laws and regulations (wetlands, etc.)
- proximity to population centers, etc.
- utilization of existing utility corridors and easements
- other engineering factors.

What is usually not taken into account in the siting process is the potential costs of environmental impacts during construction as well as ecological and liability costs that may result from accidental releases after construction has been completed. Some of these costs can be substantial (potentially millions of dollars) and include:

- environmental damage
- litigation and settlement costs
- environmental response and investigation
- criminal and civil penalties
- environmental remediation
- damage to reputation and community relations.

Over the past few years, an increasing number of environmental spatial data sets have become available to the general public, offering a great opportunity for companies to avoid these environmental and liability risks with relatively little effort by incorporating them into their normal GIS siting procedures. This paper provides guidance on the environmental spatial data sets available to the public (many over the internet) and examines some of the attributes that may be used in the siting process to lessen impacts to the environment, minimize the risk of damage to the pipeline (e.g., from erosion, debris, or third party damage), and reduce liability in the event of an accidental release. In addition, this process may also help to lessen permitting costs and identify sections of existing

pipeline where additional preventive measures may be needed. First, we examine some of the environmental criteria, spatial data sets, and attributes that should be considered and where this data can be obtained, then conclude with an example utilizing many of the data sets outlined. It is important to mention that the criteria used in this paper are meant to augment rather than replace the traditional site selection criteria. Furthermore, the list provided is to be used as a guide and is not meant to be all-inclusive.

In addressing environmental concerns, there are three main objectives:

- What are the ecological parameters that need to be addressed?
- Where does this information exist and how is it obtained?
- How is this information incorporated into GIS so that informed decisions can be made about site location?

Ecological Parameters and Data Sets

Pipeline Vulnerability

Pipelines are vulnerable to damage when exposed. Pipeline cover may be lost where a pipeline is near water features such as tidal areas or river crossings. Loss of cover may result because of erosion from river meandering, undercutting, or flooding. Additionally, during peak flows, suspended sediment, soil, and debris such as logs and limbs can cause damage through abrasion. Pipeline damage may also result from external forces applied to a pipeline from third party activities (e.g., heavy machinery use). Information sources available for assessing pipeline vulnerability risks are listed below.

Flood information. Classifies high-risk areas as Flood Hazard Areas. This data can be purchased from the Federal Emergency Management Agency (FEMA) (appendix A). Data for much of the United States is available in hard copy maps, and approximately 30% are available in digital form (Q3 data) at a scale of 1:24,000.

Peak stream flows. This information can be used not only to differentiate between the size of streams, but also to help avoid construction during high flows, thereby reducing impact to the environment and construction costs. Base discharge and peak discharge information is available for free over the internet from the U.S. Geologic Survey for stream gaging stations throughout the United States (appendix A).

Areas of urban density. Areas with high urban density may increase the liability risk in the event of an accidental release. Data sets such as Metropolitan Statistical Areas and Census Block Tracts/Groups can be used for determining proximity to high-density population areas. Spatial data sets (TIGER files) are available from the U.S. Census Bureau and include Metropolitan Areas, Urbanized Areas, Census Tracts, and Census Block Groups. These data sets can be downloaded or ordered over the internet at varying costs and scales ranging from 1:100,000 and smaller (e.g., 1:5,000,000 which is free) (appendix A). Some of this data (Census tracts, census block groups, etc.) is also provided on CD-ROM from ESRI and included with the purchase of ArcView (ESRI Data & Maps) at varying levels of detail (ESRI, 1998).

Land zoning. Areas zoned for commercial or residential development may be useful for determining risks from third party damage from future construction activities. Zoning data is available from state, county, or local governments. As many of these agencies are beginning to utilize GIS technology, this data is increasingly available in digital form.

Land use/land cover. Land use/land cover themes provide information on general cover and land use that may be used in lieu of or to supplement zoning and urbanized areas. This theme can be used to help identify those areas of higher risk of third party damage as well as areas that have a relatively low risk. In addition, this theme can help identify areas to minimize construction costs. Land use/land

cover classifications include urban or built-up land, residential, commercial services, industrial, transportation/communications, industrial and commercial, mixed urban or built-up land, other urban or built-up land, agricultural land, cropland and pasture, orchards/groves/vineyards/nurseries, confined feeding operations, other agricultural land, rangeland, herbaceous rangeland, shrub and brush rangeland, mixed rangeland, forest land, deciduous forest land, evergreen forest land, mixed forest land, water, streams and canals, lakes, reservoirs, bays and estuaries, wetland, forested wetlands, nonforested wetlands, barren land, dry salt flats, beaches, sandy areas other than beaches, bare exposed rock, strip mines/quarries/gravel pits, transitional areas, mixed barren land, tundra, shrub and brush tundra, herbaceous tundra, bare ground, wet tundra, mixed tundra, perennial snow and ice, perennial snowfields, and glaciers (USGS, 1990). Land use/land cover data is available for free over the internet from the USGS GeoData site and the Environmental Protection Agency (EPA) (appendix A). These are generally at a scale of 1:250,000, although a limited number of areas are available at 1:100,000. While the small-scale data may be too general for final site selection, it may be useful as an initial filter in the siting process. However, larger scale data (up to 1:24,000) is becoming available for free or purchase from individual state agencies such as Departments of Natural Resources.

Slope. Slope data can be used to determine areas of high erosion potential. Digital elevation model (DEM) data used to calculate slope is available for free over the internet from USGS at varying scales (1:24,000 in many areas) (appendix A).

Soils. Soils data at varying scales (from 1:24,000 and smaller, e.g., STATSGO and SSURGO) is available from state and county agencies (e.g., Departments of Natural Resources) as well from the U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) over the internet (appendix A) for many regions in the United States. Soils information may help identify regions where corrosion risk is high and, in conjunction with slope, may help determine risk of erosion.

Ecologically Important Areas

Wetlands. Wetlands are ecologically important areas with national significance (societally important) because of the historical losses from development, and the ecological services they provide including habitat for migratory waterfowl and amphibians. Wetlands provide water for storage, aquifer recharge, water cleansing, aquatic and nonaquatic species reproduction, cover, and feeding. Additionally, they are sensitive to petroleum discharges because of limited dilution (small size, limited water exchange). The National Wetlands Inventory (NWI) maintains a spatial database of wetland areas with alphanumeric codes identifying the type of wetland feature (appendix A). The NWI has mapped 89% of the area of the lower 48 states. About 39% of the area of the lower 48 states are available in for free over the internet in digital form at a scale of 1:24,000.

Areas of special status species. Areas that support rare species and rare and/or relatively natural plant and animal communities provide reservoirs of genetic diversity and ecological integrity, and thus require special protection. National Heritage Programs provide lists of locations of (1) federally listed threatened or endangered species, (2) state or local species of special concern, and (3) areas containing habitats or natural communities of ecological significance. Additional sources of information include the US Fish and Wildlife Service Division of Endangered Species (appendix A) and the U.S. National Park and Forest Services.

Water features. Flowing water, ponds, lakes, and reservoirs provide ecological services and nonuse values, including (1) recreation (hunting, fishing, swimming, boating); (2) aquatic and nonaquatic species reproduction, cover, and feeding; and (3) water and sediment quality. Water features can serve as a conduit for spilled oil, as well as being ecologically important. Water features are available for free from the USGS internet site (appendix A) in the form of digital line graphs (DLGs). The attributes relevant to water features include (major and minor codes) area to be submerged (050 0108); marsh, wetland, swamp, or bog (050 0200); mangrove area (050 0112); bay (050 0112); gut

(050 0122); shoreline (050 0207); manmade shoreline (050 0201); indefinite shoreline (050 0203); apparent shoreline (050 0421); stream (050 0412); ditch or canal (050 0414); channel (050 0419); lake or pond (050 0421); right & left bank (050 0605-6); intermittent (050 0610); submerged (050 0612) (USGS, 1999b).

Public Lands and Recreation Areas

Many public lands and recreation areas provide important ecological and societal services and values and should therefore be considered in the siting process. Publicly owned lands include national, state, city, or county forests, grasslands, seashores, monuments, parks, refuges, recreation areas, and wilderness areas. Information on public lands is provided in the digital line graph (DLG) boundary files and is available for free from the USGS internet site (appendix A).

Other Features and Data Sources

In addition to the features and data sources listed above, there are several other sources of data that can be helpful in the siting and mitigation process.

Roads, trails, railroads, and utilities. The location of roads, trails, and railroads can play a significant role in reducing costs and limiting environmental impacts during pipeline construction. Siting a pipeline near existing road networks will minimize the creation of new roads during construction and for maintenance. Attribute information attached to the linework (such as width of roads) can be used to minimize construction costs and impacts to the environment. In addition, utilizing existing utility corridors instead of creating new ones, can reduce both construction costs and environmental impacts can be reduced (although the rights to the easements would need to be taken into consideration). These themes are publicly available for free from the USGS as DLG files at scales from 1:24,000 and smaller (appendix A).

Satellite and aerial photos. Remotely sensed data from satellites (e.g., Landsat and SPOT) and aerial photography is widely available from public and private sources (appendix A) at varying scales. As many of the data sets listed above are available for only portions of the country, remotely sensed data can be used as a source for many of these themes (e.g., hydrology, wetlands, land use/land cover, urban areas, etc.) or to enhance data that was unavailable at the scale needed. The thematic data sets needed can be extracted from the imagery by either on-screen digitizing or automated and semi-automated classification methods. Vegetative cover may also be derived and may help guide the site location away from heavily forested areas.

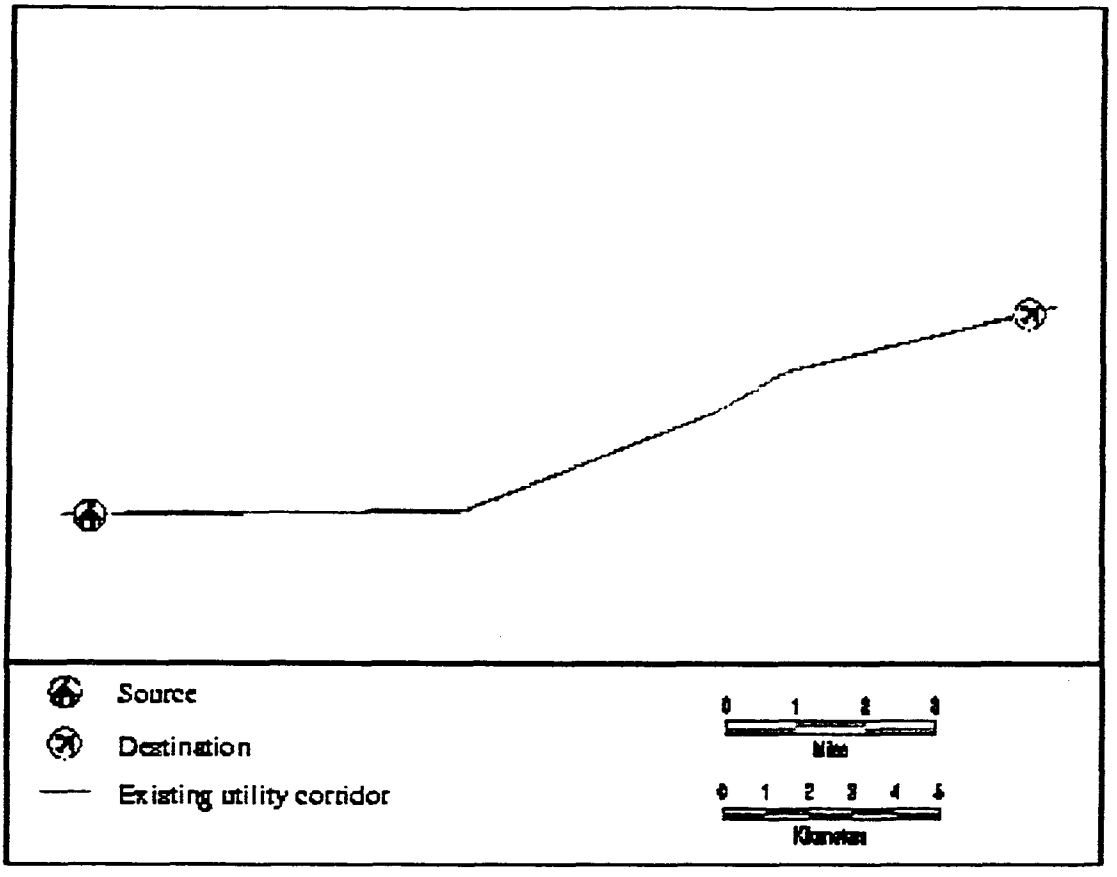
Digital orthophotos and digital raster graphics. In contrast to the remotely sensed data listed above that may require extensive processing and expertise to use, the USGS provides orthorectified aerial photos (DOQ) and rectified scanned topographic maps (DRG), either for free (DRG) or for a nominal cost (DOQ) (appendix A) over much of the country. While it may or may not be possible to extract the thematic information needed in an automated fashion from these data sets, many of the themes listed above can be obtained by on-screen digitizing or by visual evaluation. These sources of data can also be used to evaluate the accuracy of the thematic layers. In addition, these data sets can provide information that is unavailable in other data sets (e.g., locations of isolated buildings, etc.). The spatial resolution of these data sets is often much greater than can be obtained from satellite imagery (up to 1 meter for DOQ and 1:24,000 for DRG).

Hard copy sources. Many of the data sets listed above that are not available for a specific region of the county may be available in hard copy form. By scanning or digitizing these maps, they can be incorporated into the GIS procedure. However, even if they aren't utilized in a digital format, the data can be used to visually guide the siting process.

Case Study

The case study outlined below is intended to illustrate the process of acquiring, processing, and implementing a pipeline siting procedure in a GIS. The basic problem addressed is this case study is as follows. Assuming that an existing utility corridor might realistically be used to site a pipeline between source and destination points (given land easement costs, etc.) (Figure 1), where could a pipeline be sited between these same two points that would result in the least environmental impact and liability risks given spatial data that is available for free over the internet? Since the purpose of this paper is to show how GIS can be used to minimize environmental impacts and liability risks, this case study utilized mainly environmental data sets and attributes and a minimal attempt was made to address engineering parameters related to construction or operating efficiency.

Figure 1. Existing utility corridor theme converted from USGS DLG files (USGS, 1999b).



Data Acquisition

The first step in the process is to acquire all the data sets needed at the scale desired. Many of the data sets available are indexed by county or USGS quadrangle index and therefore, digital topographic indexes at 1:250k, 1:100k, and 1:24k should be used in conjunction with digital state and county data to facilitate the download process.

Two adjacent USGS 1:24,000 topographic quadrangles were selected from the southeastern United States. The criterion used to select these was based solely on the availability of as many themes as possible at the largest possible scale. All data sets used in the analysis were available for free over the

internet. Table 1 describes the sources and data sets acquired.

Table1. Data sets acquired

Description	Source	Format	Scale
Transportation	USGS GeoData Internet Site	DLG-SDTS	1:24,000
Railroads	USGS GeoData Internet Site	DLG-SDTS	1:24,000
Utility and Pipelines*	USGS GeoData Internet Site	DLG-SDTS	1:24,000
Public Land Boundaries	USGS GeoData Internet Site	DLG-SDTS	1:24,000
Digital Elevation Model (DEM)	USGS GeoData Internet Site	SDTS-Raster Profile	30 meter
National Wetlands Inventory (NWI)	Fish & Wildlife Service, National Wetlands Inventory Internet Site	ARC/INFO Export	1:24,000

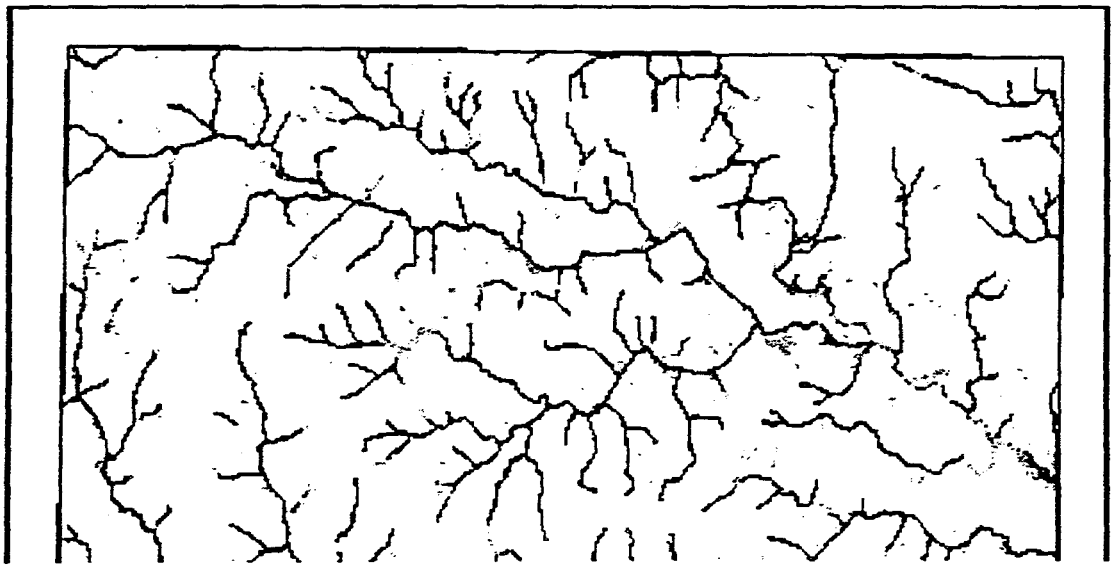
*Data used for comparative purposes only.

Data Processing

After the data were downloaded for each quadrangle from the sites, each theme was imported into either ARC/INFO coverage format (vector themes) or grid (DEMs), and all associated attribute files were joined with the appropriate feature attribute tables. In addition, because many of the data sets contained cryptic alphanumeric attribute codes (DLG and NWI), lookup tables were created from metadata sources.

After the data had been converted into coverages, the individual quadrangles were joined together (using "mapjoin" or "append" for vectors, and "mosaic" for grids) to create seamless coverages for each theme. The appended themes were then checked for errors and any artificial polygon boundaries created from the merge were removed by running "dissolve." All coverages and grids were also projected into a common projection system. The processed themes used in the analysis are shown in Figures 2a-d.

Figure 2a. USFWS National Wetlands Inventory (NWI) theme (USFWS, 1999a).



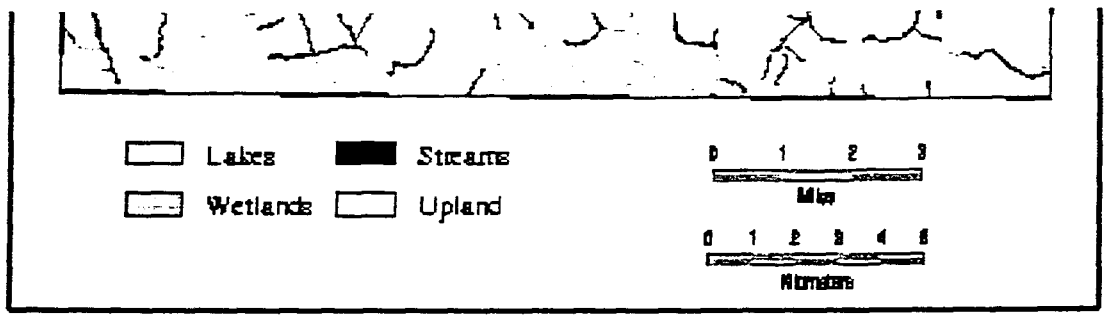


Figure 2b. Digital elevation model (DEM) data converted from USGS SDTS files (USGS, 1999a).

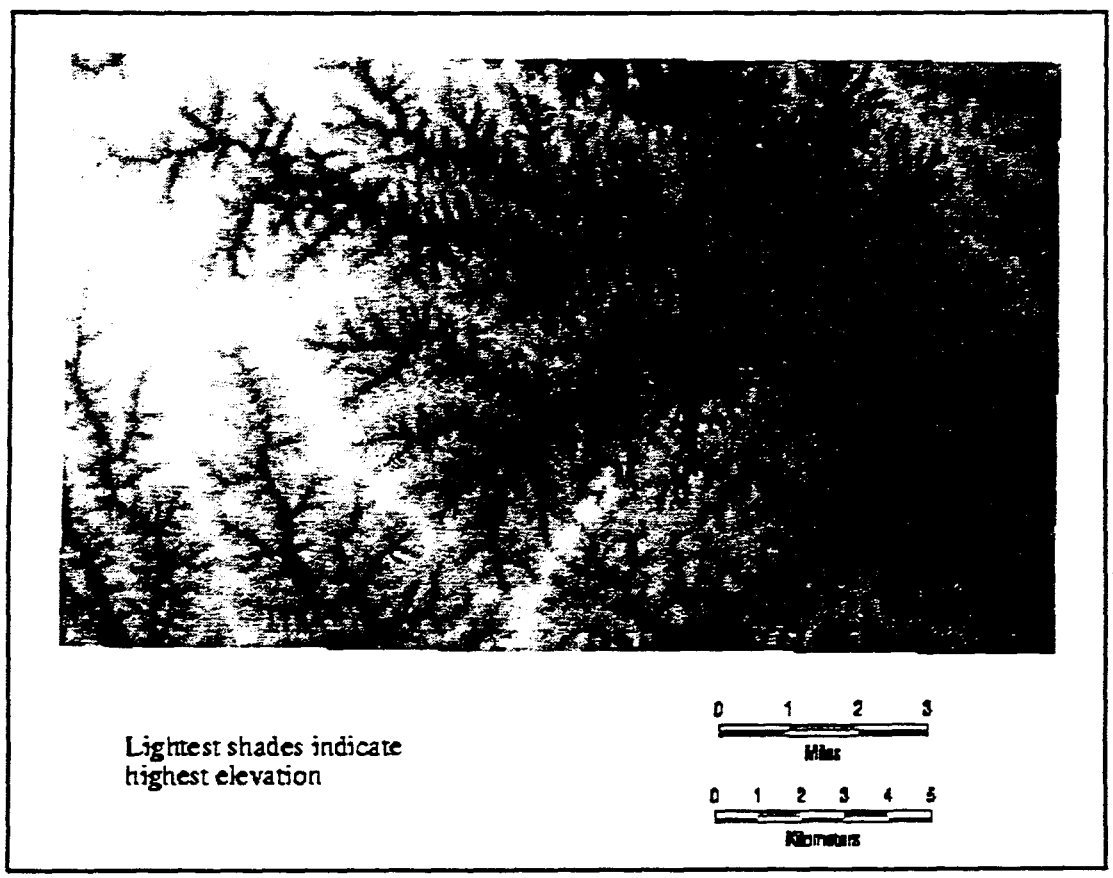


Figure 2c. Transportation theme converted from USGS DLG files (USGS, 1999b).

