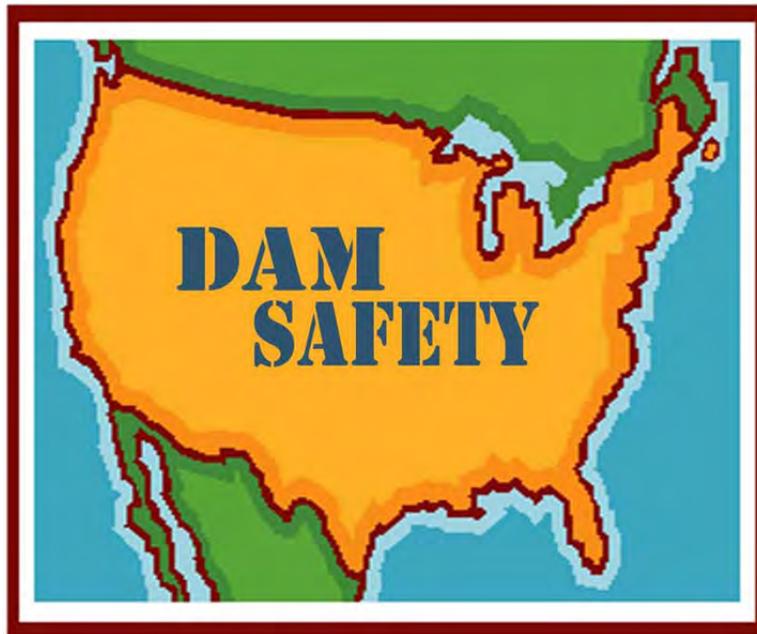


The National Dam Safety Program

Model State Dam Safety Program

FEMA 316/July 2007



Federal Emergency Management Agency
www.fema.gov

Association of State Dam Safety Officials
www.damsafety.org

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CHAPTER VI - PROGRAM STAFFING AND FUNDING

Staffing and funding requirements for a dam safety program depend primarily on the scope of the state's statutory authority and responsibilities. Some typical factors which also affect these needs include the following:

- A. Number, classification and location of dams* subject to state jurisdiction;
- B. Type of inspection program, i.e. inspections by state or by owner's* engineer*;
- C. Geography and topography of the state;
- D. Overall organizational structure of the state; and
- E. Related operation and equipment expenses and requirements.
- F. Population at risk.

As part of their total program budget, some states may also wish to consider financing mechanisms for public and private dam repair and rehabilitation projects. However, for any state dam safety program to be effective and accountable, the basic personnel and funding levels must be sufficient to satisfy the statutory mandates.

This chapter provides information which can be used in determining staffing and funding needs necessary to establish new state dam safety programs or expand existing ones. Areas covered include considerations in determining staffing needs, typical job classifications, budgetary considerations, program funding sources, potential funding resources for repair projects and a staffing level example program exercise to assist in budget preparations. Each state must assess its particular needs on the basis of its own set of legislative, organizational, geographic, and political constraints.

I. Staffing Considerations

For new or expanding programs, it is important to identify all factors which may influence personnel needs. Statutory requirements, including those established by administrative rules and regulations, form the basis for this determination.

- A. Identification and staffing needs:
 - 1. Statutory/administrative requirements. All aspects of the permitting and inspection activities including mandatory application* and plans review periods, enforcement actions, and legal proceedings should be

clearly identified. Requests for technical assistance, resolution of design problems, and preparation of reports often require more staff effort and time than initially projected. Case preparation and conferences with attorneys, depositions, court testimony, and other aspects of litigation should also be addressed in determining staff needs. The program administrator and possibly others in the program will likely have to devote time to personnel and budget issues, administrative paperwork, strategic planning and other issues pertaining to the overall operation of the program;

