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MINE DRAINAGE POLLUTION CONTROL DEMONSTRATION GRANT PROCEDURES AND REQUIREMENTS

National Environmental Research Center
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U.S. Environmental Protection Agency
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MINE DRAINAGE POLLUTION CONTROL DEMONSTRATION

GRANT PROCEDURES AND REQUIREMENTS

By

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FOREWORD

Man and his environment must be protected from the adverse effects of pesticides, radiation, noise and other forms of pollution, and the unwise management of solid waste. Efforts to protect the environment require a focus that recognizes the interplay between the components of our physical environment--air, water, and land. The National Environmental Research Centers provide this multidisciplinary focus through programs engaged in

- studies on the effects of environmental contaminants on man and the biosphere, and

- a search for ways to prevent contamination and to recycle valuable resources.

This report defines the grant procedures and requirements for Section 107 Mine Water Pollution Control Demonstrations authorized by the Federal Water Pollution Control Act Amendments of 1972.

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Director
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ABSTRACT

This report is a presentation of procedures and requirements for use by all individuals considering or participating in Section 107 grant demonstration projects authorized by the Federal Water Pollution Control Act Amendments of 1972.

The report provides an interpretation of Section 107, defines the procedures and requirements for grant applicants, and discusses all phases of demonstration projects, including monitoring requirements and reports.

This report was submitted in fulfillment of Project Number CI73-0088, Contract Number 68-03-0268, by NUS Corporation, Cyrus Wm. Rice Division, under the sponsorship of the Environmental Protection Agency.

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Interviews were conducted with state personnel and contractors having a past experience with Federal Mine Water Pollution Control demonstration grants. These persons are to be complimented for their contributions and cooperation. These contributors were as follows:

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SECTION I
INTRODUCTION

The purpose of this report is to provide a potential applicant, grantee or grantee contractor or subcontractor with specific information relative to the mine water pollution control demonstration program of the Environmental Protection Agency (EPA) under Section 107 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). The information provided in this report has one aim--to better assist all parties in assessing and understanding the procedures and requirements for Section 107 grant programs. Based on a more comprehensive understanding of EPA objectives, policies and requirements, the consideration, application and implementation of a project should result in the demonstration of feasible engineering and economic mine water pollution control abatement techniques.

It is the responsibility of an applicant or grantee to contact the EPA to become aware of grant administration procedures and requirements which are new or proposed and which may affect consideration of an application or effective and timely completion of a demonstration project.

The intent of Section 107 is to demonstrate comprehensive approaches to the elimination or control of mine water pollution from active or abandoned mining operations. These approaches should be feasible and practical from an engineering and economic standpoint. The intent of Section 107 is not research or the clean up of specific mine pollution areas, although these may be an indirect result of the demonstration. All types of mining operation and all types of abatement approaches are included under Section 107. A demonstration project may include a single point source treatment or may involve numerous abatement techniques within all or part of a watershed or river basin. Although the demonstration project objective is to demonstrate

techniques for eliminating or controlling acid or other mine water pollution, the project results may also demonstrate techniques to eliminate or control air or solid waste pollutants.

A demonstration project can involve one or more phases and can extend over a period of time of up to five years if construction is undertaken. Figure 1 illustrates typical project phases, funding periods, and acceptable time periods per phase. An applicant should submit a grant application for only the feasibility phase, with the intent that, if the abatement approach is found feasible, a demonstration project may also be implemented. In the event a feasibility study has been completed, a grant application should be submitted for the demonstration project. A demonstration project may or may not include an operational phase, but will always include water quality/quantity monitoring as a means of measuring effectiveness.

Subsequent sections of this report will discuss the various project phases, in addition to an interpretation of Section 107, grant application requirements, monitoring and reporting of project status and results.

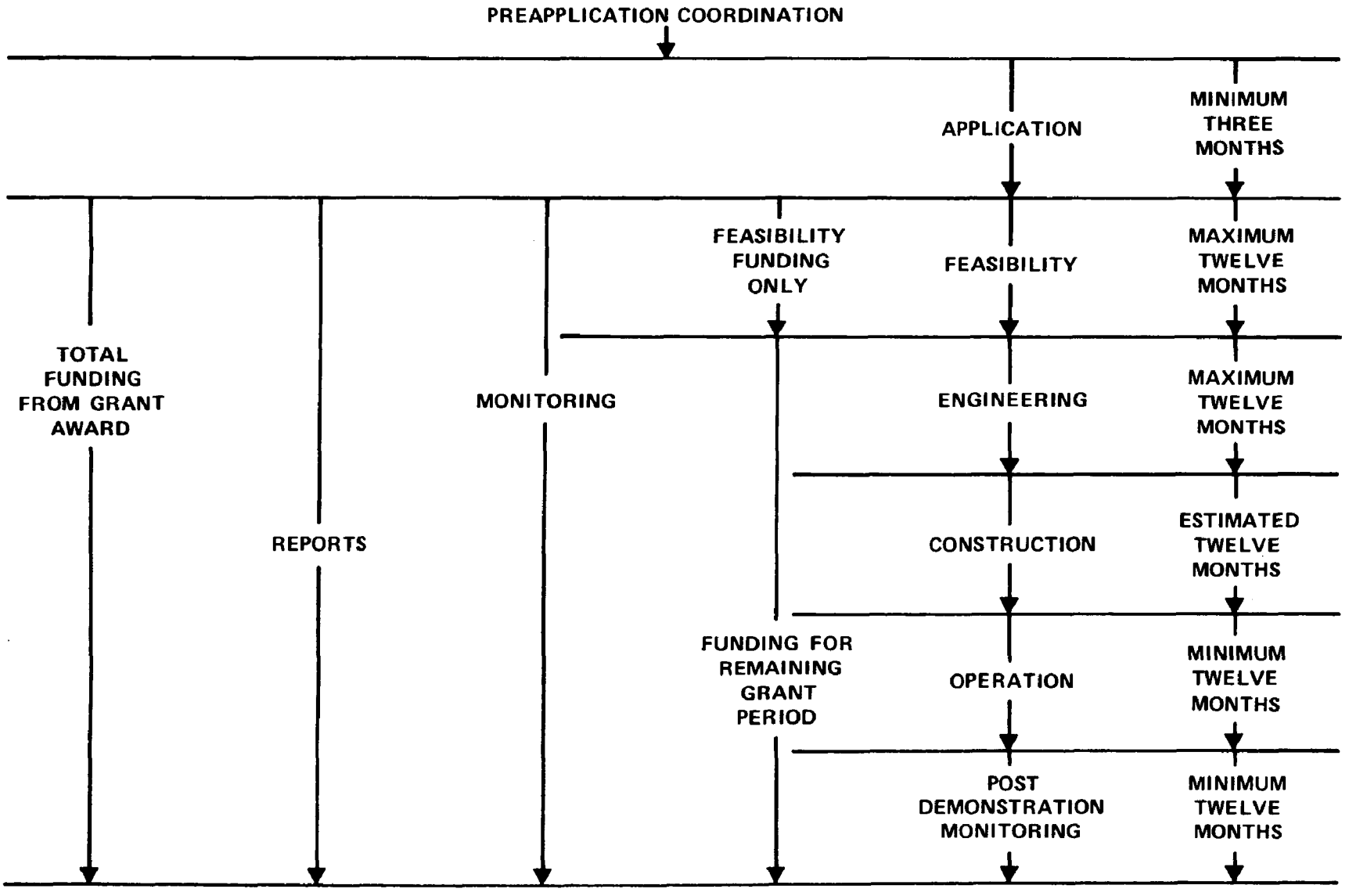


Figure 1. Grant procedures and requirements diagram.

SECTION II

INTERPRETATION OF SECTION 107

The Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) was enacted by Congress on October 18, 1972. P.L. 92-500 replaced entirely the previous language of the Federal Water Pollution Control Act, initially passed in 1956. Title I - Research and Related Programs, includes Section 107, "Mine Water Pollution Control Demonstrations," which is reprinted below:

MINE WATER POLLUTION CONTROL DEMONSTRATIONS

"Sec. 107.(a) The Administrator in cooperation with the Appalachian Regional Commission and other Federal agencies is authorized to conduct, to make grants for, or to contract for, projects to demonstrate comprehensive approaches to the elimination or control of acid or other mine water pollution resulting from active or abandoned mining operations and other environmental pollution affecting water quality, within all or part of a watershed or river basin, including siltation from surface mining. Such projects shall demonstrate the engineering and economic feasibility and practicality of various abatement techniques which will contribute substantially to effective and practical methods of acid or other mine water pollution elimination or control, and other pollution affecting water quality, including techniques that demonstrate the engineering and economic feasibility and practicality of using sewage sludge materials and other municipal wastes to diminish or prevent pollution affecting water quality from acid sedimentation, or other pollutants and in such projects to restore affected lands to usefulness for forestry, agriculture, recreation or other beneficial purposes.

"(b) Prior to undertaking any demonstration project under this section in the Appalachian region (as defined in section 403 of Appalachian Regional Development Act of 1965, as amended), the Appalachian Regional Commission shall determine that such demonstration project is consistent with the objectives of the Appalachian Regional Development Act of 1965, as amended.

"(c) The Administrator, in selecting watersheds for the purpose of this section, shall be satisfied that the project area will not be affected adversely by the influx of acid or other mine water pollution from nearby sources.

"(d) Federal participation in such projects shall be subject to the conditions--

"(1) that the State shall acquire any land or interests therein necessary for such projects; and

"(2) that the State shall provide legal and practical protection to the project area to insure against any activities which will cause future acid or other mine water pollution.

"(3) there is authorized to be appropriated $30,000,000 to carry out the provisions of this section, which sum shall be available until expended."

The objective of the Federal Water Pollution Control Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. Consistent with the Act, Section 107 provides for demonstration projects utilizing existing technologies to eliminate or control water pollution from active or abandoned mining operations. For purposes of Section 107, the following terms are defined:

1. Mining - the extraction of minerals or fuels from the earth.
2. Extraction - the process of severing a mineral or fuel from the earth, to and including the crushing, grinding, screening and refuse separation steps necessary to produce a standard salable product.
3. Mineral - any naturally occurring substance that is neither vegetable nor animal.

Demonstration projects applicable under Section 107 can be undertaken anywhere in the United States. The term "United States" means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands and the Trust Territory of the Pacific Islands.

Section 107 of the Act has five interrelated subsections, discussed below to aid in further interpretation, as needed.

Subsection (a) - The Administrator of the Environmental Protection Agency (EPA), in cooperation with the Appalachian Regional Commission and other Federal agencies, is authorized to make grants for or to contract for projects as defined under Section 107. For the purposes of this document, Section 107 will apply only to demonstration grants. Contracts under Section 107 are not discussed in this report.

The primary objective of any Section 107 project is to demonstrate comprehensive approaches to the elimination or control of mine water pollution. Demonstration projects are limited to the control of acid or other mine water pollution resulting from active or abandoned mining operations and include all forms of pollution that affect water quality. Wastes such as sewage sludge materials or other municipal wastes could be used under Section 107 if their primary use would either diminish or prevent pollution from mining activities or would result in restoration of affected land.

The words "contribute substantially" are used in Section 107 to emphasize abatement technique selection and requirements for acceptability. These words are used to ensure that any project will be a true demonstration project rather than a project merely utilizing an existing technology or technique for the elimination or control of mine water pollution.

Demonstration projects may include restoration of affected lands. Therefore, projects could include land reclamation, revegetation, reforestation, and recreational developments.

Subsection (b) - With reference to projects within the Appalachian region, Section 403 of the Appalachian Regional Development

Act of 1965, as amended, defines the Appalachian region as certain counties (including any political subdivision located within such area) in the States of Alabama, Georgia, Kentucky, Maryland, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia. The Administrator of the Environmental Protection Agency will be responsible for coordinating with the Appalachian Regional Commission any proposed demonstration project in accordance with the objective of this Subsection.

Subsection (c) - It is the intent of Section 107 that acid or other mine pollution be eliminated or controlled within the demonstration project area. It is therefore paramount in the selection of a watershed for the demonstration project that the project area will not be adversely affected by acid or other mine water pollution entering that area.

Subsection (d) - It is the responsibility of the State to provide the site for the demonstration project. The type of interest (easement, lease, permit, license, ownership, etc.) required by this Subsection would be dependent upon the particular project. It will be necessary for the Administrator of the Environmental Protection Agency to determine what type of interest in the land by the State will be necessary to ensure no interference with the use of the land for project purposes for the life of the project. The cost of obtaining easements, etc., are to be borne by the State or its agent.

The State is to provide legal and practical protection to the project area to insure against any activities that will cause future acid or other mine water pollution. The appropriate laws, rules and regulations of the State can be cited as reference. The specific application of these laws, etc., to the project area must be defined to insure compliance with the Act. The legal and practical protection to be provided by the State will

differ from project to project and will be determined on a case-by-case basis by the Administrator of the Environmental Protection Agency.

Subsection (e) - Although funds to carry out the provisions of Section 107 have been authorized, they must be appropriated. Past fiscal year funding levels appropriated have been one to two million dollars.

SECTION III
GRANT PREAPPLICATION COORDINATION

All EPA demonstration grants are subject to the Code of Federal Regulations (40 CFR 30 and 40 CFR 40). These regulations provide applicants, grantees and the public a detailed statement of grant award and administration requirements.

Preapplication coordination for all Section 107 applicants is necessary to determine program interest and eligibility, to insure conformance to objectives of the Act and Section, to insure funding availability, etc. All applicants for demonstration grants are encouraged to contact the EPA for information and assistance prior to submitting a formal application. For purposes of Section 107, applicants should contact the Mining Pollution Control Branch, National Environmental Research Center, Cincinnati, Ohio. A flow diagram of the recommended steps for preapplication coordination is illustrated in Figure 2.

Early contact with the EPA by an applicant would provide information and assistance as follows:

1. Identification of demonstration needs and priorities and specific demonstration objectives.
2. Identification of past and current grant demonstration projects.
3. Identification of research and development program results which may assist the applicant in defining approaches and feasible abatement techniques.
4. Discussion of laws, rules, regulations, procedures, assessments to be made, application forms, etc., for developing demonstration projects, completing grant applications, and conducting demonstration projects.
5. Discussion of the availability of funds for Section 107 demonstration grant projects.

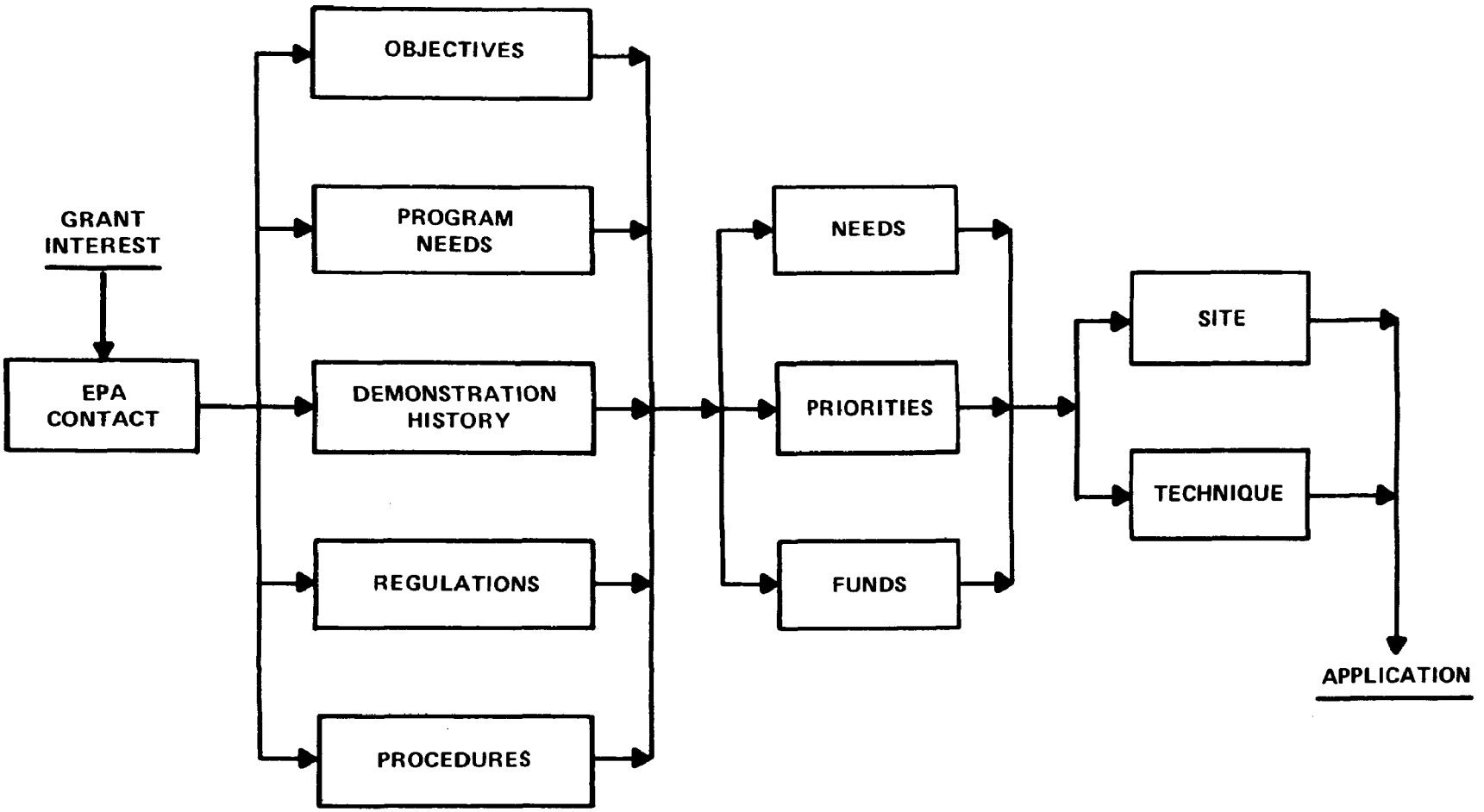


Figure 2. Preapplication coordination flow diagram.