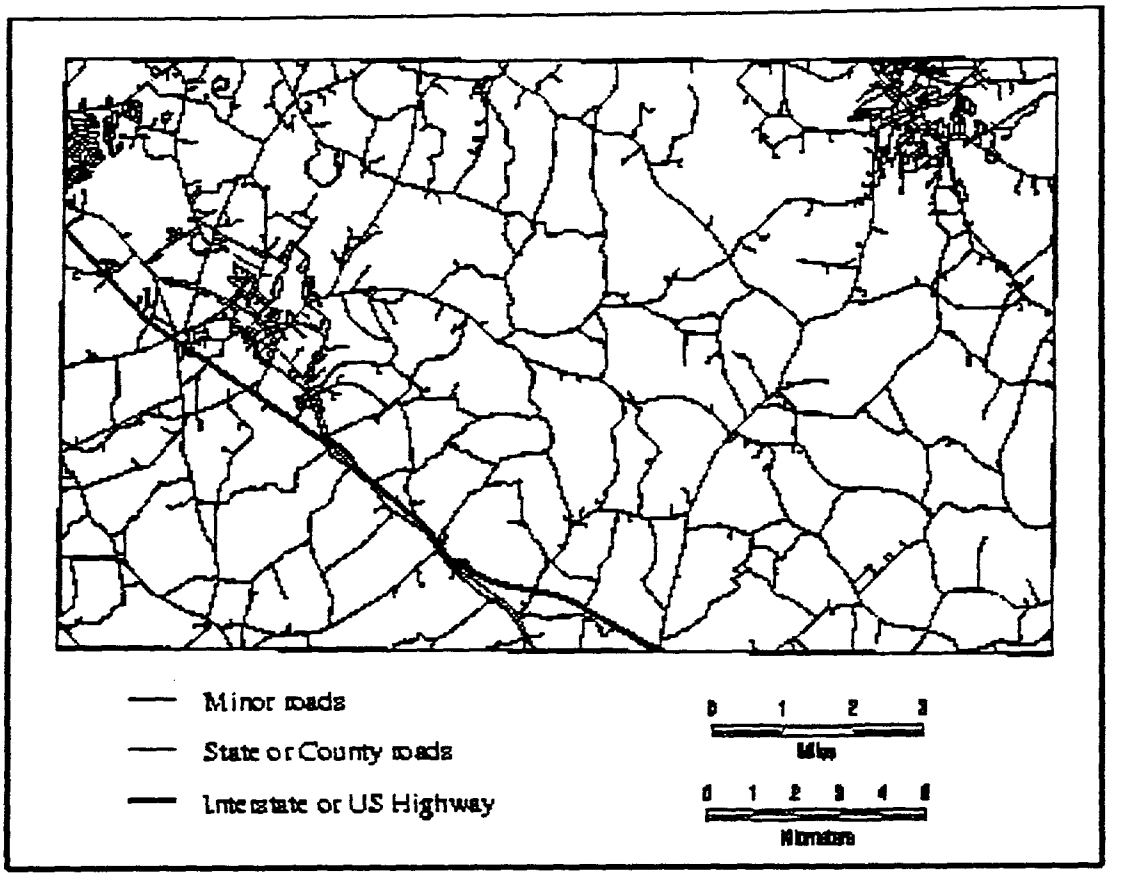
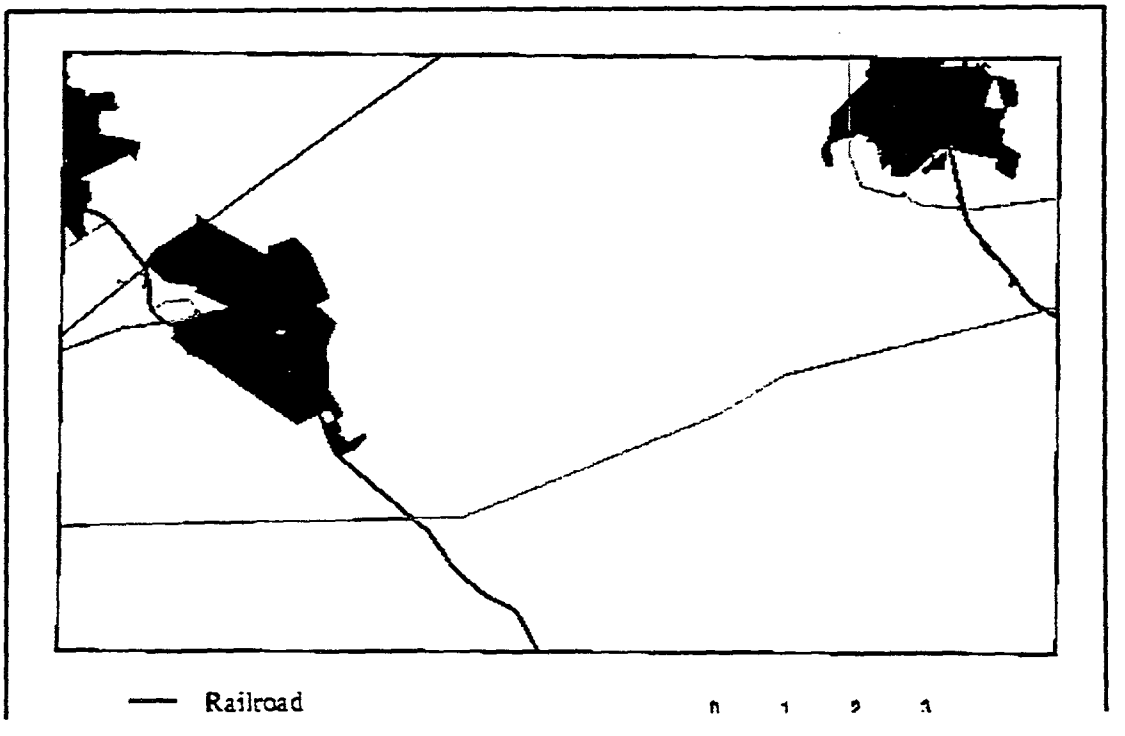
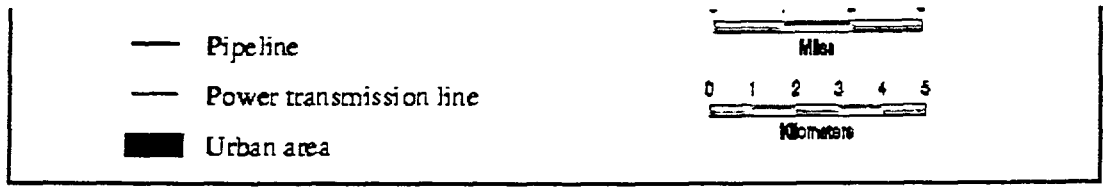


Figure 2d. Railroad, public land boundary, and utility/pipeline themes converted from USGS DLG files (USGS, 1999b).





Because the linework between the DLG hydrology and the NWI data was essentially the same, and a higher degree of discrimination could be obtained from the NWI attributes, the DLG hydrology was used for verification purposes only.

Classification and Costing

All unique codes were identified for each theme by running a frequency on the appropriate attribute field. NWI arc and polygon theme were separated and processed individually. Slopes derived from the DEM were grouped into three classes: 0-10%, 10-20%, and 20-30% (there were no slopes greater than 30% in this data set). Each polygon, line, and slope class was then subjectively assigned a relative cost on a scale of 0 to 5 based on their vulnerability (least to most) to environmental degradation in the event of an accidental release or during the construction process. The criterion used in assigning costs was based on (1) potential loss of recreation value, (2) potential loss of ecological function, (3) potential of feature to transport released petroleum, and (4) relative effort required to remediate. The costs of stream and transportation crossings were also incorporated into this structure. In addition to the cost attribute, sensitive ecological areas such as wetlands, streams, and lakes were buffered by 150 meters (492 feet) to limit the risk of environmental damage. The cost and buffer assignments are summarized in Table 2.

Table 2. Classification (USFWS, 1999b and USGS, 1990a) and relative cost assignments.

Theme	Attribute (code)	Description	Cost[a]	Buffer[a] (m)
NWI	Lacustrine, limnetic, and littoral (L1/L2)	Wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30% area coverage; and (3) total area exceeds 20 acres.	5	150[b]
NWI	Palustrine, aquatic bed (PAB)	Nontidal wetlands with plants growing on or below surface. Water less than 2 meters deep.	5	150
NWI	Palustrine, emergent (PEM)	Nontidal wetlands with erect, rooted, herbaceous hydrophytes, excluding mosses and lichens.	5	150
NWI	Palustrine, forested (PFO)	Nontidal forested wetlands.	3	150
NWI	Palustrine, scrub shrub (PSS)	Nontidal wetlands with scrub shrub vegetation.	4	150
NWI	Palustrine unconsolidated bottom (PUB)	Nontidal wetlands with at least 25% cover of particles smaller than stones and vegetation cover less than 30%.	3	150
NWI	Palustrine unconsolidated shore (PUS)	Nontidal wetlands including landforms such as beaches, bars, and flats.	3	0

NWI	Riverine lower perennial (R2)	Riverine system characterized by low gradient and slow water velocity. Substrate mainly sand and mud. Well developed floodplain.	3	150
NWI	Riverine upper perennial (R3)	Riverine system characterized by high gradient and fast water velocity. Very little floodplain development.	5	150
NWI	Riverine intermittent (R4)	Intermittent riverine system including channels that contain flowing water only part of the year but may contain isolated pools when the flow stops.	2	0
NWI	Uplands (U)	Uplands.	0	0
Transportation	Primary route (1700202)	Interstate or U.S. highway.	5	0
Transportation	Secondary route (1700205)	State or county highway.	4	0
Transportation	Road class 3 (1700209)	Class 3 road or street.	2	0

Table 2. Classification (USFWS, 1999b and USGS, 1990a) and relative cost assignments, continued.

Theme	Attribute (code)	Description	Cost[a]	Buffer[a] (m)
Transportation	Road class 4 (1700210)	Class 4 road or street.	2	0
Transportation	Cloverleaf or interchange (1700402)	Cloverleaf or interchange.	5	0
Transportation	Nonstandard road (1700405)	Nonstandard section of road.	1	0
Transportation	Cul-de-sac (1700005)	Cul-de-sac.	5	0
Railroad	Railroad (1800201)	Railroad.	3	0
Railroad	Railroad siding (1800208)	Railroad side track.	3	0
Urban	Incorporated city, town (0900101)	Urban.	5	0
Slope	Class 1	Slope 0-10%.	0	0
Slope	Class 2	Slope 10-20%.	2	0
Slope	Class 3	Slope 20-30%.	4	0

[a]All costs and buffers are relative and values are for illustrative purposes only.

[b]For simplicity, all buffers used were 150 meters.

As mentioned above, the buffers and costs assigned to each feature were subjectively assigned. The following examples illustrate the rationale used to assign a cost and buffer to several of the features used in the analysis. Lake and nontidal wetlands with aquatic bed and emergent features (NWI codes L1/L2, PAB, PEM) were assigned the highest relative cost (5) and buffer (150 meters) because of their high ecological function and importance as habitat as well as their recreational value (fishing, boating, scenery, etc.). In addition, a spill in this environment would be costly because all the lakes in the study area are relatively small and therefore would have little dilution. Similarly, wetlands with

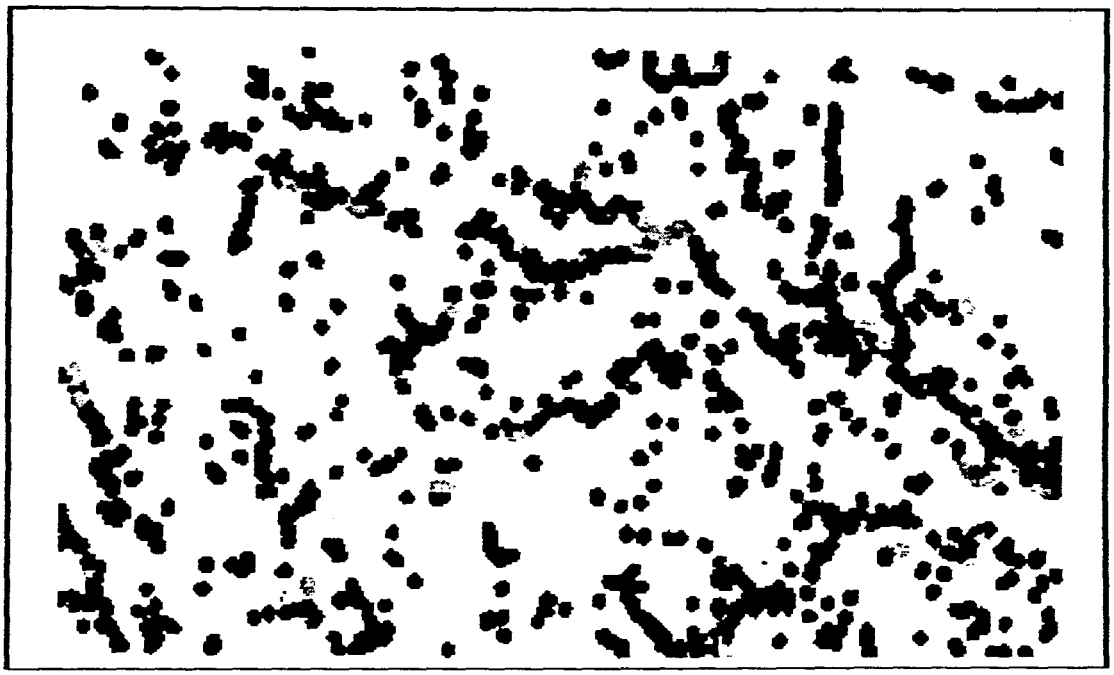
emergent/aquatic vegetation were assigned the highest cost and buffers because of their high ecological value as habitat for waterfowl and amphibians, their ability to cleanse water, and as habitat for aquatic and nonaquatic species reproduction. These environments also provide recreation activity in the form of hunting. In contrast, forested wetlands (PFO) were assigned a lower cost. While still a wetland, this type of environment was perceived as less ecologically important than the emergent wetland (less vegetation) and offered less recreation value. The highest cost and buffer was also assigned to fast-flowing river environments (R3). While these features provide less ecological function than the lake or wetland environments, their ability to transport large quantities of released petroleum and therefore their potential to damage many miles of stream habitat require assignment of the highest degree of protection. A similar rationale was used in assigning costs to the other environmental features. Finally, the costs assigned for transportation and railroad features were based solely on a relative estimate of construction costs. Therefore, the larger the road, the higher the cost.

Determination of Least-Cost Path

Relative cost and buffer values assigned to the attribute tables of the vector coverages were then converted into raster format, with each buffer assigned the appropriate cost value. For the NWI coverages, this was achieved using the "eucallocation" function in grid, which was run separately for the line and polygon features. Rasterization of the transportation and railroad layers was achieved by simply assigning the "cost" value to the output grid during the conversion process. A cell size of 5 meters was used for all raster themes so that linear features would not be over-represented (including the slope grid that was resampled).

The cost grids for each theme were then combined into a single layer, with each output cell location receiving the summation of all other grid cells for that location. For example, for a given cell location, if the transportation layer with a cost value of 5 (interstate highway) intersected a slope with a cost value of 4 (20-30%), the resultant output cell value would be 9. Individual and summary cost grids are shown in Figures 2a-e.

Figure 3a. Polygonal NWI features, gridded by relative cost value.



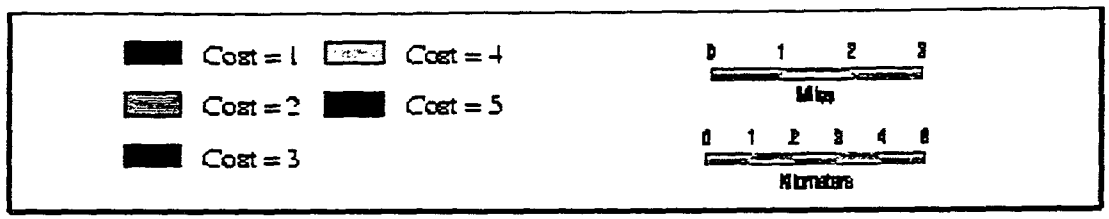


Figure 3b. Linear NWI features, gridded by relative cost value.

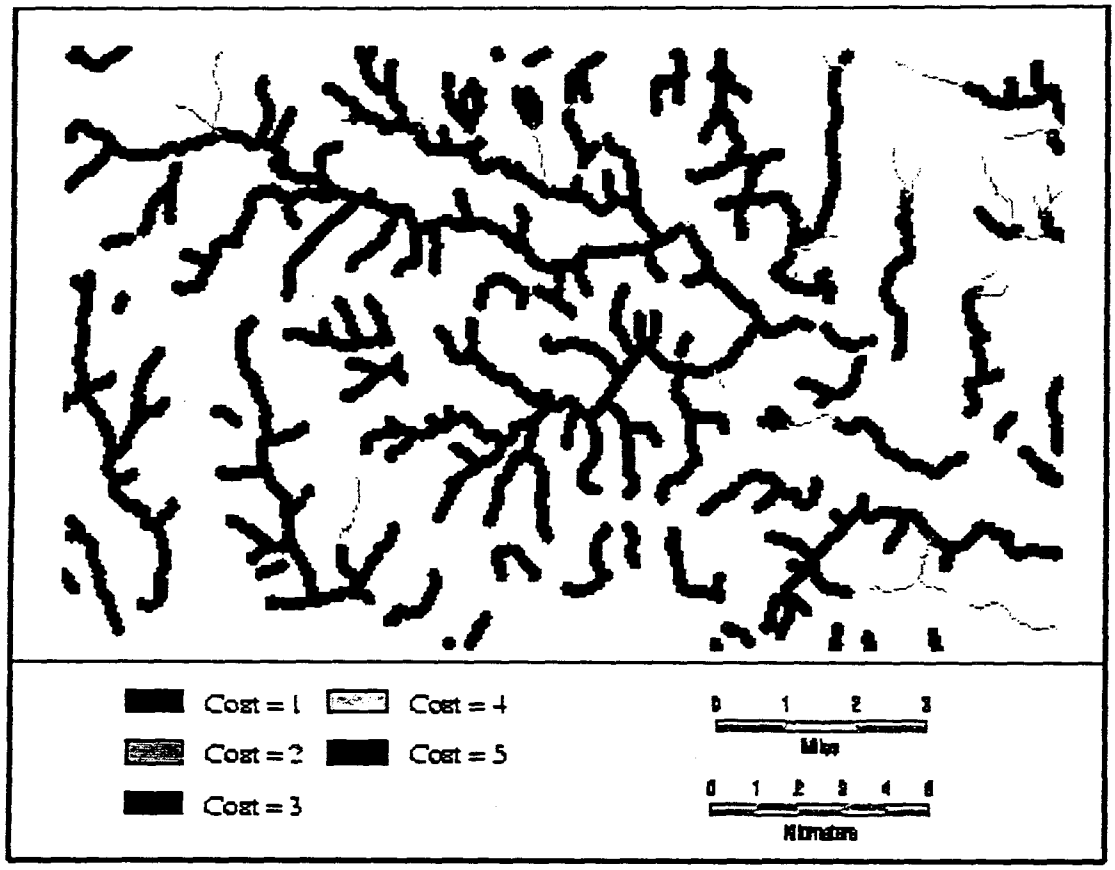
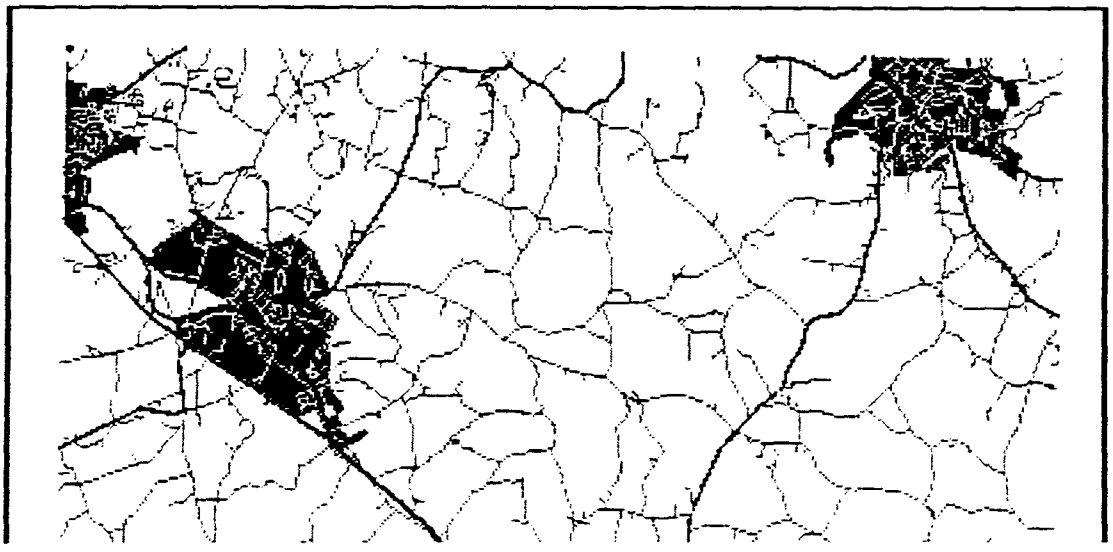


Figure 3c. Transportation routes, railroads, and urban areas gridded by relative cost value.



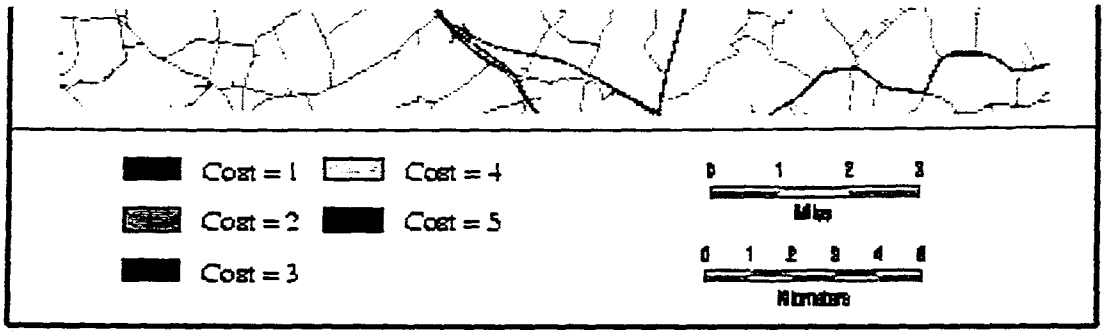


Figure 3d. Slope classes, gridded by relative cost value.

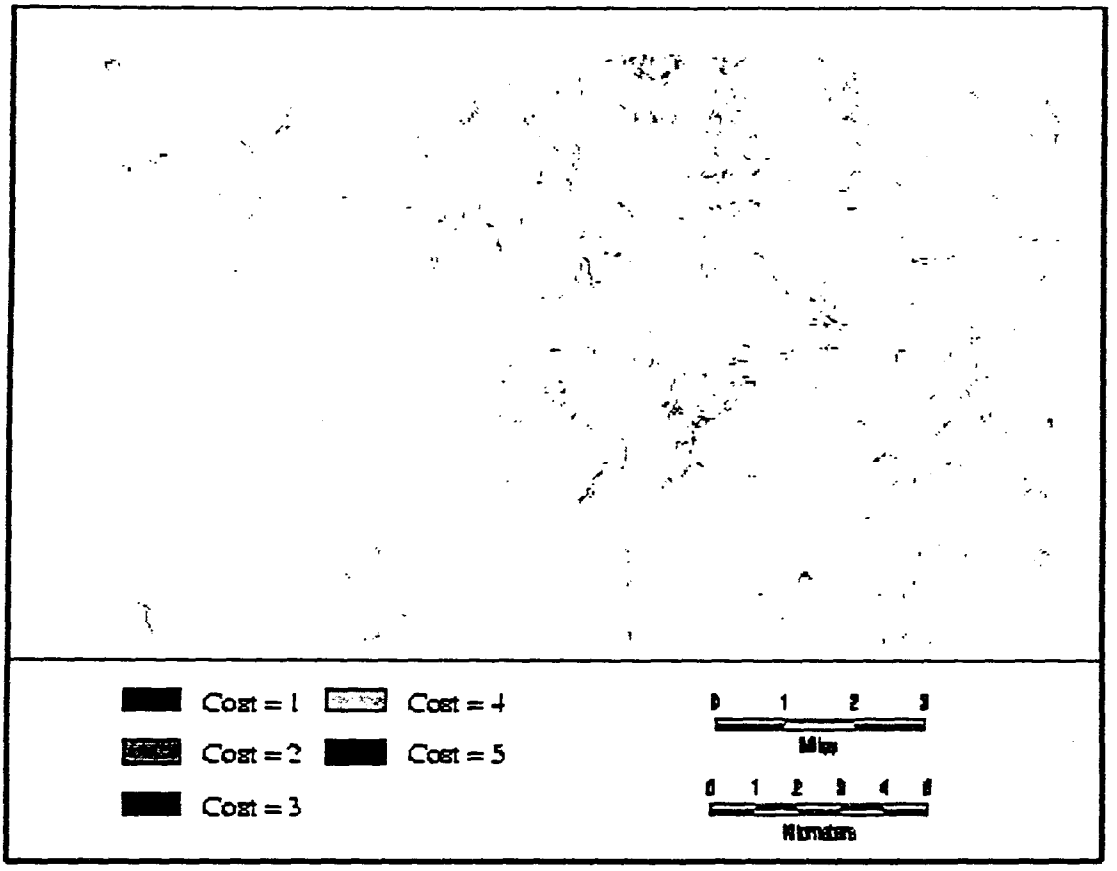
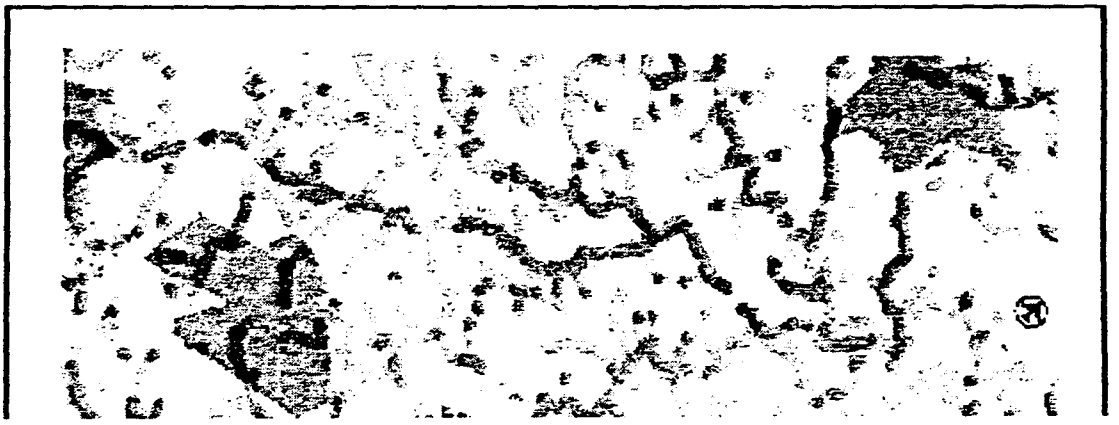
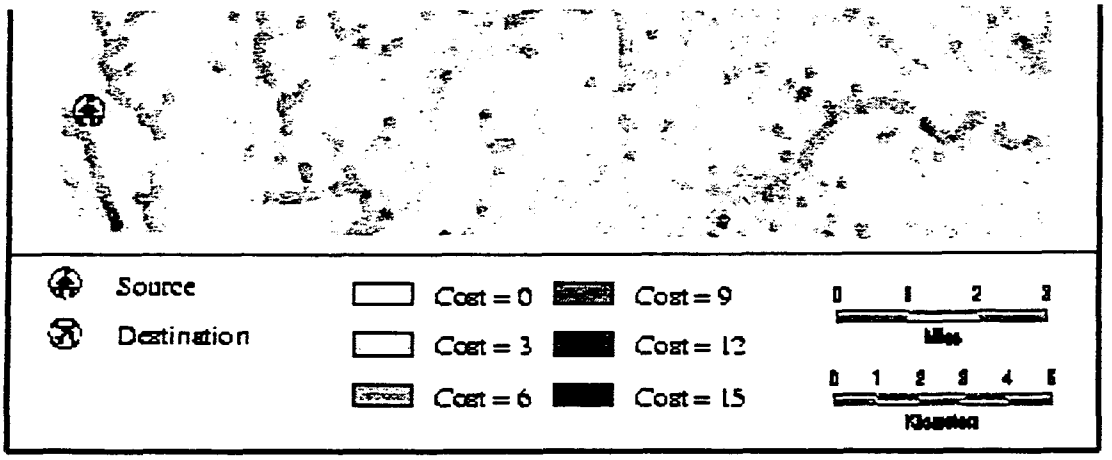


Figure 3e. Final relative cost grid, containing the summation of individual cost themes.