2. **Inspection Requirements.** An inspection team is able to inspect only a finite number of dams within a certain period of time. Because of the wide range of state laws and inspection requirements, it is difficult to identify the number of inspections that any inspection team should be expected to perform. The inspection team's degree of experience will also directly influence the capacity for performing inspections. An adequate number of qualified inspectors must be available for inspections and associated enforcement work. Average time for inspection of permitted/approved dams including travel time, on-site inspection time, and report writing may be as much as four (4) person days for high hazard potential dams, three (3) person days for significant hazard potential dams, and two (2) person days for low hazard potential dams. A detailed inspection, analysis and evaluation of a dam with production of a detailed report may take two person-months or more. This inspection time may vary on proximity and types of dams, etc. It is recommended that at least one engineer and one inspector comprise each inspection team both initially and with subsequent inspections.
 3. **Logistics.** The locations of the dams and the required travel time to and from the inspection sites should be considered. For states of larger geographic area and/or with complex topographic conditions, regional or field offices may be necessary; and
 4. **Other staff duties.** Administrative and other duties unrelated to the dam safety program will have a direct bearing on staffing requirements. The administrator may be responsible for overseeing other programs. Selected staff members may be required to devote portions of their time to other duties. An expanding staff will place an added burden on experienced supervisory personnel, particularly with respect to the training of new staff;
- B. **Organizational structure;**

Each state will need to assess and fit the dam safety program into the appropriate agency*/department in its overall organizational structure.

Many states include the dam safety program in water resources agencies. The scope and size of the program as well as the potential need for field offices must be considered in determining the organizational structure. Tables of two possible organizational structures are included in Appendix F;

C. Typical job classifications;

Several job classifications are considered essential to meet the various needs of a dam safety program. Recommended classifications include engineers, geologists, technicians, and other professional, technical, and clerical support staff. Although professional support staff does not necessarily need to be part of the actual program organization, clear and ready access to attorneys, computer specialists, and other professionals is an essential staffing consideration. Also, the importance of clerical and administrative support personnel should not be overlooked in assessing staff needs. These persons will contribute substantially to the program's success and effectiveness. Such job classifications may include, but are not limited to:

1. Engineers (both professional engineers and engineers-in-training). An appropriate mix of experienced and junior engineers will enhance any dam safety program. Applicable engineering disciplines include:
 - a. Water resources (hydrology and hydraulics);
 - b. Geotechnical;
 - c. Structural; and
 - d. Construction;
2. Engineering geologists;
3. Technicians;
 - a. Construction;
 - b. Inspection;
 - c. Surveying; and
 - d. Drafting;
4. Professional support;

- a. Environmental scientists;
 - b. Computer specialists;
 - c. Emergency management planners;
 - d. Soil scientists;
 - e. Remote sensing specialists;
 - f. Attorneys;
 - g. Public Information Officer
5. Clerical and administrative support.
- a. Secretaries; and
 - b. Fiscal/administrative assistants.

II. Program Funding

Funding of a regulatory dam safety program will depend significantly on its statutory requirements. In developing a new program, potential revenue sources for implementation should be analyzed and any necessary funding mechanisms such as fees should be included in the enabling legislation. Principal funding sources for dam safety programs are direct legislative appropriations and various types of fees.

The logistics for submitting an appropriation request to the administration and the legislature will vary from state to state. Usually before an appropriation is made, administrative, fiscal, and legislative entities will scrutinize and determine the need for such an appropriation. As part of the appropriation process, it will be necessary to develop a detailed program budget including appropriate justifications for identified needs. For new or existing programs, several factors must be addressed in determining financial needs and preparing an operating budget. Costs associated with personnel, equipment, facilities, training and education, supplies, and emergency actions are just a few factors which directly influence budget needs. It is important that the program's management and administrative staff be directly involved in the budget preparation to assure that all needs are addressed.