The EPA generally requires a minimum of three months from submittal of a grant application through review and decision on that application.

The preapplication meetings are defined as follows:

Meeting 1 - General informational session covering items such as the above.
Meeting 2 - Discussion and/or review of applicant's specific approach, abatement technique, and demonstration plan.
Meeting 3 - General review of draft grant application.

It may be feasible, depending on the project, to combine Meetings 1 and 2 or 2 and 3.

Preapplication coordination with the EPA will not in any way insure the approval of a grant application.

SECTION IV
GRANT APPLICATION REQUIREMENTS

Section 107 applicants will receive from the EPA an Application Kit for Grant, which will be reviewed during the initial preapplication coordination meeting. The instructions and forms should be studied and carefully followed. The EPA should be contacted to resolve any questions concerning the application, since many items are not self-explanatory and an incomplete or incorrectly completed application may result in delay in processing the application. This section will describe the grant application requirements specifically relative to Section 107.

Grant applicants are expected to understand and comply with Regulations 40 CFR 30 and 40. Copies of these rules and regulations and administration requirements should be obtained from the EPA. The EPA Grants Administration Division should be contacted or the Federal Register should be searched from the date of the last published pertinent CFR to ensure that subsequent regulations (interim or final) are understood or incorporated prior to submission of an application. Concerning Title 40 regulations, specific items or definitions of importance to a grant applicant include:

1. Eligibility - Grants for Section 107 demonstration projects may be awarded to any responsible applicant in accordance with 40 CFR 30.304.

   In order to qualify, a prospective grantee must meet the following standards:

   a. Adequate financial resources for performance, or ability to obtain such resources as required;

b. The necessary experience, technical qualification and facilities, or ability to obtain them (including proposed subagreements);

c. The ability to comply with the proposed or required completion schedule for the project;

d. A satisfactory record of integrity, judgment and performance, including, in particular, performance grants from the Federal Government;

e. The ability to conform to the Equal Opportunity requirements of the Federal Government;

f. Otherwise, the qualifications and eligibility to receive a grant award under applicable laws and regulations.

2. Assistance - Grants for Section 107 demonstration projects are cost-sharing in accordance with 40 CFR 30.207. Participation by a grantee in the cost of conducting a demonstration project is mandatory. A contribution by the grantee of not less than 5% of the allowable actual project costs, excluding land acquisition costs, is considered minimum participation.

3. Project Officer - The EPA representative responsible for monitoring and reporting on the project is the Project Officer.

4. Duration - The demonstration grant budget period cannot be in excess of two years, except in the case of projects involving construction. No demonstration grant will be awarded by the EPA for a project in excess of five years, except in cases where time extensions are

necessary and the project can be continued without the aid of Federal funds. For the purposes of a demonstration grant under Section 107, the term "construction" is intended to include land reclamation, mine sealing, revegetation, treatment works, etc.

5. Effective Date - The effective date of a grant is the date that the Grant Agreement is signed by the grantee. A Grant Agreement must be completed and returned to the EPA within three weeks after receipt or within any extension of time as may be granted by the EPA. Receipt of a written refusal or failure to return the properly executed document within the prescribed time will result in the automatic termination of consideration of the grant offer by the EPA.

6. Cost Incurrence - No costs may be incurred prior to the execution of the Grant Agreement by the EPA and the grantee.

7. Time Extensions - If the initiation of actual work may be delayed due to the negotiation of contracts or subcontracts, and if this delay will affect the expected completion date of the project, a grantee must immediately inform the EPA in writing, defining the cause for delay and requesting a revised starting date and proposed completion date. The foregoing applies after initiation when a demonstration project is delayed due to extreme weather conditions, delivery of equipment, etc. Concurrence by the EPA will result in an amendment to the Grant Agreement.

8. Contracts, Subcontracts and Purchases - Any contract or subcontract under a Grant Agreement exceeding

$25,000.00 shall receive a cost analysis by the EPA prior to approval by the EPA Project Officer or grantee, or execution of a contract or subcontract agreement. Costs incurred by the grantee contractor or subcontractor prior to receipt of written approval from the EPA Project Officer are unallowable. The grantee must ensure that the EPA personnel will have access to records of the proposed contractor or subcontractor for the purpose of cost analysis and audit.

A grantee must secure prior approval from the EPA Project Officer for any proposed purchases of articles, supplies, equipment, materials, and services having a unit value exceeding $2,500.00.

9. Equipment, Materials or Supplies - Expenditures of project funds for equipment, materials or supplies may be allowed as direct project costs when such equipment, materials or supplies are required for the conduct of the project during the EPA grant support period. Accountability for such purchased items is defined under 40 CFR 30.800. A grant applicant should understand all aspects of ownership, vested interest, value assessments, final sale, disposition and accountability for all purchases of equipment, materials or supplies from project funds. Agreement on the requirements of this regulation should be made with the EPA prior to project initiation.

10. Payment - EPA grant funds can be paid to a grantee in advance or the grantee may be reimbursed periodically, based upon estimated requirements or actual costs. A written expenditures report for each budget period must be submitted to the EPA within 90 days after the end of each budget period within the project period,

and within 90 days after completion of the demonstration project. (In usual practice, an advance payment of the funds is made for the first quarter, followed by payments based on requests for reimbursement for all future grant funds.)

Payment by a grantee to contractors and subcontractors should be defined in any agreement between these parties.

11. Retention of Payment - The EPA may withhold payment of grant funds of a sum equal to either 10% of the amount of the grant or $10,000.00, whichever is greater, until receipt of the final report. Such retention will be dependent upon a specific demonstration project.

It is important that all grant applicants recognize that, as a grantee, they will be subject to certain statutory requirements, Executive orders, and policies and procedures regarding patents and inventions, rights in data and copyrights. Information concerning these important regulations can be found in 40 CFR 30 (Subparts C and D).

Any applicant submitting a grant application containing confidential data should clearly indicate its desire for confidential treatment of such data by the EPA. When an applicant desires that certain data be considered confidential, the statement included under 40 CFR 40.155 should be inserted on the cover sheet of the application.

Specific regulations are defined under 40 CFR 30.604 concerning public dissemination of information relative to the project (publicity and publications), surveys and questionnaires, and signs where the project work is visible to the public. These regulations should be understood by the grantee and its contractors or subcontractors.

All applications for demonstration grants should be submitted in an original and 14 copies to the Grants Operations Branch, Grants Administration Division, Environmental Protection Agency, Washington, D. C. 20460. Figure 3 defines the typical application process. Each application should include the following (these forms, etc. are furnished in Application Kit for Grant)

1. Completed Grant Application/Proposal Receipt card (EPA Form 5700-8)
2. Completed Application for Federal Assistance (EPA Form 5700-12)
3. Completed clearinghouse notification
4. Completed Environmental Assessment (outline is provided)
5. Relocation Assistance and Real Property Acquisition Information
6. Completed Assurance of Compliance - Title VI, Civil Rights Act of 1964 (EPA Form 4700-1)
7. Completed Notice of Research Project (EPA Form 5760-1)
8. Written certifications, as defined in 40 CFR 40.135-2 (a) and (b), for applications involving human subjects or laboratory animals

As previously defined in this report, the EPA will be solely responsible for coordination with the Appalachian Regional Commission when the proposed project will be located in the Appalachian region.

Background information concerning each of the above parts of an application will be discussed to assist an applicant in understanding the requirements and procedures necessary for preparation and submission of a grant application and for accountability during a grant demonstration project.

The Grant Application/Proposal Receipt card, when completed, permits the EPA to record the receipt of the grant application,

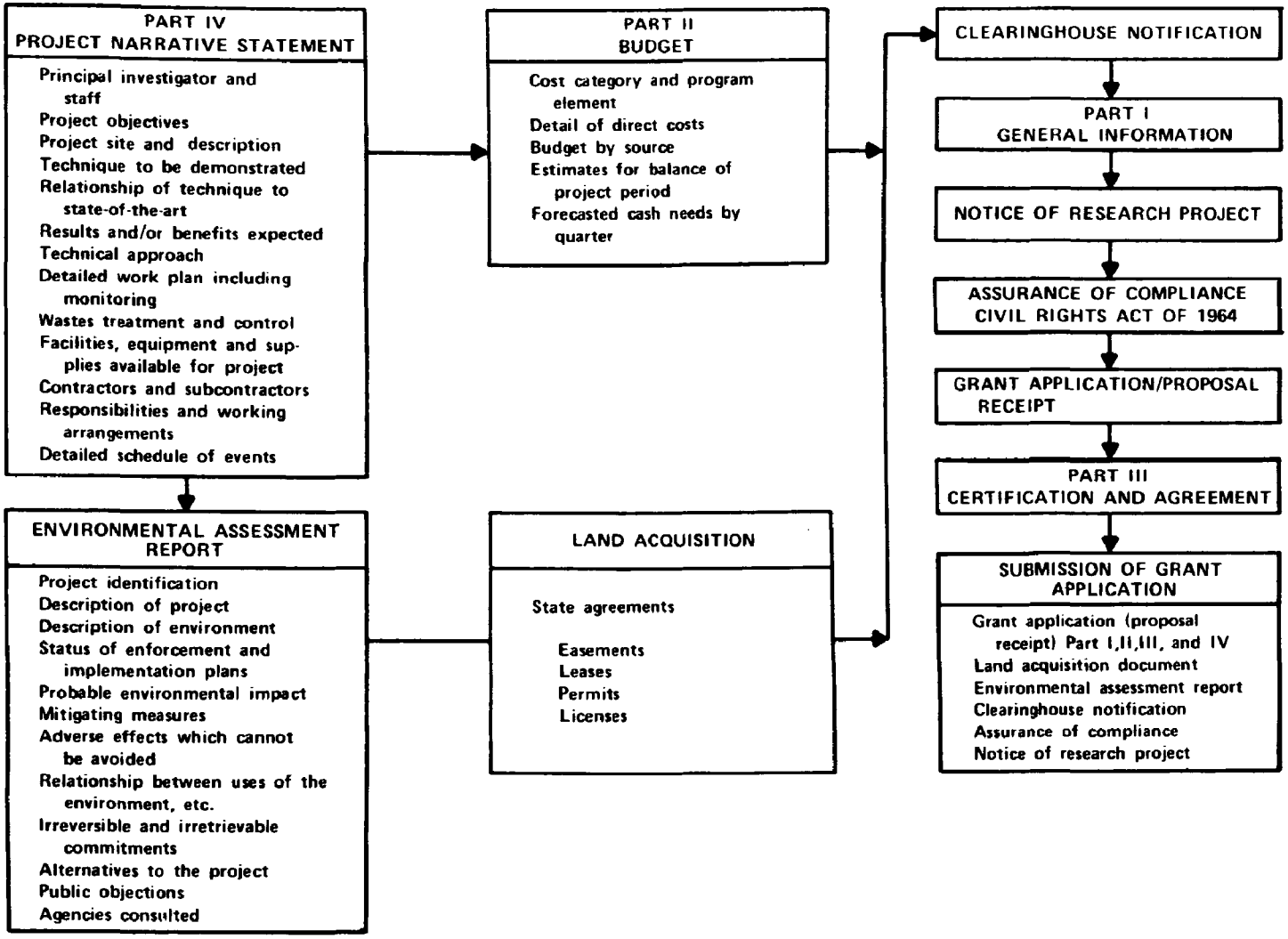


Figure 3. Application flow diagram.

initiate processing procedures, and notify the applicant that the application has been received and the application number assigned. The application number should be used in all correspondence with the EPA (note number on upper right of page).

The planning and development clearinghouse(s) of the State (or States), region (if one exists), or metropolitan area in which the project is to be located must be notified by an applicant of its intent to apply for Federal assistance. Information and assistance concerning notification procedures should be obtained from the appropriate clearinghouse(s). A copy of the applicant's response(s) from the appropriate clearinghouse(s) must be attached to the application at the time of submittal.

The EPA will provide to an applicant a copy of the regulations governing the preparation of the necessary environmental impact assessment for a proposed demonstration project and a copy of the environmental assessment outline to assist the applicant in making such an assessment. The environmental assessment, submitted as a separate document by an applicant, will be utilized by the EPA in preparing its Environmental Impact Statement required by the National Environmental Policy Act of 1969, Executive Order 11514, and the Council on Environmental Quality's Guidelines of April 23, 1971. The environmental assessment report to be completed by an applicant (and supported by the Application for Federal Assistance) should include, as appropriate, the following information:

1. Identification
    a. Project title
    b. Name and address of applicant
    c. Date
    d. Name, title and signature of authorized representative of applicant

2. Description of proposed project
   a. Proposed project description
   b. Purpose of project
   c. Location of project
   d. Project time schedule
   e. Project interrelationship with other projects or proposals in the project area
   f. References for supporting documents (feasibility - design studies)

3. Description of the environment
   a. Location
   b. Physical characteristics
   c. Topography
   d. Historical and archaeological sites
   e. Geology
   f. Seismology
   g. Geography
   h. Climatology and meteorology
   i. Hydrology
   j. Land and water uses (current)
   k. Ecology - aquatic and terrestrial
   l. Chemical and physical characteristics of air and water in the vicinity of the proposed project
   m. Present and anticipated level of economic development

4. Definition or reference to any pending legal or enforcement actions
   a. Enforcement conference recommendations
   b. Air or water quality standards
   c. Implementation plans
   d. Other legal or enforcement actions
   e. Respective status or progress on each

5. Probable impact of the proposed project on the environment
   a. Land use compatibility
   b. Water use compatibility
   c. Heat dissipation
   d. Chemical wastes
   e. Sanitary wastes
   f. Solid wastes
   g. Biological impact
   h. Impact, adverse or beneficial, the proposed project will have on the land use and economic and social well-being
   i. Aspects which could result in man-caused accidents or natural catastrophes
   j. Unknown or partially understood impacts relative to the ecology
   k. Construction noise, gaseous emissions, or other areas of specific interest

6. Mitigating measures included in the proposed project
   a. Measures to be initiated to protect or mitigate the impact of the proposed project on the environment
   b. Proposed investigations and continuous monitoring/surveillance programs
   c. Air or water quality or solid wastes impacts, in accordance with local, State or Federal regulations

7. Adverse effects which cannot be avoided should the proposed project be implemented
   a. Environmental impacts previously described in (5) and (6) above, the relative values placed upon those impacts, and analyses of who or what is affected and to what degree

b. Action(s) which would be taken if adverse environmental effects became known through (6.b) above

8. Relationship between local short-term uses of the environment and maintenance and enhancement of long-term productivity
   a. Assessment of the construction and operation of the proposed project
   b. Immediate and long range beneficial uses of natural resources
   c. Actions to minimize short-term effects on the environment due to construction, and anticipated long-term effects, if any
   d. Local short-term effects of air releases, liquid discharges or solid wastes disposal on the environment
   e. Trends of similar activities on the environment

9. Any irreversible and irretrievable commitments should the proposed project be implemented, including a discussion and quantification, where possible, of any irrevocable uses of resources
   a. Resource extraction
   b. Erosion
   c. Destruction of archaeological or historical sites
   d. Animal or plant habitat
   e. Changes in land use (solid waste disposal, etc.)

10. Alternatives to the proposed project
   a. Not proceeding with the project
   b. Alternative site locations
   c. Alternative processes
   d. Alternative energy sources
   e. Plant design alternatives

f. Water sources
   (1) Surface water development
   (2) Groundwater development
   (3) Improved water management practice
   (4) Recycling of sanitary and industrial effluents to industrial, agricultural, etc., users

11. Public objections, if any, to proposed project and their resolution

12. Agencies consulted about the project, including name, title and address of representative contacted
   a. Federal
   b. State
   c. Local

Section 107 provides that, for a demonstration project, the State shall acquire any land or interests therein. Projects which involve the acquisition of land must include documentation from the State specifying land acquisition commitments. When a proposed project results in the acquisition of land and displacement of any person from his home, business, or farm, the State must insure the EPA, at the time of application, of compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, P.L. 91-646. Procedures for complying with the Act are defined in 40 CFR 4.1 et seq.

