Reclamation Manual

Design Data Collection Guidelines
Chapter 3 – Feasibility Designs

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1. Dams. The Introduction (Chapter 1) for these design data collection guidelines contains additional information concerning: preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal. The following is a list of possible data required for design of a storage dam; however, design data for a diversion dam are compatible with the list so far as the items are applicable.

A. **General Map(s) Showing:**

(1) A key map locating the general map area within the State.

(2) The proposed structure site.

(3) Existing towns, residences, private property, highways, roads, railroads, public utilities, transmission lines, substations, stream-gauging stations, township, range, and section lines.

(4) Locations of construction access road(s), and sites available for construction facilities.

(5) Sources of natural construction materials and disposal areas for waste material.

(6) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project feature such as: recreation areas, fish and wildlife areas, building areas, and areas of archeological, historical, and mining or paleontological interest.

(7) Sources of construction power and power transmission facilities.

B. **General Description of Local Conditions Covering:**

(1) The capabilities of and constraints imposed by local access, shipping and transportation facilities.

(2) Availability of housing or other facilities in nearest towns; requirements for a construction camp; and need for permanent buildings for operating personnel.

(3) Availability or accessibility of public facilities or utilities such as: water supply; sewage disposal; and electric power for construction, and for operation and maintenance.

(4) Climatic conditions that will affect construction and operation procedures such as: amount, rate and distribution of rain and/or snow; ice conditions; summer and winter temperatures, with extremes; and extreme wind velocities and prevailing directions. (Extensive tabulations are not necessary.)

(5) Names and telephone numbers of local utilities and contacts within those organizations.

C. **Survey Control.** Minimal field surveys should be done to obtain horizontal and vertical control. Use of any existing coordinate system or vertical control system is acceptable but tying to the State plane coordinate system is recommended.

D. **Topographic Map(s).** A topographic map covering an area sufficient to accommodate all possible arrangements of dam, spillway, outlet works, diversion works, and other appurtenant structures. The topography of the reservoir area should also be included and should extend to an elevation high enough to allow for cut slopes above the dam and for the safe passage and/or storage of the design flood. Use of existing U.S. Geological Survey (USGS) topographic data is encouraged for the reservoir topography.

For structures such as diversion dams which are a significant part of the system, topography of 1 inch equals 50 feet with a 2-foot contour interval is desirable. For dams and large structures a scale of 1 inch equals 100 feet with a 5-foot contour interval is desirable. The scale, contour interval, and detail should be based on the conditions and need at each particular site.

E. **Foundation Data.** The need for foundation data should be established by the joint efforts of personnel from the area, region, and Technical Service Center. For major structures it is recommended that a field conference be held, including an inspection of the site. This conference should result in a geologic investigations program outlining the need for and extent of surface and subsurface studies, and other requirements. The geologic investigations program must be based on site conditions, type of structure, and the time and funds available for the study and will make maximum use of existing data. The complexity of the site will determine the detail of the investigation which will be restricted to that needed to obtain an adequate cost estimate for planning purposes only.

(1) **Geologic Data.** All geologic data will be included in a geologic report to support the design studies. The report should be as concise as possible, consistent with the geologic program, which was previously established. The following should be considered in preparing the geologic report.

(a) A description of regional geology.

(b) A description and interpretation of site geology, including physical quality, excavation characteristics and geologic structure of the

foundation strata and ground water conditions, existing and potential slide areas, and engineering geologic interpretations, as appropriate.

(c) Geologic logs of all subsurface exploration. All exploratory hole locations and elevations should be based on the same survey control system.

(d) A geologic map, plotted on the topographic map of the site, showing surface geology and the location of geologic sections, soil profiles, and all subsurface exploration.

(e) Geologic sections, with soil profiles as required, showing known and interpreted subsurface conditions.

(f) Aerial photographs or mosaics of the dam site and reservoir area, if available. Aerial coverage should extend beyond the reservoir area to include geologic and terrain features that would influence water-holding capability of reservoir.

(g) A concise evaluation of site seismicity and earthquake geology.

(h) Samples of foundation strata as needed for visual examination or laboratory testing.

(i) A delineation of the lateral extent and thickness of critical, incompetent, or potentially unstable strata.

(j) A determination by limited tests of the significant engineering properties of the soil and rock materials at the site such as excavation characteristics, density, permeability, compressive strength, elastic modulus, shear strength, strain characteristics, and consolidation or expansion characteristics, and the effect of structure load, changes in moisture, and fluctuations or permanent rise of ground water on these properties. The description should also include:

- A description of the depth to and contour of bedrock; thickness of weathered, altered, or otherwise softened zones; and other structural weaknesses and discontinuities.

- A delineation of structurally weak, pervious, and potentially unstable zones and strata of soft rock and/or soil.

(k) Geological information pertinent to reservoir water-holding capability, operation, and use; location and type of mines or mining claims, potential landslides, and major faults.

(2) **Seismotectonic Data.** Provide background information on the seismic loadings in the area and recommendations for coordination of data collection.

F. **Construction Materials Data Including:**

(1) Inventory of available impervious and pervious embankment materials and rock for riprap and rockfill.

(2) Information on concrete aggregates.

(3) Data on commercial concrete plants within hauling distances from the site.

(4) Information on sources and character of acceptable road surfacing materials, if required.