- A. Identification of funding needs; and

- B. A detailed budget should include all operating costs necessary to properly implement and enforce the statutory requirements. For any dam safety program to be effective, the level of funding must match the legal and safety mandates. The following items should be considered in developing a budget:
1. Personnel costs;
 - a. Staff costs (salaries, fringe benefits, etc.);
 - b. Consultant services - Investigations of special problems or third-party opinions may be needed in evaluating safety issues;
 - c. Utilities and rent;
 - d. Computer specialist charges;
 - e. Travel (both in-state and out-of-state); and
 - f. Miscellaneous
 2. Equipment;
 - a. Office equipment, reference books, and maps;
 - b. Four-wheel drive vehicles;
 - c. Field equipment (cameras, video equipment, first aid kits, high power lights, rain gear, global positioning system (GPS) equipment, surveying instruments, measuring devices, etc.);
 - d. Computers, including laptop computers for field work;
 - e. Communication equipment (mobile radios with emergency frequencies, cellular telephones, pagers); and
 - f. Special items (pipe inspection cameras, siphon pipe equipment).
 3. Training and education (publications, seminars, public relations material, etc.);
 - a. Staff;
 - b. Owners; and
 - c. General public.

4. Funding for emergency actions;

As a minimum, a non-lapsing source of easily accessible money should be identified. Some states have a specially designated fund for such actions. The dam safety legislation could require that a portion of civil penalties be earmarked for such a special fund. Some means of recovering the cost of an emergency action from the dam owner should also be provided;

5. General support allocation for umbrella agency.

C. A funding source needs to be identified. As previously indicated, there are two principal funding sources: direct appropriations and fees.

1. Direct appropriations are self-explanatory;

2. Fees;

- a. Application, filing, or permitting fees. These charges are typically made to cover the costs of plan review and approval, construction inspection, and associated aspects of new dam construction, reconstruction or repair. These fees may be charged as a flat rate or as a graduated schedule based on the estimated construction cost;
- b. Certificates of approval to impound*, permit-to-operate, or registration fees. These fees are usually charged on an annual basis for the continued operation of the dam. The fee may be in the form of \$X per dam dependent on hazard potential classification or \$Y per foot of height, acre-foot of storage, or other measurement; and
- c. Inspection fees -These charges are usually imposed to offset the costs of the state's periodic inspection program. The fees may be similar to the ones noted for a certificate of approval to impound or may be for the actual cost of the inspection.

3. Other sources include federal grants, direct assistance, etc.

III. Funding Resources for Repair Projects

Protection of the public from the failure of dams cannot be assured unless deficiencies and unsafe conditions identified through regulatory inspections are properly corrected in a timely manner. Funding of major dam repair and

rehabilitation projects can be a difficult problem in both the public and private sectors.

A large percentage of the high hazard potential dams are owned by federal, state, or local governments. Many high and significant hazard potential private-sector dams are owned by industrial and commercial entities, by homeowners' associations and by private owners. For large and moderate sized dams, repairs can cost in the hundreds of thousands or millions of dollars. Such costs may well exceed the financial capability of almost any governmental unit or private entity.

Infrastructure deterioration and funding problems have gained a great deal of attention throughout the nation (See appendix I).

APPENDIX F

ORGANIZATIONAL CHARTS

Appendix F shows examples of different options for dam safety organizations. These examples show sections organized by function or expertise.