The Application Kit for Grant contains an Assurance of Compliance Statement under Title VI, Civil Rights Act of 1964. This EPA form must be executed and included as part of the application.

Each applicant for a Section 107 demonstration grant must complete and submit as part of an application a Notice of Research Project (NRP). This form, furnished with the Application Kit

for Grant, shall contain the name and address of applicant, name of applicant's project director, or principal investigator, the project title and a summary of the proposed project (200 words or less), defining the objectives, technical approach and work plan. Confidential data is to be omitted. If the proposed grant project receives EPA approval, the NRP will be registered at the Smithsonian Science Information Exchange and may be released to others who request references on research currently in progress in specified subject fields. Additional information may be obtained by writing to:

Smithsonian Science Information Exchange
1730 M Street, N. W.
Room 300
Washington, D. C. 20036

The Application Kit for Grant furnished to an applicant by the EPA will contain the Application for Federal Assistance, with instructions. The application, to be completed for Section 107 grant demonstration projects, shall consist of:

Part I	General Information
Part II	Budget Information
Part III	Certification and Agreement
Part IV	Project Narrative Statement

Usually, applicants for Section 107 grant demonstration projects initially apply only for a grant to conduct a feasibility study, as shown in Figure 1; however, they may make application for a complete demonstration project. The selection of approach will depend primarily on an assessment of the technical and economic feasibility of a proposed project, and the ability of an applicant to sufficiently define the various project phases (such as engineering, construction, operation, monitoring, etc.) and detail the budgets for such phases. When the feasibility and/or

engineering for a proposed demonstration project has been previously ascertained or completed, an applicant can submit an application for construction, operation (if applicable) and monitoring. All demonstration projects must include monitoring. Subsequent sections of this report define the general requirements for each applicable project phase, including monitoring and reports. Figure 1 also provides for an applicant the general period of time for each project phase.

The narrative statement (Part IV) to be prepared by an applicant must include all appropriate items defined under Part IV - Narrative Statement, Research and Demonstration Grants (pages 8 of 13 and 9 of 13 of instructions). Each page of the narrative statement should be numbered consecutively. Additional information to be included in Part IV, or to be included in the project planning, as applicable, is as follows:

1. Capabilities, experience, facilities, and biographies of principal staff members and proposed contractors and subcontractors. A consultant is considered a contractor or subcontractor. Information should be provided on specific capabilities and experience to perform the proposed project work.
2. A detailed time schedule of events expressed as a bar chart, with narrative description in text form.
3. Specifications for water sampling, including a definition of methods for collection (grab, composite, use of automatic samplers, frequency of collection and analyses, etc.).
4. Specifications for water analyses, including a definition of field and laboratory test methods to be utilized, and the determinations to be completed (i.e., pH, turbidity, mercury, specific conductance, dissolved iron, etc.).

5. Detailed plans for conforming to any requirements imposed under Federal, State or local authority for providing required treatment for liquid, solid or airborne wastes.
6. Discussion of specific responsibilities and proposed working arrangements with contractors and subcontractors.
7. Discussion of project delays which may be encountered due to extreme weather conditions; delivery of equipment, materials and supplies; time availability of contractors or subcontractors; and negotiation of contracts or subcontracts.
8. Plan for preparation of photographs and slides to provide a pictorial history of the project.

Figure 3 provides a listing of the items to be included in Part IV - Project Narrative Statement. An applicant should make an assessment of the proposed demonstration project, prepare an outline, and obtain agreement on the Part IV items with the EPA during the preapplication coordination meetings. In the event an application is submitted only for a feasibility study, the grantee must submit another application for a continuation grant. To be eligible for a continuation grant, the grantee must:

1. Provide supportive information that the feasibility study being conducted or completed justifies the demonstration project; and
2. Demonstrate satisfactory performance during all previous budget periods; and
3. Submit a continuation application no later than 90 days prior to the end of the budget period.

Allocation and allowability of costs to perform a grant demonstration project must be in compliance with 40 CFR 30.701. The following regulations apply:

1. To State and local governments, Office of Management and Budget (OMB) Circular A-87.
2. To educational institutions, OMB Circulars Nos. A-21 (Revised) and A-88.
3. All others are governed by the Federal Procurement Regulations, Title 41, Code of Federal Regulations, Chapter 1, Subpart 1-15.2.

Detailed budgets for Section 107 grants are to be prepared in accordance with the instructions for Part II included with the Application for Federal Assistance. These instructions must be thoroughly understood by an applicant and the forms (Part II) prepared as directed. The budget and supporting financial data, quotations, etc., must be auditable by the EPA. Such an audit includes contractors and subcontractors.

Part II of the application is divided into the following schedules and sections:

1. Schedule A - Budget

Section A	Budget by source
Section B	Budget estimates for balance of period
Section C	Forecasted cash needs by quarter
Section D	Budget by cost category or program element
Section E	Detailed itemization of direct costs
Section F	Indirect costs

2. Schedule B - Budget (For construction projects and other projects involving land acquisition, land development, or the relocation of individuals and businesses)

Section A	Calculation of EPA grant (cost classification)

Section B · Indirect costs
Section C Budget by funding source

After the work plan has been defined (Part IV of application), the budget estimates should be prepared by identifying all elements of cost and specifying when it is anticipated that the costs would be incurred. The budget by cost category and time schedule can then be prepared.

The following will define some of the general requirements for preparing the estimates and budgets in accordance with Part II, Section D cost categories:

1. Personnel - Estimates of labor hours (person-months) per individual or labor category should be determined based on the work plan and schedule. Actual annual salaries for identified individuals should be used. Less than person-year efforts are determined by using monthly or bi-monthly salaries. When a project extends over a salary review period, the salary rate used may be adjusted in accordance with applicable Federal guidelines. When a labor category is used, the salary must represent the average salary or average of the range for all individuals in a specific labor category. Since many grant demonstration projects extend over 12-month periods, salaries used for the budget should reflect the costs that may be incurred. This cost category is for grantee personnel only. Item 6 defines personnel costs for contractual services.
2. Fringe Benefits - The cost of fringe benefits can generally be determined to be a percentage of direct salary costs. Fringe benefits generally include the cost of sick leave, vacation and holiday pay; unemployment, excise and payroll taxes; and contributions for social

security, employment compensation insurance, retirement benefits and medical and insurance benefits.

3. Travel - Estimates of travel and living expenses must be defined by number of trips, person-days, destination, purpose and unit costs per element. Travel and living expenses include the following:
   a. Auto mileage
   b. Airline fare (coach travel)
   c. Parking
   d. Auto rental
   e. Taxi
   f. Motel or hotel
   g. Meals

4. Equipment, Materials and Supplies - Quotations should be obtained to budget the cost of equipment, materials and supplies. Forward pricing estimates may be used when such items are to be purchased 90 days or longer after project initiation. Prices quoted for these items may be established catalog or market prices if they are commercial items sold in substantial quantities to the general public in accordance with the criteria defined in the Federal Procurement Regulations. Items such as film, slides, etc., are included under this cost category.

5. Construction - Quotation costs are to be itemized using the cost categories in Part II, Schedule B, Section A. Projects involving construction are subject to 40 CFR 40.145-3. Construction work will be performed by the fixed-price (lump sum) or fixed-rate (unit price) method, or a combination of these two methods, unless some other method of contracting is approved in writing by the EPA.

6. Contractual Services - The grantee should select contractors and subcontractors on a competitive basis to the maximum practical extent consistent with the objectives and requirements of the services to be performed. Contracts or subcontracts may be awarded on a fixed-price (FP) basis depending on the nature of work to be performed. In any event, procurement practices of the grantee organization shall be followed, and the grantee is expected to obtain the lowest reasonable costs.

The cost elements and general methods of preparing contract or subcontract proposals are provided in the following example:

a. Direct Labor

	Estimated Hours	Rate/ Hour $	Estimated Cost $	Total Estimated Cost
Project Manager	200	9.00	1,800	
Project Engineer	700	8.00	5,600	
Chemical and Sanitary Engineer	1,500	7.25	10,875	
Draftsman	80	5.00	400	
Secretary	100	3.25	325	
		Total Direct Labor		$19,000

b. Labor Overhead

	O.H.Rate	X Base	Estimated Cost $	Total Estimated Cost
Department or Cost Center	85%	$19,000	16,150	16,150
	Subtotal			$35,150

c. Other Direct Costs (see Reference A)

Travel	$ 1,000	
Per Diem or Subsistence	500	
Printing or Reproduction	700	
Communications	400	
	$ 2,600	2,600
Subtotal		$37,750

d. General and Administrative

8.0% of Cost Elements a, b, and c	3,020
Subtotal	$40,770
e. Fee or Profit	3,262
Total Estimated Cost and Fee	$44,032

(A) All Other Direct Costs should be itemized separately as previously defined (note reference above).

The overhead rate and general and administrative expense percentages are determined from the contractor or subcontractor financial reports in accordance with Federal Procurement Regulations. The calculations are based on the following:

$$\text{O.H. Rate (\%)} = \frac{\text{Total Overhead}}{\text{Direct Labor}}$$

$$\text{G\&A Rate (\%)} = \frac{\text{General and Administrative Expense}}{\text{Total Direct Costs and Overhead}}$$

Certain costs are non-allowable in calculating the above. These include entertainment expense, special officer life insurance policy payments, bad debts, and interest expenses.

7. Laboratory Services - Laboratory analyses may be budgeted on a unit price basis as shown in the following example:

Determination	Number of Tests	Unit Price	Total Price
pH	150	$ 1.50	$ 225
Turbidity	150	1.50	225
Mercury	150	10.00	1,500
Specific Conductance	150	1.50	225
Dissolved Iron	150	3.00	450
	Total Price		$2,625

Once the budget is prepared by cost category, it can then be expanded by program element to complete Part II, Section D. A forecast of the costs to be incurred can then be completed. The applicant should determine at this time the proposed cost sharing per cost category. In order to resolve equipment or materials disposition at project completion, the applicant may decide to propose that his cost share be used for purchase of these items. The proposed disposition of equipment should be defined in the application. In-kind contributions are considered part of a grantee's cost share, except for land acquisition.

In the event funding will be obtained from Federal sources in addition to the EPA, the combined funds represent the Federal share of allowable project costs. Proposed funding commitments from Federal sources other than EPA should be submitted in written form with the application.

Accounting for project funds includes receipts, grantee contributions and expenditures, and contractor and subcontractor expenditures, and must be in accordance with generally accepted accounting principles and practices. Supporting records of grant expenditures must be recorded in sufficient detail to show that grant funds were used for the purpose for which the grant was made (40 CFR 30.605). Any income derived from a demonstration project shall be in accordance with 40 CFR 30.603.

SECTION V
FEASIBILITY STUDY

The purpose of the feasibility study is the collection of appropriate, meaningful data about a proposed demonstration project (techniques and project site), the presentation of benefits to be gained from the proposed project and the performance of sufficient preliminary engineering to provide a reliable cost estimate. It is not a study of alternatives but must be confined to one project site and one proposed solution. While only one project is to be considered by one feasibility study, such project may include one or more individual control methods at one or more locations within the project's watershed area.

The feasibility study will identify the problems that will be encountered during the implementation and operation of the project and will document the proposed solutions to these problems. The basic steps required for the preparation of a feasibility study are outlined in Figure 4 and are discussed in more detail later in this section. A suggested format for the documentation and presentation of the feasibility study and supporting information is presented at the end of this section.

As a first step in the preparation of the feasibility study, the existing legal and jurisdictional system affecting the proposed project must be analyzed. A legal and administrative framework for the implementation and operation of the proposed project must be identified and documented. This documentation should include such pertinent data as enabling legislation, proposed allocation of administrative responsibility, ownership and surveillance. Additional legislation or administrative actions that might be required for project implementation should be initiated immediately in order to be completed prior to the application for demonstration grant funds.

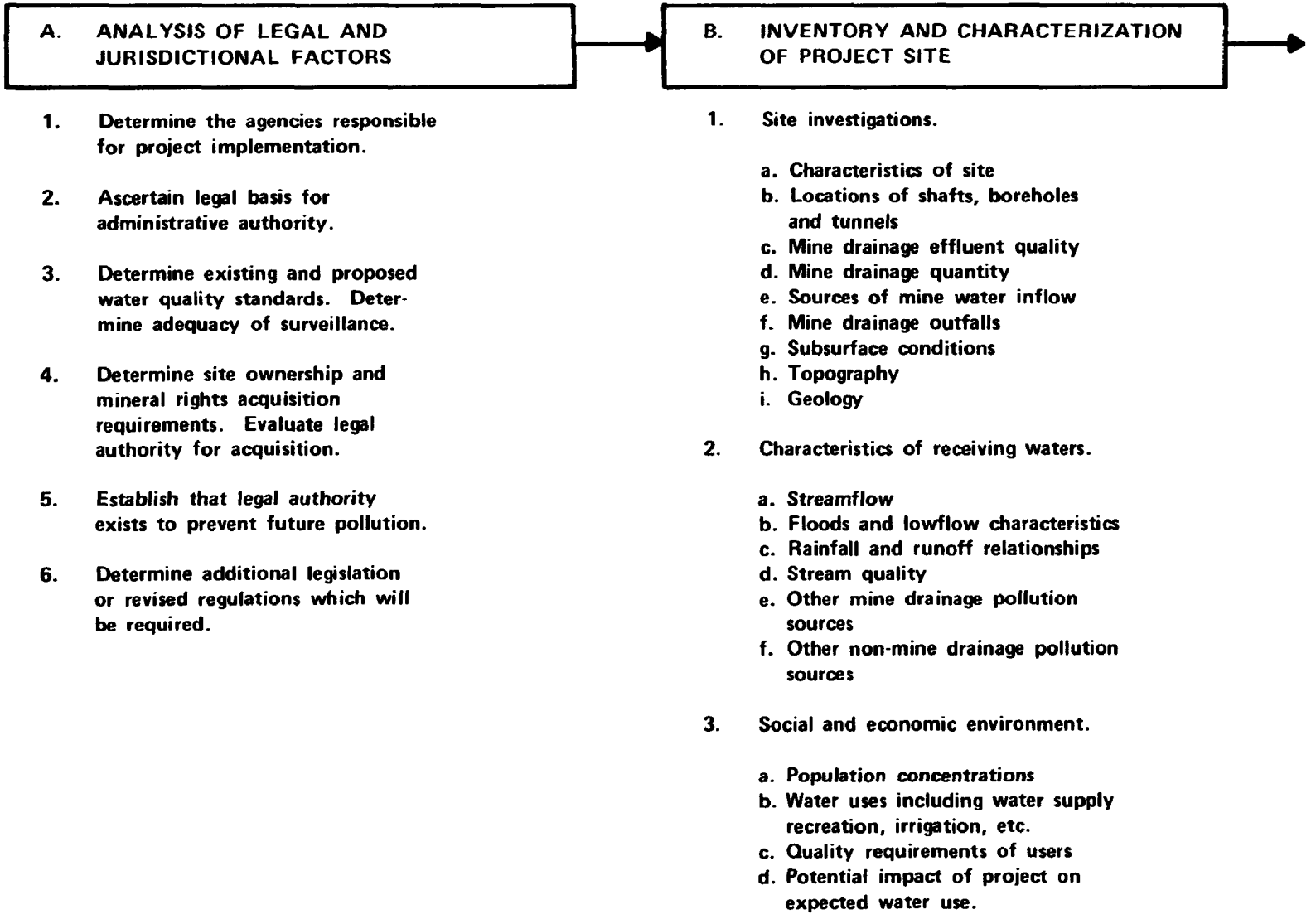


Figure 4. Feasibility study phase diagram.