Additional grids were created to provide the source and destination locations for the pipeline route. As mentioned above, these locations were chosen at the endpoints along an existing utility corridor so that the two routes could be compared. The source grid and the summation grid of costs were used as inputs into the GRID function "costdistance." The output of this function is a cost accumulation grid in which each cell value is the accumulated cost to the closest source cell. This output was then used as input into the "costpath" function to derive a least-cost path grid. The syntax used for these functions is shown as:

Grid: pipeaccum = costdistance(pipesrcg, pipecost, pipeback, pipealloc, #, pipesrcg)

where "pipecost" is the summed cost grid, and "pipesrcg" is the source grid.

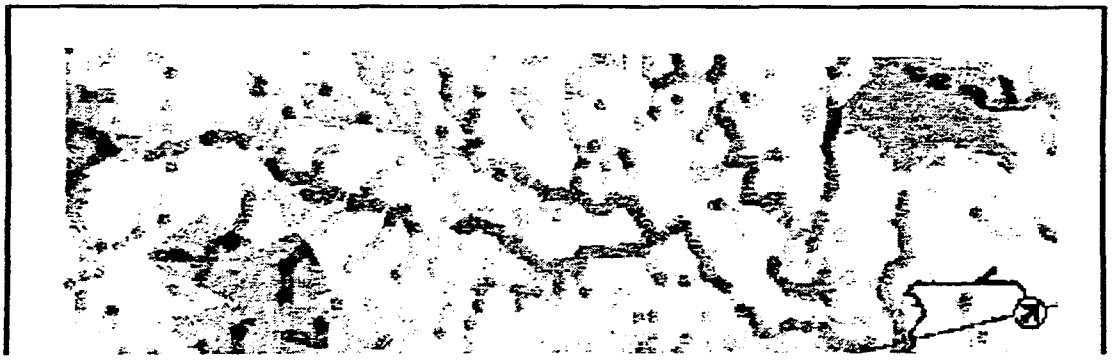
Grid: pipepath = costpath(pipefromg,pipeaccum,pipeback,bylayer)

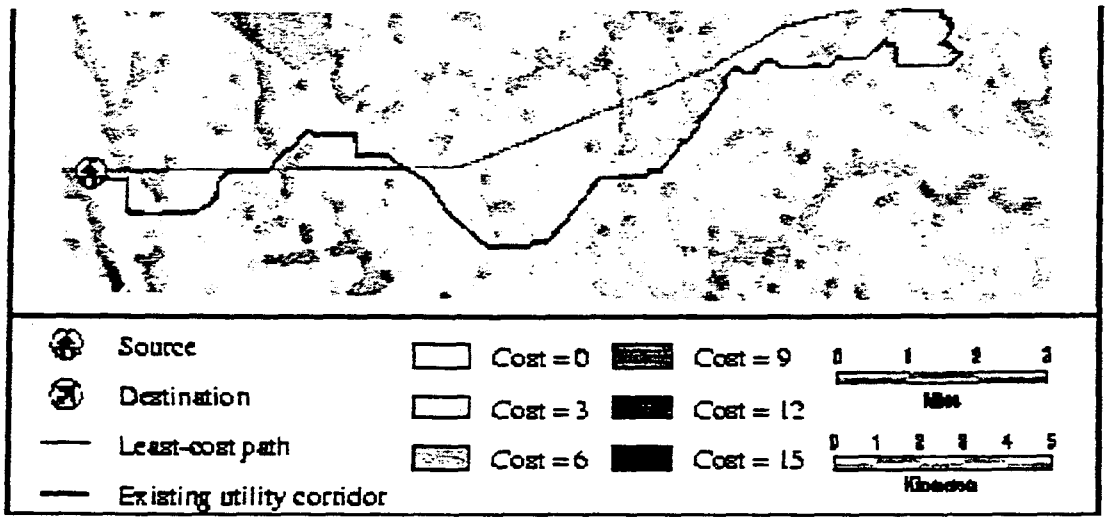
where "pipefromg" is the destination grid, "pipeaccum" is the output from the costdistance function, "pipeback" is a grid that can be used to reconstruct a route to the source, and "bylayer" is an option that specifies the single least-cost path as output.

Results

The final least-cost route overlaid on the total cost grid is shown in Figure 4. The black line represents the path that would provide the best protection against environmental impact during construction or from an accidental release given the weighting parameters used, and the green line represents an existing utility corridor that might be used to site a pipeline using traditional methods.

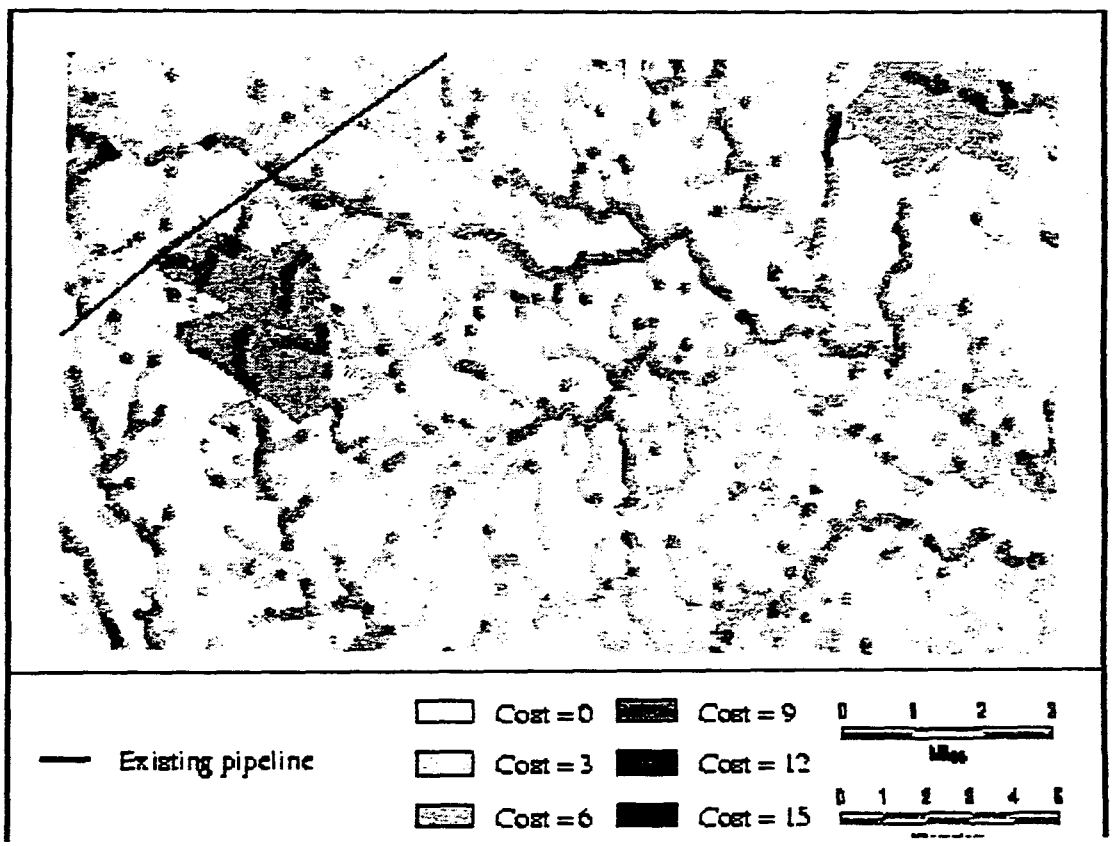
Figure 4. Utility corridor route and relative least-cost route overlaid on total relative cost grid.





Since the path shown represents only environmental parameters, it does not necessarily show the optimal site location given engineering, land easement, and other costs (e.g., efficiency of transport) that would be used in the normal siting process. However, while use of the entire path shown is probably not desirable, the use of individual portions would provide some ecological benefit. In addition, by overlaying existing pipelines on the total cost layer (Figure 5), areas where the pipeline crosses ecologically sensitive areas can be identified as potential locations where additional monitoring or mitigation measures might be beneficial.

Figure 5. Existing pipeline overlaid on the total cost grid.



Further Refinement

In comparing the two routes, an obvious refinement to the model would be to incorporate a parameter that takes into account the total length of the pipeline. Such a modification would probably create a more realistic path. In addition, a much more extensive cost structure based on scientific and engineering parameters that better approach reality would need to be developed. Ultimately, by incorporating both the environmental and traditional sets of criteria into a costing structure similar to the one above, an optimal route could be achieved. Finally, it should be mentioned that in the traditional siting process where GIS is used, many of the data sets used in this case study have already been acquired. The addition of a few more layers related specifically to the environment would therefore require minimal additional effort, and the potential savings could be enormous.

Appendix A. Sources and locations of data sets.

Data	Source	Internet Location
Census data (TIGER)	U.S. Census Bureau	http://www.census.gov/geo/www/tiger/ or http://www.census.gov/geo/www/cob/
Endangered species data	U.S. Fish and Wildlife Service Division of Endangered Species	http://www.fws.gov/r9endspp/endspp.html
Flood information (Q3 data)	Federal Emergency Management Agency (FEMA)	http://www.fema.gov/msc/ordrinfo.htm
Hydrology, transportation, land use/land cover, public ownership, digital elevation model (DEM)	U.S. Geological Survey (USGS)	http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html
Land use/land cover	U.S. Environmental Protection Agency (EPA)	ftp://ftp.epa.gov/pub/spdata/EPAGIRAS/
National Wetlands Inventory (NWI)	U.S. Fish and Wildlife Service	http://www.nwi.fws.gov
Orthorectified aerial photography	Digital Orthophoto Quad (DOQ)	http://edcwww.cr.usgs.gov/webglis
Satellite imagery	Landsat satellite data	http://geo.arc.nasa.gov/sge/landsat/landsat.html or http://edcwww.cr.usgs.gov/webglis
Satellite imagery	SPOT Image	http://www.spot.com/spot/spot-us.htm
Scanned topographic maps	Digital Raster Graphics (DRG)	http://mcmcweb.er.usgs.gov/drg/avail.html#online
Soils data	USDA-NRCS	http://www.ftw.nrcs.usda.gov/soils_data.html
Stream flow data (stream gaging data)	U.S. Geological Survey (USGS)	http://water.usgs.gov

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USFWS. 1999a. National Wetlands Inventory Inventory 1:24,000 digital data. [ftp://www.nwi.fws.gov/arcdata.]

USFWS. 1999b. National Wetlands Inventory, Wetcodes.exe. [ftp://www.nwi.fws.gov/maps]

USGS. 1990a. Digital Line Graphs From 1:24,000-Scale Maps, Data Users Guide 1, Appendix D, DLG attribute codes.

USGS. 1990b. Land Use And Land Cover Digital Data From 1:250,000- and 1:100,000-Scale Maps, Data Users Guide 4, U.S. Geological Survey Land Use and Land Cover Classification System for Use with Remote Sensor Data.

USGS. 1999a. 1:24,000 Digital Elevation Model data. [http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html]

USGS. 1999b. 1:24,000 Digital Line Graph data. [http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html]

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Fig. 1. Pipe line corridor at Novorossiysk shown on Band 1 of Landsat TM and SPOT merged image with Black Sea in lower left.

GIS, remote sensing analysis used to select potential route

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Using remotely sensed data and geographic information systems (GIS), a prototype least-cost analysis was performed for routing a small section of a proposed pipe line to transport Caspian Sea area crude oil to a terminal on the Black Sea.

A model was developed incorporating pipe line length, topography, geology, land use, and stream, wetland, road, and railroad crossings to identify a least-cost pathway.

Satellite remote sensing imagery was used as a base to display results and to define the land cover, and GIS analysis was used for spatial modeling and data overlay. Cost associated with terrain conditions, geology, and land use were calculated from actual costs on a recent Bechtel Corporation pipe line project.

From 1992 through 1994, Bechtel worked with the Caspian Pipeline Consortium to design and build a pipe line that would carry oil from the Tengiz Oil Field in Kazakhstan on the Caspian Sea to Novorossiysk in Russia on the Black Sea.

The consortium was composed of the Sultanate of Oman, the Republic of Kazakhstan, and the Russian Federation. The proposed pipe line would be one of the first projects in the Commonwealth of Independent States to be planned, financed, managed and constructed primarily by Western firms and technology.

The Tengiz Field in the North Caspian Basin is one of the 10 largest oil fields in the world and is the deepest of the super giant fields. Chevron Overseas Petroleum has reported on it's efforts to develop the Tengiz Field. The North Caspian Basin also has high potential for new oil and gas discoveries. Three super giant fields have been discovered in the basin in the last 15 years.

As proposed, the line would be 700 km long and would link with an existing 700 km line. Using two pipe line segments, the proposed system in its fully developed form would be capable of transporting 1.5 MM bpd of oil. In one scenario, the oil would be transported from the Tengiz region to the new terminal facilities on the Black Sea and then to world markets. At the present time, alternative routes also are being considered, as well as phased approaches, which would allow the project to be completed in stages.

The general route of the proposed line was chosen after an evaluation of eight different options by the consortium. The selected route was determined to be the most politically and economically attractive at the time and one that could be completed on a short construction schedule. A pilot project was developed using remotely sensed data and GIS technology, which could assist the routing process (Fig. 1).

Pipe line routing criteria

The factors influencing pipe line route selection are technical and engineering requirements, environmental considerations, and population density.

To the extent possible, pipe lines are routed in straight lines to minimize construction costs. However, other than the application of many years of experience, accurate methods to balance engineering and construction costs against environmental costs and present or future liability have been lacking.

Engineering and technical considerations used in this analysis of the Caspian pipe line routing include length, topography, surface geology,

river and wetland crossings, road and railroad crossings, and the proximity of large population centers. High relief terrain would result in higher construction costs and increase the need for pump stations. Consolidated rock units at the surface or in the shallow subsurface would require blasting compared with unconsolidated finer grained materials, which would not. River, wetland, road, and railroad crossings also increase the expense of laying pipe.

Cost factors used in the least-cost path analysis were calculated from actual pipe line costs on a recent Bechtel project and normalized to a baseline cost. Using dollar values on an in-house pipe line project, percentages over the baseline cost were calculated for construction in rock, for clearing brush and trees, for crossing rivers, railroads, and wetlands, and passing through agriculture land.

Estimates were made of the slope ranges associated with seven terrain categories that are commonly used by pipeline estimators; flat, slightly rolling, washboard, sharp, choppy, rough, and mountainous. Additional costs were calculated for the six slope ranges deviating from flat. Pump station cost, however, has not been considered in this analysis. Because it generally is not desirable to route pipe lines through urban and industrial areas, these areas were assigned high costs above the baseline value.

Data acquisition, analysis

Maps, aerial photographs. Maps, aerial photographs, and field work are required for routing decisions, design and engineering. Aerial photographs of the Caspian line route were not available.

Acquisition of remotely sensed data in combination with GIS analysis can be viewed as a possible solution to the restrictions on maps and the lack of aerial photography.

Satellite imagery. Landsat TM (resampled to 25 m) and SPOT Panchromatic (10-m spatial resolution) imagery of the Novorossiysk area were used in combination with the available 1:500,000-scale topographic map and the 1:500,000-scale geologic map. The area of interest for this analysis was defined as an inverted "L"-shaped corridor (Fig. 1) that previously had been chosen by the Consortium. The least-cost pathway analysis, using remotely sensed data and GIS analysis, was intended to confirm the best route within this corridor.

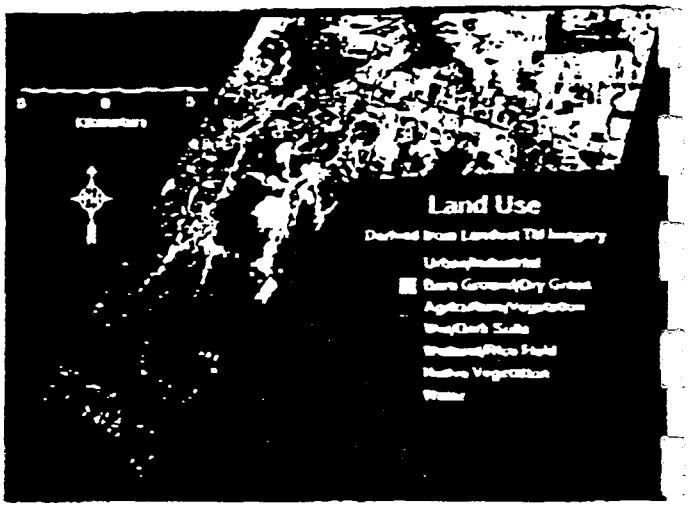

Fig. 2. Pipe line corridor land use map is derived from Landsat Thematic Mapper data, Bands 3, 4 and 5.

A color composite was made of Landsat TM Bands 3, 5, and 4 as blue, green, and red. The bands selected for the color composite showed the features of interest and were used to subdivide land use categories. The land use map produced is shown in Fig. 2.

The land use map was checked for accuracy against field photographs and with pipe line field personnel. Within the limits of our knowledge, the match was found to be quite good.

The Landsat image was coregistered to the SPOT image. An intensity-hue-saturation (IHS) transformation was performed to combine images and take advantage of the spectral characteristics of the Landsat TM imagery and the higher spatial resolution of the SPOT imagery.

Topographic, geologic data input. Topographic, geologic, and infrastructure data for this section of the Caspian pipe line area were developed as input to the GIS database. Locations of roads and drainage features were digitized from the topographic maps. Some minor roads and streams on the maps were not visible on the imagery. Contours within the "L"-shaped corridor were digitized to produced a digital elevation model. Lighter tones represent low elevations and darker tones represent higher elevations. Elevations range from sea level in the Black Sea, in the extreme south, to over 600 m in the Caucasus section of the "L"-shaped corridor. The slope map, derived from the elevation data, that was used as input to the least-cost pathway analysis is shown in Fig. 3. Lighter tones indicate gentler slopes. Most of the steeper slopes are found within about 11 km of the Black Sea. The northern two-thirds of the corridor consists primarily of slopes between zero and five degrees.

The boundaries between geologic units were extracted in digital form from the 1:500,000-scale geologic map and incorporated into the GIS database. These geologic units were divided into "consolidated or hard rock" and "unconsolidated" categories, here termed "rock" and "nonrock" based on descriptions in the Russian geological map legends. Faults were not considered in the analysis because the map data were incomplete.

Least-cost analysis

Project personnel defined four points through which the Caspian pipe line was constrained to pass in the area chosen for analysis. The objective of the least-cost pathway analysis was to compare the cost of a straight-line route to a least-cost pathway between the four points.

The analysis was accomplished by entering remote sensing imagery and map data into a GIS. The remote sensing data were used to derive land use information and as a base to overlay GIS results. GIS analysis was used for spatial modeling and data overlay. GIS provided the framework for developing and overlaying all input layers and carrying out spatial analysis. ERDAS Imaging and ELAS software were used for remote sensing analysis, and ARC/INFO and GRASS

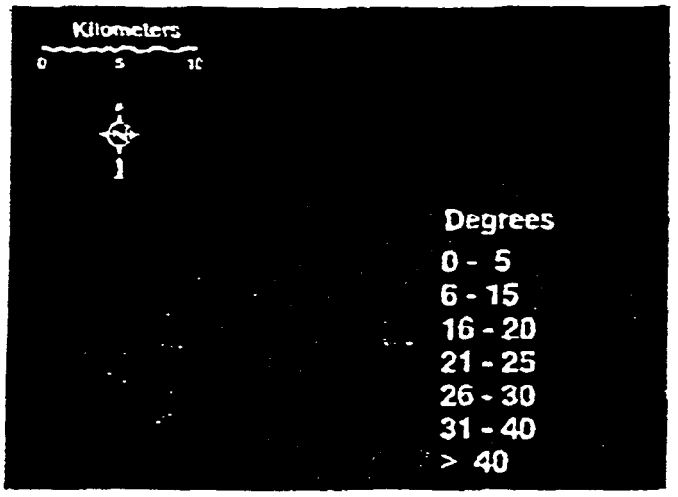

Fig. 3. Topographic data are used to determine slope map of the corridor.

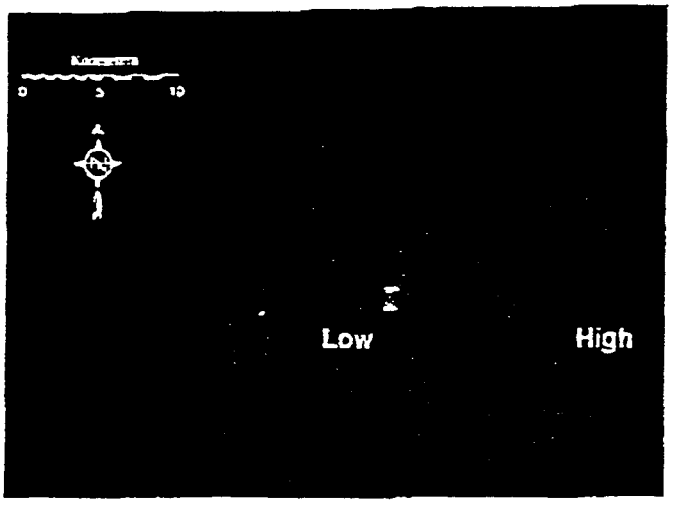

Fig. 4. For corridor cost surface the purple colors show areas of higher cost.

software were used for digitizing and GIS analysis, respectively.

The topographic, geologic, land use, and infrastructure data were used to develop a least-cost pathway for pipe line placement. The least-cost analysis was performed by assigning cost factors associated with the crossing of slopes, streams, wetlands, roads, railroads, rock, agricultural land, and urban and industrial area; developing a cumulative cost surface; and then calculating a path of least resistance across that surface. Slope data were derived from the digitized contour map. Stream, road, and railroad crossing locations were digitized from the topographic map.

The areas where rock was likely to be encountered were defined from the geologic map. A land use classification map, produced from the satellite imagery, was used to identify agricultural land and urban and industrialized areas. Pipe line construction costs associated with terrain conditions, geology, and land use were calculated from actual pipe line construction costs on previous Bechtel pipe line construction projects. High values were assigned to urban and industrial areas and to areas outside the defined corridor.

The cost surface is shown in Fig. 4. The darkest tones show the areas with highest costs and the lightest tones indicate areas with lowest costs. The highest costs in the corridor were in urban and industrial areas and in large bodies of water. Moderate costs were in sparsely populated areas with high slopes. The lowest costs were in areas with bare ground, dry grass, less dense native vegetation, and agriculture.

In the present model, three surfaces were generated between three sets of points (A-B, B-C, and C-D, Fig. 5). Once the least-cost pathway analyses were completed for the three pairs of points, a single path joining all the segments between points A and D was assembled. This layer was used as a mask through which to accumulate summary statistics for the original weighted surface (cost surface). The same masking technique was used for the straight-line path between the three segments.

The three segments of the cumulative cost surface and the least-cost pathway are shown in Fig. 5. Cumulative costs were calculated from B to A, C to B, and D to C. The starting points for each segment (D, C, and B) show the lowest cumulative cost and the end points (C, B, and A) show the highest cumulative costs along the least cost route. A halo effect around the corridor borders has resulted from assigning high values to picture elements outside the corridor.

Conclusions

The results of the least-cost corridor analyses are shown in Fig. 6. The straight-line path is the shortest distance between points A, B, C, and D. The least cost pathway analysis has resulted in the route labeled "Model" in Fig. 6. Incremental costs resulting from terrain, geology, and land use were accumulated for these routes along the cost surface. The straight-line path was 42-km long, and the least-cost pathway was 51-km long. Although the least-cost pathway was longer, the analysis indicated that it would be 14% less costly to construct than the straight-line path. These results indicate that the shortest route is not always the most cost-effective.