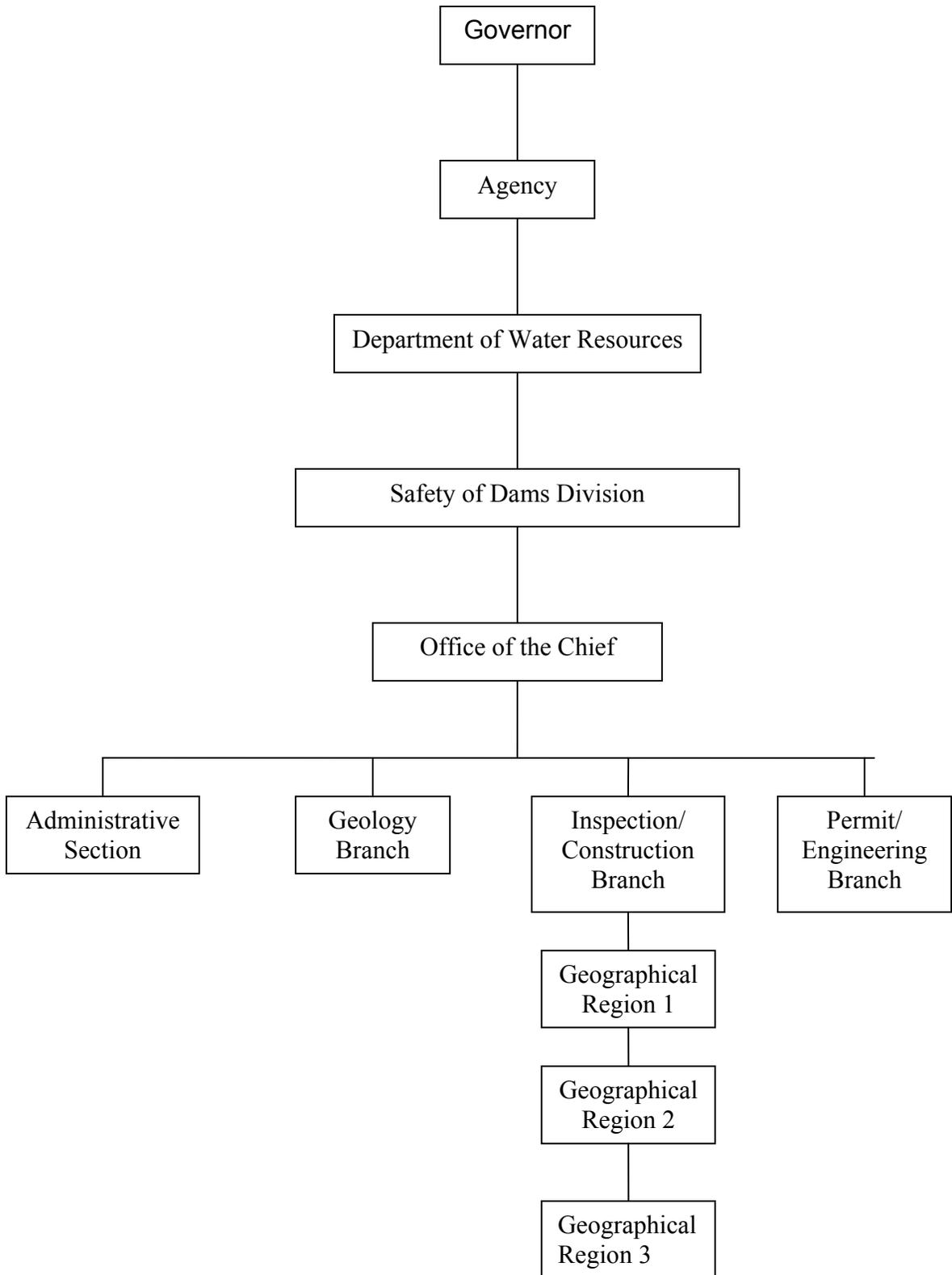
The first example is of a state, such as California, with a large organization utilizing functions. The organization is headed by a Chief then four branches with unique functions for each. The administrative section handles all clerical, personnel and business type functions for the organization. The Geology Branch supports both engineering branches. The Inspection/Construction Branch is responsible for all maintenance and construction inspections. The Permit/Engineering Branch conducts permit reviews for new construction, and alteration and repair reviews of existing dams. This Branch also conducts any in depth evaluations. While it may be desirable to have the same engineer in charge of construction who supervised the design review, efficiency can be increased by separating staff by function and expertise.