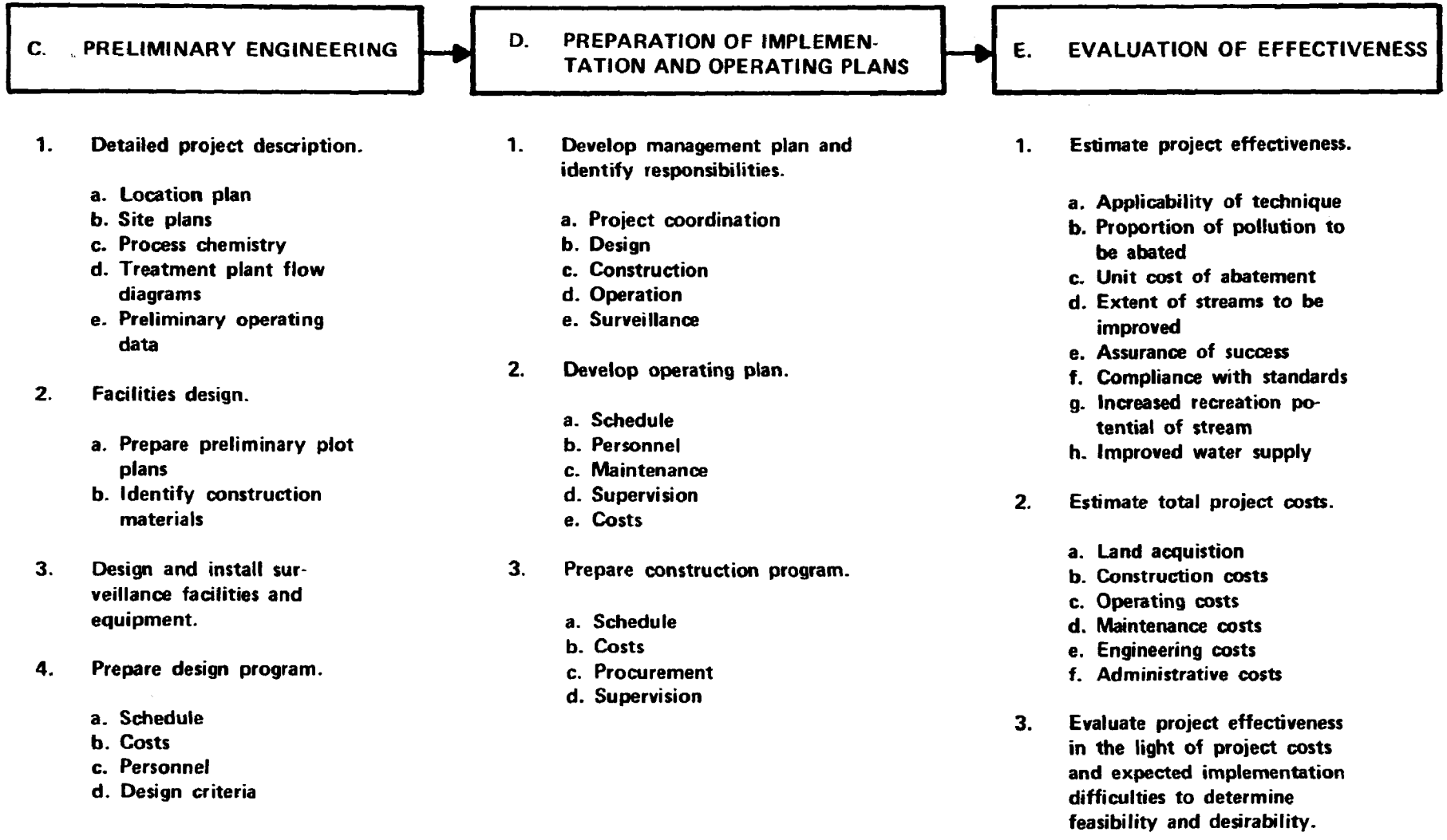


Figure 4. Feasibility study phase diagram.

An inventory of the existing and expected physical and socio-economic environment of the proposed project site must then be made. This inventory should provide supporting data for the design of the project and for the estimation of effectiveness, benefits and cost. Data collected during the inventory phase must be included in the supporting documentation of the feasibility study.

Based on the data collected in the inventory of physical conditions, preliminary designs must be prepared to determine the physical practicability of the project, as well as the cost of development. Preliminary engineering should be based on sound field survey data, including field and laboratory analyses of water quality, subsurface investigations, and hydrologic and topographic data. The expected impact of the project must be translated into measures of effectiveness, and project costs must be documented. As a final step in the preparation of the feasibility study, plans for implementation and continued operation should be prepared.

The desirability and feasibility of a mine drainage abatement demonstration project will be determined by a combination of factors including:

1. Technical feasibility
2. Demonstration value
3. Wide applicability
4. Economics and public benefits
5. Political and jurisdictional factors

The dual criteria of desirability and feasibility are included since a project or the aspect of a project might appear to be feasible in the strict sense of the word, while the difficulties, costs of the solution and limited application could outweigh the value of the project. For example, if extensive legislative changes are required to enable project implementation, these

changes might be possible, but only with extensive delays and political and economic costs that would be considered excessive when evaluated in light of expected project effectiveness. The rationale for determining that the project is feasible and desirable should be included in the Conclusions and Recommendations section of the Feasibility Report.

In performing the feasibility study, each of the applicable major steps in this section must be addressed in adequate detail such that the merits and demerits are clearly evident for the proposed project. The study need not be limited only to the steps shown, however.

A. JURISDICTIONAL FRAMEWORK

It is essential that the legal authority be clearly established for the State or interstate agency or their agents to engage in all facets of the demonstration project. The agencies concerned with acquisition, design, construction and operation must be identified, as well as the orders and regulations under which they operate relevant to the proposed mine drainage demonstration project. How the project would operate under existing legal authority is extremely important.

1. Cognizant Authority

Reference the legislation, regulations, or other orders which the State or interstate agency has authorized for work in mine drainage abatement. List the subagencies responsible for contracting, administering and operating the proposed demonstration project and the scope of their operations, as well as their relevance to mine drainage. Discuss clearly the adequacy of the present legal and administrative structure for accomplishing the purposes of the project.

2. Existing and Proposed Standards

Identify any present or proposed water quality standards for the stream or streams involved. These should be referenced in the text, with relevant sections included in the report appendices. Show how any stated quality requirements for treated effluents are or are not relevant to the project. Discuss any proposed higher public uses of the waters concerned and the criteria associated with such uses. Discuss how the project proposes to affect the quality of the drainage in order to meet the subject criteria. Discuss the applicability of existing water quality and land use standards for the proposed uses. Discuss which agencies are charged with surveillance and enforcement of standards and whether the capability and authority exist to accomplish the surveillance and enforcement required by the project.

3. Site Acquisition

Determine the legal authority by which the purchase of lands, easements, condemnation, leases, or other access control techniques for the proposed site may be applied. Discuss how and when site acquisition will be accomplished within present legal authority, as well as the duration of such acquisition.

4. Water and Mineral Rights

Determine what water and mineral rights are involved in the project and how, when, and for what term the project would secure such rights under existing legislation and regulations.

5. Prevention of Future Pollution

Specify clearly and in depth the State's provisions for legal and practical protection to the demonstration area that will assure the prevention of future mine drainage pollution from areas

outside the proposed project site. Show how such protection will be achieved under existing authority for the duration of the proposed project, as well as for the post-demonstration period.

B. INVENTORY AND CHARACTERIZATION OF PROJECT SITE

Analyze physical, economic and social conditions in the mine drainage abatement program area in sufficient detail to generate the data required for planning, implementation and operation activities. Analysis of physical conditions will define the site, surface and subsurface, and will provide constraints on the abatement system selected. The inventory of water resources will define pollution sources and levels in the project area. Social and economic analysis will provide the basis for forecasting water demands and evaluating beneficial effects.

1. Physical Conditions

Determine the location of the project area and its relevant features on U. S. Geological Survey 7-1/2 minute topographic maps. Complete surveys by ground parties or aerial photography, or both, if necessary. Show at least the following for the project:

a. Political jurisdiction such as county, municipality, borough, township, city, etc., and area boundary.
b. Watershed boundary, if appropriate.
c. Location and official names of the receiving streams influenced by the demonstration project.

In the event the project deals with a watershed survey, reclamation or mining techniques, the following should be considered and reported, if applicable:

a. The minerals mined; the mineral reserve to be owned, leased or otherwise controlled by the project; and whether that reserve will be mined or unmined.
b. The name, type of mine, status and surface areas mined and affected by surface mining.
c. The location of surface subsidence areas resulting from underground mines.
d. The name, type and status of deep mines; location of mine openings and mine discharges; and maps of mine areas.
e. The location of interconnections between adjacent deep mines, as well as deep-mine/surface-mine intercepts.
f. The location of gas, oil and water wells and levels of producing formations of each.
g. The location of boreholes and elevation of mineral seams.
h. Subsurface geology indicated from boreholes and other sources.
i. The location of geologic faults.
j. The location of any surface or subsurface water impoundments.
k. An analysis of the materials remaining that could contribute to mine drainage pollution.

Show proof that the physical information obtained on the project area from the foregoing survey is adequate for the project. Discuss the effect on the project of inadequacies, inaccuracies or voids in the foregoing and how the proposed project will compensate for such.

2. Water Resources

The quantity and quality of surface and subsurface water in the project area must be known, as well as the quality and quantity of existing mine water pollution. Since rainfall affects both

of the foregoing, such information is also desired seasonally. The following information should be reported, if applicable:

a. The mean low, mean, mean high, and high flow for a ten-year period for each affected stream, as well as seasonal variations in mean flow. The lack of this historical information should be reported. Flow data should be collected for high and low flow periods or at least for one hydrological cycle.
b. Mean flow seasonally (at least one year) for each mine water pollution source.
c. Annual withdrawals from any water wells and, if available, any record of variation in water table.
d. Quality of water in streams and wells, with particular attention to those parameters reflecting mine water pollution, as well as those covered by relevant stream standards.
e. Quality of mine water discharges, with emphasis on those parameters causing pollution in receiving streams and subject to alteration by the proposed demonstration project.
f. Rainfall data, including ten-year and one-year maximum rainfall.
g. Frequency of sampling which will depend upon the conditions for each project. One sample per month will be considered as a minimum, with weekly sampling preferred. The analyses of these samples should be correlated with the historical data available.

Discuss the sources of the water resource data and their adequacy for the project. Show how the project will compensate for inadequacies, inaccuracies, or voids in the foregoing. Present water quality data on a loading basis to indicate kg per day (pounds per day).

3. Social and Economic Environment

State the population and major industrial activity and their location in both the demonstration area and the downstream adjacent areas. Project the probable changes in such social and economic environments for the areas concerned.

Determine the water requirements for both quality and quantity for municipal, industrial, recreational, agricultural and power uses in the watershed and/or in the adjacent downstream area.

Discuss the changes that the social and economic environment will require in utilizing the water resources of the area concerned. Show whether the proposed mine water pollution control project will aid in meeting these requirements; indicate what changes in water utilization will be affected by the project.

C. PRELIMINARY ENGINEERING

Present sufficient details of the proposed mine drainage abatement method, identifying the application to the proposed site, capital and operating costs and past use, so that the effectiveness and means of implementation and operation can be clearly determined. Clearly show that the proposed project will fulfill its purpose of demonstrating one or more workable mine water pollution abatement or control methods. This is not a research project with only problematical prospects of success. Examples of information desired are given under each of the following headings. Additional information should be supplied whenever relevant.

1. Abatement Method Description

Describe the abatement or control method employed, including the principle of operation. Give the supporting past pilot or field

experience, the mine drainage control effected by the application, and the interrelationship between methods when more than one is proposed.

2. Preliminary Design

a. Drawings - Show in appropriate drawings and maps the following:

(1) The location and outline of the area influenced by the proposed abatement or control method and the existing mine water pollution abated or controlled.

(2) The points at which remaining drainage or treated discharge will occur and the course taken by such to the receiving streams.

(3) Topography of the area after project construction.

(4) In the case of treatment methods:

(a) Process flow sheet from point of collection through process to discharge.

(b) General location plan, with controlling dimensions, grades and elevations.

(c) Plot plan locations of major units indicated on the process flow sheet.

(5) In the case of mine sealing:

(a) The location of seals and grout curtains to be constructed.

(b) The method of construction of the seals and grout curtains.

(c) The extent of flooding of the mined out area, including elevation of pool surface.

(6) In the case of backfilling, the profile of the completed backfill, including its relation to the cut, spoil bank, seam top and bottom, and previous natural contour.

(7) In the case of stream diversion:
    (a) The plan and profile of streams after diversion.
    (b) The cross-sections of the diverted channel.
(8) In the case of revegetation, a typical profile and plan of the revegetated area.

b. Specifications - State at least the following for each of the relevant abatement or control methods:
(1) The maximum, minimum and average design drainage flows and quality to be handled by treatment methods.
(2) The unit dimensions, capacities and materials for each flow sheet component for treatment methods.
(3) Materials for construction of seals, grout curtains and diversion channels.
(4) Composition of soils used in backfilling, top grading and revegetation.
(5) Estimated volume and method of movement of soils in backfilling and top grading.
(6) Minimum, mean and ten-year maximum flows in diverted stream channels.
(7) Types and sizes of plantings and seedings, distribution, density and estimated survival.
(8) Soil preparation, including amount and type of soil additives or fertilizer.
(9) Method of planting or seeding.

c. Expected Mine Water Quality and Quantity -
(1) Minimum average and maximum values for quantity of discharge, if any, from each control method, including brines, residues and sludges.
(2) Average and maximum values for each quality parameter, including all those required for effluent or stream standards for all discharges, if any, from each control method, including brines, residues and sludges.

(3) Analysis of the feedwater if treatment methods are proposed.

d. Design and Construction Schedules - Prepare planning, design, construction and startup schedules for the remaining phases of the project. Include the operating and monitoring schedule for the demonstration and post-demonstration period.

e. Program Surveillance Measures - State the types of anticipated results and the data collection means by which the results are accumulated and evaluated during the demonstration and post-demonstration period. Such results must include costs, as well as quantitative and qualitative performance of the project.

f. Program Emergency Procedures - State the significant emergency events that may occur during the life of the project and show both the impact on the project effectiveness and the measures that are planned to correct or prevent such emergencies.

3. Capital and Operating Costs

Cost data must be prepared and presented in sufficient detail and accuracy to assure the financial resources needed for completion of the demonstration if it is funded.

a. Site Acquisition Costs - State all legal fees and purchase or lease costs for land, minerals and water rights.

b. Construction Costs - Identify all estimated equipment purchase costs, construction costs and engineering fees. Include the method and basis for the estimates.

c. Operating Procedures - Prepare and present administrative, purchasing, operating and maintenance procedures for both demonstration and post-demonstration periods. List estimated quantities of materials and supplies required.

d. Personnel Requirements - Present the requirements for administrative, operating and maintenance personnel, including job description, experience level and expected compensation range.

e. Operating Costs - Prepare estimated costs of operating and maintenance for personnel, supplies and utilities. Include allowances for purchasing, administration and surveillance.

D. PREPARATION OF IMPLEMENTATION AND OPERATING PLANS

Plans and schedules in addition to those discussed under Preliminary Engineering must be developed for the implementation and operation of the proposed mine water abatement demonstration project. These plans must include the schedules of required action by the responsible agencies, as well as construction, operation and maintenance budgets and financial programs. Present the following information:

1. Project responsibility and schedules for acquisition, design, construction, operation and surveillance.
2. Project operation and maintenance budget for demonstration periods.
3. Procedures and schedule for providing required project personnel.
4. Plans for supervision of the entire project, including the post-demonstration period.

5. Responsibility for and schedule for remaining project progress reports and final project evaluation report. Report requirements and formats are discussed in greater detail in Section X of this guide.

E. EFFECTIVENESS OF PROJECT

Projects which provide the most effective demonstrations or important abatement methods will be considered under the demonstration grants program. All demonstration and other public benefits that can be attributed to the project must be identified and presented in an orderly manner for evaluation.

1. Demonstration Value

Provide the following measures of project effectiveness as applicable:

a. The proportion of mine water pollution in the State or area that might be abated by the project.
b. The proportion of mine water pollution that will be abated at the project site.
c. The approximate unit cost of abatement of the polluted discharge to be abated in terms of dollars per thousand gallons or other acceptable basis.
d. Annualized capital and operating costs per ton of mine water pollutants removed. For acid mine drainage, this should be dollars per ton of acid.
e. The extent of streams and/or lakes to be improved and the degree of improvement provided by the project.

2. Public Benefits

The public benefits of the project should be stated and discussed in terms of the location of the project relative to population

concentrations, the visibility of the project and of the improved water quality, and the extent of public interest in the quality of the receiving waters. The following should be included as applicable:

a. Increased recreational opportunity.
b. Increased industrial activity.
c. Increased agricultural activity.
d. Aesthetic improvement.
e. Improved habitat for fish and wildlife.
f. Compliance with quality standards.
g. Income from sales of water.
h. Reduced costs for water users.

F. FORMAT AND CONTENTS OF A FEASIBILITY REPORT

This section identifies the typical major items that should be included in conducting a feasibility study to demonstrate methods for controlling pollution from mine drainage under Section 107 of the Federal Water Pollution Control Act, as amended. In order to provide uniformity, all feasibility studies will be presented in the same format as outlined in the "Interim Specifications for 'OR & M GRANT' Contract and In-House Reports," March 1973, as amended at the date of the report preparation.

A typical feasibility report will contain the following items, realizing, however, that common sense will dictate that all items may not necessarily apply to all studies.

1. Cover
2. Title Page
3. Abstract
4. Table of Contents
5. List of Figures
6. List of Tables

7. Acknowledgements
8. Conclusions
9. Recommendations
10. Body of Report
    a. Introduction
        (1) Scope and Purpose of the Project
        (2) General Description of the Project
        (3) Effectiveness of Project
    b. Jurisdictional Framework
        (1) Authority
        (2) Standards
        (3) Site Acquisition
        (4) Water and Mineral Rights
        (5) Prevention of Future Pollution
    c. Inventory and Characterization
        (1) Physical Conditions
        (2) Water Resources
        (3) Social and Economic Environment
    d. Preliminary Engineering
        (1) Abatement Method Description
        (2) Preliminary Design
        (3) Capital and Operating Costs
    e. Implementation and Operating Plans
    f. Effectiveness of Project
        (1) Demonstration Value
        (2) Public Benefits
11. References
12. Glossary of Terms, Abbreviations and Symbols
13. Appendices

SECTION VI
ENGINEERING

The intent of this section is to define the recommended sequence and identify the areas of responsibility for the required project engineering tasks. The approved feasibility report serves as the basic document for identifying the engineering requirements. The next logical step is the expansion of the engineering requirements presented in the Preliminary Engineering Section of the Feasibility Report.