Most of the cost difference between the straight-line route and the least-cost analysis can be attributed to the greater cost associated with the larger number of urban and industrial cells along the straight-line route. The high cost assigned to urban and industrial cells also can be contributed to the cost difference.

This is a prototype analysis and uses cost data from other pipe line projects. To be most effective, the least-cost pathway analysis must be fine tuned on this project and on a project-by-project basis to account for actual project costs in the geographic area under consideration. However, having built a database that includes topography, geology, and land use from satellite imagery and available maps for an area of interest, additional data can be incorporated to refine the model.

Results from this project have demonstrated the advantages of integrating remotely sensed data sets at varying spatial resolutions in combination with GIS analysis in delineating a least-cost pipe line route. These tools are especially useful in areas where only limited maps or aerial photographs are available, or where there are restrictions on the use of maps and aerial photography.

The Caspian pipe line least-cost pathway analysis has shown that the use of satellite-based remotely sensed data and GIS analytical techniques can facilitate the process of pipe line

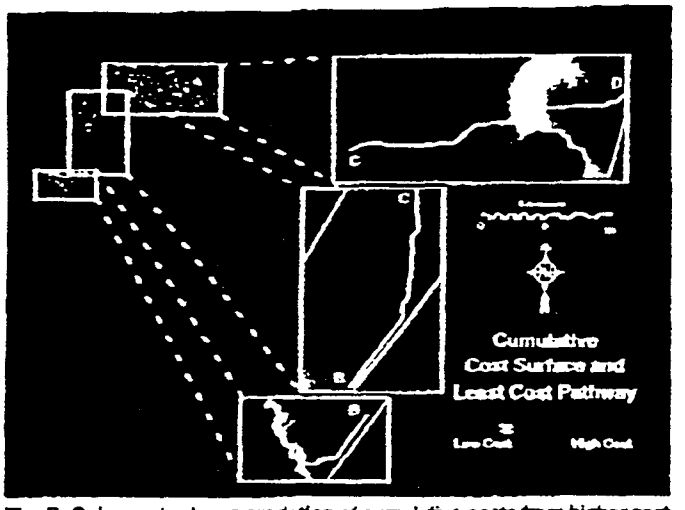

Fig. 5. Color scale shows gradation of cumulative costs from higher cost with the least-cost pathway calculated between D and C and B and A.

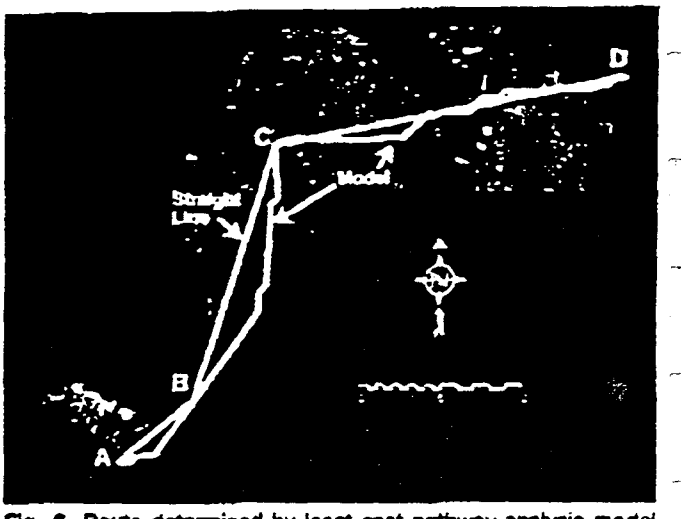

Fig. 6. Route determined by least-cost pathway analysis model compared to straight-line route.

routing, engineering, and cost estimating. However, these techniques must be used in conjunction with the many years of field experience of pipe line industry personnel and refined on a case by case basis to obtain the maximum benefits.

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APPLICATION OF GIS IN SITING OF LINEAR FACILITIES

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Abstract. Geographic information systems (GIS) are powerful tools in the analysis and selection of environmentally acceptable corridors for linear facilities, such as roads and utility lines. GIS can serve several functions in corridor siting, including managing and manipulating extensive environmental databases, weighting and compositing data layers to enable spatial analysis for a "path of least resistance," summarizing statistics for comparison of alternative corridors, preparing color graphics for presentations and reports, and providing a record of alternative analysis for permitting reviews and legal challenges. In this paper, we examine the benefits and limitations of using GIS to site linear facilities, based mainly on our experience in siting a 600-mile natural gas pipeline in Florida.

We implemented a phased analytical approach to define acceptable corridors several miles in width and then selected viable routes within the corridors using a magnified scale. This approach resulted in a dynamic siting process which required numerous iterations of analysis. Consequently, our experience has instilled the benefits derived by expending preliminary effort to create macros of the GIS analytical process so that subsequent effort is minimized during numerous iterations of corridor and route refinement.

One of the major limitations of GIS applications in corridor siting is the lack of available digitized databases in appropriate formats and scales. Because of the unavailability of some key environmental information in digital format, we had to integrate traditional manual techniques with automated mapping from GIS to complete the siting process. Other considerations in developing a reliable GIS include the potentially major effort needed to screen databases for erroneous data, the technical difficulties in meshing incongruent data from different sources, and development of a justifiable weighting scheme to composite environmental criteria.

INTRODUCTION

Permitting, design, and construction of linear facilities such as roads and utility lines require a comprehensive environmental planning and design phase that embodies what is known as the siting process. Siting of linear facilities is typically an iterative process: (1) identifying all possible alternative corridors that satisfy the project purpose and operational re-quirements; (2) narrowing the possible alternatives to environ-mentally viable routes; and (3) selecting a preferred route that will generally result in minimization of environmental impacts relative to other viable siting opportunities and provide for an optimal balance of environmental, engineering, and economic factors. Geographic Information System (GIS) technology is well suited for use in this siting process. GIS can facilitate compositing a number of layers of environmental data, speed data analysis, ensure consistent data management, enable statistical comparisons of alternatives, and display data layers at variable levels of resolution. This paper illustrates our experience in using GIS to assist in siting of a proposed pipeline.

Beginning in March 1992, our company undertook a corridor siting project on behalf of ANR Pipeline Company to identify an environmentally suitable corridor for a 600-mile natural gas pipeline proposed to transport natural gas from northwestern Florida to customers in central Florida. The proposed pipeline facilities include a 30-inch-diameter mainline and several smaller diameter lateral pipelines, as well as five compressor stations.

A GIS methodology was selected as the primary tool to integrate and manage the significant amount of data needed to site the proposed pipeline. We used GIS to achieve four primary goals: (1) to identify candidate corridors which met operational as well as environmental criteria; (2) to statistically compare environ-mental impacts of candidate corridors to aid in selection of the preferred corridor;

(3) to provide documentation of the process and results of alternative analysis; and (4) to generate graphic representations of the corridors.

We applied three principal criteria in the siting process: (1) co-locate the proposed pipeline with existing linear facilities (i.e., transportation and utility corridors), wherever practicable, to minimize fragmentation of habitat and concentrate energy transmission facilities in common areas; (2) avoid or minimize crossings of environmentally sensitive areas or features, such as wetlands or known archaeological sites; and (3) avoid or minimize crossings of areas potentially hazardous to pipeline construction and operation, such as karst (sinkholes) or erosion-prone areas. The environmental features for which we acquired data and used as siting criteria included:

Existing transportation and utility corridors,
Protected natural areas (public lands),
Lands proposed for public acquisition,
Water bodies of environmental significance,
Urban areas,
Major mining areas,
Wetlands,
Wellfield protection areas,
Protected species/critical habitat,
Archaeological sites,
Erosion-prone areas,
Karst areas (sinkholes),
Groundwater wells,
Hazardous waste sites,
Major planned or existing developments,
Active landfills, and
Leaking underground storage tanks.

Our original objective was to selectively weight these environmental criteria based on their relative importance or susceptibility to impacts from construction and operation of the pipeline. This evaluation would essentially quantify the environmental "sensitivity" of each criterion, as judged from regulatory or resource management programs and public sentiment. This subjective determination of environmental sensitivities is intrinsic in siting of facilities, regardless of whether a traditional or GIS methodology is used. However, because of time constraints and the large scale of the project, the development of a comprehensive weighting model was not considered feasible in this case.

Although GIS technology is a valuable tool for a project of this nature and magnitude, we found that in this case its use was constrained by the availability, uniformity, and quality of data. The lack of digitized data may be overcome by digitizing mapped information; however, this practice can be very time-consuming for expansive data bases. Because most energy transmission projects, such as pipelines, have expeditious schedules to meet market conditions, extensive digitizing is not a viable option. Consequently, for this project, we had to integrate traditional manual (mapping) techniques with automated mapping of GIS to compensate for missing or incomplete digitized data coverages.

In the following sections, we explain the limitations we encountered in using GIS to site the proposed pipeline and the methods that we devised to overcome these constraints.

DEVELOPING THE GIS DATA BASE

In order to meet project goals in the allotted time frame, it was recognized that a GIS was needed to store, process, display, and analyze the large amounts of spatial data required for this project. A DEC 5000 workstation with 5 gigabytes of disk space running ARC/INFO 6.01 was used to support the siting application. In addition, PC ARC/INFO was used to perform tasks on specific data layers at the onset of the project. Once the data layers were processed, ARC export files were created on the PC and transferred to the workstation.

The first task was to define critical data requirements and to identify data sources. We spent several weeks identifying data sources and data formats, with special attention given to the quality and age of the data. The time constraints of the project and the large areal extent of the study precluded the development and collection of source data; therefore, a concerted effort was made to identify and acquire the best available data where possible and supplement these data as needed. Source data used in the project are presented in Table 1.

Because the information received from various federal, state, and local agencies was provided in a diverse array of data bases and formats with varying levels of quality, it was difficult to incorporate the data directly into the GIS data base, necessitating a routine of quality checks and reformatting.

Data in formats other than ARC/INFO were transformed into ARC/INFO coverages. Point data (e.g., underground storage tanks [USTs], wells, archaeological sites) coverages were subjected to a two-level locational check for quality assurance (QA). These checks were performed using locational attributes typically assigned to the data, such as county or section, township, and range (STR). The first check was accomplished by overlaying a county coverage with each point data layer. Points that matched their recorded county attribute with the county coverage were retained. Points that did not match were reselected into a separate coverage. This new coverage was visually checked. Points which fell near the county boundary (within the resolution of the county coverage) were retained; all other erroneous points were removed from this data layer. The checked points from the non-matching data set were appended to the matched data layer. Point data sets that had STR attributes were overlaid with the Public Land Survey coverage and were processed in a similar manner.

To create a GIS base map for the corridor siting study, we used the United States Geological Survey's (USGS's) Topologically Integrated Geographic Encoding and Referencing (TIGER) system files. TIGER file features of interest (i.e., major roads, rivers, pipelines, powerlines, and railroads) were visually checked with USGS 1:100,000-scale maps. The TIGER files were found to contain errors, mainly omissions of segments of linear features. There were also problems with importing selected linear features that were caused by the files' assignment of multiple, inconsistent labels for a single feature. However, overall, this data base was excellent in creating a road and hydrological base map for the corridor siting study at the 1:100,000 scale.

Some of the information which was collected was checked and found to be unusable as provided. Data on public potable water wells which serve more than 25 people were available from the Florida Department of Environmental Regulation (FDER) in ASCII free field format. The information included the latitude and longitude, name, address, and number of people served by the well. However, a routine QA check of the information revealed that the latitude and longitude coordinates provided were not for the well, but for the address of the well's operator; therefore, we were required to contact each operator in the counties of interest to identify the actual well locations relative to the

study corridors. FDER (Bureau of Hazardous Waste) also provided us with a complete data base on known UST sites found in the state of Florida. We searched the data base for USTs that were known to be leaking (a concern to pipeline construction) and incorporated those records that passed the locational accuracy QA check into our data base.

The United States Environmental Protection Agency Region IV provided us with an electronic data base of listed hazardous waste sites found in the state of Florida. This information was limited to the latitude and longitude of each site; these site locations were subjected to a QA check to confirm positional accuracy. The Florida Division of Historical Resources (Bureau of Archaeological Research) provided diskettes containing known National Register of Historic Places-eligible sites in the state of Florida, as well as known prehistoric and historic sites found in the state of Florida. Of the 60,000 sites in the data base, latitude/longitude coordinates were provided for only 7,000 sites. The remainder of the sites had only STR descriptors; however, the square mile resolution of the sections was too large for our application. The locational QA check of the data found that over 15% of the data was positionally questionable. The Bureau of Archaeological Research indicated that most of the positional information was copied directly from the text of individual research reports and that the reports are most likely in error; the bureau did not verify site locations provided in the reports.

The Florida Sinkhole Research Institute, a non-profit research organization, provided us with an extensive data base containing known sinkhole locations and a full page of data attributes concerning each sinkhole. The information incorporated into the GIS data base included the latitude and

Table 1

Sources and Formats of Data Bases Used in Creating GIS Coverages

Data Layer	Source	Format
Public Supply Wells	FDER	ASCII
Active Landfills	FDER	Paper
Underground Storage Tanks	FDER	ASCII
Archaeological Sites	SHPO	DBASE
Hazardous Waste Sites	EPA Region IV	ASCII
Sinkholes	FSRI	DBASE
Threatened and Endangered Species and Species of Concern	FNAI	ASCII
Public Lands	FNAI	DXF
National Forests	USFS	Paper
Phosphate Mining Areas	FIPR	DXF
Vegetation	FGFWFC	ERDAS
Land Use	WMDs	ARC/INFO
Permitted Water Wells	WMDs	ARC/INFO
Roads, Rivers and Linear Features	U.S. Census	TIGER
Population Density	U.S. Census	TIGER
Public Land Survey	FREAC	ASCII
Developments of Regional Impact	TBRPC	ARC/INFO

Key:

EPA = United States Environmental Protection Agency.
FDER = Florida Department of Environmental Regulation.
FGFWFC = Florida Game and Freshwater Fish Commission.
FIPR = Florida Institute of Phosphate Research.
FNAI = Florida Natural Areas Inventory.
FREAC = Florida Resources and Environmental Analysis Center (Florida State University).
FSRI = Florida Sinkhole Research Institute (University of Central Florida).
SHPO = State Historic Preservation Officer.
TBRPC = Tampa Bay Regional Planning Council.
USFS = United States Forest Service.
WMDs = Water Management Districts.

longitude, size, depth, and age of each sinkhole in the study area. A QA check of thisinformation found all but a few of the positions given to be accurate.

The Florida Game and Freshwater Fish Commission (FGFWFC) provided us with a vegetative cover data base (containing 22 vegetative classes) for the entire state of Florida, county by county, in an ERDAS.GIS raster format. This information was processed in ARC/INFO GRID, and county data bases were matched to provide a seamless data base. This information has 30-meter by 30-meter resolution from satellite imagery. However, for this project, it was necessary only to provide resolution down to 5-acre parcels. To accomplish this resolution, the data were filtered and resampled to identify blocks 5 acres or larger with the dominant vegetative class assigned to each block. This information was very useful and accurate, but in some areas of Florida, the data were outdated, as was evident when comparing the 1989 vegetative cover plots against more recent aerial photographs. However, for the corridor siting study and initial corridor comparisons, this data base provided much more detailed and current information than USGS topographic maps.

The Florida Natural Areas Inventory (FNAI), Florida's natural heritage program, provided us with detailed records on the location of threatened and endangered species and species of special concern within the proposed study areas. Positional records were cross-referenced to files with species names. The precision of recorded species locations was also provided by FNAI once several study corridors were identified, thus limiting the amount of data processing required of FNAI. FNAI's positional precision information was given in one of three levels: 300-foot radius, 0.75-mile radius, or general vicinity (somewhere within the USGS quad map). FNAI also provided us with AutoCAD files containing boundaries of most public lands found in the state of Florida (state and federal holdings at the 1:24,000 scale). We had to digitize the remaining public lands to augment this data base.

The state's water management districts (WMDs) traversed by the proposed project provided some of the most accurate and useful information for data base development. Land use/land cover data developed following the Florida Department of Transportation Florida Land Use/Cover Classification System was provided by each WMD in ARC/INFO format, except the Northwest Florida WMD, which has not developed a land use/land cover data base. The WMDs also provided digitized information concerning permitted water wells within their district as well as district-owned lands and those proposed for acquisition. All of this information was developed at the 1:24,000 scale.

Some of the regional planning councils within the project study area provided locational information on approved Developments of Regional Impact (DRIs). DRIs consist of major facilities and infrastructure projects (e.g., malls, housing developments, airports) planned or under construction. This information was helpful when siting occurred near municipalities; however, not all regional planning councils had this information digitized, and the information had to be transferred manually to 1:24,000-scale maps.

The Florida Institute of Phosphate Research, a non-profit research organization supported by the phosphate mining industry in south-central Florida, provided extensive coverage on previously mined areas, areas held for future mining, and areas currently being mined. The polygon coverage was useful in identifying landowners throughout the phosphate mining district, an area which had to be traversed to deliver natural gas to utilities planning to build facilities in reclaimed mining areas.

In acquiring data for the GIS data base, we found that some environmental information necessary for the siting application was available only in traditional hard copy formats. This information included

some archaeological sites, erosion-prone areas, water bodies of environmental significance (e.g., Outstanding Florida Waters, shellfishing waters, potable surface waters), wellfield protection areas, and some proposed land acquisitions.

The next section describes the methods we used to integrate this environmental information with the GIS data base in the siting process.

INTEGRATING GIS WITH TRADITIONAL SITING METHODS

Because of the lack of GIS coverages for some environmental criteria and the time needed to develop the GIS data base, we employed a four-step iterative siting process that integrated the use of GIS with traditional siting methods using hard copy maps: (1) identifying 3- to 5-mile-wide study corridors through the project area to connect the intended delivery points using a resolution of 1:100,000; (2) selecting primary and secondary wide study corridors (at the 1:100,000 scale) that best satisfied our environmental and operational criteria; (3) narrowing these wide study corridors down to potential 1/3-mile-wide corridors with variations and alternatives using a scale of 1:24,000; and (4) statistically evaluating each corridor against potential alternatives and variations to determine the final corridor alignment with the least environmental concerns.

First, while data were being acquired and incorporated into the GIS data base, numerous 3- to 5-mile-wide corridors were identified using traditional siting methods on 1:100,000-scale USGS maps. The boundaries of gross environmental constraints were delineated on the USGS maps, and potential corridors that avoided these areas and generally paralleled existing linear facilities were drawn in by hand. These large-scale environmental constraints included large wetland areas, urban areas (except where delivery points were located), concentrations of known threatened/endangered species and archaeological sites, and public lands (existing and proposed). The centerlines for these wide study corridors were then digitized and incorporated into the GIS data base for siting analysis.

To complete the second step of the siting process, GIS composite maps were used in conjunction with the hard copy 1:100,000-scale maps to select primary and secondary 3-mile-wide study corridors from the numerous study corridors identified during the first iteration. To create several overlays on the workstation monitor simultaneously, we used TIGER base map files containing linear features such as major roads, powerlines, and pipelines; FGFWFC vegetative cover screened to reveal only forested and scrub-shrub/emergent wetlands; sinkholes; leaking USTs; water wells; threatened/ endangered species; and public lands. This information was reviewed in an iterative manner using hard copy 1:100,000-scale maps which contained additional information including proposed state and WMD land acquisitions and other existing public lands which were not contained in the GIS data base.

During the third step, we identified 1/3-mile-wide corridors from the primary and secondary corridors selected in the second iteration, using the same information as outlined above at the 1:24,000 scale, augmented with land use/land cover information in a separate composite map. The land use/land cover maps were first aggregated, where appropriate, into the following categories: residential, commercial, industrial, conservation, recreational, orchards, and planted pine areas. Reviewing two separate GIS composite maps allowed us to review the corridors in relation to wetland vegetation and other important land use categories. Because the 3-mile-wide study corridors were now in the GIS system, the corridors could be reviewed at the 1:24,000 scale for four to five USGS 7.5-minute quadrangles simultaneous-ly. Reviewing the composite maps on the GIS was augmented with reviewing the appropriate USGS quadrangle maps containing supple-mental information such as the location of known archaeological sites (transferred by hand from information collected from the state

historic preservation office's files). Aerial photographs, which were available for only portions of the study area, were also reviewed with the hard copy maps and GIS information. By integrating these different forms of information, we were able to rapidly develop 1/3-mile-wide preferred and alternative corridors for the entire 600-mile system. The centerlines of these corridors were drawn on the USGS quadrangle maps by hand and then digitized. These digitized corridors were subsequently brought into the GIS data base. This level was completed within 30 days for the entire 600-mile pipeline system.

The final siting iteration of the proposed corridors was the result of statistical comparisons between preferred and alternative corridors and between preferred corridors and local variations. This comparison was to provide a statistical basis of the visual evaluation performed using the GIS and hard copy maps. Statistics were generated for all vegetative classes, land use/land cover classes, and critical point data found within each corridor segment in side-by-side comparisons of the proposed mainline and alternatives and variations. This comparison was the best use of the GIS data base and was clearly superior and time-saving when compared to traditional hand-copied methods for a long linear facility such as this proposed project. Plots of each USGS quadrangle depicting either vegetative cover or land use/land cover information with the proposed corridor and any variations were made to review the corridor a final time and refine the location based on fine-scale environmental features. These plots were also overlaid onto the USGS topographic maps to review the corridors in relation to mapped archaeological sites and topographic contours.

CONCLUSIONS

GIS is particularly well suited as a data management tool in support of corridor siting efforts for proposed linear facility projects. With respect to the siting of large projects that will traverse great distances, GIS has become indispensable in the identification and evaluation of multiple siting scenarios within a broad regional setting.

The role of GIS in the siting process for large linear facilities will continue to become more critical as regulators:

- Expand the array of environmental and land use issues that must be incorporated into siting applications;
- Expect that complex interrelationships between these issues be weighed as part of the alternative analysis; and
- Require a demonstrated higher degree of detail and accuracy in order to support determination of completeness and sufficiency for application review.

The advent of GIS as a siting tool will heighten expectations of both applicants and regulators with regard to the level of detail provided in siting studies and the presentation of data. In order to meet these expectations, applicants, environmental firms, and regulators must recognize that each plays a crucial role in determining the degree to which GIS will enhance the quality of any given siting study and subsequently serve the needs of all parties concerned:

- Applicants for certification of major transportation and transmission system projects should consider potential support applications of GIS in siting, permitting, engineering, design, as-built, and operations management as part of the pre-planning

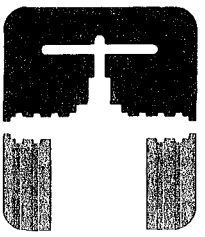
process. However, market pressures for meeting public demand require that transmission system projects proceed from the drawing board to in-service operation within the most timely fashion possible. Project schedules in turn demand that the planning and permitting phases of projects be completed in the most expeditious manner possible. Thus, realistic goals for effectively supporting the siting process with GIS should be established in the context of agency reporting requirements for siting, availability of reliable electronically formatted data bases, and schedule and budget constraints.

- Environmental firms tasked by applicants to develop data bases, conduct analyses, and assist in preparation of comprehensive siting studies must develop expertise not only in the potential applications of GIS, but in integrating the system with traditional siting and reporting methods. As agency GIS data bases continue to develop in the coming years, environmental firms can expect to face the task of unraveling a complex array of information of differing precision and quality gathered from numerous sources and often presented in varying or incompatible formats.

- Agencies and private institutions have recognized the utility of GIS in managing the data on which they depend to accomplish their own respective missions; therefore, these internal needs drive the development and organization of GIS data bases. Second party needs and compatibility are secondary, and, therefore, the type, format, and quality of data available to the public vary considerably. The providence of data in many cases are the very same parties who subsequently play a role in the review and decision process regarding completeness and sufficiency of siting applications. The usefulness or reliability of GIS data to make detailed decisions at a site-specific level is directly related to the completeness of the data and map accuracy standards employed in the development of GIS data. Therefore, agencies should seek to enhance the accessibility, quality, and compatibility aspects of their GIS functions in order to provide useable, spatially referenced information that can facilitate quality siting studies.

Due to sociopolitical and landowner considerations and other factors which do not lend themselves to quantification or spatial analysis utilizing GIS and require interactive input from environmental and engineering specialists, it is unlikely that traditional siting methods will ever be completely replaced by GIS. However, as applications of this technology continue to develop, it should be the goal of applicants and regulators alike to expand the role of GIS in data management in order to reduce the monumental efforts traditionally required for data collection, siting analysis, and presentation.

I · N · G · A · A



Coordinating Federal Agency Review During the Environmental Approval Process

Foundation

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Coordinating Federal Agency Review During the Environmental Approval Process

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F-9909

The INGAA Foundation, the research arm of the Interstate Natural Gas Association of America, sponsored a study to improve the coordination of state and federal agencies in issuing environmental permits for pipeline construction projects. The study includes a survey of INGAA members on their experience with recent field surveys and project reviews, and provides recommendations to promote a more coordinated environmental review process.