(5) References to results of previous tests of materials including service history and photographs of sources.

(6) Report alkali conditions in soil and water which might affect the choice of sulfate resisting cement.

(7) Requirements concerning stockpiles and suggested permanent stockpile locations.

(8) Environmental impacts associated with removing or obtaining construction material.

G. **Hydrologic Data:**

(1) Deterministic and probabilistic flood studies should be prepared by specialists in the TSC and the results of their efforts included or referenced in the design data submittal. The deterministic flood studies will typically include the probable maximum flood hydrograph developed using the currently accepted practices and data. The probabilistic flood studies will typically include a flood frequency analysis that provides the peak flood inflows having return periods up to 10,000 years using the currently accepted practices and data.

For a diversion dam involving little or no storage, a probabilistic flood frequency analysis with flood peak discharges up to the 100-year return period will be sufficient. However, if the structure is judged to pose a

significant threat to a downstream population, the design flow may be based on a longer recurrence interval.

(2) Flood hydrographs for frequencies of 5, 10, and 25 years for use in diversion during construction. Legal or other requirements for maintaining streamflow or diversions during construction and maximum length, time, and number of permitted interruptions.

(3) Reservoir operation criteria for flood control, maximum permissible releases, and the estimated safe discharge capacity downstream of the dam site.

(4) Annual periodic fluctuations of reservoir levels shown by tables or charts summarizing reservoir operation studies with the expected initial reservoir level for the flood routing studies.

(5) Tailwater curves, sedimentation studies, degradation and aggradation studies should be included if they are critical to the development of the cost estimate. The detail in these studies should be held to a minimum.

H. **Reservoir Data:**

(1) Area-capacity curves and/or tables to at least the expected dam crest elevation .

(2) Completed Reservoir Storage Allocations showing storage allocations and corresponding elevations.

(3) Physical, economic, or legal limitations to maximum reservoir water surface.

(4) Anticipated occurrence and amounts of sediment, ice (thickness) and drift (trash), and possible effect on reservoir outlets, spillway, and other appurtenances.

(5) Extent of anticipated wave action including discussion of wind fetch.

I. **Operating Data:**

(1) Details of required downstream control sections, measuring devices, gauging stations, or other operating works.

(2) Reservoir backwater curves, including the effect of sediment details if upstream right-of-way will be critically affected or damaged.

(3) Location, hydraulic section, and water surface elevation of irrigation or power canal diverting from the reservoir.

(4) Required outlet and sluiceway capacities for respective reservoir water surfaces; and minimum sill elevations. Give type and purpose of reservoir releases and the time of year to be made; include minimum release during winter.

(5) Type of operation, i.e., full-time resident caretaker, remote control, etc.

(6) Number of operations and support personnel.

J. **Miscellaneous Data:**

(1) Details and requirements of roadway on crest of dam (and approaches), if required.

(2) Details of fishways and screens with requirements of State and Federal fish authority.

(3) Existing works to be replaced by incorporation into dam.

(4) Future powerplant or power development, or future pumping plant.

(5) Navigation facilities.

(6) Possibility of need for future enlargement.

(7) Required provisions for public safety and visitor facilities.

(8) Data on upstream dams that appear to be structurally or hydrologically inadequate.

(9) Anticipated recreation facilities that will affect the dam design.

(10) Data on upstream and downstream log booms.

(11) Use and allocation of water (downstream habitat, irrigation, municipal and industrial, etc.)

(12) Many Reclamation projects may require a security risk assessment. The need for a site-specific security risk assessment should be considered for feasibility designs where an assessment may impact the field cost estimate and for specifications designs. Specific issues to consider are contained in Section 14 of Chapter 7 – Site Security and Public and Worker Safety. If assistance is required to determine specific design data needs, contact the Office of Security, Safety and Law Enforcement. Where design data and designs include site-specific security assessment, compliance with Reclamation Manual DM Part 444 – Physical Protection and Facility Security, Chapters 1 and 2 is required.

K. **Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect dam design and a brief description of the environmental resources that could be affected by the construction and operation of the proposed development. The emphasis should be on those areas within the range of alternatives open to the designers in developing a structural design. The following items should also be considered in preparing design data:

(1) The environmental setting. Photographs, both black and white and color, are most helpful.

(2) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the dam and the reservoir basin.

(3) Recommendations for ensuring water quality standards are met including: suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction; also requirements for multilevel intakes.

(4) Background on the need for fish facilities such as screens, fishways, and barriers.

(5) Recommendations or commitments to maintain specific flow requirements for biological and/or recreational resources.

(6) Erosion and sediment control.

(7) Special considerations to provide structures compatible with surroundings.

(8) The need for a field conference to resolve critical environmental problems with participation of other agencies.

(9) Review of designs by other agencies, including the findings of the Fish and Wildlife Coordination Act Report (if available).

(10) Reservoir clearing plan to consider fish and wildlife requirements and environmental constituents.

(11) Anticipated public use around the structure.

(12) Location of closest residence for noise/dust/light control requirement.

(13) Potential Indian trust issues.

(14) Potential environmental justice issues.

(15) Any threatened and/or endangered critical habitat in/or adjacent to the project.

(16) Location and size of any solid waste or hazardous waste facilities within the reservoir basin.

(17) Location of buried tanks in the reservoir basin.