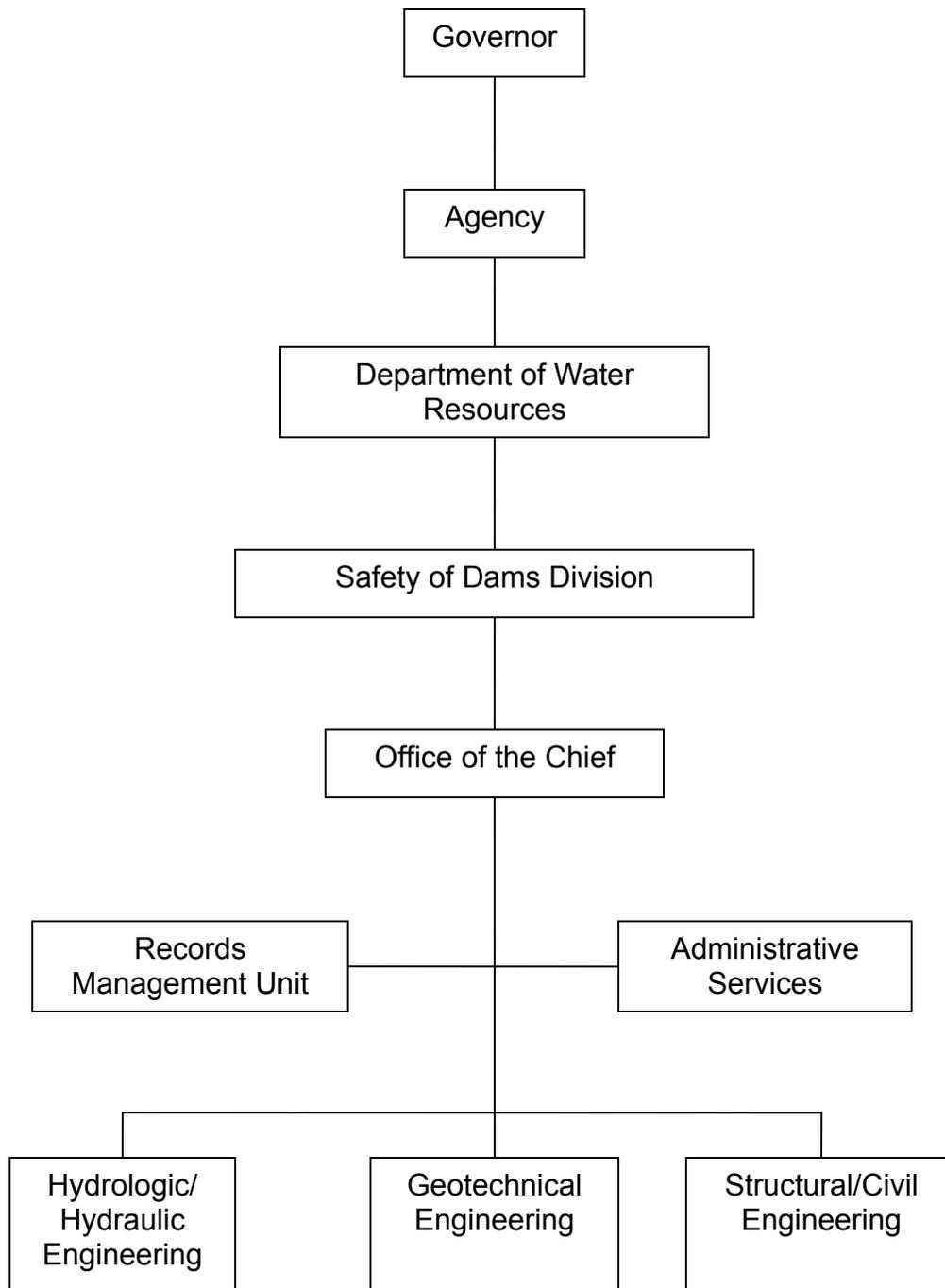
This organization structure could be used for states with large or small programs or engineers could be assigned to specific projects and work across the functions.

The second example chart is set up by field of expertise and would generally be applied to smaller programs where coverage of all aspects of dam safety is desirable. A team approach is used for design review with construction of safety inspections being handled by one or more field inspectors or all staff would participate in field work.

Modifications of either of the above examples may be required depending on the personnel and expertise available. For example, a state could have a permits unit with engineers who are assigned projects and have responsibility of design review and construction inspections. Similarly, the safety inspection unit would handle the periodic inspection, modification design reviews and construction inspections for all dams assigned to them. Then engineers could be rotated between units for further cross-training.

State programs which require the owner to hire a qualified civil engineer to perform inspections and attend a percentage of inspection for quality control would result in a smaller organization and would probably require engineers to perform a variety of tasks.





APPENDIX I

BUDGET PREPARATION

STAFFING LEVEL REQUIREMENTS: EXAMPLE STATE DAM SAFETY PROGRAM

Chapter VI discusses program staffing and funding. This appendix is intended as a supplement to Chapter VI.