ENTRIX is an international environmental and consulting firm with headquarters in Houston, Texas. Since its founding in 1984, ENTRIX has worked extensively in environmental compliance on a variety of pipeline projects throughout the United States and internationally. One of ENTRIX's core practices is the environmental review of proposed and existing natural gas pipelines. ENTRIX has been selected by the Federal Energy Regulatory Commission (FERC) as the third party contractor to develop the Environmental Impact Statement for several major interstate pipeline projects.

ACHP	Advisory Council on Historic Preservation
BLM	Bureau of Land Management
CAA	Clean Air Act
CEQ	Council on Environmental Quality
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DOI	U.S. Department of Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FWS	U.S. Fish and Wildlife Service
MMS	Minerals Management Service
MOA	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOI	Notice of Intent (to prepare an environmental document)
OCSLA	Outer Continental Shelf Lands Act
SHPO	State Historic Preservation Office
THPO	Tribal Historic Preservation Office

Building a natural gas pipeline requires careful review of whether the construction, operation and maintenance of the facility will affect water quality, cultural and historic resources, air quality, threatened and endangered species and many other aspects of the human environment. Numerous local, state and federal agencies are involved in these reviews, and some agencies are called upon to issue permits or clearances in their areas of expertise. These local, state and federal agencies are also involved in the Environmental Analysis or Environmental Impact Statement prepared for the proposed pipeline project under the National Environmental Policy Act.

The purpose of this study is to identify those points in the existing project review processes of key federal agencies where additional interagency coordination could improve the process for both applicants and participating agencies. A better coordinated permitting and certification process would be timelier and more likely to conserve the resources of business and government.

This study found that both applicants and agency reviewers experience problems coordinating the environmental permitting process. Most difficulties encountered during the permitting process occur either during the initial period of planning and execution of field surveys, or during the later period when the project is under complete review by multiple agencies.

It is recommended that, without modifying the scope or procedures of any permit, each agency designate the three to five points that are on the "critical path" for the agency's review of the project. These critical points should be harmonized among the permitting agencies so that information gathering, preliminary analysis, final analysis, and decision making on the proposed project can result in coordinated resource evaluation and protection.

It is further recommended that federal agencies with key roles in the pipeline construction process enter into an Interagency Agreement to signal to their agencies that coordinated review of natural gas pipeline project applications is an agency objective. To further this objective, the Foundation supports the adoption of an Interagency Agreement among key federal agencies that may participate in project review, before and during the construction of an interstate natural gas pipeline. A form of Interagency Agreement is included in this study, in Appendix A, as an example of what an agreement might include. The Discussion Draft provides for concurrent review of a proposed project, and for submittal of comments by federal agencies within the minimum timeframes suggested by the President's Council on Environmental Quality.

Figure 1: FERC National Environmental Policy Act (NEPA) Review and Consultation Process

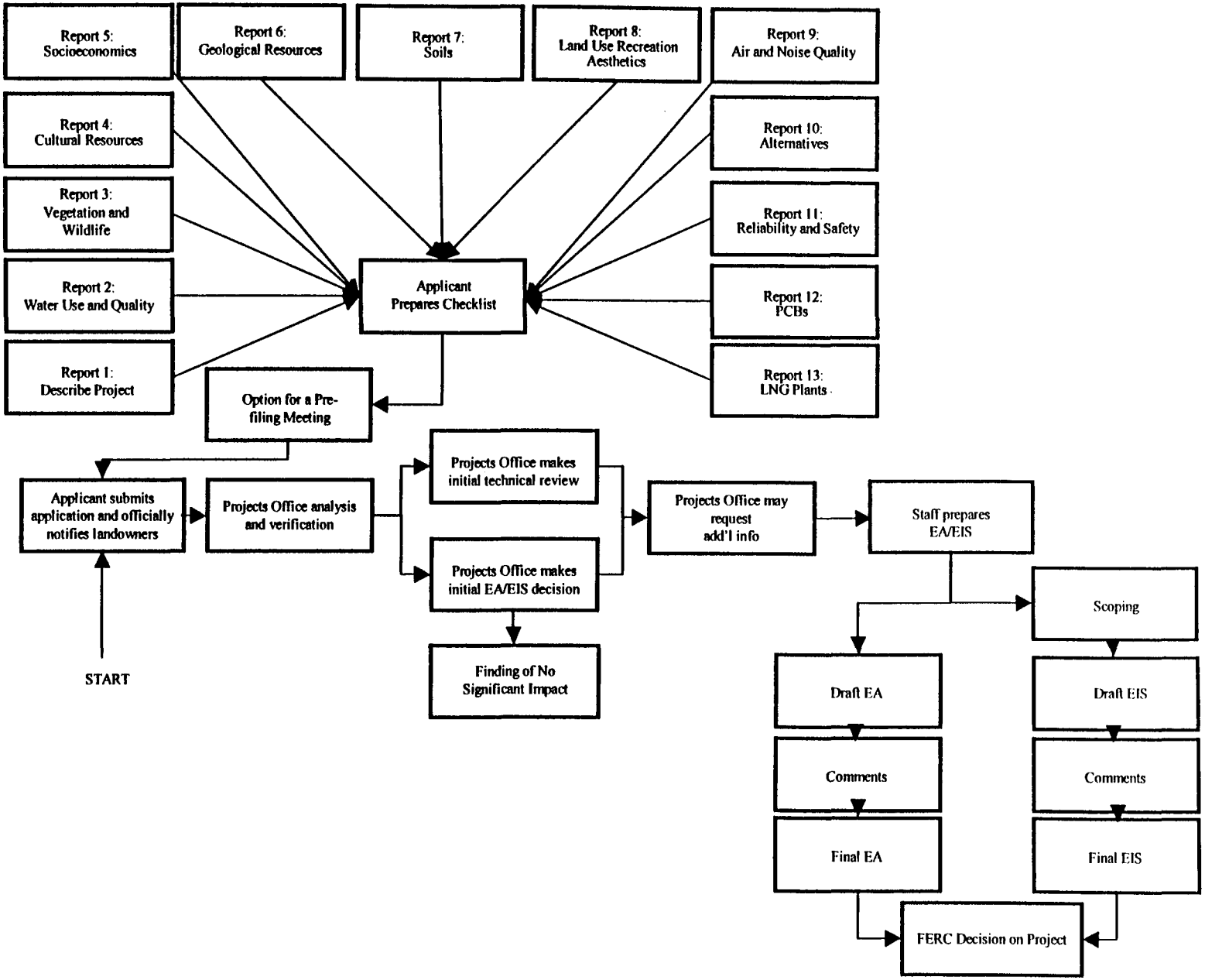


Figure 2: Clean Water Act (CWA), Section 404 Compliance

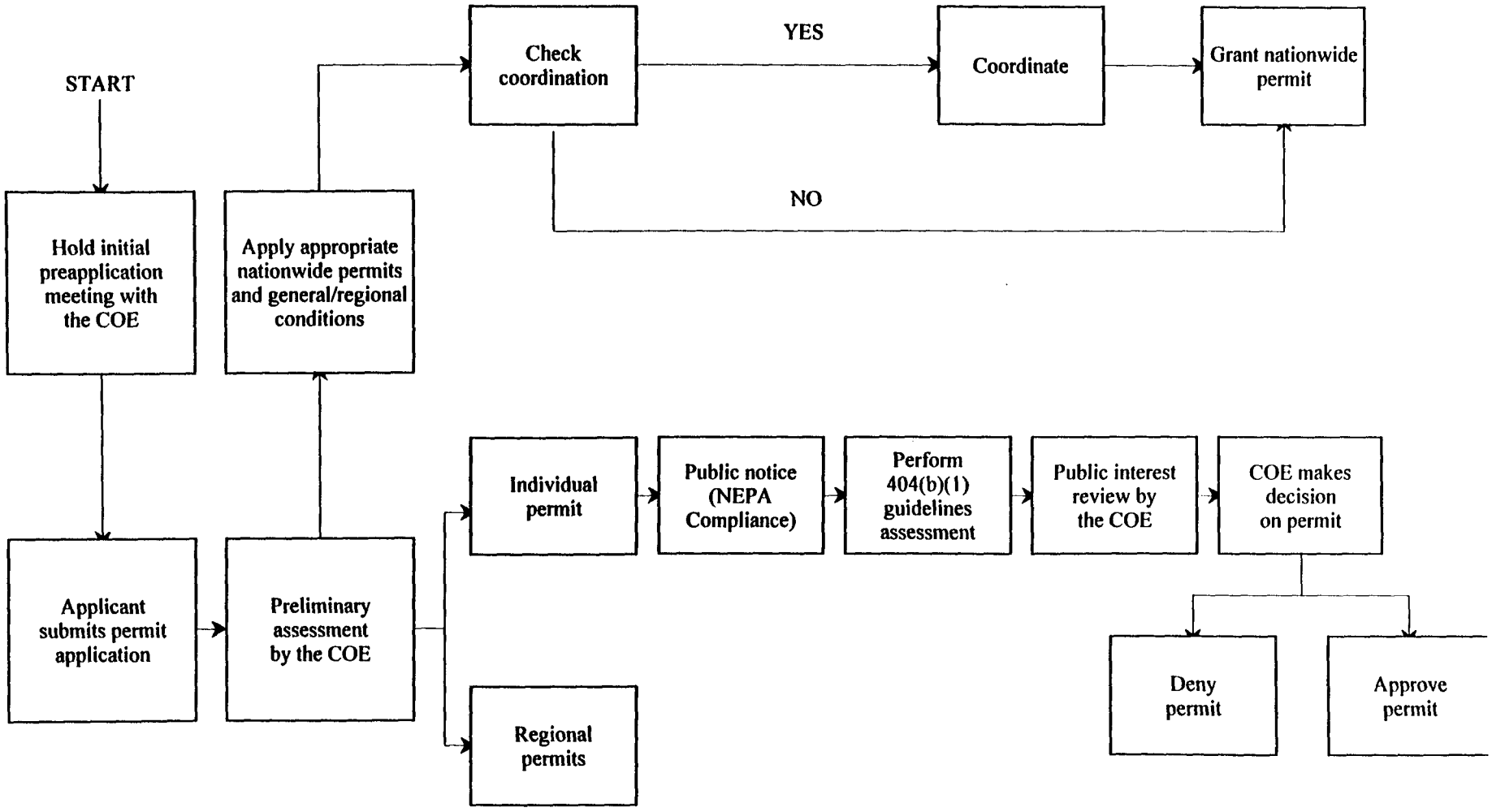


Figure 3A: Endangered Species Act (ESA) Section 7 Compliance Informal Consultation

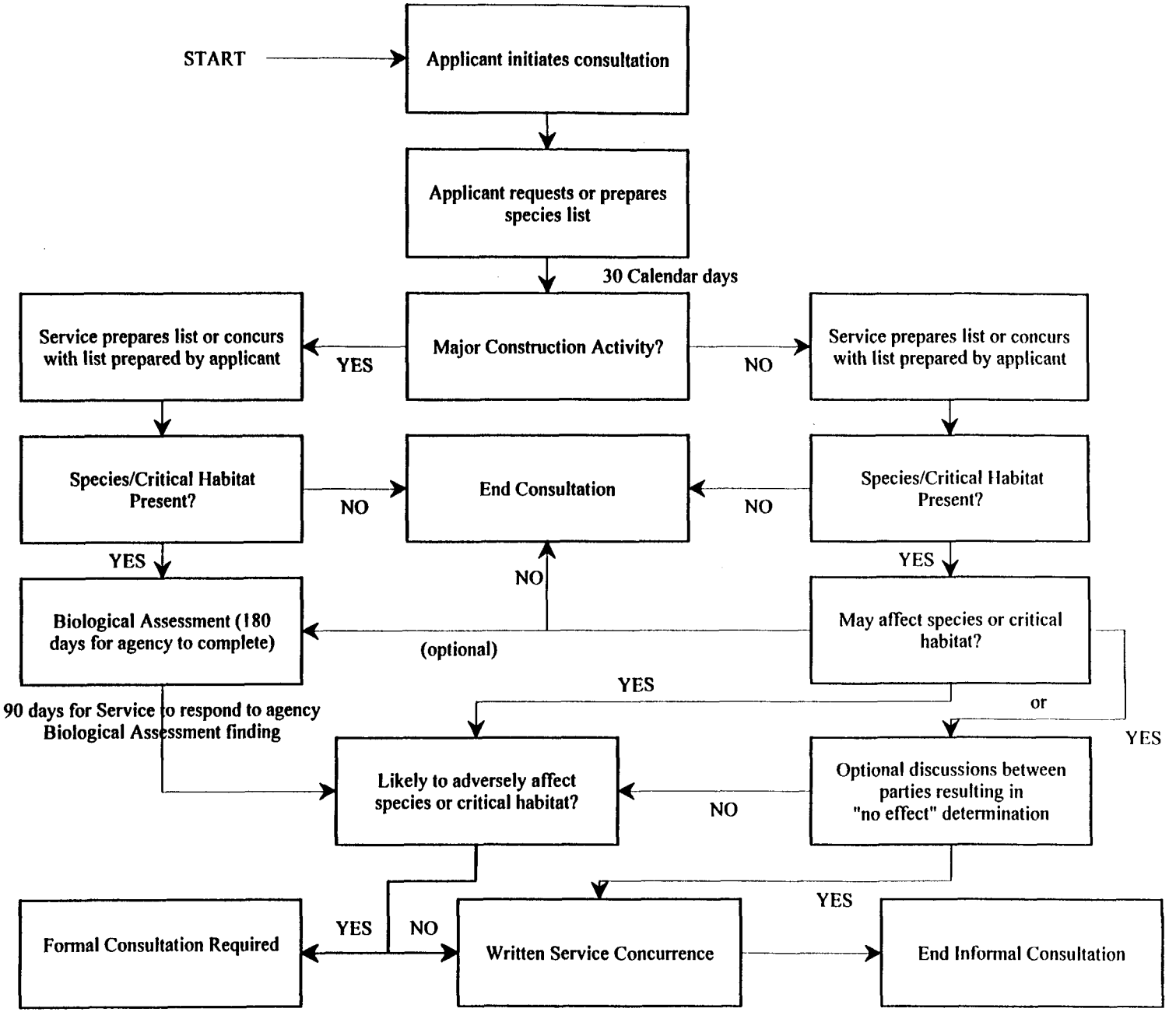


Figure 3B: Endangered Species Act (ESA) – Section 7 Compliance Formal Consultation

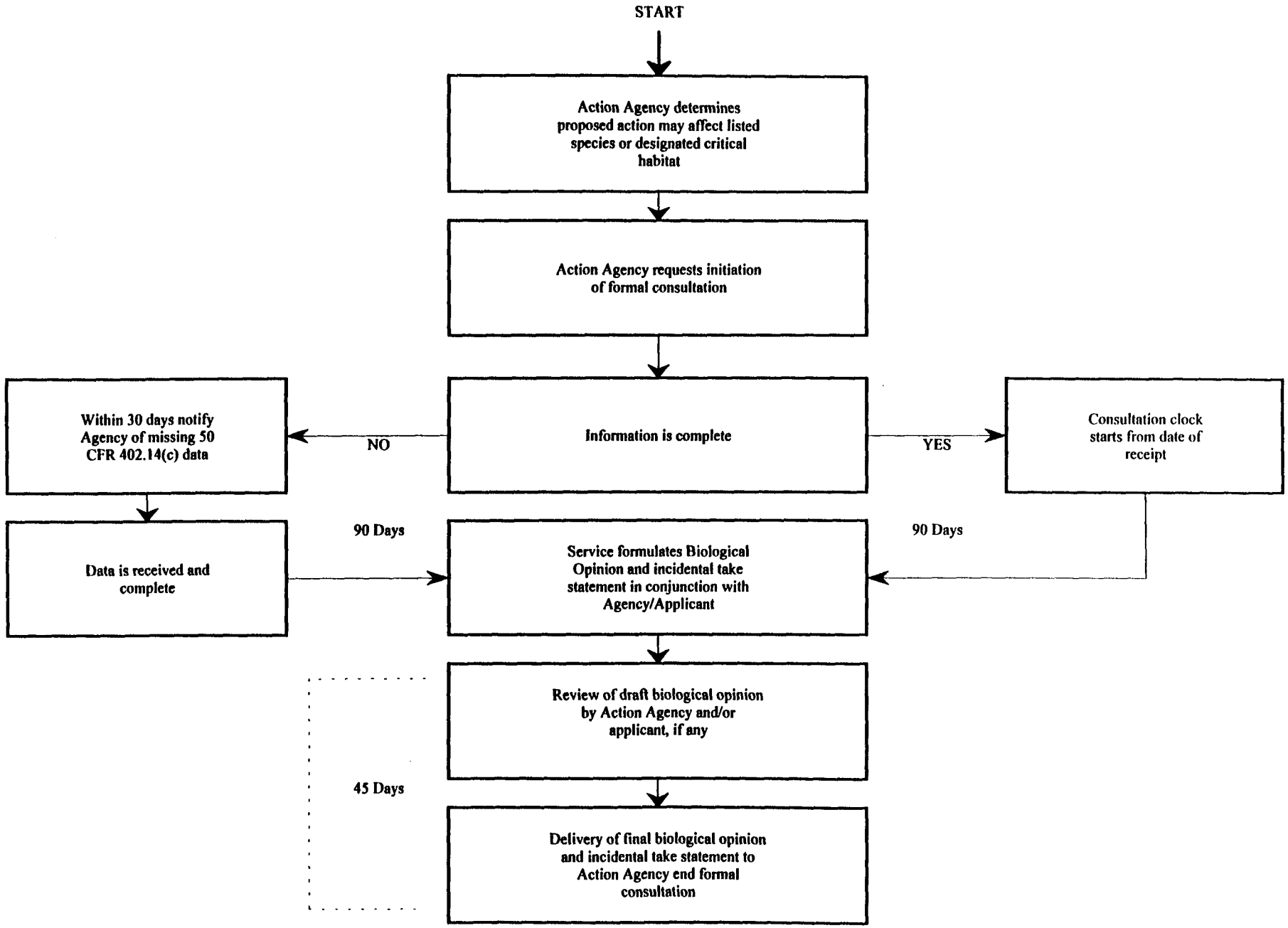


Figure 4: National Historic Preservation Act (NHPA) Section 106 Compliance

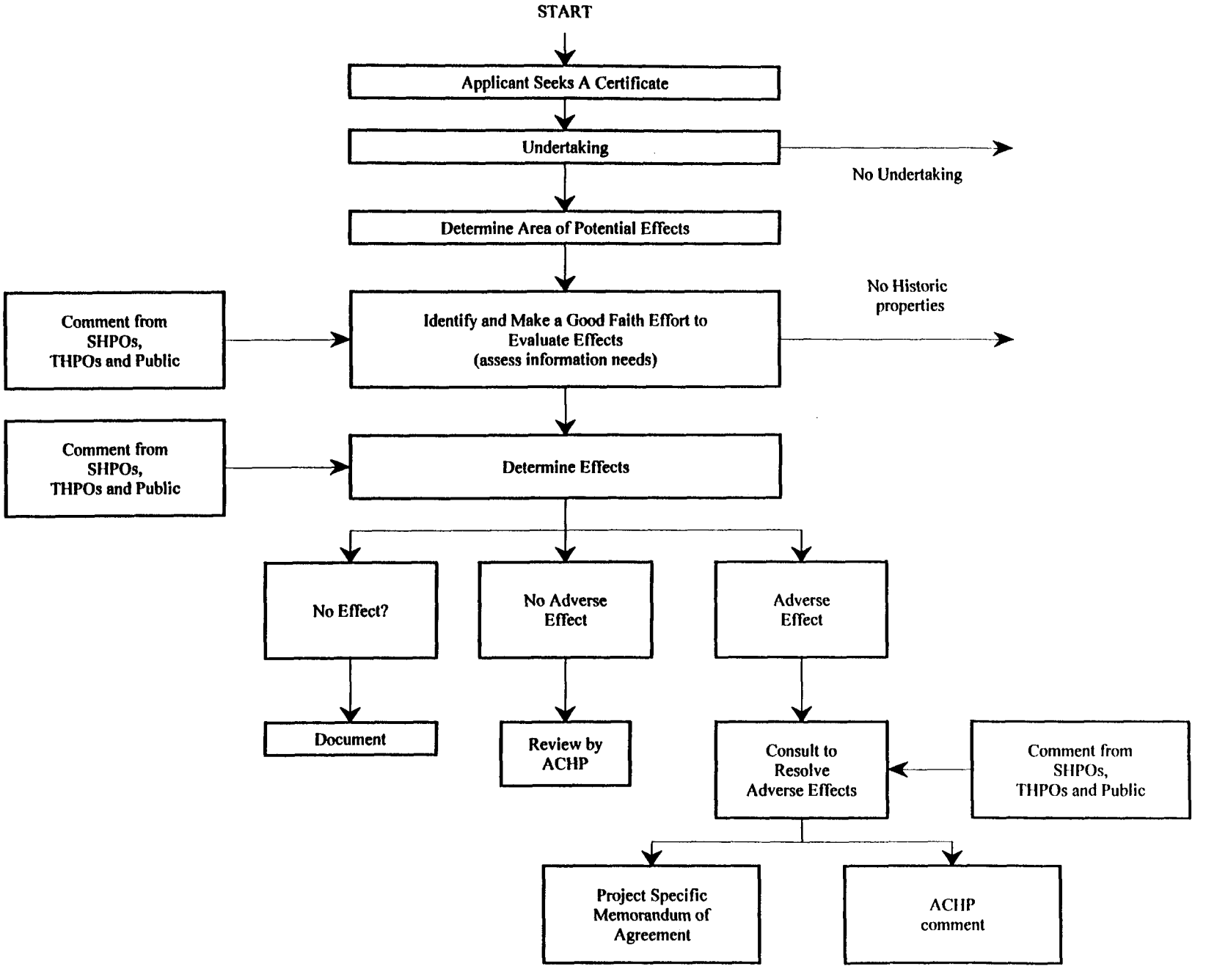
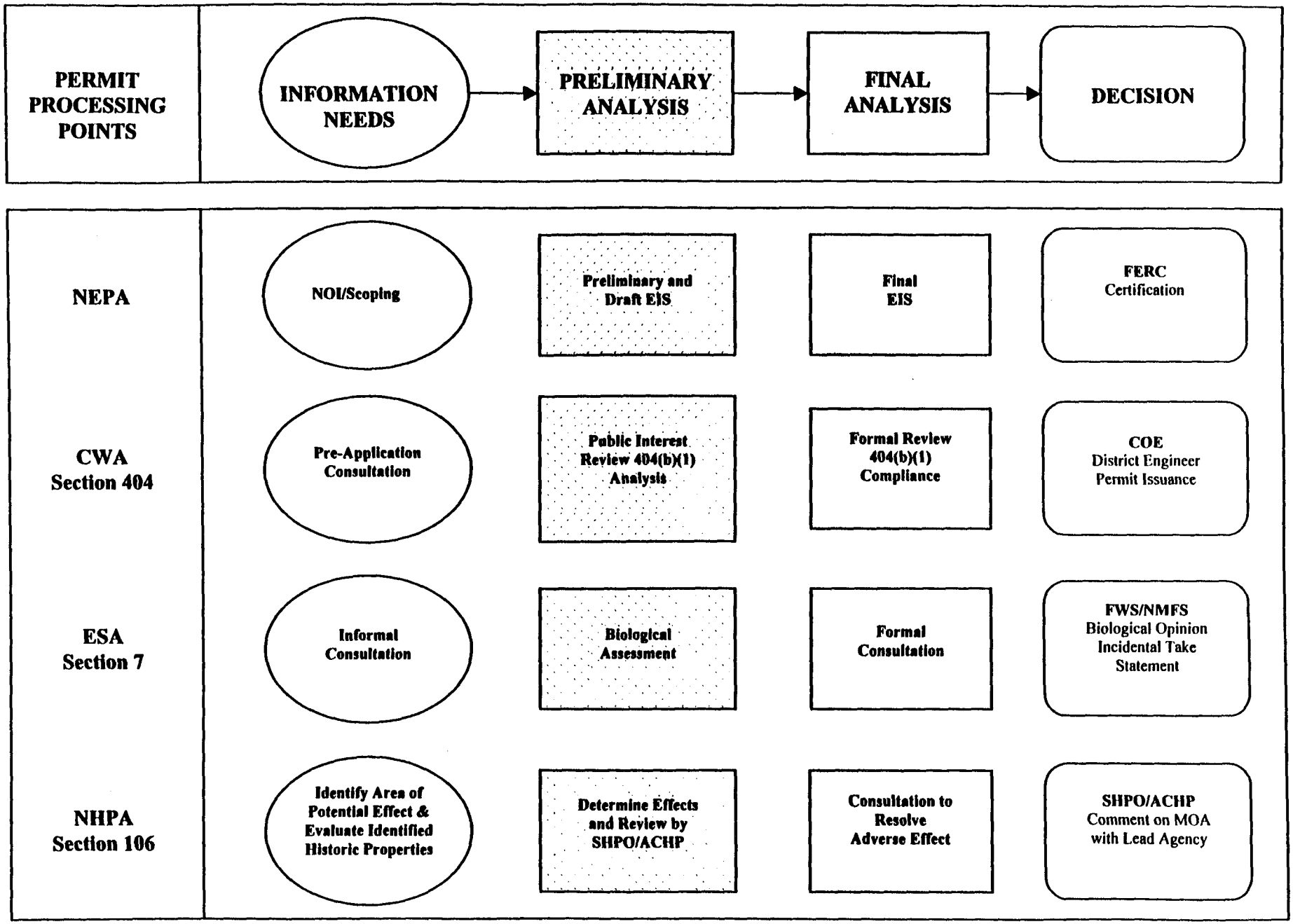


Figure 5: Flow Chart Relating NEPA Compliance Steps with Major Permit Processes



1.0—The Role of Key Federal Agencies

The roles of key federal agencies in permitting interstate natural gas pipeline projects can be summarized as follows:

- Because the Federal Energy Regulatory Commission (FERC) must approve interstate natural gas pipeline projects under the Natural Gas Act, FERC is most often the "lead federal agency" for review under the National Environmental Policy Act (NEPA). FERC must consider whether the project will have a major effect on the environment and determine under NEPA whether an Environmental Analysis, or a full Environmental Impact Statement, is necessary. FERC also has separate responsibilities for evaluating the effect of the proposed project on cultural and historic properties and on threatened and endangered species.
- Under the Clean Water Act section 404, the project may need to obtain permits for major water crossings from the Corps of Engineers, in the Department of the Army.
- Under the Endangered Species Act section 7, the Fish and Wildlife Service, in the Department of the Interior, may need to issue a "biological opinion" and a statement on incidental takings of protected species.
- Under the National Historic Preservation Act, section 106, the state and/or tribal historic preservation officer(s) and the Advisory Council on Historic Preservation may need to comment and may need to develop an agreement with the lead agency on how to treat cultural resources.