Since the demonstrations funded by Section 107 grants can cover such a wide range of activity, it is impossible to present a step-by-step format of engineering development for all projects. The grantee should utilize as a guide those sections that relate to his specific project. A typical engineering phase diagram is illustrated in Figure 5.

A. GENERAL ENGINEERING PROCEDURES

There are generally two methods of performing an engineering and construction project. The first method is to employ an independent Architect-Engineer (AE) to prepare the drawings and specifications, obtain and evaluate construction bids and provide construction management to the selected contract. The second method is to employ an engineer-contractor on a total lump sum, turnkey basis. The primary difference between the two methods lies in the responsibility for the project. In the first, the responsibility for process development and design engineering of the system lies with the AE, while purchasing and installation is the responsibility of the contractor. With a lump sum construction contract, the total responsibility is under single management. Each method has its advantages, and the project coordinator assigned to the demonstration grant must determine which method suits the particular circumstance.

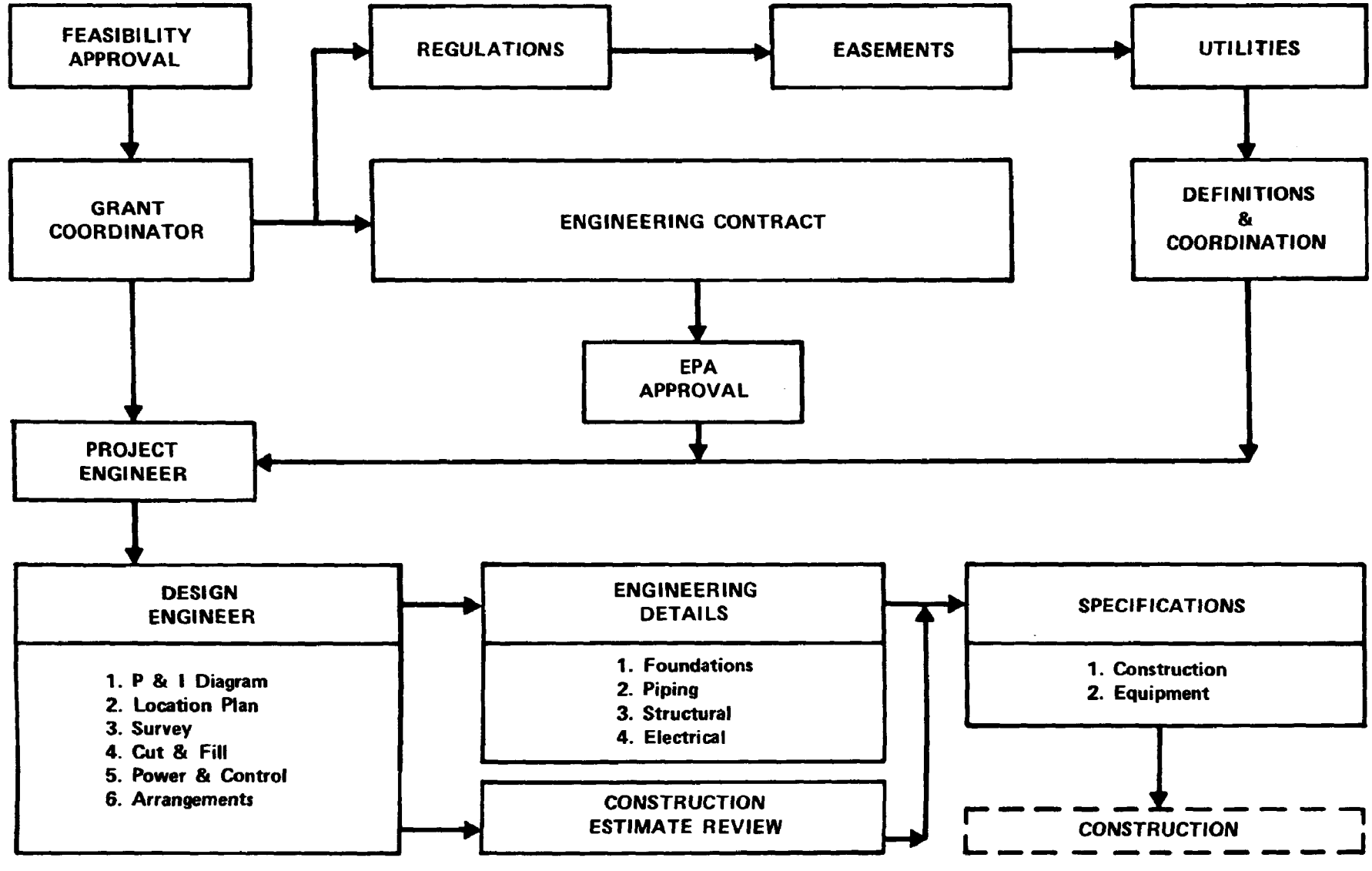


Figure 5. Engineering phase diagram.

The advantages of the first method, utilizing an AE, are:

1. A system of checks and balances is provided between the engineering and construction of a project.
2. Independent engineering evaluations can be made of construction bids and bids received on specified equipment.
3. Project costs can be appropriated on a basis of separate engineering and construction contracts.
4. Provision is made for construction and equipment specifications inquiry and evaluation during the engineering phase, resulting in more definitive estimated costs. This reduces the contractor's percentage of extras in construction projects due to construction unknowns.
5. The bidding on the project is not limited to only those contractors employing engineering staffs.
6. Agencies can purchase major equipment for contractor's installation.

The advantages of the second method, engineer-contractor, are as follows:

1. Project coordination is the responsibility of a single company.
2. The grant coordinator is not required to maintain an administration staff for the project.
3. The project can be scheduled over a shorter time, since engineering and construction could be a simultaneous effort.

Other considerations for selection of AE or engineering-contractor are:

1. Technical capabilities and availability of personnel for project.
2. Past references and history of similar projects.
3. Completion performance references for past projects.

If the Architect-Engineer method is selected, engineering work can be performed by the fixed-price (lump sum) or fixed-rate (unit price) method. Any other method of procurement must be approved in writing by the EPA. Invitations for bids or requests for proposals for the engineering services should be based on a clear and accurate description of the technical requirements. The grantee is expected to obtain the service at the lowest reasonable cost consistent with the procurement practices of the grantee organization.

B. DEFINITIONS AND COORDINATION

The first step in initiating the design engineering of a project is to establish definitions and coordination procedures. The definitions should include:

1. Agencies involved in the demonstration project. This should include assignment of the project coordinator and other State personnel, including their responsibilities and designation of authority.
2. Assignment of the engineers, project manager, other project personnel, their responsibilities and designation of authority.
3. Terminal conditions of project.
4. Contract details and any special work conditions (access to sites, safety requirements, etc.).
5. Completion date of engineering tasks, with engineering schedules defining the completion dates of specifications and drawings.
6. Limitations of drawings, including a definition of the types of drawings to be developed.

The coordination procedures should define:

1. Drawing sizes and types of material, such as vellum, mylar and cloth, and who furnishes the drawing material. Standard drawing sizes are:

8-1/2" x 11"	24" x 36"
11" x 17"	36" x 48"
17" x 22"	30" x 42"

   The drawing numbering system should be established in conjunction with drawing size and field of endeavor.
2. Type and number of prints to be transmitted for reference, approval and construction. Many clients prefer sepias, which are reproducible drawings. Prints can be obtained from the sepia, thus eliminating the transmittal of numerous prints by mail.
3. A numbering system for all distributions and copies of correspondence, for record keeping purposes.
4. Monthly drawing progress reports.
5. Conference reports, written for all meetings and technical decisions.
6. Field trip reports.
7. Telephone messages.
8. Monthly billing and financial reports.
9. Engineering, procurement and construction schedules. Such items as a CPA Schedule (critical path method) should be used for complex projects.

The grant coordinator should be responsible for determining and publishing the following:

1. Laws, ordinances and regulations pertaining to the project.
2. Sales taxes, use taxes.

3. Permits, such as building, water discharge, sewage.
4. Easements, such as highway, ponds, utility, etc.
5. Stream, river and roadway crossings.
6. Property or land requirements for project, including lease or purchase arrangements.
7. Trade union requirements, for both construction and operation.

C. ENGINEERING DESIGN

The next engineering task is to develop the drawings which establish the treatment process or activity and the physical parameters for the design engineering. These drawings can be classified in the following basic categories.

1. Process and Instrumentation Flow Diagram

This is a schematic diagram identifying the flows, equipment size, chemical treatment, water constituents, operation principals, and final effluent discharge. The process flow diagram developed for the feasibility study is used as the background for developing and expanding this drawing.

2. Power and Control Diagram

This is a schematic diagram identifying the electrical and instrumentation modes for operation and monitoring related to the treatment functions.

3. Location Plan or Plot Plan General Arrangements

This identifies the project location with respect to certain boundary conditions such as roads, rivers, etc., and serves as the index for the total engineering package. A site survey and survey drawing may be required if elevations, boundary lines,

bench marks, monuments, etc., are not properly identified through available reference material. Bench marks or monuments are established survey markers for referencing, with elevations and coordinates inscribed on them.

4. Hydraulic Profile

This drawing identifies the slope of water flow through a treatment system, indicating whether pumps are required or gravity flow is compatible with equipment, lagoons and basins.

5. Cut and Fill Earthwork

This drawing sets the grade or yard elevation of the plant site, with heights and levels of dike walls, dams, water levels, etc. If the project is not complex, the hydraulic profile can be combined with this drawing.

6. Electrical Single Line Diagram

This drawing establishes the complete electrical power requirements for the project.

Some projects demonstrating treatment techniques could require a process flow diagram to identify the interrelationships of various pieces of equipment.

Once the process flow diagram is completed and has been approved, the equipment specifications can be written, submitted and evaluated by the project coordinator and the project officer. These specifications should be incorporated into the construction documents. In order for the engineering to proceed, preliminary or certified equipment drawings must be available. In the event of a lump sum turnkey construction contract, the contractor purchases the equipment; thus, preliminary drawings are

used for the basis of engineering, and it is the contractor's responsibility to backcheck equipment size with foundation anchor bolt locations, pipe sizes, clearances, etc., to ensure that the equipment will fit.

After the plot plan or location plan is approved, the secondary general arrangement drawings can be drawn. These would show chemical feed systems, control houses, mixing or pumping stations, mine seals, reclamation techniques, etc. When these drawings are completed, the budget estimate from the feasibility study should be reveiwed and updated to determine whether costs are still in line with the original grant estimate.

Once the general arrangement drawings are finished and approved, the design detail drawings can be completed.

D. SPECIFICATIONS

When the engineering is partially finished, the construction specifications can be written. Drawings and equipment purchase specifications become part of the construction specifications. The specifications should contain the following information, as required:

1. Section A - Bidding Documents
2. Section B - General Conditions
3. Section C - General Requirements
4. Section D - Scope of Work
    a. Site Work
    b. Concrete
    c. Metals
    d. Carpentry
    e. Specialties
    f. Equipment

g. Special construction
    (1) Mine sealing
    (2) Flooding maps
    (3) Seal location
    (4) Reclamation
        (a) Plans
        (b) Sections
        (c) Revegetation
h. Mechanical
i. Electrical

The context of these items is defined as follows:

1. Section A - Bidding Documents
    a. Instruction to Bidders
        (1) Name and address for proposal submittal
        (2) Numbers of copies required for submittal
        (3) Last date of proposal acceptance
    b. Invitation for Bids (defined in detail in Section VII, Construction)
    c. Bid Form
        (1) Legal typed and signed name and address of bidders (phone number)
        (2) Date
        (3) Taxes included
        (4) Lump sum price
        (5) Contractor's price on specific alternates
        (6) Time of completion
            (a) Number of days after award of contract to commence construction
            (b) Number of days from commencement of construction to completion of work
        (7) Proposed subcontractors and subcontract amounts
        (8) Unit price schedule for any particular work such

as excavation (dollars/cubic yard), trucking earth (dollars/cubic yard), foundations, etc.

(9) Length of time proposal shall remain firm (usually 60 days firm unless trade union contracts)

(10) Contractor's state of incorporation, partnership, or individual

d. Representation and Certifications - Some States require contractors to be registered, especially if from out of state.

e. Bid Bond - Agencies may require a bid bond with contractor's proposal. The grant coordinator should define this requirement.

f. Affidavit of Individual Surety - If requested by the grant agency, the contractor should furnish a surety company bond conditional upon the faithful performance of the contract and the payment of all obligations for the project. The premium charge for such bond can be borne either by the agency or contractor, and the premium assumption should be mutually agreed upon.

g. Construction Contract, Plans and Drawings

2. Section B - General Conditions

a. Responsibility of contractor

b. Definitions

c. Correlation and intent

d. Construction schedule and monthly progress reports

e. Indemnification

f. Damages

g. Risk of loss

h. Insurance

i. Protection of person and property

j. Permits and regulations

k. Guarantees

l. Surveys
m. Inspection of site
n. Materials and workmanship
o. Contractor's shop drawings and "as built" drawings
p. Explosives and combustible materials
q. Progress photographs
r. Signs
s. Work completion and acceptance
t. Liquidated damages
u. Liens
v. Contractor's superintendent
w. Taxes
x. Approval of equipment and material manufacturers
y. Tests
z. Delivery of materials
aa. Terminations
bb. Contractor's default
cc. Payments of contractor
dd. Suspension of operations
ee. Cleaning of premises

3. Section C - General Requirements
   a. Field offices
   b. Temporary utilities

4. Section D - Scope of Work
   a. Site Work - The site work should be clearly described as to grubbing, clearing, grading, excavation, back-filling, compaction, dewatering, and well pointing.
   b. Cast-in-Place Concrete - The concrete work should be installed and defined as follows:
      (1) Concrete type at 28-day compressive strength. Usual types are 2500, 3000, 3500 PSI concrete. Samples should be taken every 40 cubic yards and

tested in accordance with ASTM C-31 and C-39 standards. Generally, 3000 PSI concrete is a standard mix for industrial construction.

Slump test for determining proper cement mix; generally, 3 inches $\pm$ 1 inch test in accordance with ASTM C-143 standards. Test reports should be sent to grant agency for review. All concrete work should conform to American Concrete Institute (ACI) Code.

c. Masonry - Masonry should define type of block, brick and mortar to be used for construction.

d. Metals - Metals should define type of steel to be used. Structural strength steels are generally ASTM A-36 plain carbon steels.

e. Carpentry - Wood should conform to American Lumber Standards and should generally include construction grade Douglas Fir for wood framing.

f. Equipment -

(1) All equipment should be installed in accordance with manufacturers' recommendations and in accordance with the following:

(a) Local and State building codes
(b) State fire codes
(c) American Standards Institute
(d) American Society of Mechanical Engineers
(e) National Electric Manufacturing Association
(f) National Electric Code
(g) National Fire Protection Association
(h) American Society for Testing Materials
(i) Occupational Safety and Health Standards of the Occupational Safety and Health Administration, U. S. Dept. of Labor

(2) Piping should be specified by the engineer with regard to size, schedule, material, supports, hangers, etc., cleaning and testing insulations.

g. Special Construction - Mine sealing.
h. Conveying or Material Handling Systems - Conveying or material handling systems should include methods of sludge removal, chemical storage and handling, raw materials transport, etc.
i. Electrical and Instrumentation - The electrical design should be in accordance with the previously defined electrical codes. Minimum requirements and materials should be specified by the standard specifications.

Upon completion of the engineering and before the completion of construction, an operating and maintenance manual should be prepared, incorporating:

1. Process and control maintenance procedures and catalogs
2. Equipment maintenance procedures and catalogs
3. Construction startup punch list

This manual is discussed in detail in Section VIII, Operation.

SECTION VII
CONSTRUCTION

At this stage of the demonstration project, the engineering phase will have been completed, construction and purchase specifications prepared, and approval received from the project officer to initiate the construction phase. This section identifies the recommended procedures and sequence of performance for the construction tasks, as illustrated in Figure 6, Construction Phase Diagram.

The approved construction specifications developed during the engineering phase serve as the basis for determining the construction procedures.

The methods used in initiating a construction project will be the same regardless of whether an AE and contractor or engineering-contractor arrangement is used. In either case, the construction specifications will be prepared by the consulting engineers who performed the engineering phase.

The first step is the selection of qualified contractors. Qualified contractors' names and addresses can be obtained from the following:

1. Municipal, State or Federal purchasing agencies' "approved bidders" lists.
2. Government publications advertising for bids.
3. Public announcements in newspapers and periodicals.
4. Consulting engineers who have personnal recommendations or knowledge of qualified contractors.

A minimum of five contractors should be selected and a letter of inquiry and "Request for Proposal" sent to each of them.