For any state dam safety program to be effective and accountable, personnel levels must be sufficient to satisfy the statutory mandates. Each state must assess its particular needs based on its legislative, organizational, geographic, topographic and political constraints, some of which are described above under Chapter VI, section I. Due to the wide range of these constraints from state to state, it is difficult to provide precise guidelines for the number of inspections one engineer should be expected to perform in a year. This is equally true of each of the other functions of a state dam safety program. With these limitations in mind, an attempt has been made to provide guidelines that should provide assistance in the preparation of a budget for a state dam safety program.

INSPECTION OF EXISTING DAMS:

If inspection frequency is not set by law, annual inspections of high hazard potential dams, biennial inspections of significant hazard potential dams and inspections every five years for low hazard potential dams are recommended. Each dam should be inspected at least once every five years. Some states require the owner to hire a qualified engineer to conduct the inspections. When this is the case, a staff of one engineer per 250 - 400 inspections would be required to review the inspection reports and to attend 20 percent of the inspections for quality control purposes. Most state programs conduct safety inspections utilizing state employed engineers. For budget preparation, the recommended time for a detailed visual inspection of one existing high hazard potential dam including file review, preparation, travel time, on-site inspection time, engineering analysis and report writing is four (4) person-days. For significant and low hazard potential dams the recommended time to budget for inspections are three (3) and two (2) days respectively. It is desirable to include more than one person on the inspection team. There are many reasons for including more than one person on the inspection including training, personal safety, and special needs at the dam. Special needs include surveying and the complexities of the particular dam being inspected that may require staff members with different areas of expertise.

APPLICATION APPROVAL:

Chapter II describes the tasks included in the processing of an application. Statutory and internal policy controls may define the time allocated to review and approve or deny an application. The complexity of the application under review, the completeness of the data provided, the experience of the staff assigned to the review, etc., are factors in determining the length of a particular review. The

length of the permitting process can vary greatly; however, a recommended engineering review time for a complete application is 20 person days, with an additional 5 days for clerical/administrative tasks. The engineering review should include a site inspection as part of the application review. Reviews should also include the major aspects of the engineering design for the dam being proposed. Among these aspects are hydrologic, hydraulic, geotechnical, seismic, and stability considerations. Review and approval of the Emergency Action Plan (EAP), if required, is also part of the application approval.

CONSTRUCTION ASSURANCE:

Although it is the owner's responsibility (through the owner's engineer) in most states to assure that any construction is completed according to the approved application and that all unforeseen conditions are properly handled, review of construction activity by the state is recommended. Inspection and approval of all foundation preparation is essential and is a part of most programs. Inspection of the outlet, the main structure, and the spillway should also be conducted. In addition, many projects include prefinal and final inspections. A recommended inspection length is two (2) person days including preparation, travel and report preparation. The recommended time could double in those states where travel distances are significant. The recommended number of construction assurance inspections per new dam is fifteen (15). Ten (10) construction assurance inspections are recommended for repair of existing dams. The above inspection frequencies include review of quality assurance records of the owner's engineer. Changes to the approved application during construction require additional review. The time required for such additional review is not included in this section but is included in the application approval section above.

FOLLOW-UP ON DEFICIENCIES:

Inspections of operational dams frequently reveal deficiencies that require correction. The inspection report shall identify deficiencies and include an appropriate schedule to complete corrective actions. A program to follow up and assure that these actions are taken should be part of all state programs. The amount of time required to conduct a follow-up inspection can vary, however, for operating dams it can take an average of three (3) persons-days per deficiency. For budget preparation purposes, it should be anticipated that deficiencies will occur at 20 percent of the dams inspected.

Contacts with owners of unsafe dams to bring about the remediation of unsafe conditions is also an essential part of follow-up activities. The actual amount of time required can vary. It is recommended that 15 person-days per unsafe dam be used in budget preparation. The 15 person-days recommended does not include application review time for repair, reconstruction, breach or removal of the dam. In most cases a state will have to prioritize follow-up activity since the time required can easily exceed the available staff.