The detailed processes for four key federal entities – the Federal Energy Regulatory Commission, the Army Corps of Engineers, the Fish and Wildlife Service, and the Advisory Council for Historic Preservation, are set out in Figures 1, 2, 3A, 3B, and 4.

While each agency follows a set of well-defined and discrete steps, the steps are in fact consistent in function and goal across the agencies. As shown in Figure 5, each agency engages in a process with four essential steps: (1) the applicant gathers and submits information to the agency; (2) the agency performs a preliminary assessment of the project and may seek comment from other government entities and members of the public; (3) the agency issues a final analysis; (4) the agency considers that analysis in making a final decision on whether to issue a permit or a certificate. Understanding the need to harmonize data gathering and project review at key points in the process would improve the environmental review of all of the federal agencies and of interstate pipelines involved in the permit process.

Coordinating these processes is important to reduce time and burden on the federal reviewers, as well as the applicants. To better understand the review and permit process the INGAA Foundation's independent environmental contractor, ENTRIX, Inc., surveyed the interstate natural gas pipeline members of the INGAA Foundation. The survey responses are in the following section.

ENTRIX surveyed interstate natural gas pipelines companies to collect information on their experiences during the: (1) field survey phase and (2) project review phase. The survey was distributed to interstate pipelines during March 1999. In all, ENTRIX received 16 responses from eight pipeline companies, covering nine construction projects. Some projects were the subject of more than one response. The projects were built between 1992 and 1999.

The survey results below are presented for the "Field Surveys" and "Project Review" sections of the questionnaire. Each question is presented below and followed by the distribution of responses. The responses are presented in italics, with the number of responses presented first followed by the response type, i.e., a result of *5 Yes* indicates that a specific question had five "yes" responses.

2.1—Field Surveys

The Field Surveys portion of the questionnaire is divided into four sections representative of the permitting process: (1) qualifications; (2) protocols; (3) timing and (4) survey area. Each of these sections is presented in the following.

The questions and responses are discussed below in section 2.3, Highlights of Findings, which provides a more detailed discussion of certain responses.

Field Surveys – *Qualifications:*

1. In preparation for field efforts, did you experience difficulties with approvals of personnel qualifications?
13 No 1 Yes

2. Were surveys repeated due to personnel qualifications?
13 No 1 Yes

3. At what point in the permitting process did difficulties with personnel qualifications arise?
1 Final Analysis 1 Preparation of drawings for permit application 9 No Answer

4. At what point in the permitting process could difficulties with personnel qualifications, have been avoided?
1 Preliminary Analysis 1 Prior to field survey 9 No Answer

Field Surveys – *Protocols:*

1. Were comments on protocols or procedures solicited prior to field efforts?
11 Yes 3 No

2a. In cases where comments were received on field procedures, were clear established standards available?
9 Yes 4 No 3 No Answer

2b. In cases where comments were received on field procedures, were problems with the procedures revealed only after field work was complete?
9 No 4 Yes 3 No Answer

2c. In cases where comments were received on field procedures, was field work repeated due to non-conformity of procedures?
12 No 1 Yes 3 No Answer

2d. At what point in the permitting process did you receive requests for field efforts to be repeated?
1 Final Analysis 1 After SHPO's Review 1 During preparation of permit drawings 8 No Answer 3 Decision

3. Were differing criteria on the same resource topic required by different agencies?
8 Yes 6 No

3a. If yes, what pair of agencies?
2 Federal/Federal 7 Federal/State 8 No Answer

4. At what point in the permitting process could protocol problems have been avoided?
2 Preliminary Analysis 14 No Answer

Field Surveys – *Timing:*

1. Were specific requirements for seasonal or multiple-pass surveys clearly indicated?
7 Yes 2 No 3 No Answer

1a. If no, please provide the resource topic.
1 ESA 1 Biological 9 No Answer

2a. When agencies requested surveys to be repeated, (did the requests come from the same) agency?
1 State 6 Federal 9 No Answer

2b. When agencies requested surveys to be repeated, (did the requests come from different) agencies?
7 Federal/Federal 9 No Answer

2c. When agencies requested surveys to be repeated, could these agencies have resolved the problem through consultation?
3 Yes 3 No 11 No Answer

3. At what point during the permitting process were timing problems encountered?
1 Final Analysis 13 No Answer 2 Decision

4. At what point in the permitting process could the timing problems have been resolved?
3 Preliminary Analysis 0 No Answer 1 Final analysis

Field Surveys – *Survey Area*:

1. Were significant changes in the ROW a factor that led to repeated surveys?
9 No 7 Yes 1 No Answer

2. What were the reasons for changes to the ROW area?
6 Project changed after initial surveys 0 Nature of potential impacts changed
5 Both 5 No Answer

3. Was there clear definition of direct vs. indirect impact zones?
8 No 5 Yes 3 No Answer

3a. When were indirect impact areas identified?
2 Prior to Final Analysis 6 During Preliminary Analysis 1 Post FERC filing
1 After National Register Eligible Sites identified 6 No Answer

3b. Was survey of indirect impact zones required?
5 Yes 5 No 3 No Answer

4a. Did the initial field surveys include coverage of all alternative routes?
6 No 4 Yes 1 No Answer

4b. Did the initial field surveys include coverage of all ancillary sites?
9 No 6 Yes 1 No Answer

5. At what point in the permitting process did you encounter problems with the survey areas?
4 Preliminary Analysis 10 No Answer 2 Final Analysis

6. At what point in the permitting process could problems with the survey areas have been resolved?
2 Preliminary Analysis 1 During Development
1 A better agreement between State and Fed 12 No Answer

The Project Review portion of the questionnaire is divided into three sections where difficulties may have been encountered during the permitting process: (1) jurisdiction; (2) review procedures; and (3) communication.

The questions and responses shown in the shaded boxes are discussed below in section 2.3, Highlights of Findings.

Project Review – *Jurisdiction*:

1. Did you experience jurisdictional difficulties with the project review process with a federal agency?
9 No 6 Yes 1 No Answer

1a. Were there difficulties with one federal agency or more than one?
5 Difficulties with one agency 2 More than one 9 No Answer

2. Did you experience jurisdictional difficulties with the project review process with a state agency?
9 No 5 Yes 2 No Answer

2a. Were there difficulties with one state agency or more than one?
2 Difficulties with one agency 11 No Answer 3 More than one

3. At what point in the permitting process did you encounter jurisdictional problems?
1 Preliminary Analysis 2 Final Analysis 12 No Answer 1 Decision

4. At what point in the permitting process could the jurisdictional problem have been resolved?
1 Initial Project Review 2 Preliminary Analysis 12 No Answer 1 Final Analysis

Project Review – *Review Procedures*:

1. Was reliable information made available on the review procedures, such as sequence and information needs?
7 Yes 8 No 1 No Answer

2. In general did the agencies participate during early consultation?
12 Yes 1 No 3 No Answer

3a. If an agency declined to proceed with review pending information or approval from another agency or part of the same agency, please list the agencies:
5 Federal 1 State 8 No Answer

3b. From what agency or agencies was information or approval(s) expected?
3 Federal 2 State 7 No Answer

4. At what point in the permitting process did you encounter problems with the review procedures?
2 Preliminary Analysis 4 Final Analysis 1 No particular time
1 Pre-Application Meetings 8 No Answer

5. At what point in the permitting process could problems with the review process have been resolved?
1 Initial Project Review 1 Preliminary Analysis 1 Pre-Application Mtg.
11 No Answer 2 Final Analysis

Project Review – *Communication*:

1. On average, how many different people did you deal with at a given agency?
8 1-2 people 6 2-5 people 2 No Answer

2. Did your contacts for NEPA review communicate well with those responsible for permit reviews?
8 Yes 6 No 2 No Answer

2a. Were the communication problems within the same agencies?
7 Federal 1 Other 8 No Answer

2b. Were the communication problems between two or more agencies?
7 Federal/Federal 4 Federal/State 6 No Answer

3a. Did you experience inconsistencies with required information?
11 Yes 3 No

3b. Did you experience inconsistencies with agency review personnel?
10 Yes 4 No 2 No Answer

3c. Did you experience inconsistencies with responses to questions on the project review process?
9 Yes 4 No 3 No Answer

4. Which agency(ies) had requirements which were unclear, changed, or unpredictable?
6 Federal 2 State/local

5. Which agency(ies) communicated their requirements well?
4 Federal 2 State

2.3—Highlights of Findings

- Of the two parts of the company survey, the "Project Review" part generated more problematic comments than "Field Surveys."
- Within "Project Review," the "Communication" questions 3a, 3b, and 3c generated the strongest comments regarding inconsistency of information.

Field Surveys

- Within **Field Surveys – *Qualifications,*** the responses suggest this is not a frequent problem.
- Within **Field Surveys – *Protocols,*** the responses suggest this is not a frequent problem, but problems have arisen from differing criteria between federal and state agencies.
- Within **Field Surveys – *Timing,*** the responses suggest this is not a frequent problem, but occurs more often with federal/federal coordination than with federal/state coordination.
- Within **Field Surveys – *Survey Area,*** the responses suggest that this may be the most problematic of the Field Survey issues. A moderate level of difficulty was noted regarding:
  - changes in the ROW
  - direct vs. indirect impact zones
  - alternative routes

Project Review

- Within **Project Review – *Jurisdiction*,** the results suggest this is only an occasional problem occurring within federal agencies more frequently than with state agencies.
- Within **Project Review – *Review Procedures,*** the results suggest that even though agencies participate in early consultation, inadequate detail on review sequence and information needs may lead to problems during the preliminary and final analysis points.
- Within **Project Review – *Communication*** the strongest results of the survey suggest that federal agencies often have inconsistent information on the project review process, possibly arising from the different personnel interfacing with the applicant.

3.0—Recommendations

The following three recommendations came from the results of the survey coupled with the experience of the survey team with field surveys and project reviews of FERC jurisdictional pipeline projects.

3.1—Harmonize Permit Processing Points

There are many environmental issues to be addressed with a pipeline construction project, and many individual federal, state, and local permits to be acquired. Without modifying the scope or procedures of any permit, it is recommended that each agency designate 3 to 5 points within their existing permit process that are the fundamental steps in their method of project review. In the interest of consistency, these fundamental steps should be "harmonized" so that environmental information gathering, preliminary and final analysis and decision making on a proposed project results in better coordinated natural resource protection. Better coordination will also result in reducing unnecessary conflict between the company and agency environmental professionals who work together with the same goals in mind, but who may be at odds due solely to unharmonized timing of project review steps.

3.2—Increased Delegation of Field Authority

After approval of the EA or EIS and major permits, pipeline construction projects often encounter unexpected field conditions that require a modification of plans. In addition, some conditions are encountered with opportunities to further reduce impacts and/or costs, if approved plans could be modified. In these situations, field personnel of the pipeline company, the FERC-designated environmental monitor, and the cooperating agencies often come to on-scene agreement as to what should be done. However, without the clear authority to approve a change in plans, a less desirable option may be implemented by field personnel that has the primary benefit of not requiring further approvals. The number and variety of mitigation tactics that have been developed over the past few decades of pipeline construction, coupled with the telecommunications advances of the past few years, offers the opportunity to increase the delegation of field authority to approve plan changes within the bounds of EA/EIS and the major permits. This increased delegation should be accompanied by increased clarity of the responsible parties, the process, and the expected response time for making field-level decisions.

3.3—Interagency Agreement on Integrating Federal Review

In order to improve the EIS process by reducing expenses and time, the pipeline community has supported a draft Interagency Agreement integrating review among federal agencies. The agreement would establish a process that merges environmental review responsibilities of the participating agencies, so that their substantive decision making authorities are exercised in connection with the authorization of interstate natural gas pipeline projects. The participating agencies would work together, along with appropriate involvement of other federal agencies, the public, states, tribal governments, and local governments to achieve the common goals of ensuring that decisions regarding the authorization of new pipeline projects reflect the responsibilities of each agency and authorities they administer.

APPENDIX A

DISCUSSION DRAFT:

INTERAGENCY AGREEMENT ON INTEGRATING NEPA, ESA AND NHPA REVIEW WITH THE ISSUANCE OF FERC CERTIFICATES, RIGHT-OF-WAY PERMITS ON FEDERAL LANDS, AND COE 404 PERMITS FOR INTERSTATE NATURAL GAS PIPELINES

The Federal Energy Regulatory Commission

The Department of the Interior

The U.S. Army Corps of Engineers

The Environmental Protection Agency

The Advisory Council on Historic Preservation

The Council on Environmental Quality

The U.S. Forest Service

November 18, 1999 *Draft*

I. INTRODUCTION

Numerous studies have concluded that the expanded availability and use of natural gas is an important public policy goal. The efficient permitting of new interstate pipeline projects is essential to facilitate the nation's ability to meet this goal.

The National Environmental Policy Act of 1969, as amended, ("NEPA") requires federal agencies to evaluate fully the environmental impact of every major federal action significantly affecting the quality of the human environment, through the preparation and consideration of an Environmental Impact Statement ("EIS"). Unless the federal action is categorically excluded from the EIS requirement, the federal agency must prepare an Environmental Assessment ("EA"). Based on the EA, the agency will then either make a finding of no significant impact or prepare an EIS. 40 C.F.R. §1501.4 (Regulations of the Council on Environmental Quality ("CEQ") on NEPA implementation by federal agencies).

The Federal Energy Regulatory Commission ("FERC") is the federal agency responsible for authorizing the construction and operation of interstate natural gas pipelines. It issues certificates of public convenience and necessity for such pipelines under section 7 of the Natural Gas Act of 1938, as amended. The issuance by the FERC of a certificate of public convenience and necessity for a major pipeline construction project using right-of-way in which there is no existing natural gas pipeline is an action that normally requires the preparation of an EIS. 18 C.F.R. § 380.6(a)(3) (FERC regulations on NEPA).

The Bureau of Land Management ("BLM") is the federal agency within the Department of the Interior principally responsible for issuing right-of-way permits for natural gas pipelines that cross certain federal lands. Section 28 of the Mineral Leasing Act of 1920, as amended, gives BLM the authority to issue right-of-way grants for natural gas pipelines through lands held by the United States, except lands in the National Park System, lands held in trust for an Indian or Indian tribe, and lands on the Outer Continental Shelf. The issuance of a right-of-way permit for a major pipeline is categorized by BLM's guidelines implementing NEPA as an action that normally requires an EIS. 48 Fed. Reg. 43731, 43732 (September 26, 1983) (Para. 5.3.A.(5)(b) of Appendix 5 to 516 DM 6). These EIS requirements may be satisfied through cooperative efforts by the agencies. 40 C.F.R. § 1506.3(c). Significant pipeline projects that do not require an EIS typically require the preparation of an EA, which should also involve the relevant agencies in a cooperative effort.

The Endangered Species Act of 1973, as amended, ("ESA") requires each federal agency to insure that any action it authorizes is not likely to jeopardize the continued existence of any endangered or threatened species ("listed species") or result in the destruction or adverse modification of critical habitat for such species ("critical habitat"). Section 7(a)(2) of the ESA. The Department of Interior's U.S. Fish and Wildlife Service ("FWS") is the federal agency principally responsible for implementation of the ESA. Other federal agencies are required by section 7 of the ESA to consult with the FWS in carrying out their ESA responsibilities and the FWS is responsible for issuing biological opinions

on the impact of a proposed agency action on listed species or its critical habitat. The consultation and other ESA requirements applicable to federal agencies may be carried out in coordination with and as part of the agencies' NEPA processes. 50 C.F.R. § 402.06 (Joint Regulations on ESA).

The Minerals Management Service ("MMS") is the federal agency within The Department of Interior principally responsible for leasing and facilities in the offshore federal waters of the United States pursuant to the Outer Continental Shelf Lands Act of 1978 ("OCSLA").

The United States Army Corps of Engineers ("COE") is a major Army command that is responsible for, among other things, the administration of laws for the protection and preservation of waters of the United States, including wetlands. The COE grants permits under section 404 of the Clean Water Act ("CWA") for the discharge of dredged or fill material into navigable waters, including wetlands.

The Environmental Protection Agency ("EPA") is the federal agency responsible for administering a wide variety of environmental laws. The responsibilities of EPA relevant to the pipeline permitting process include commenting on Environmental Impact Statements of all federal agencies under section 309 of the Clean Air Act, the authority to restrict in certain circumstances, the COE's authority to issue section 404 permits, and the authority to issue permits for pipeline-related activities that involve discharges of pollutants subject to the requirements of the National Pollutant Discharge Elimination System or emissions that may be subject to permitting requirements under the Clean Air Act.

The National Historic Preservation Act requires federal agencies to take into account the effect of the actions that they authorize on property listed or eligible for listing in the National Register of Historic Places and to afford the Advisory Council on Historic Preservation ("ACHP") a reasonable opportunity to comment with regard to such actions.

The Council on Environmental Quality ("CEQ") was established by NEPA within the Executive Office of the President in 1969. Its purpose is to formulate and recommend national policies to promote the improvement of the quality of the environment. CEQ has issued regulations applicable to all federal agencies for implementing the procedural provisions of NEPA. 40 C.F.R. Parts 1500 through 1508.

The U.S. Forest Service, an agency within the United States Department of Agriculture, manages National Forest System lands. The Forest Service issues special use authorizations under the authority of Section 28 of the Mineral Leasing Act and pursuant to regulations found at 36 C.F.R. Part 251 for natural gas pipelines located on forest system lands.

II. PURPOSE

The purpose of this Agreement is to establish a general framework for cooperation and participation among the FERC, the Bureaus and Services within the Department of the Interior, the COE, the EPA, the ACHP, the Forest Service and the CEQ (the "Participating Agencies") that will harmonize the processes through which their environmental review responsibilities are met and their substantive decision-making authorities are exercised in connection with the authorization of interstate natural gas pipeline projects. The Participating Agencies will work together and with appropriate involvement of other federal agencies, the public, States, Indian Tribal Governments, and local governments to achieve the common goals of insuring that in decisions regarding the authorization of new pipeline projects, the responsibilities of each agency and of the authorities they administer, including the purposes of NEPA, the requirement to conserve listed species under the ESA, and the provisions of the NHPA encouraging the preservation of historical places, are met.

The overall objective is to build consensus among all involved agencies to assure the timely, cost-effective development of needed, environmentally sensitive natural gas pipeline projects. Formal concurrences from the relevant agencies should be given at appropriate key stages of project development. This process should provide an orderly procedure through early identification of environmental resources at sufficient level of detail to develop quality documentation to meet NEPA/ESA/NHPA requirements.

In consideration of the above premises,

III. THE PARTICIPATING AGENCIES AGREE TO THE FOLLOWING:

Each individual agency that is a party to this Agreement will:

A. Seek Early Involvement. As soon as practicable after an application for authority to construct a pipeline project has been accepted for filing by the FERC, and before a Notice of Intent ("NOI") to prepare an environmental document is published, the Participating Agencies will, in consultation with each other, conduct a preliminary review of the proposed project. Based on such review, the Participating Agencies will:

1. Identify the lead agency for preparation of the EIS or EA. This will normally be the FERC, in light of its overall responsibility for determining whether such projects are consistent with public convenience and necessity.

2. Identify a person or persons at each agency who will serve as the contact for that agency for purposes of the NEPA, ESA, CWA, NHPA and other relevant review processes concerning the proposed project.

3. Identify principal areas of potential concern to each agency and assess the need for and availability of agency resources needed for participation in the NEPA/ESA/CWA/NHPA/other relevant review process.

4. Agree upon a schedule for further steps in the NEPA/ESA/CWA/NHPA/other review process and pipeline authorization that will be as expeditious as possible, consistent with the periods for analysis and response by the agencies and others that are required by the statutes and regulations applicable to the particular project. In establishing this schedule, the agencies will strive wherever possible to ensure that individual permitting processes and permit review activities occur on a concurrent, rather than sequential basis, with the objective of reducing the overall permitting timeframe to the greatest extent possible.

5. Establish a common repository in which all filings with all of the agencies involved in reviewing or authorizing the project will be maintained, along with all orders, requests, etc., issued by all of the agencies. The agencies may maintain their own permit dockets or files in addition to the common repository.

6. Include in the published NOI guidance to the public regarding the foregoing subjects.

B. Be Proactive Participants. The Participating Agencies will provide on their own initiative the information and expertise they have available within their agencies that are appropriate for consideration or application in the NEPA/ESA/CWA/NHPA/other review process. The Participating Agencies will provide such information and expertise at the earliest possible time and on a continuing basis. To this end, the Participating Agencies agree that they will:

1. At the scoping stage of the process, identify the statutory, regulatory and policy responsibilities of each agency that are applicable to the review and ultimate approval of the proposed project.

2. Also at the scoping stage, identify the significant issues and concerns related to the proposed project that need to be addressed in order for each agency to meet its obligations under NEPA, ESA, CWA, and NHPA, and under any other relevant statutory or regulatory requirement.

3. In connection with the preparation of draft and final NEPA documents, furnish relevant studies, data (such as maps showing features over which each agency may have jurisdiction), and any other information concerning the status of relevant matters (including matters that may be under consideration,

such as proposing a species for listing as endangered or threatened, or proposing an area for wilderness status), which the Cooperator may have in its possession or to which it may have access.

C. Compile a Common Data-Base. The Participating Agencies will assure that facts will be gathered, considered and relied upon by all Participating Agencies in a single NEPA/ESA/CWA/NHPA/other review process involving all Participating Agencies. The Participating Agencies will:

1. Cooperate in the preparation of requests for additional studies or data from the applicant, to avoid duplicative requests and to compile a common data-base on which all of the Participating Agencies will rely.

2. Cooperate in deciding the level of detail that will be required for the NEPA/ESA/CWA/NHPA/other review and the level of detail that will be addressed at later stages of project development.

3. Cooperate in the development of a common set of alternative actions for consideration.

4. Cooperate in proposing mitigation measures that are agreed upon by mutual consent of the Participating Agencies.

D. Adopt an Efficient Schedule. The Participating Agencies will conduct the comprehensive review required under NEPA, ESA, CWA, NHPA and other relevant authorities as efficiently as possible, taking into account statutory and regulatory time requirements. To this end, they will:

1. Not exceed the statutory or regulatory minimum time requirements except for exceptional circumstances.

2. Provide informal comments in advance of deadline for written comments, to reduce the amount of time and effort that is otherwise involved in cataloging and reviewing comments on areas where no significant differences of opinion exist.

E. Agree on Decision Points. The Participating Agencies will agree on appropriate major decision points for significant decisions and will seek to achieve consensus among the Participating Agencies on such issues at the agreed-upon decision points. The Participating Agencies agree, for example:

1. To agree upon the choice of a recommended action, where alternative courses of action have been considered, prior to the issuance of the final NEPA document.

2. To agree upon all significant mitigation measures that will be required, prior to the issuance of the final NEPA document.

F. Resolve Disputes. To avoid unnecessary delay and to enable the agencies to take a uniform position, the Participating Agencies agree to resolve potential disputes by mutual agreement, if possible, or by reference to CEQ, if necessary. If a dispute cannot be resolved among the Participating Agencies, the Participating Agencies agree that:

1. All documentation concerning the dispute will be forwarded to the CEQ.

2. The Participating Agencies will defer further action regarding the subject of the dispute for a reasonable time within which to receive comments from CEQ.