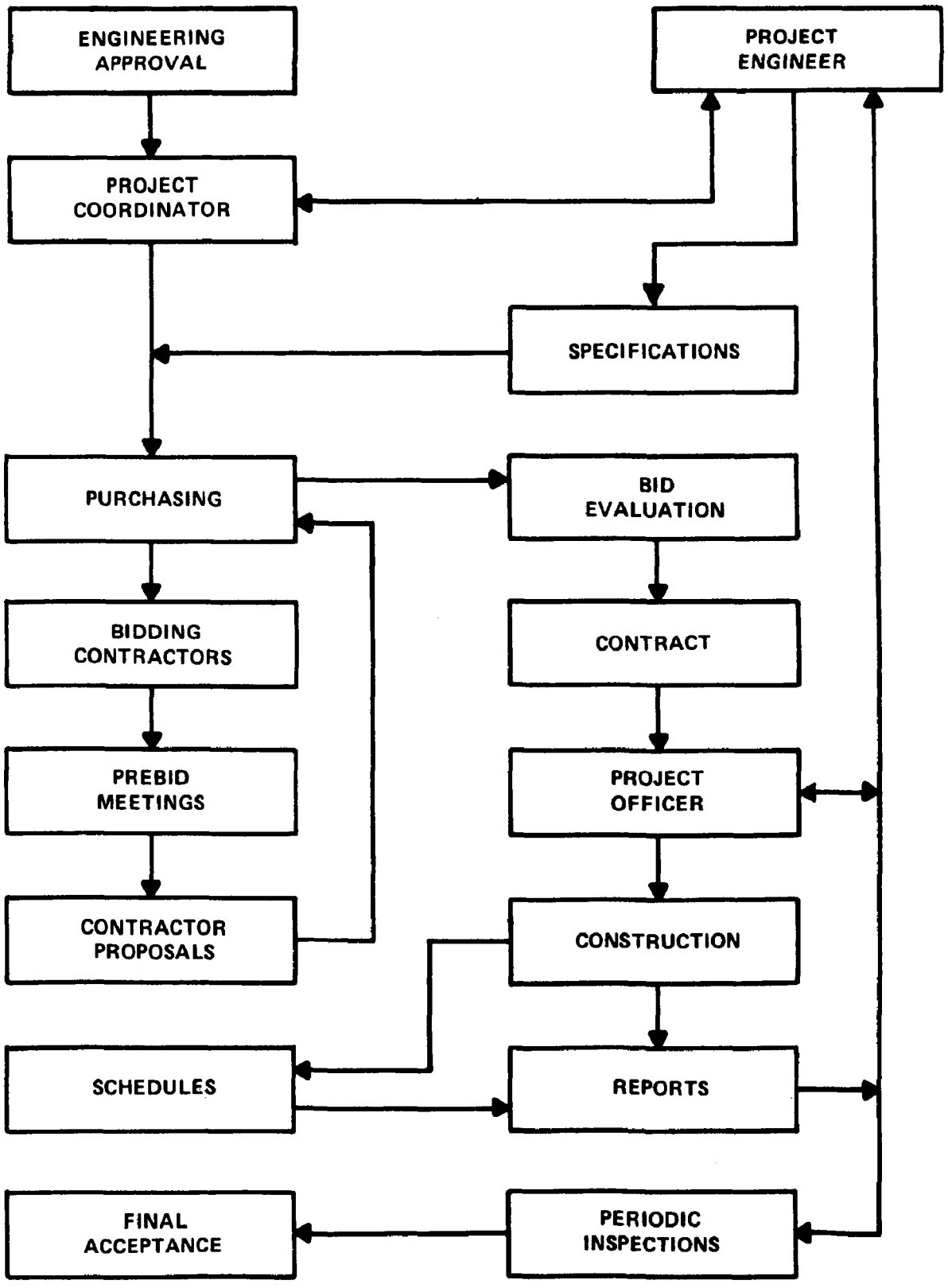


Figure 6. Construction phase diagram.

The selection of five contractors will provide an allowance in the event some of the contractors decline to bid. The letter of inquiry should state:

1. The inquiry letter return answer date.
2. Date, time and location for a pre-bid meeting with the grant coordinator and/or the engineer.
3. Address and time where the contractor may obtain copies of construction specifications, plans and drawings, etc.
4. Preliminary outlines of the project, with construction completion time.

The return answer date should allow the contractors sufficient time to obtain and determine the extent of construction specifications and prepare any questions.

The contractors' pre-bid meeting should finalize:

1. Answers to all contractors' questions.
2. Final date of contractors' sealed bids acceptance.
3. Construction completion schedule.
4. Issuing of any deletions, corrections, or modifications to construction specifications. Any changes to specifications should be covered with a letter and "addendum" to the specifications, to prevent any misinterpretation of documents.
5. Examination of project site.

If publication announcements are used for obtaining contractors' proposals, the same items as identified in the letter of inquiry should be stated in the publication.

The grant coordinator and the engineer should evaluate the proposals submitted on the basis of costs and conformance to specifications, and any exceptions or alternatives.

Based on the bid evaluation, a contractor is selected and a legal contract signed.

A. CONSTRUCTION SCHEDULE AND MONTHLY PROGRESS REPORTS

Immediately after execution and delivery of the contract and before construction work is initiated, the contractor should submit to the project coordinator an estimated construction progress schedule in CPM or bar chart form, indicating the proposed start date and completion dates of each of the various work subdivisions. On or before the seventh calendar day of each month, the contractor should be required to submit to the coordinator a monthly progress report stating the percentages of the work completed on the last day of the preceding month. Progress reports should list or update the tasks in the same order as presented in the approved construction.

B. PROGRESS PHOTOGRAPHS

In order to better document and illustrate project progress, the contractor should be instructed to furnish with the progress report black and white photographs showing to the fullest extent possible the work completed during the previous month.

C. SIGNS

A project sign approved by the grantee and the project officer should be erected on the site in a prominent location, as directed by the project coordinator.

Any signs or advertisement which, in the judgment of the project officer, are objectionable shall be immediately removed from the project.

D. CONTRACTOR'S SUPERINTENDENT

The contractor should be required to keep a competent superintendent and any necessary assistants at the site throughout the progress of the work. All directions given to the superintendent should be as binding as if given to the contractor. Such directions should be confirmed in writing to the contractor.

The contractor's superintendent and/or any of his assistants should be promptly replaced in the event he or they prove to be incompetent and/or unsatisfactory to the resident engineer.

E. CLEANING OF PREMISES

The contractor should at all times maintain the entire premises free of rubbish and debris caused by his work and his employees, or by his subcontractor. Prior to final acceptance, the contractor should remove from the premises all items such as temporary office and storage sheds, fence material, construction tools, and equipment used during construction.

F. WORK COMPLETION AND ACCEPTANCE

The grant agency should consider the work completed, including final acceptance and final payment, only when all construction work is finished, and all equipment and systems, if any, are in operating condition satisfactory to the project coordinator and the project officer. Sufficient functional tests or inspections should be conducted to determine that the work meets all requirements of the specifications.

Such inspections should be made as soon as practicable. The conditions of any tests must be mutually agreed upon by the grant agency, project officer, and the contractor. If inspections or tests indicate that the work or any part thereof is

not as represented and/or contracted for, or if any portion of the work fails to operate to the satisfaction of the grantee, or if any defects are disclosed by any of the aforementioned tests, the grantee should refuse to accept that work. The contractor should be required to make good any defective portions of the work at his own expense before final acceptance.

SECTION VIII
OPERATION

This phase is for those projects requiring extended periods of equipment or systems operation and is the "proving time" of the concept originally thought feasible, engineered, built and put on-line. In order to maximize the demonstrative abilities of each system, continuous, efficient "on-line" time during this phase is imperative. A carefully preplanned operating scheme will insure this effort. This section attempts to point up those tasks that should be considered.

A preliminary operating and maintenance plan and a budget will have been developed during the feasibility study. The requirement in this phase is to expand and refine in detail these tasks and responsibilities.

One of the first and most important tasks will be to write the operating and maintenance manual. This should be completed in time for the start of operator training. An outline of a typical operating and maintenance manual is presented at the end of this section.

The operating tasks and personnel responsibilities for program implementation, as developed during the feasibility study, should be reviewed in detail and re-evaluated. This can best be accomplished during the construction phase of the project, since it is at this time that revisions to the engineering and design drawings are finalized. System operational changes may become evident during the startup and testing phase of the system.

The tasks assigned to each individual should be defined in detail in order to identify each required task and clarify the time element involved. Figure 7 defines typical tasks and responsibilities.

	TASKS	RESPONSIBILITY	FREQUENCY
1.	Operating and maintenance manual	Design Engineer	During startup
2.	System startup	Design Engineer	Construction
3.	Operator training	Design Engineer	During startup
4.	System operation	System Operator	Daily
5.	Inspect all mechanical and electrical equipment	System Operator State Field Office State Main Office, Design Engineer EPA	Daily Weekly Monthly Quarterly
6.	Record operating supplies usage	System Operator	Daily
7.	Reorder supplies	State Main Office	As required
8.	Schedule equipment maintenance	System Operator, State Field Office	As required

Figure 7. System operation - typical tasks and responsibilities.

The job descriptions of operating and maintenance personnel, which will have been established earlier in the project, should also be reviewed at this time for possible minor revision.

The operator will have definite assigned activities that should be conducted hourly, daily, weekly and monthly. These activities should be clearly defined.

Preventative and routine maintenance assignments identified and carried out will assure continued operation of the facility. The scope and assignment of these responsibilities will be a function of the magnitude of the system. It is highly possible that a plant operator can make routine daily maintenance inspections, then call for contract maintenance or an on-site repairman.

The remaining area of responsibility is the control of materials and supplies. A method should be developed to continuously record the inventory of operating and maintenance supplies, with order points developed for the reordering of economical bulk quantities.

Other areas of consideration in planning the operating phase are itemized as follows:

1. Safety

   System components and personnel must be protected throughout construction, testing and operation of the project. Items to be considered for personnel safety may include:

   a. Protective clothing, goggles, face shields, hard hats, safety shoes, rubber gloves.
   b. First aid kits, stretchers, blankets.

c. Eyewash stations.
d. First aid and medical assistance availability.

2. Fire Protection

Items to be considered for fire protection may include:

a. Municipal fire company availability.
b. Hand fire extinguishers and water hoses.
c. Planning of fire fighting procedures.

3. Supervision and Control

Systems and operation must be carefully supervised and controlled. Site and operating inspections should be scheduled at the start of the operation phase to insure qualified supervision and/or approval by EPA, State and designer personnel.

A data acquisition system and analysis program should be formulated for the collection of operating information to enable monitoring daily operations. This information, properly logged, will be utilized for documenting the effectiveness of the project.

Cost records should cover operation, maintenance and supplies, so that a detailed cost analysis can be made.

With the above, the system can be evaluated and the project effectiveness determined for inclusion in the project final report.

OUTLINE OF TYPICAL OPERATING AND MAINTENANCE MANUAL

Title Page

Table of Contents

Introduction

This section should discuss the content of the manual, briefly identifying the type, purpose and capacity of the system.

Section I: The System

1. Description: This subsection should describe the system with reference to equipment, pumps, and instrumentation, but without detailing process conditions.

2. System and Operating Principles: This subsection should describe the theory and principles of the system, system variables and their effects. It should also discuss unit control. Graphs and data may be included for establishing operating variables.

Section II: Starting Procedure

This section should describe the overall startup plan. It should go through process procedures step by step, in narrative form, giving full details and noting special precautions.

Section III: Shutdown Procedure

1. Normal Shutdown: This subsection should describe the overall shutdown plan for intentionally taking the system out of service.

2. Emergency Procedures: Special emergency procedures, precautions, and automatic showdown should be described in detail.

Section IV: Appendix

1. Standards: Standard instructions, descriptions, equipment lists, and tabulations should be included in this subsection.

2. Drawings: This section should include drawings pertinent to the system and of interest to the operator such as: a plot plan or layout, process flow sheet, an anticipated operating conditions sheet, instrumentation flow sheet, equipment drawings and data sheets.

SECTION IX
MONITORING

Monitoring is a critical part of all demonstration projects. It is essential to document changes in water quality and quantity, as well as physical changes to the project area, in order to satisfy the requirements of demonstrating and evaluating the effectiveness of a given technique. The purpose of this section is to assist in planning and initiating a monitoring program. Figure 8 illustrates a typical monitoring program plan.

A. WATER CHARACTERIZATION

1. Selection of Sampling Points

The design of a sampling program will vary with each demonstration project. The sampling stations can be classified as primary or secondary.

A primary sampling station is the one located such that it accurately reflects the quality of water leaving the project area and permits the successful measurement of stream flow. This station is the key to the documentation of water quality before, during and after construction and to the evaluation of the technique being demonstrated.

At the primary station, flow is usually measured continuously. This data should be backed up with weekly grab samples. The frequency of sample collection can be decreased if a definite correlation between sample data is established.

As a rule, these stations will be expensive, on the order of ten thousand dollars ($10,000.00); therefore, serious consideration must be given to this item in the preparation of the grant budget.

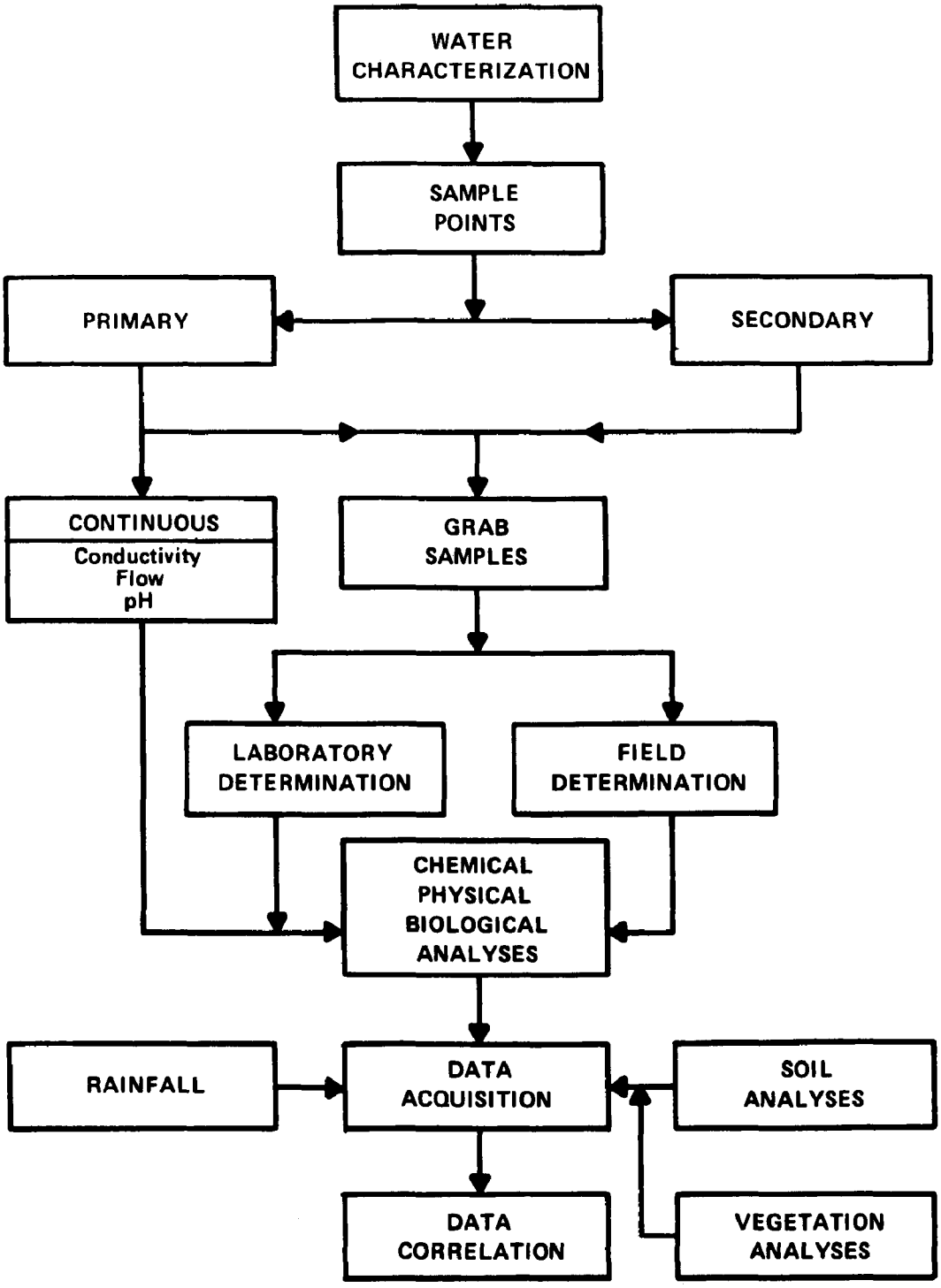


Figure 8. Monitoring plan diagram.

Secondary sampling sites are those located at selected key points in the project area for the purpose of recording the water quality and flow of special interest streams. In most cases, grab samples only will be collected at these locations. Secondary sites would be used to periodically record seasonal variations, changes resulting from construction disturbances and special problem areas, and to isolate results from any one technique.