ENFORCEMENT:

In the event that progress toward correction of deficiencies is not satisfactory, enforcement actions must be pursued. Enforcement can be very time consuming. For budget estimates a recommended time for each enforcement action is 50 person-days for the dam safety engineering staff. The estimated time includes the time of the legal staff as well as that of the engineering staff for preparation, etc. The above estimates assume that actions taken by the technical staff have been properly documented to support the enforcement actions.

TRAINING:

Education and training of staff is an important part of an effective program. It is recommended that a minimum of 5 percent of staff time be devoted to specific training provided by short courses, etc. as described in Chapter VII.

ADMINISTRATION/OVERHEAD:

Depending on the agency within which the dam safety program is placed and the overall state government organizational structure, the administration of the dam safety program can require significant amounts of time. The administrator may be responsible for overseeing other programs as well. The recommended administrative staffing time is 30 percent of the technical staff time described above. The above estimates include supervision and support of the program.

Example Program Staffing Level Requirements

Example program: 200 Dams:

70 High hazard potential,
60 Significant hazard potential,
70 Low hazard potential

with inspection frequency as follows:

High hazard potential, annual;
Significant hazard potential, every two years; and
Low hazard potential, every five years

<u>TASK</u>	<u>No. of Tasks (Dams)</u>	<u>Person-Days Per Task</u>	<u>Total Person Days</u>
Average annual inspections ²			
High hazard potential	70/yr	4	280
Significant hazard	60/2 = 30/yr	3	90
Low hazard potential	70/5 = 14/yr	2	28
Special Conditions, Requests	30	2	60
Training new staff	1	15	<u>15</u>

Sub-Total: Annual Inspection Days = 473 days

	<u>Person Tasks per Task</u>	<u>Person-Day per Task</u>	<u>Total Person-Days</u>
Application approval:			
New Dams	10	20	200
Repair Existing Dams	10	10	100
Emergency Action Plans (EAP)	25	5	125

Sub-Total: Application Approval Days = 425

	<u>Person Tasks Per year</u>	<u>Person-Day per Task</u>	<u>Total Person-Days</u>
Construction Assurance:			
New Dams	10	30^3	300
Repair Existing Dams	10	20^4	<u>200</u>
Sub-Total: Construction Assurance Days = 500			

Follow-up on deficiencies:

114 dams/yr. X 20% =	23	3	69
Unsafe dams	2	15	30
Enforcement:	4	50	200

Summary of Tasks:

Inspections:	473 days
Applications:	425 days
Construction:	500 days
Follow-ups:	69 days
Unsafe Dams:	30 days
Enforcement:	<u>200 days</u>
TOTAL:	1,697 days

Professional Development/
Continuing Education:

$$1697 \times 5\% = 85 \text{ days}$$

Total Engineering/
Technical Staff:

$$1697 + 85 = 1782 \text{ days} / (225 \text{ days/FTE/yr.}) = 7.9 \text{ FTE}$$

Administrative/
Clerical:

$$1782 \times 30\% = 535 \text{ days} / (225 \text{ days/FTE/yr.}) = 2.4 \text{ FTE}$$

TOTAL STAFFING REQUIRED:
(For Inventory of 200 dams)

10.3 FTE

³2 person-days per inspection X 15 inspections per year = 30

⁴2 person-days per inspection X 10 inspections per year = 20

Note:

- 1) In geographically large states without regional dam safety offices, a "distance multiplier" of 1.5 may be used to estimate the number of person-days required for field inspections.
- 2) "Construction Assurance" would include site inspections during:
 - A. Foundation Preparation
 - B. Embankment Construction
 - C. Low Level Outlet Structure Construction/Placement
 - D. Spillway Construction
 - E. Final Review
- 3) In states with seismic risk, a "seismic multiplier" of 1.5 may be used to estimate the number of person-days required for application approval.
- 4) Initial inspection of an existing dam and production of a Phase I inspection report will likely take up to between 10 to 15 man-days.
- 5) Other administrative activities must be considered

Chapter VI lists other costs which must be considered in the budgeting process.