3. Comments received from CEQ will be taken into account by the Participating Agencies in determining further actions regarding the subject of the dispute.

IV. IT IS MUTUALLY AGREED AND UNDERSTOOD THAT:

A. Nothing in this Agreement shall obligate the Participating Agencies to expend appropriations or enter into any contract or other obligations.

B. This Agreement may be modified or amended upon written request of any party hereto and the subsequent written concurrence of all of the Participating Agencies. Cooperator participation in this Agreement may be terminated with the 60-day written notice of any party to the other Participating Agencies.

C. This Agreement is intended only to improve the internal management of the executive branch and is not intended to, nor does it create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, it agencies, its officers, or any person.

D. This Agreement is to be construed in a manner consistent with existing law and regulations.

E. The terms of this Agreement are not intended to be enforceable by any party other than the signatories hereto.

V. PRINCIPAL CONTACTS

The following persons will be the principal contacts for their respective agencies at the time of execution of this Agreement. These contacts may be changed at an agency's discretion upon notice to the other Participating Agencies.

Federal Energy Regulatory Commission:

Bureau of Land Management:

U.S. Fish and Wildlife Service:

Minerals Management Service:

Army Corps of Engineers:

Environmental Protection Agency:

Advisory Council on Historic Preservation:

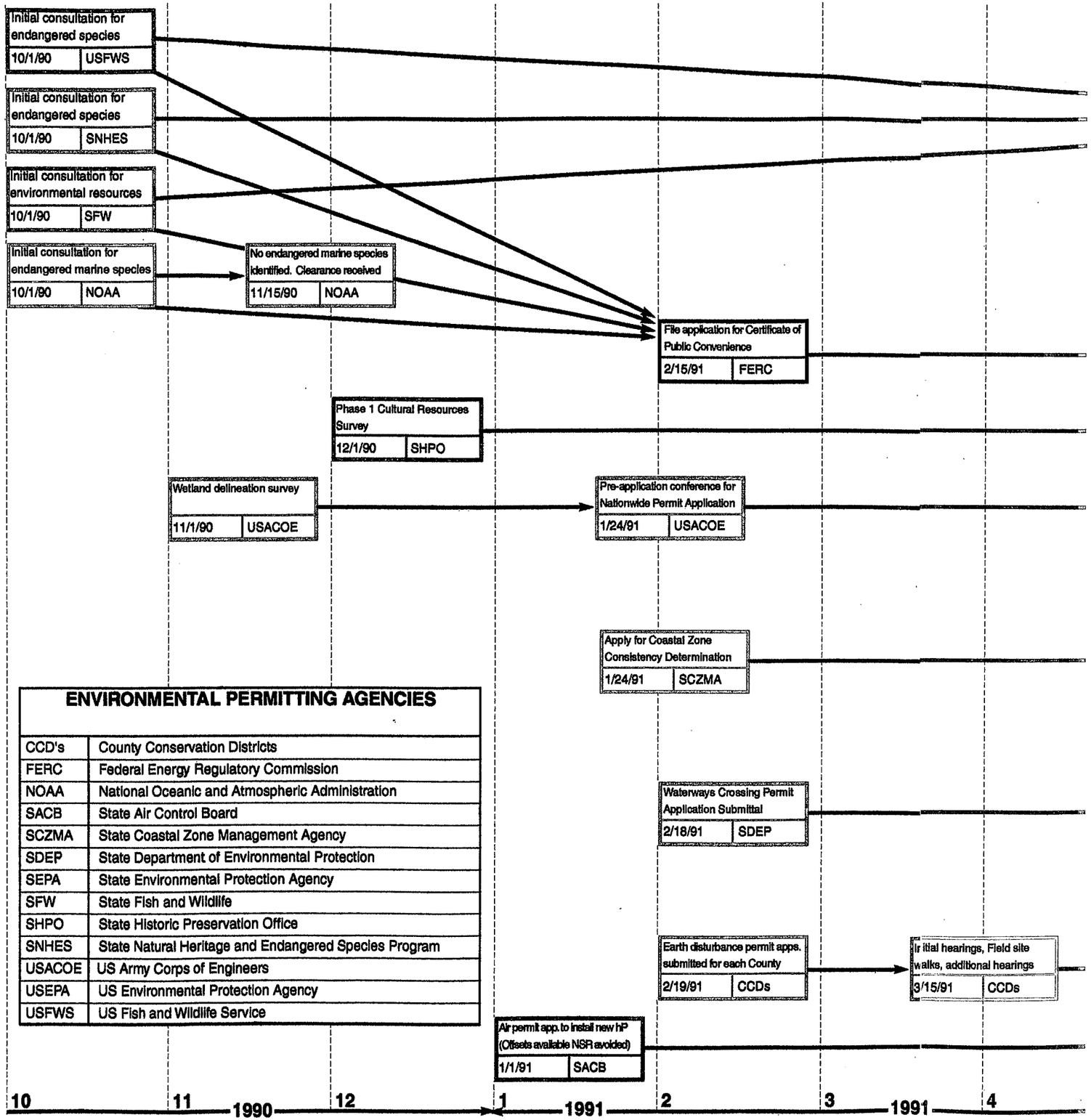
Council on Environmental Quality:

U.S. Forest Service:

CONSULTATIONS, NOTIFICATIONS AND APPROVALS

TIMELINE FOR A TYPICAL PIPELINE PROJECT

The INGAA Foundation, Inc.
555 13th Street, NW
Suite 300 West
Washington D.C. 20004



ENVIRONMENTAL PERMITTING AGENCIES	
CCD's	County Conservation Districts
FERC	Federal Energy Regulatory Commission
NOAA	National Oceanic and Atmospheric Administration
SACB	State Air Control Board
SCZMA	State Coastal Zone Management Agency
SDEP	State Department of Environmental Protection
SEPA	State Environmental Protection Agency
SFW	State Fish and Wildlife
SHPO	State Historic Preservation Office
SNHES	State Natural Heritage and Endangered Species Program
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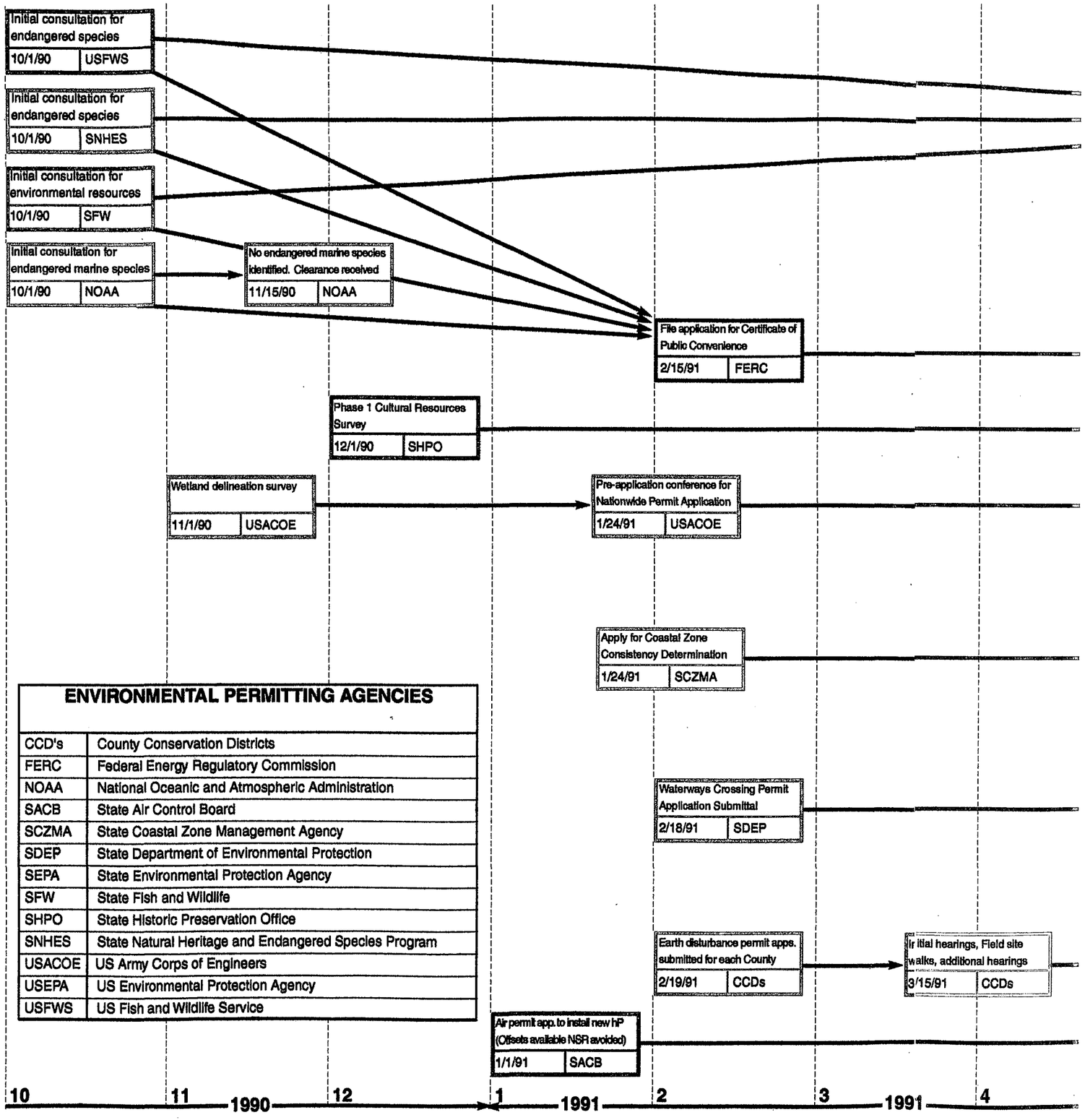

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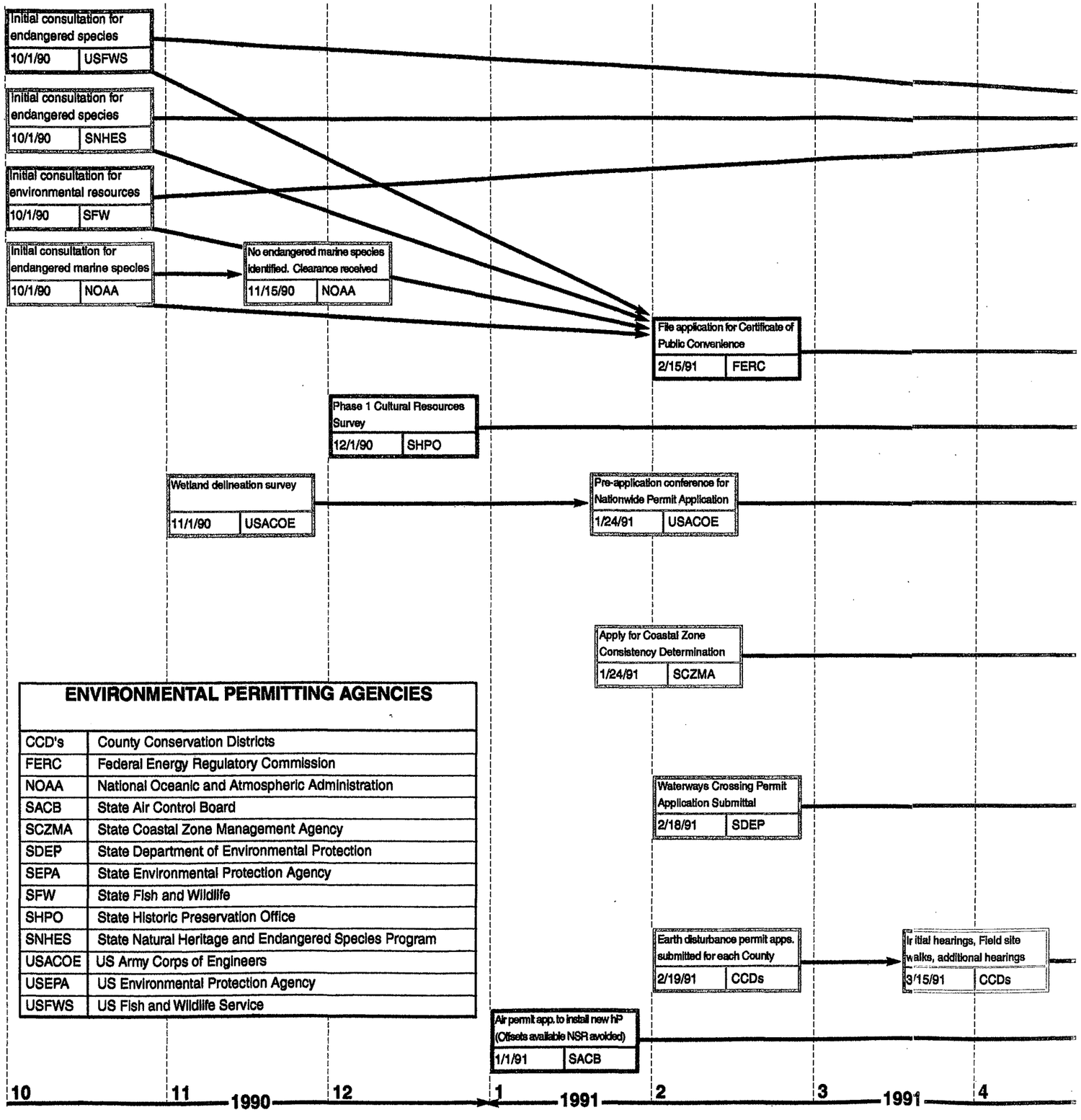