Since these sites will be used to establish baseline data, it is important that the locations of both the primary and secondary stations provide representative samples. Tributaries immediately above the station, special seepages and other influences in the immediate vicinity of a station should be avoided.

2. Water Quality Data

Measurement of the chemical, physical and biological (if appropriate) properties of the affected water is dependent on the type of mining operation causing the pollution, the control technique being used and the geographical location of the site. A complete analysis of the water at each sampling site performed early in the project during the feasibility study will facilitate the selection of parameters to be studied throughout the demonstration. The following analyses are recommended, but in no way limit the tests which should be performed.

a. Physical Properties

Temperature (at time of sampling), turbidity and solids, both total and filterable.

b. Chemical Properties

Acidity, alkalinity, aluminum, arsenic, cadmium, calcium, chemical oxygen demand, chloride, chromium, copper, cyanide, fluoride, hardness, iron, lead, magnesium, manganese, mercury, nitrate, organic carbon, pH, potassium, sodium, specific conductance, sulfate and zinc.

c. Biological Properties

Fecal coliform, to be determined if appropriate.

The following references are suggested for procedures in performing chemical analyses:

"Methods for Chemical Analysis of Water and Wastes," EPA - AQCL, Cincinnati, Ohio 45268 (1971).

"Standard Methods for the Examination of Water and Wastewater," 13th Edition APHA - AWWA - WPCF (1971).

"Book of ASTM Standards," Part 23 (latest edition).

"Manual on Water," ASTM Special Technical Publication No. 442.

Any laboratory analyses performed in support of Section 107 grants shall use approved EPA methods whenever possible. The ability of the supporting laboratory to provide reliable data shall be demonstrated by satisfactory performance on reference samples provided to the contractor by EPA's Methods Development and Quality Assurance Research Laboratory (MDQARL), Cincinnati, Ohio 45268. Internal laboratory control shall conform to practices recommended by MDQARL as required by the project officer.

3. Water Quantity Data

The basic function of a stream monitoring station is to record water quantity data. The stream gaging function can be carried out through the use of a control device and a water-stage recorder. From these, a stage-discharge relationship or rating can be determined. The selection of stream gaging sites depends on two factors: the objectives of the demonstration and the physical land features necessary to meet these goals.

Factors influencing the choice of the site include:

1. Presence of impermeable material
2. Stream gradient
3. Stream alignment
4. Character of stream banks
5. Depth of channel
6. Topography and drainage at the site
7. Gaging station design
8. Accessibility

The most common types of control are weirs and flumes, which are recommended for small streams and discharges. Larger streams may require cross sectioning and gaging with current meters to establish a stage-discharge curve. In either case, available flow meters can record either stage or total flow and can operate on-line current, batteries or springs.

The following publication, available from the U. S. Government Printing Office, Washington, D. C., is a good reference for water monitoring:

> "Field Manual for Research in Agricultural Hydrology," Agriculture Handbook No. 224, Agricultural Research Service, U. S. Department of Agriculture.

The U. S. Geological Survey can also be of assistance in planning a stream gaging station.

A weir is an overflow structure built across an open channel and used to measure the rate of flow of water. The weir, when properly set and maintained, is considered one of the most accurate methods of measuring water flow.

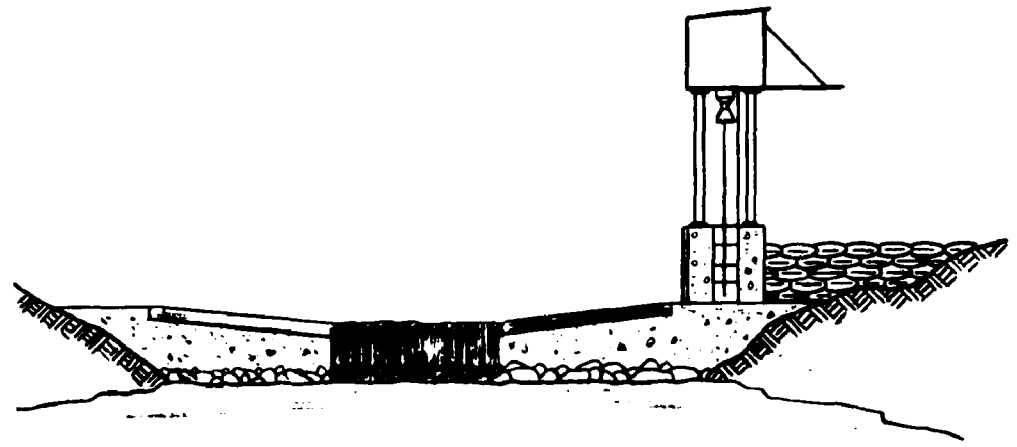
Where heavy sediment-laden flows are common, flumes should be used. A flume is a stabilized channel with access to a stilling well. Flumes must also be used where the gradient of the stream is particularly low.

Weirs or flumes are constructed of various materials, such as treated wood, concrete blocks and metal. Concrete, because of its strength and performance, is probably the most widely used. The materials of construction should be selected based on the corrosive nature of the waters being monitored. Typical weir and flume installation are illustrated in Figures 9 and 10.

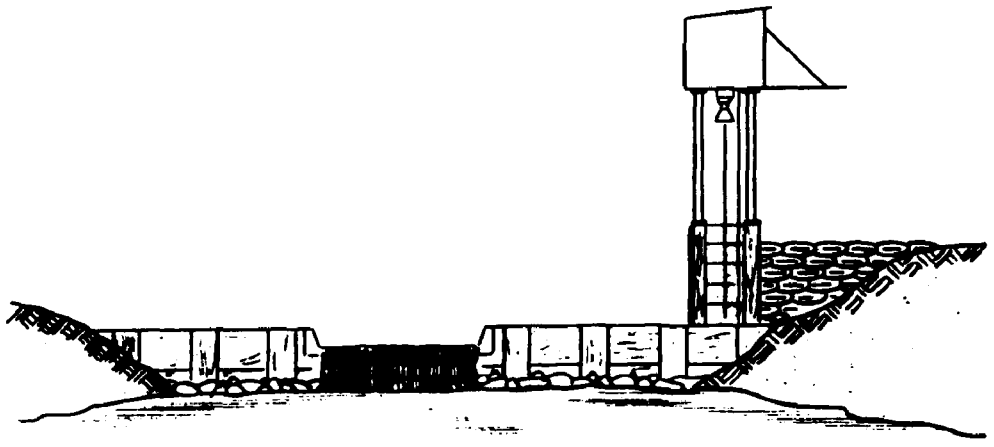
During the planning and design stages of a monitoring program, it is imperative that the grantee budget funds and manhours for the operation and maintenance of the monitoring stations. Serious consideration must be given to providing for winter operation, access to remote areas, sediment control, maintenance and periodic inspections.

B. FIELD SAMPLING METHODS

Stream compositions are determined by collecting samples of the water and analyzing them for various constituents. An accurate analysis will determine the correct composition of a sample; however, this composition may not be the same as the stream composition unless a representative sample is collected. Therefore, proper sampling techniques are as important as accurate analyses in obtaining reliable data.



CONCRETE STRUCTURE



WOOD STRUCTURE

Figure 9. Typical weir installations.

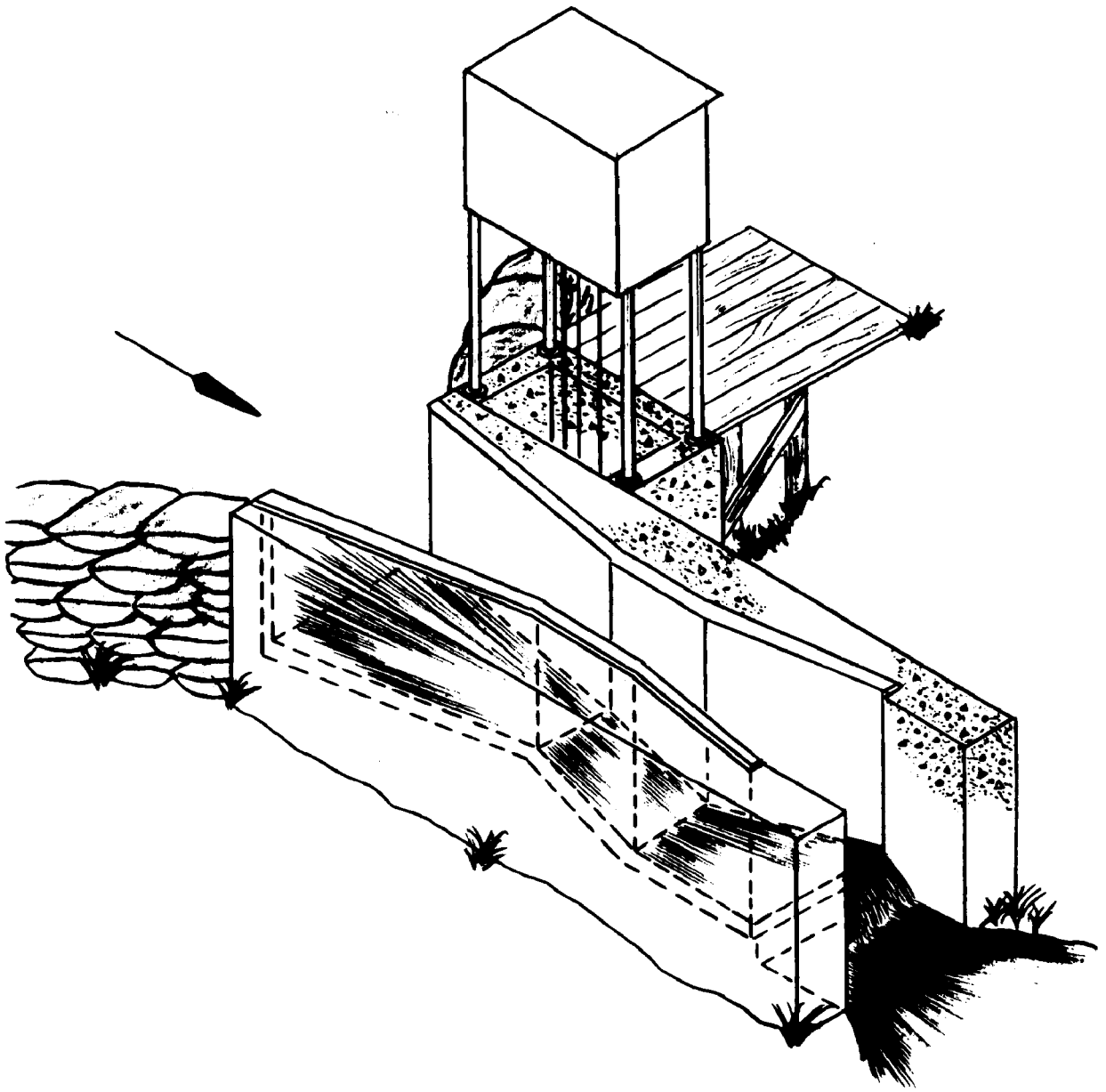


Figure 10. Typical flume installation.

The type of sample that should be collected depends on the variability of the stream composition. A grab sample, which is a single portion of water collected at a specific instant in time, represents only the stream composition at the time of sampling. This type of sample is not suitable for streams with highly variable compositions. These streams should be sampled by blending a number of grab samples collected over a length of time. The resulting composite sample represents the average stream composition during the sampling period. Compositing also reduces the effects of variations in the sampling technique.

Good collection techniques must be used to obtain truly representative samples. Both the container and the sampling device must be clean and free from contaminants. The sampling device should be rinsed with sample water prior to the collection of the actual specimen. The sample should be collected preferably from the center of the stream, to avoid trapping bottom sediment, floating scum or debris in the sample.

Samples should be analyzed as soon after collection as possible, since they can deteriorate during storage. When samples cannot be analyzed immediately after collection, they must be properly preserved. For example, acid can be added to samples which will be analyzed for metals. Refrigeration can also be used. In any event, even when properly preserved, samples must not be stored for long periods of time.

The samples should be taken frequently enough to adequately record the variation of stream composition. During the initial phase of the monitoring program, samples should be collected at least weekly. As stream quality becomes more defined, the sampling schedule and the chemical analyses to be performed must be determined with and approved by the project officer. Key parameters will be measured frequently; other parameters less frequently. The designation of key parameters will be

determined in conjunction with the project officer. Factors such as rainfall and seasonal variation should also be considered when scheduling sampling activities.

C. DATA COLLECTION AND PROCESSING

EPA is developing an automatic data acquisition system which will record field data, process it by computer, and print out water quality reports. Strict adherence to the output capability suggested for the data recorder will allow all demonstration projects to be handled by the EPA system. The result will be uniform water quality reports for every project. However, not all projects will require the use of this system. The decision concerning the use of this facility will be finalized by the project officer and the grantee.

D. EQUIPMENT

1. pH Unit

The unit should be suitable for use in acid mine drainage and should consist of a completely submersible pH sensor assembly and a transmitter unit.

a. Sensor Assembly
   (1) Acid mine water submersible
   (2) 5.9 meters (20 ft) of cable, minimum
   (3) Automatic temperature compensation
   (4) Amplifier circuitry at the sensor

b. Transmitter Unit
   (1) Sensitivity and accuracy: 0.1 pH unit minimum
   (2) Recorder output: 0-100 mV
   (3) Ambient temperature: 6°C to 50°C; humidity to 100%
   (4) All solid state electronics

The recorder output must be 0-100 mV for the unit to be compatible with other units and recorders used on EPA projects. The pH unit should have output adjustments to allow a 100-mV full scale reading to represent 10 pH units.

2. Conductivity Unit

The unit should be suitable for use in acid mine drainage and should have a completely submersible probe. It shall consist of a conductivity probe and a transmitter analyzer.

a. Probe
   (1) Acid mine water submersible
   (2) 5.9 meters (20 ft) of cable, minimum
   (3) Automatic temperature compensation

b. Transmitter Analyzer
   (1) Sensitivity and accuracy: ± 1% full scale
   (2) Ambient temperature: 6°C to 50°C
   (3) Recorder output: 0-100 mV full scale
   (4) All solid state electronics

The recorder output must be 0-100 mV for the unit to be compatible with other units and recorders. The actual conductivity range will depend on the probe constant, and should be selected to fit the conductivity of the individual sample site.

3. Strip Chart Recorders

These are to be used to record pH, conductivity and stage. The units should be single-channel d-c recorders with:

a. Input signal: 0-100 mV
b. Chart quick review
c. Response time: 1.0 second
d. Accuracy: ± 2%

Single pen, dual channel recorders are not recommended as backup units.

4. Water Level Gaging Equipment

The unit should be designed to provide reliable, accurate, short-range measurements of water level. The sensing element should be unaffected by acid water or scale buildup, or should be the noncontact type. It must be capable of complete submersion in acid mine drainage, in the event of a flood. The unit may consist of an electronics package and a sensor, if available.

a. Electronics

(1) Maximum range: 0-3 meters (0-10 ft)

(2) Output: 0-100 mV full scale, suitable for field calibration and adjustable to provide full scale output over any span of measurement of 24.8 cm (7 in.) or more

(3) Accuracy: 1% of range

(4) Resolution and linearity: 1%

(5) Operating temperature: -1°C to 50°C

E. OTHER EVALUATION TECHNIQUES

1. Rain Gage

While not a part of the water quality monitoring station, a recording rain gage is essential for documentation of water movement. At least one gage is necessary; however, the size and topography of the demonstration area may dictate the installation of several strategically located units in order to record representative precipitation. The units should be equally spaced over the project area or placed at major irregularities

in the terrain, such as each side of a steep mountain or inside a narrow valley.

2. Soil Analyses

Projects relating to reclamation techniques or spoil and refuse benefaction will require a soil sampling and testing program.

Representative soil samples should be collected after grading. The samples should be analyzed for lime and fertilizer requirements to establish neutralization and nutrient requirements. Following the treatment, the testing can be conducted again to verify the success of the treatment prior to planting.

3. Vegetation Inspections

After the land has been formed, treated and planted in restoration projects, the success of the demonstration must be documented. This can be accomplished by periodic inspections to record pictorially and statistically the degree of vegetative growth and cover. The statistical documentation can be recorded using a weight of vegetation and percent of cover technique.

F. POST-OPERATIONAL MONITORING

Annual inspections and interim reports of some project sites may be required in order to evaluate the long range effectiveness of the demonstrated technique. Projects in this category are those dealing with land restoration, refuse and spoil control, groundwater quality control, sediment control, sludge disposal, mine sealing and deep mining techniques.

The annual inspections may consist of recording the chemical and physical characteristics of project waters and soils, vegetative

survival in general and species survival in particular. Reports of these inspections should be forwarded to the EPA.

These steps should be considered early in the project planning, and provisions should be made to permit access by EPA for such inspections for a period of ten years.

SECTION X
REPORTS

Project reports are used for communicating the data and opinions relating to the demonstration project, and for planning and decision making. The flow and interrelationship of the various types of reports is illustrated in Figure 11.