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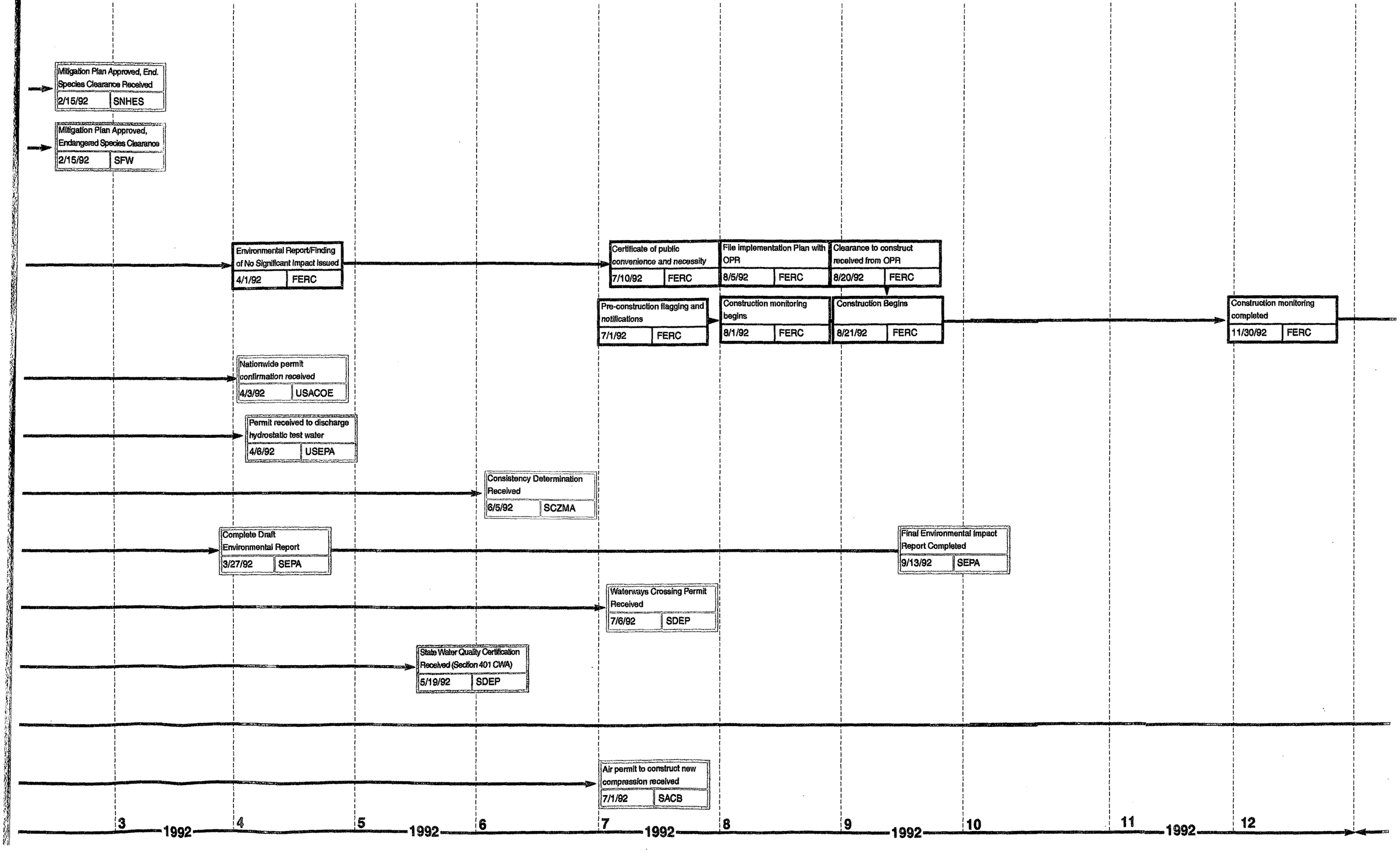
Mitigation Plan Approved, End. Species Clearance Received
2/15/92
SNHES
Mitigation Plan Approved, Endangered Species Clearance
2/15/92
SFW
Environmental Report/Finding of No Significant Impact Issued
4/1/92
FERC
Certificate of public convenience and necessity
7/10/92
FERC
File implementation Plan with OPR
8/5/92
FERC
Clearance to construct received from OPR
8/20/92
FERC
Pre-construction flagging and notifications
7/1/92
FERC
Construction monitoring begins
8/1/92
FERC
Construction Begins
8/21/92
FERC
Construction monitoring completed
11/30/92
FERC
Nationwide permit confirmation received
4/3/92
USACOE
Permit received to discharge hydrostatic test water
4/6/92
USEPA
Consistency Determination Received
6/5/92
SCZMA
Complete Draft Environmental Report
3/27/92
SEPA
Final Environmental Impact Report Completed
9/13/92
SEPA
Waterways Crossing Permit Received
7/6/92
SDEP
State Water Quality Certification Received (Section 401 CWA)
5/19/92
SDEP
Air permit to construct new compression received
7/1/92
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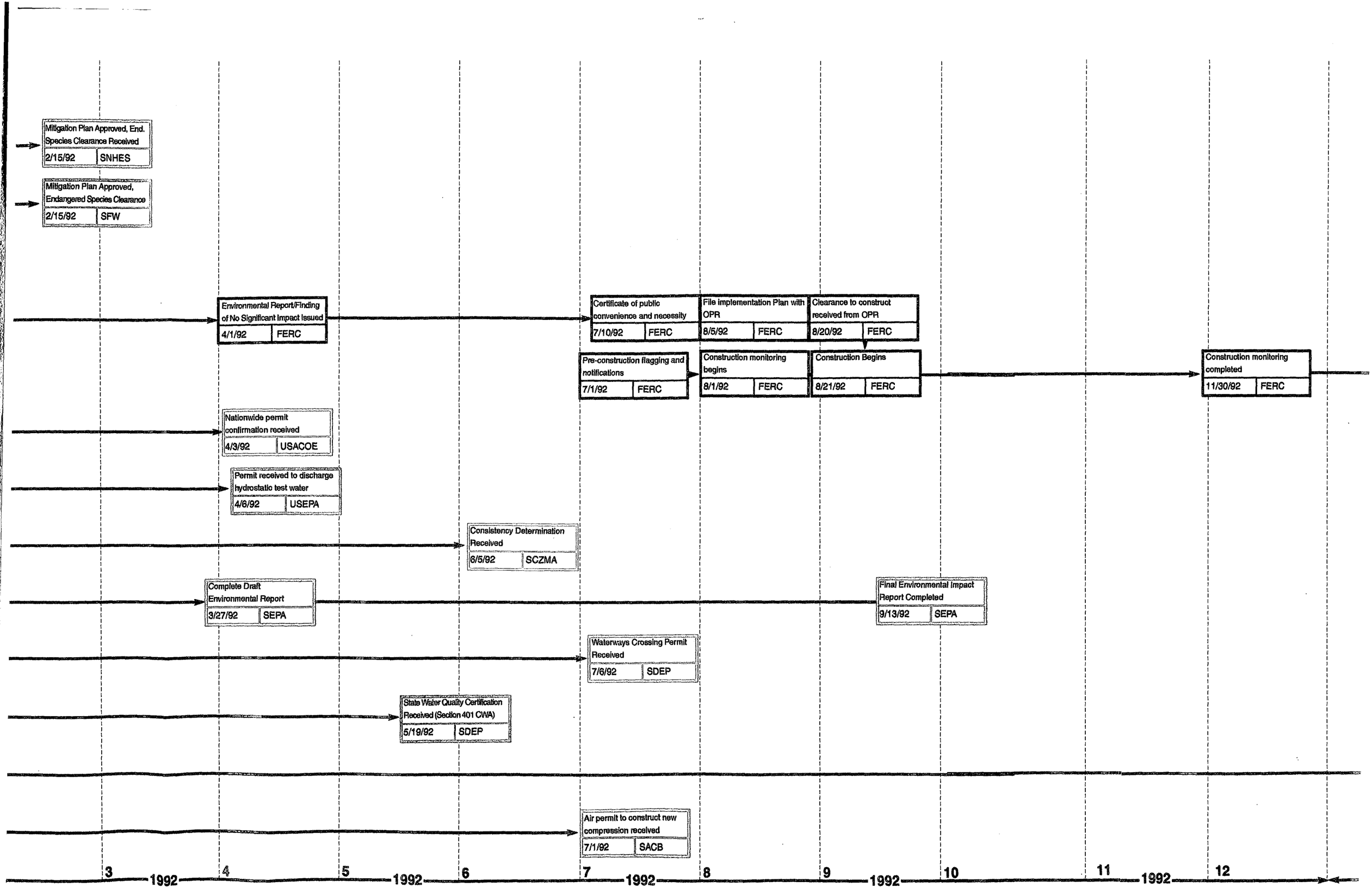
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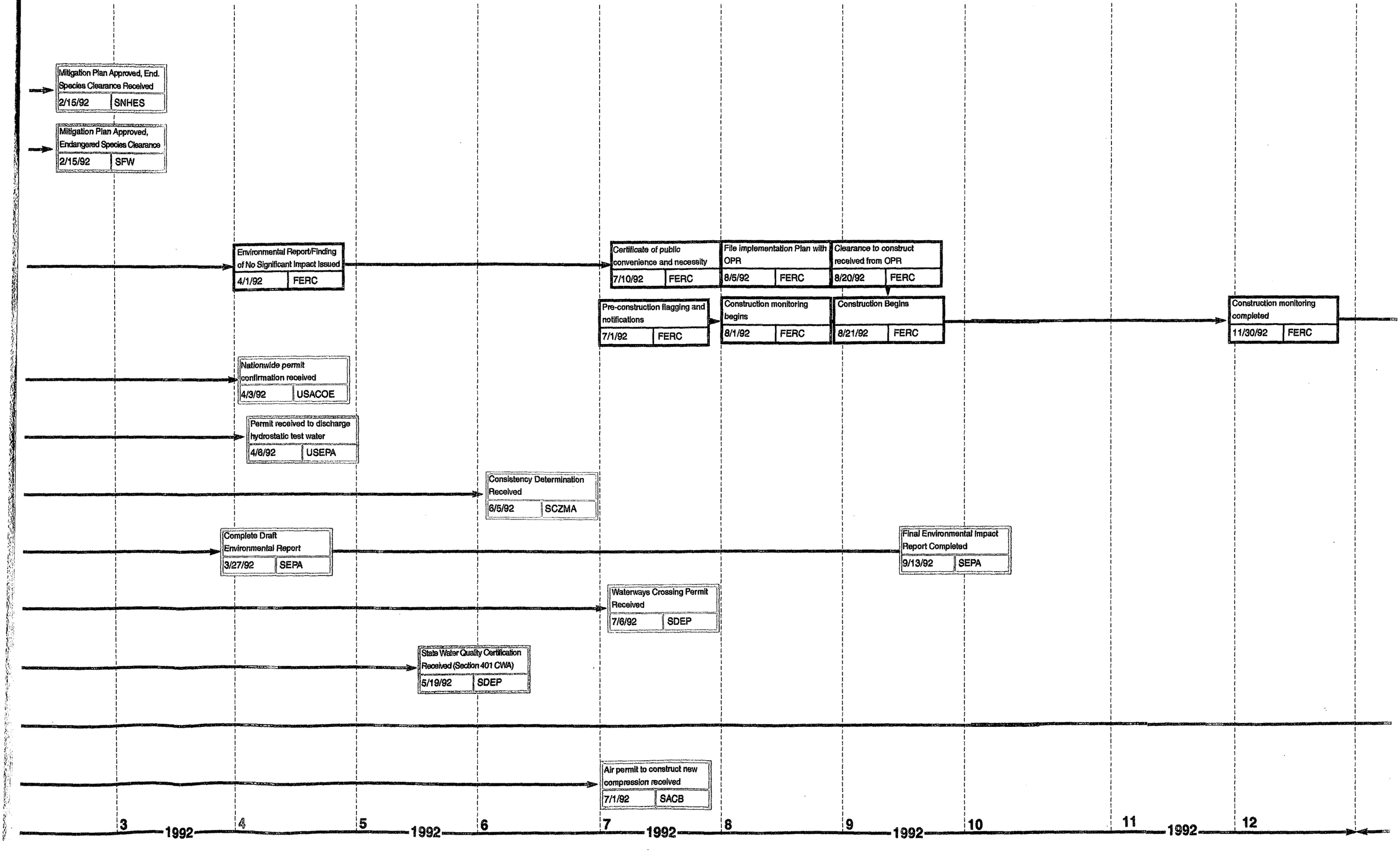
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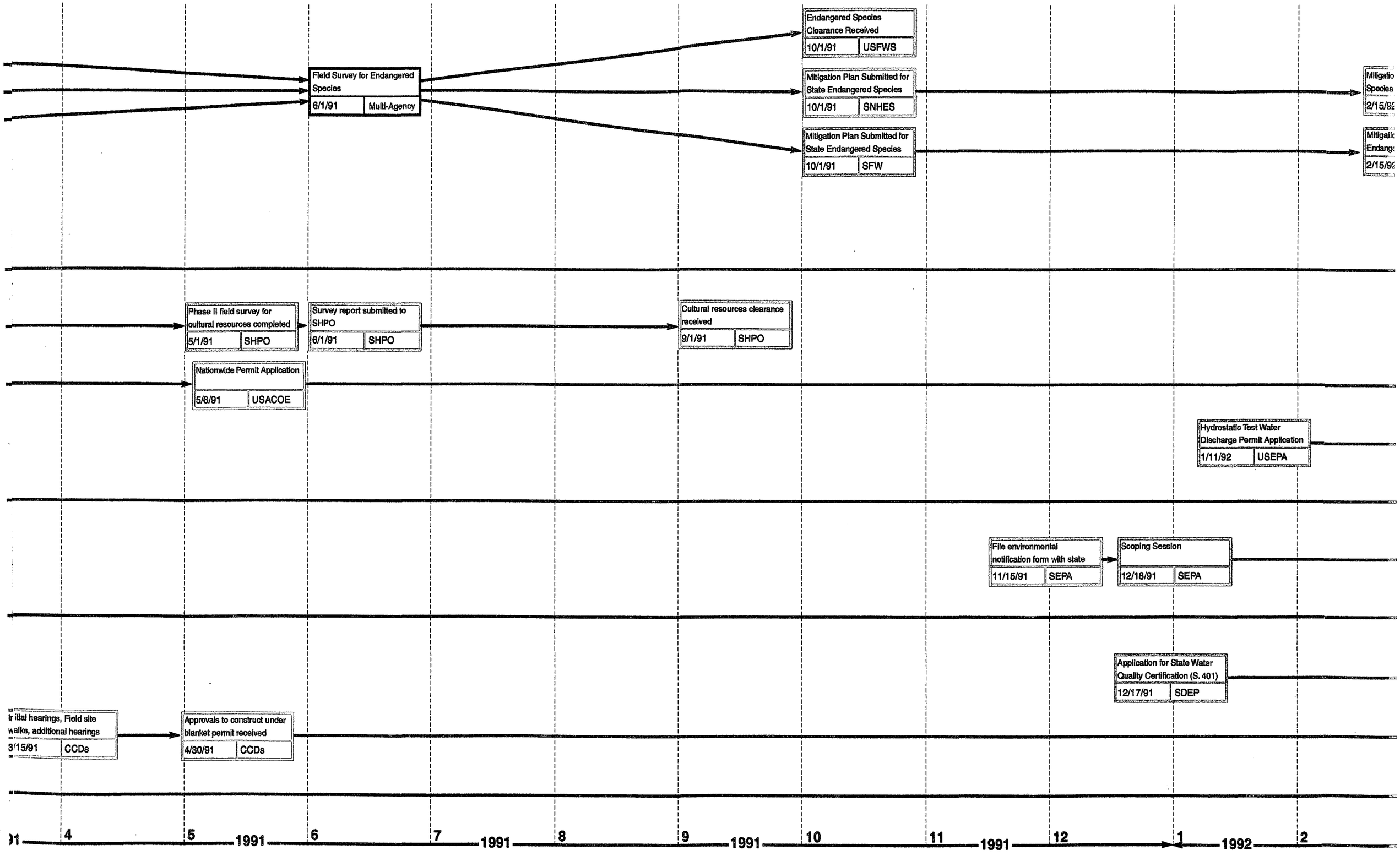
Field Survey for Endangered Species
6/1/91
Multi-Agency
Endangered Species Clearance Received
10/1/91
USFWS
Mitigation Plan Submitted for State Endangered Species
10/1/91
SNHES
Mitigation Plan Submitted for State Endangered Species
10/1/91
SFW
Phase II field survey for cultural resources completed
5/1/91
SHPO
Survey report submitted to SHPO
6/1/91
SHPO
Cultural resources clearance received
9/1/91
SHPO
Nationwide Permit Application
5/6/91
USACOE
Hydrostatic Test Water Discharge Permit Application
1/11/92
USEPA
File environmental notification form with state
11/15/91
SEPA
Scoping Session
12/18/91
SEPA
Application for State Water Quality Certification (S. 401)
12/17/91
SDEP
Approvals to construct under blanket permit received
4/30/91
CCDs
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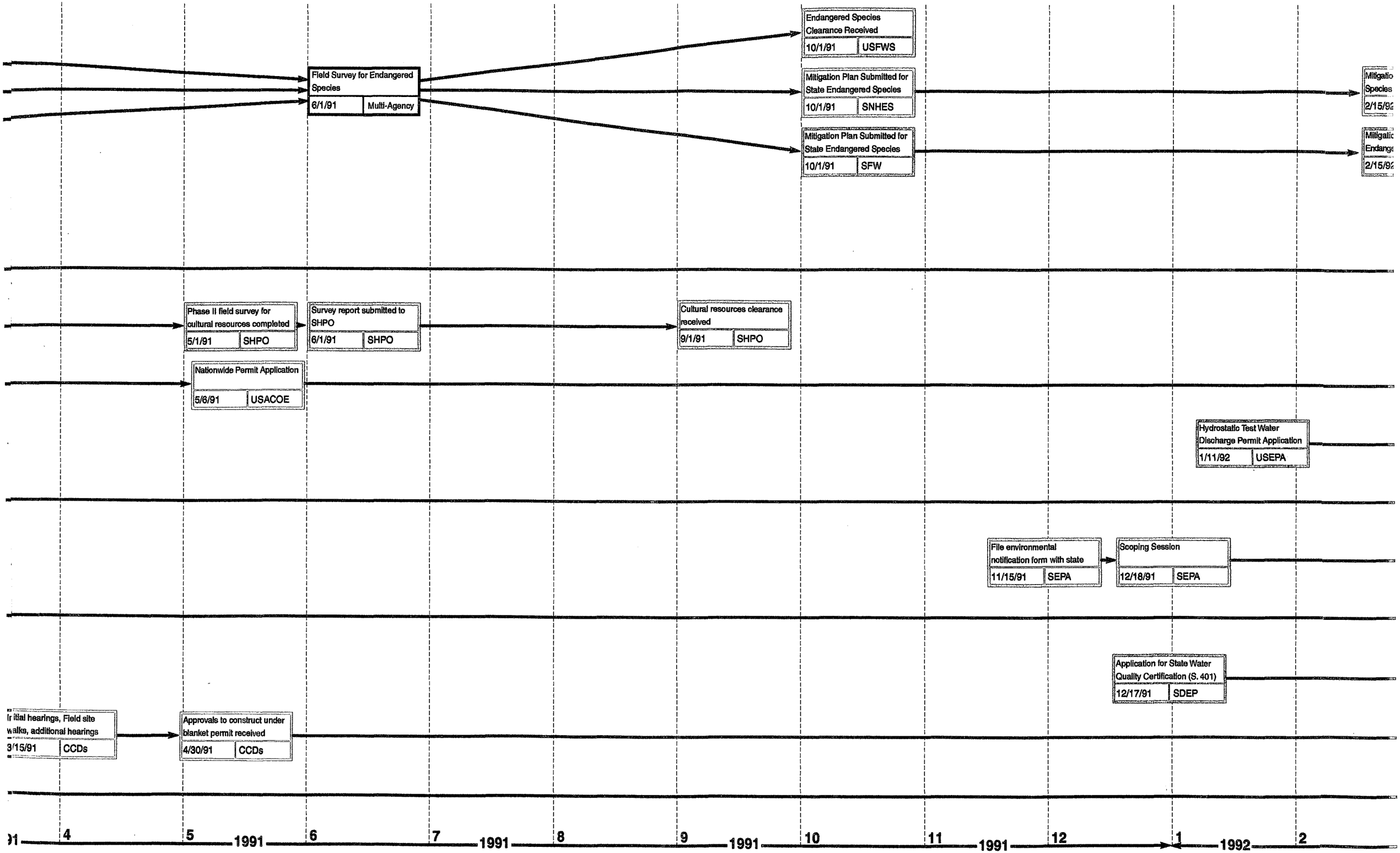
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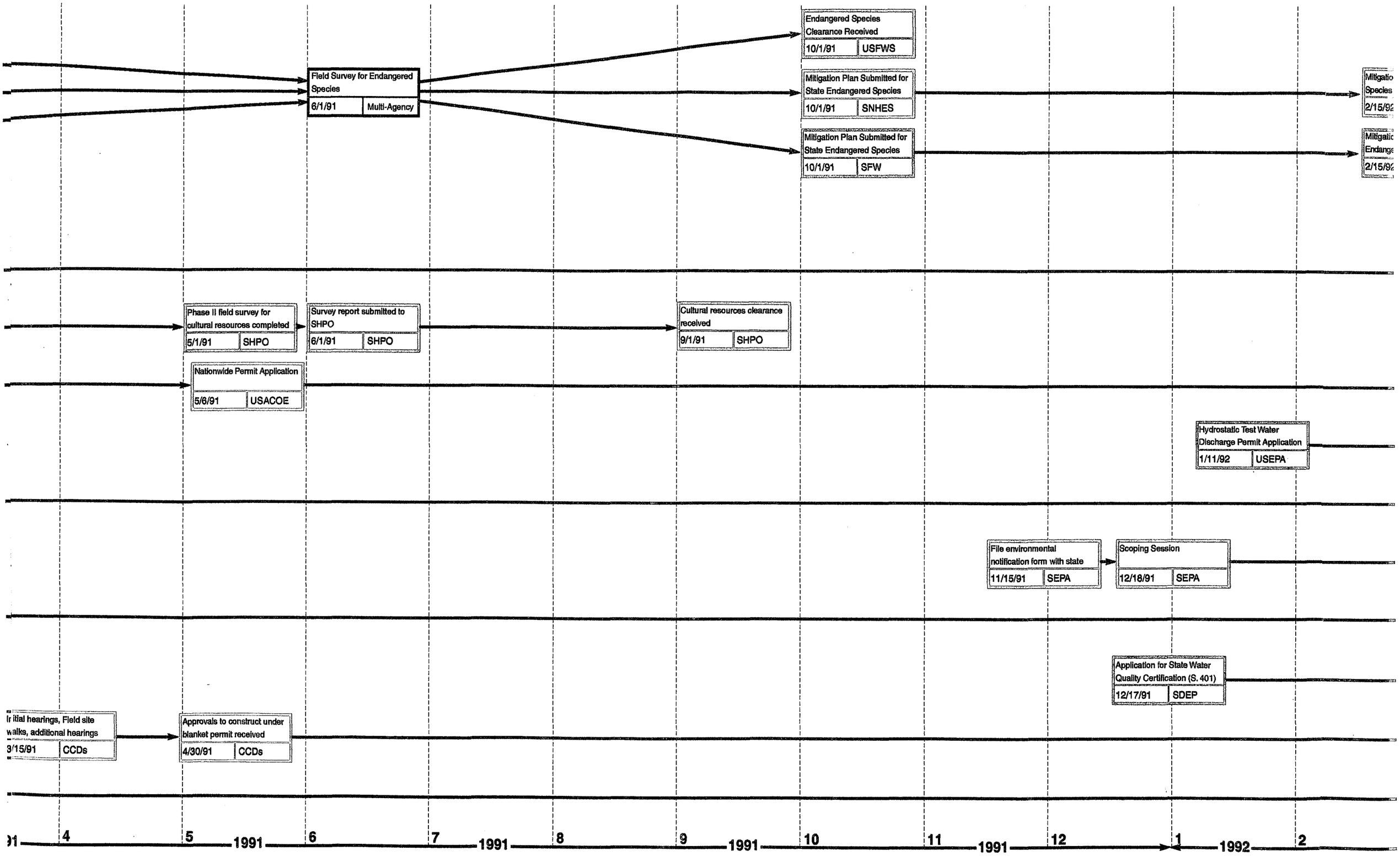
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SHPO
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5/6/91
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11/15/91
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Scoping Session
12/18/91
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Application for State Water Quality Certification (S. 401)
12/17/91
SDEP
Initial hearings, Field site walks, additional hearings
3/15/91
CCDs
Approvals to construct under blanket permit received
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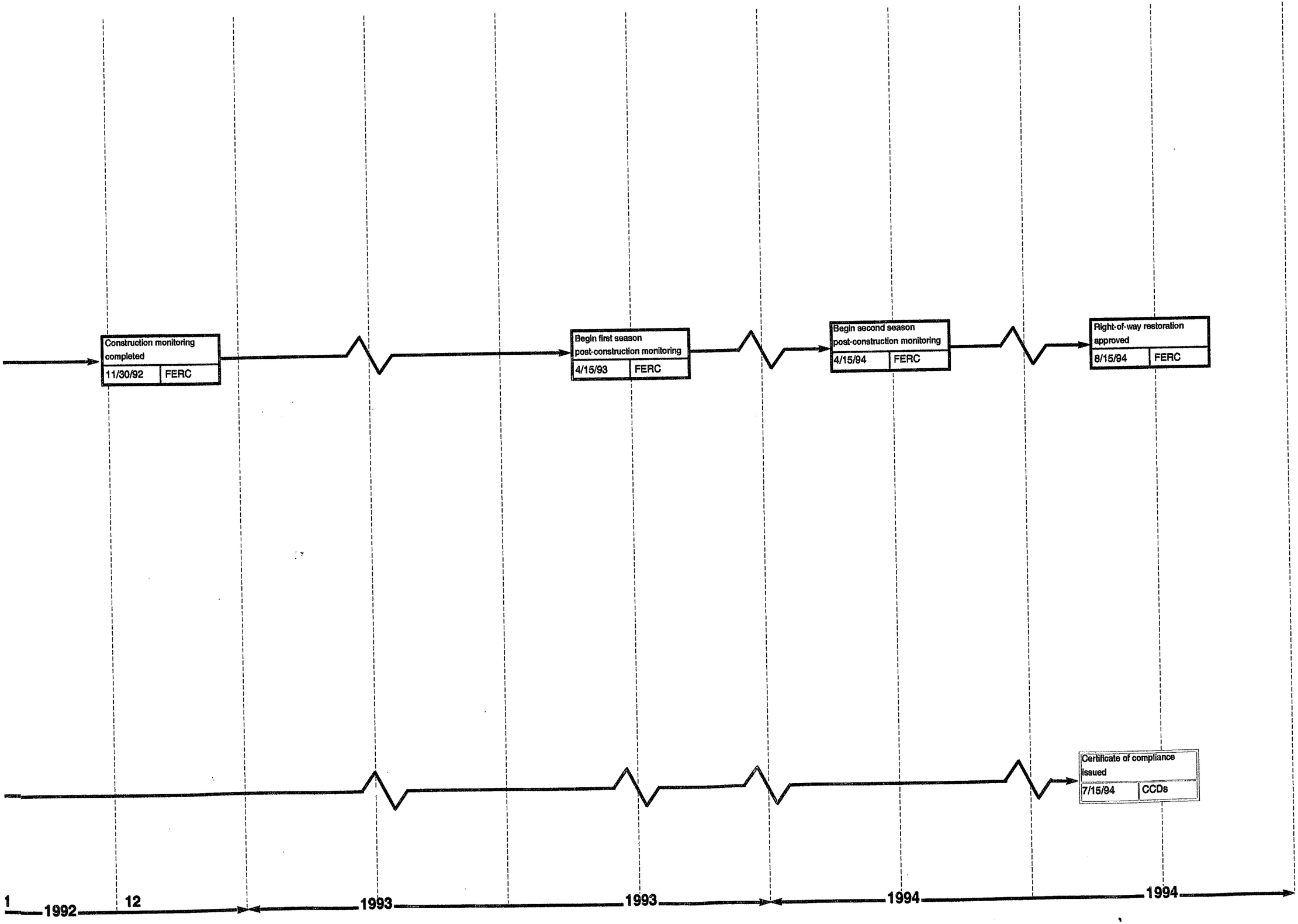
Construction monitoring completed
11/30/92
FERC
Begin first season post-construction monitoring
4/15/93
FERC
Begin second season post-construction monitoring
4/15/94
FERC
Right-of-way restoration approved
8/15/94
FERC
Certificate of compliance issued
7/15/94
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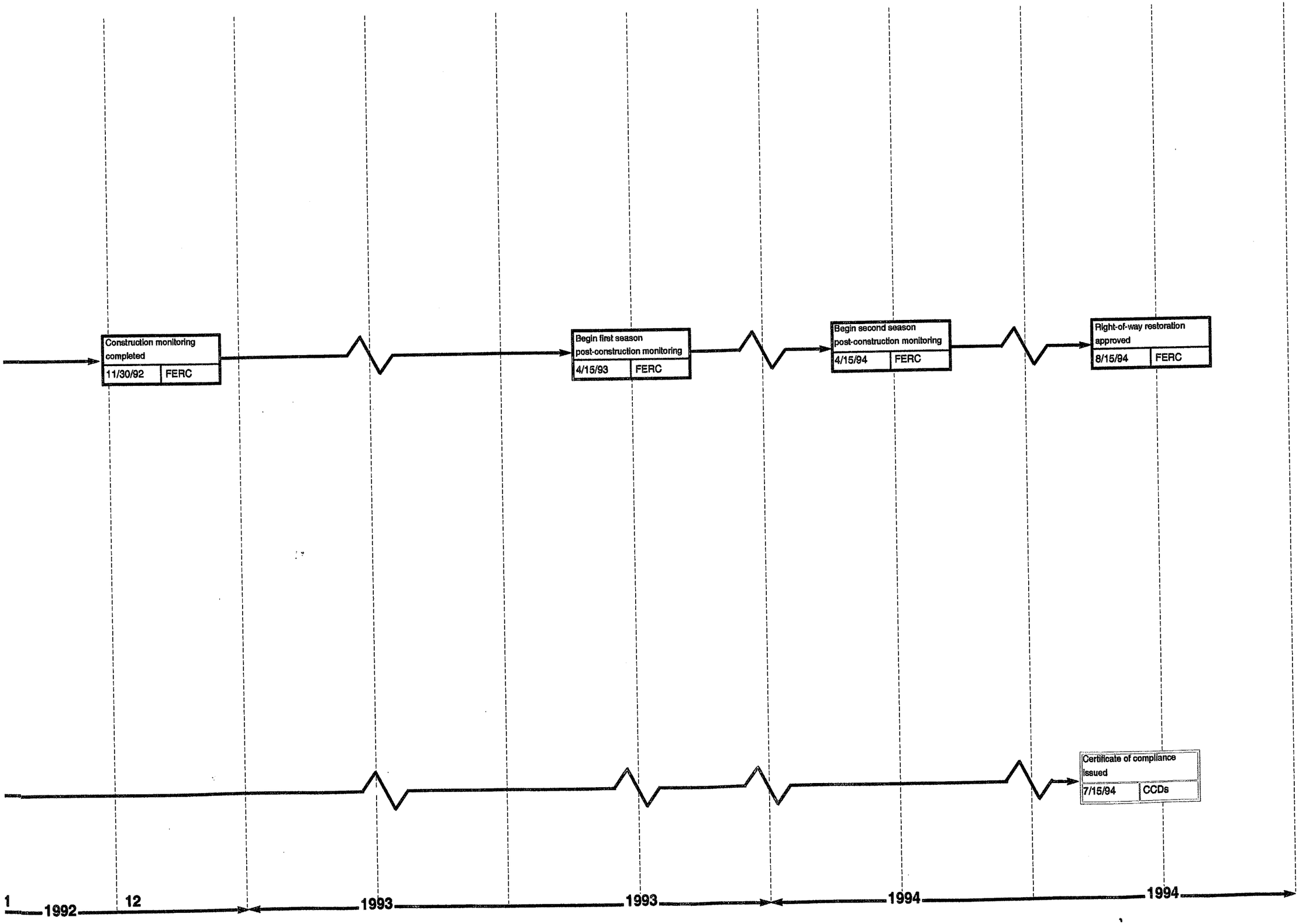
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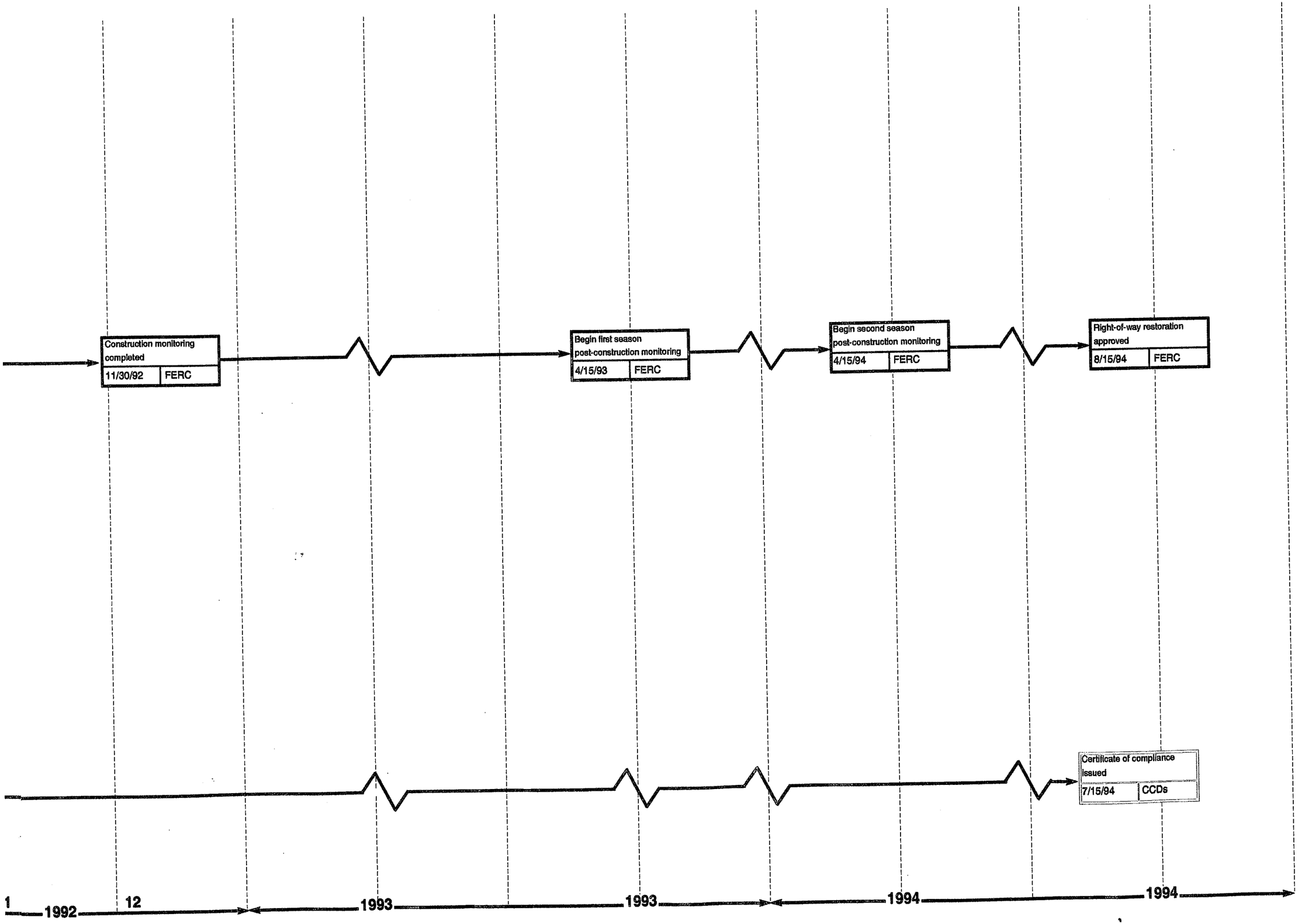
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