There are two basic types of reports for demonstration projects. The first includes project or phase completion reports, along with feasibility and final reports. These reports will be prepared in accordance with "Interim Specification for OR & M Grant, Contract and In-House Projects," March 1973, as amended at the date of preparation of the report.

The second type includes annual progress reports, quarterly and monthly progress reports, trip reports and conference reports. These are discussed in detail in this section.

All measurements are to be expressed in metric units. For the convenience of engineers and scientists accustomed to using the British system, British unit values should be given in parentheses after the metric unit values. The expression of measurements by both systems of units is encouraged. Engineering drawings can be prepared and submitted using British units.

Project reporting will vary to some extent for each grant and will include all or some of the above mentioned reports. The type and distribution will usually be defined in the Grant Special Offer Conditions. It is imperative that consideration be given to this phase of the project early in the planning stage in order to allocate funds and assign responsibilities.

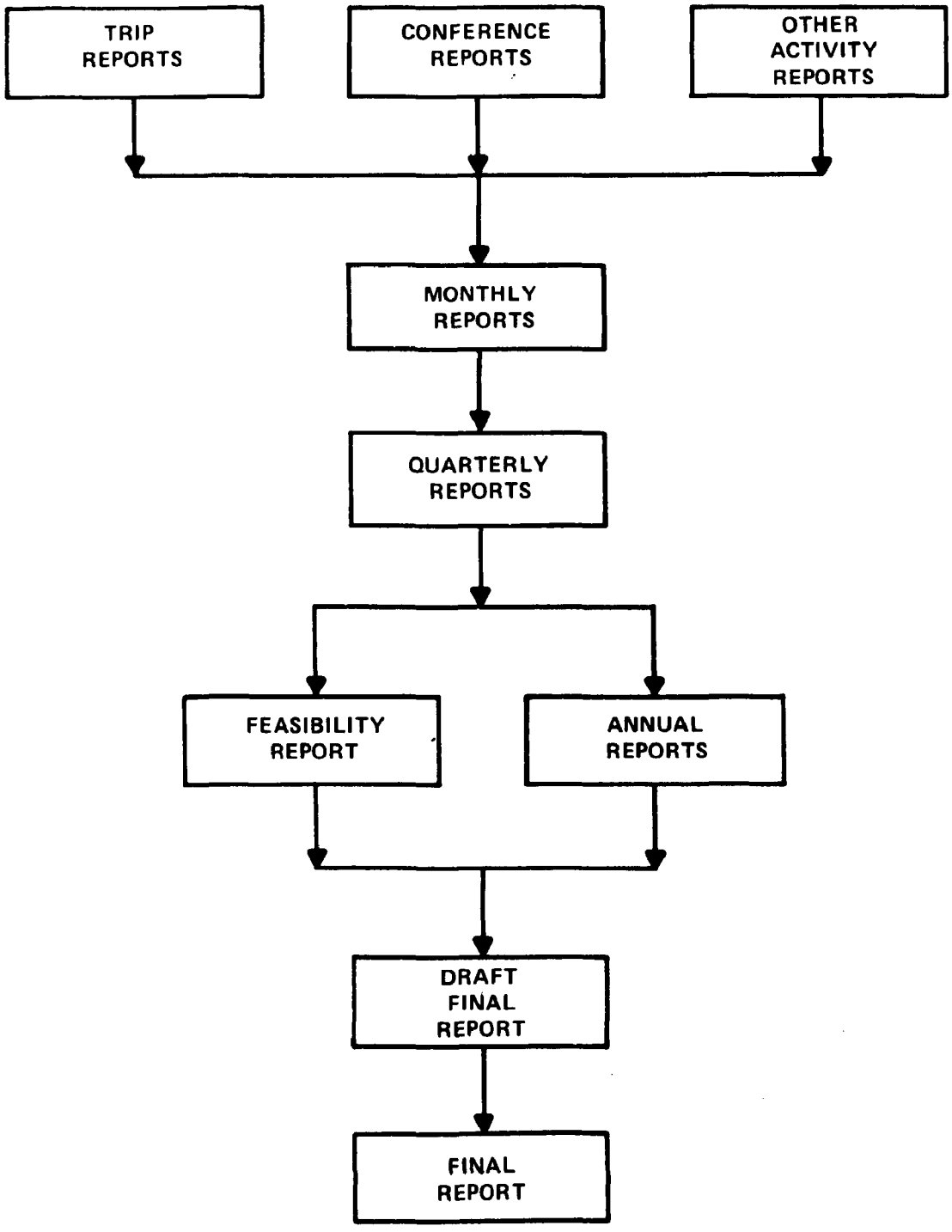


Figure 11. Reports flow diagram.

A. TRIP REPORTS

This is an optional item; however, the use of individual trip reports is recommended on projects with tasks requiring extensive travel and survey type investigations. The reports will prove invaluable in reviewing past activities while preparing quarterly and annual reports and for publishing activities during the interim periods of the formal report requirements. A typical format for trip and conference reports is illustrated in Figure 12.

B. CONFERENCE REPORTS

This is also an optional report, but is recommended as a means of reporting discussions and decisions during project meetings.

C. MONTHLY PROGRESS REPORTS

The monthly reports should be letter type reports and should cover work status, work progress, difficulties encountered during the reporting period, remedial actions taken, and activity anticipated during the subsection report period. Issue date to the project officer and other designated addresses will be the 15th of the month, beginning after the first full month of grant performance.

D. QUARTERLY REPORTS

The detailed quarterly report will summarize all work performed during the preceding months. This report will be issued by the 15th of the month, in lieu of a monthly report for that month. The quarterly report is in essence a summary and expansion of the monthly progress reports. A typical format for a quarterly report title page is illustrated in Figure 13.

Identification of issuing agency or company

Section 107 – Demonstration Project

Project No. _____

Trip Report No. _____

Conference Report No. _____

DATE: _____

LOCATION: _____

_____

PURPOSE: _____

_____

_____

_____

_____

_____

_____

_____

_____

DISCUSSION:

1.0 _____

_____

_____

Submitted By: _____

Figure 12. Typical format for trip reports and conference reports.

QUARTERLY REPORT
Months – Year

Section 107 – Demonstration Project
Project No._____

PROJECT TITLE

Grantee

Project Officer:

Project Director:

Project Coordinator:

Project Manager:

NOTE: Discussion starts on 2nd page.

Figure 13. Typical format for monthly and quarterly progress report title page.

A description of equipment, techniques, materials to be used or evaluated, and analytical data for the reported quarter should be included, along with project expenditures and changes of personnel concerned with the project.

A graph of planned and actual expenditures versus time should be included. The time span displayed should be based on the grant year period. A typical expenditure versus time graph is illustrated in Figure 14.

The detailed, bar-type project time schedule should be updated and reissued each quarter as part of this report. See Figure 15 for a typical bar schedule.

E. ANNUAL PROGRESS REPORT

The annual progress report will present in a clear, concise format all information, results and opinions resulting from the work undertaken during the preceding year. The term "year" in this case is based on the anniversary date of the grant, as opposed to a fiscal or calendar year. The format for this report should be similar to and an expansion of the quarterly reports.

F. FEASIBILITY REPORT

The feasibility report content and format are described in detail in Section V.

G. FINAL REPORT

The final report will contain all useful information, results and data acquired in the performance of the project work. The work will be explained in such detail that others may reproduce the work, equipment and processes, and all significant results, conclusions and recommendations will be presented.

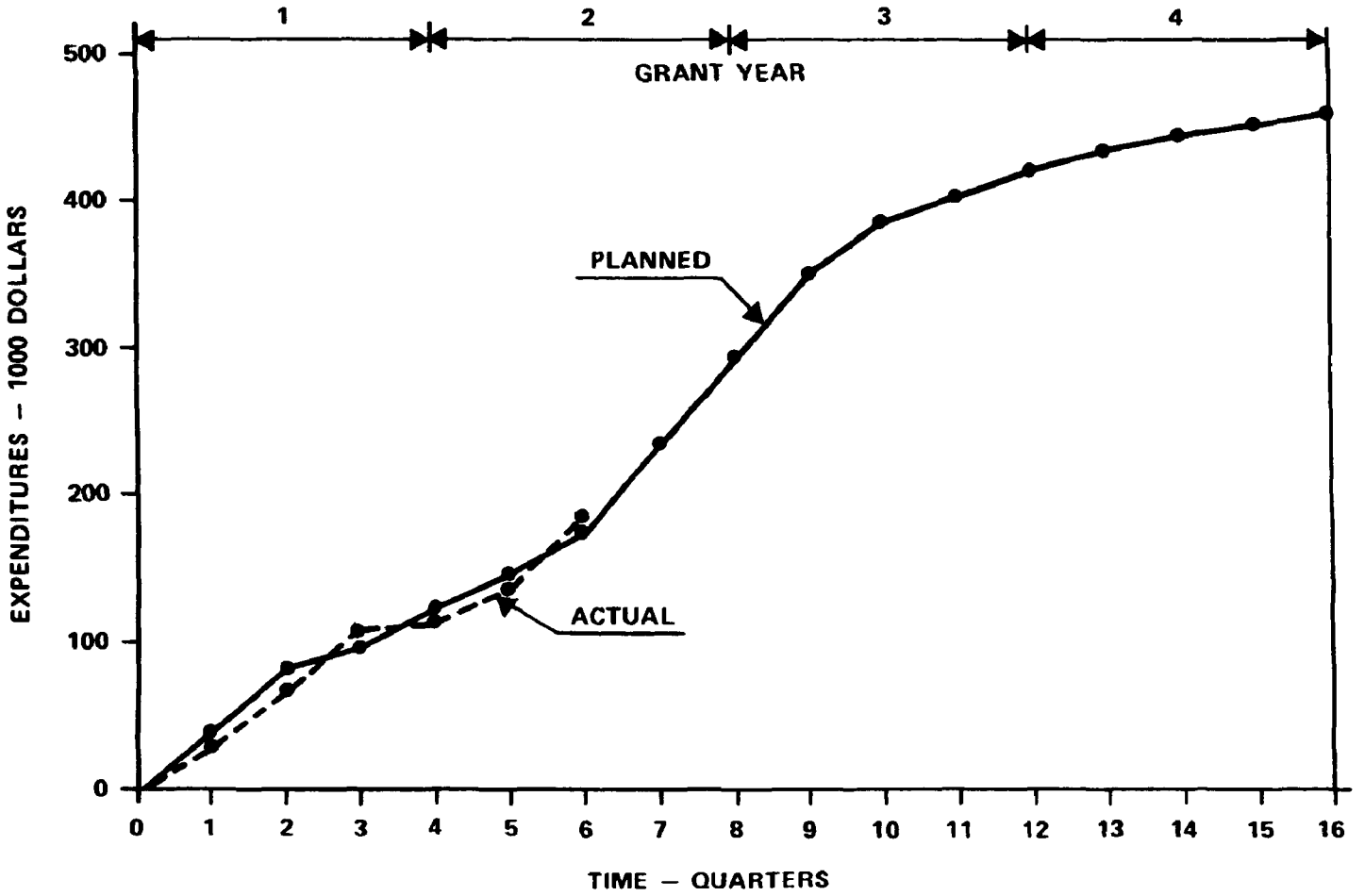


Figure 14. Expenditure versus time.

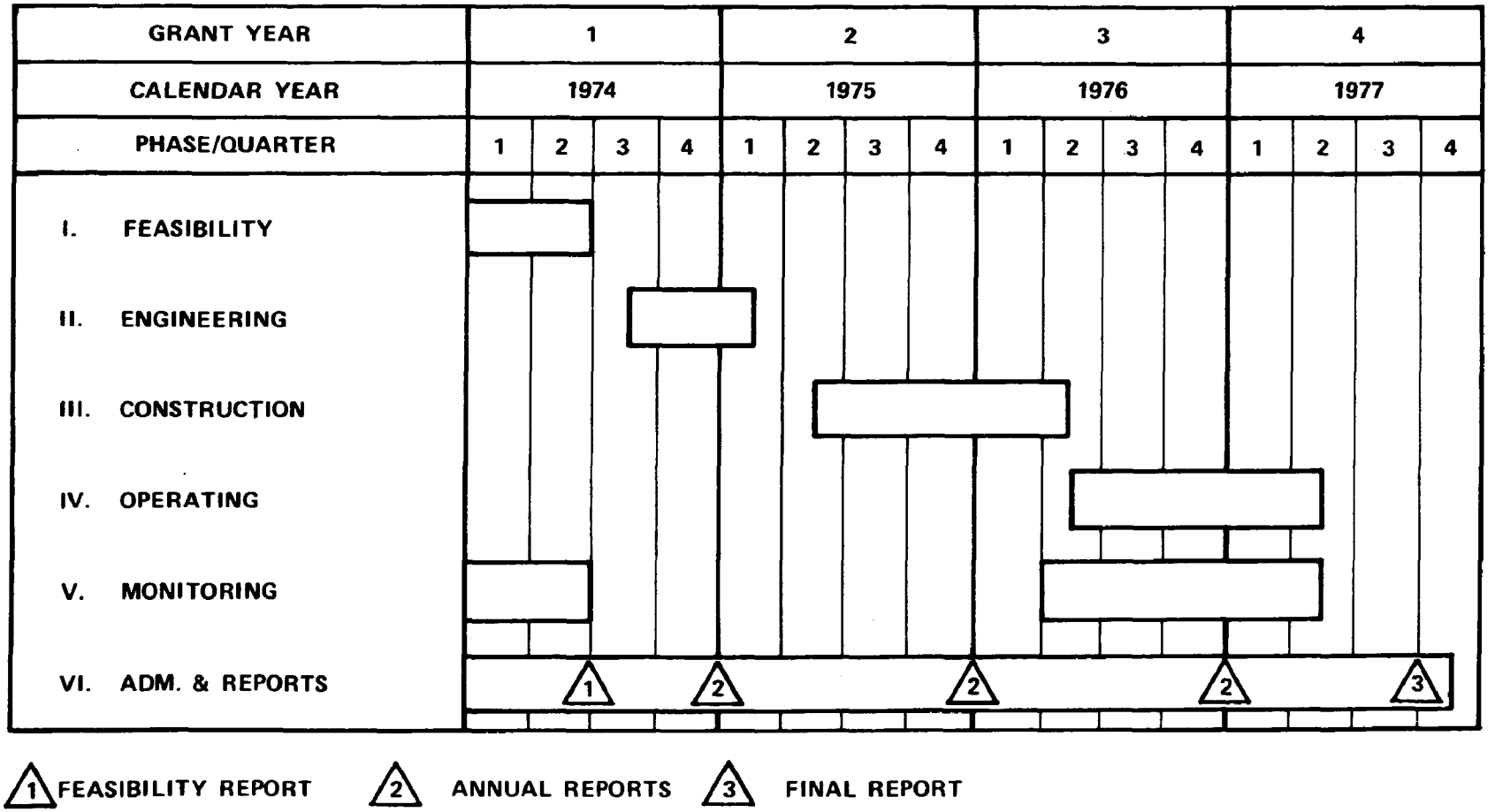


Figure 15. Typical project bar schedule.

In order to provide uniformity, all final reports will be presented in the format as outlined in the "Interim Specifications for OR & M Grant, Contract and In-House Reports," March 1973, as amended at the date of the report preparation.

A typical final report will contain the following items, as applicable:

1. Cover
2. Title Page
3. Table of Contents
4. List of Figures
5. List of Tables
6. Acknowledgments
7. Conclusions
8. Recommendations
9. Body of Report
    a. Introduction
        (1) Scope and Purpose of the Project
        (2) General Background
        (3) Description of Various Phases
        (4) Theoretical Approach to Problem Solution
    b. Design
        (1) Engineering Approach to Problem Solution
        (2) Plans and Drawings
        (3) Cost Evaluation
    c. Construction
        (1) Methods
        (2) Schedules
        (3) Costs
    d. Operation
        (1) System Operation
        (2) Results
        (3) Costs
        (4) Evaluation

e. Monitoring
    (1) Program Philosophy
    (2) Data Presentation
    (3) Evaluation

10. References
11. Glossary
12. Appendices

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-670/2-74-003		

4. TITLE AND SUBTITLE	5. REPORT DATE
Mine Drainage Pollution Control Demonstration Grant Procedures and Requirements	October 1974 Issuing Date
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Frank J. Zaval, Robert A. Burns	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
	IBB040/ROAP 21 AGC/TASK04
NUS Corporation Four Research Place Rockville, Maryland 20850	11. CONTRACT/GRANT NO. 68-03-0268
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
National Environmental Research Center Office of Research and Development U. S. Environmental Protection Agency Cincinnati, Ohio 45268	Final 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

This report is a presentation of procedures and requirements for use by all individuals considering or participating in Section 107 grant demonstration projects authorized by Federal Water Pollution Control Act Amendments of 1972.

The report provides an interpretation of Section 107, defines the procedures and requirements for grant applicants, and discusses all phases of demonstration projects, including monitoring requirements and reports.

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17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*Grants Financing Water pollution Mining engineering *Mining research Requirements Reclamation	*Mine drainage pollution Grant procedures Demonstration	13B

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