

**15. Fish Barriers.** 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.

**A. General Map Showing:**

- (1) A key map locating the general map area within the State.
- (2) Location of the structure site.
- (3) County, township, range, and section lines.
- (4) Existing towns, highways, roads, railroads, public and private utilities, transmission lines, substations, rivers, streams, and stream-gauging stations.
- (5) Locations of construction access road and sites for required construction facilities.
- (6) Sources of natural construction materials, location of commercial quarries, and disposal areas for waste material.
- (7) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project feature such as: housing and building areas; and areas of paleontological, archeological, historical or mining interest.
- (8) Sources of construction power and power for operation.
- (9) Scale of the general map should be adequate to clearly show listed details.
- (10) North arrow.

**B. Topographic Maps.** Both a map and a electronic file, in AutoCAD or compatible format, of the topography covering the structure site should be provided. A contour interval of 1-foot is required in the immediate vicinity of the structures. Elsewhere, larger contour intervals may be acceptable. These site maps normally will be on a scale of 1 inch equals 50 feet. Exploration holes should be located on the maps. Aerial photographs of the proposed structure site should also be provided if available. Details to be shown are:

- (1) Proposed locations of fish screen facilities including bypass pipe.
- (2) Location of existing features such as diversion dam, headworks, highways, railroads, public and private utilities, and any other features that may affect the location and cost of the fish screen facilities. Note modifications required to headworks, if any.

- (3) Existing right-of-way. Proposed acquisition of additional right-of-way should be discussed.
- (4) Location of river thalweg.
- (5) Below water contours should be included.

**C. Site Plan Drawing.** Both a drawing and an electronic file, in AutoCAD or compatible format, should be provided. The following should be shown:

- (1) Proposed fish screen facilities including bypass pipe.
- (2) Highways, roads and railroads.
- (3) Right-of-way and easement lines.
- (4) North arrow and land survey lines.
- (5) Existing utility lines within the right-of-way and requirements for relocation.
- (6) Fences.
- (7) Contours.

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

- (1) The capabilities of and constraints imposed by local shipping and transportation facilities.
- (2) Names and telephone numbers of local utilities and irrigation districts and contacts within those organizations.
- (3) Name and brief description of similar construction in the area or region. Preferable to use Reclamation projects if possible.
- (4) Previous applicable studies.
- (5) Access to the site.
- (6) Availability or accessibility of public facilities or utilities such as: water supply; sewage disposal; telephone utility; fire protection services; and electric power for construction.
- (7) 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.)

- (8) Any construction restrictions such as timeframe restrictions, climatic restrictions, blasting limitations, etc.
- (9) Seismic conditions.
- (10) Photographs of the construction site and existing features which may effect design.

**E. Survey Control.** Use of an existing coordinate system or tying to the township and range system is acceptable, but tying to the State or national system is recommended if practical.

- (1) Right-of-way surveys are required to locate government owned property at the structure site.

**F. Foundation Data:**

- (1) **General Engineering Requirements.** The data for Specifications design is very similar to that for Feasibility design. They differ only in *greater accuracy, detail, and completeness* of investigation and testing, particularly for specific conditions (e.g., ground water, very soft or unstable foundation materials, and zones of rock excavation). If only minor additions or revisions are involved in the descriptions, interpretation, and geological sections previously submitted for feasibility design, the new data may be submitted as a supplement; otherwise completely revised new text, sections, and profiles should be prepared.

The need for additional foundation data should be established by originating office personnel with assistance from the region and TSC representatives. 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.

Sufficient data on foundation conditions must be included to determine type of excavation materials that will be encountered. Logs of all drill holes, auger holes, and exploration pits will be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, rock, and high-water tables.

**G. Geologic Data.** The following list of geologic design data provides general guidelines for the collection and reporting of geologic information. The geologist should apply these guidelines with good judgment and sound reasoning, elaborating upon them as required by the particular geologic setting and engineering requirements. Because the collection of geologic data is a dynamic process and often continues into the preparation of final designs, all stages of the specification design geologic exploration program must be constantly coordinated with the designer through the appropriate geology office. The TSC geologic and geophysical staff will provide necessary assistance and guidance in the gathering of these design data.

- (1) Compilation, summary, and reporting of Reclamation and non-Reclamation geologic information on the area, with attention being paid to the sequence of explorations and historical geologic events.
- (2) Surface geologic map of the fish screen facilities site showing location of explorations. Locations of all existing explorations should be indicated by coordinates or stationing of the permanent survey control system for the canal.
- (3) Specific foundation exploration at fish screen facilities site to explore particular geologic problems such as soft foundations or low-density material.
- (4) Factual narrative description of surficial deposits with attention being paid to engineering geologic matters, such as swelling minerals, low-density material, presence of gypsum and other sulfates, caliche, erodibility (see *Earth Manual*).
- (5) Factual narrative description of bedrock with attention being paid to engineering geologic matters such as swelling minerals, presence of gypsum and other sulfates; and to depth, weathering, joints, faults, and other planes of weakness.
- (6) Selected determination of engineering properties of surficial deposits and bedrock by laboratory or field tests (in-place density, penetration resistance, permeability, shear strength, gradation, and consolidation or expansion characteristics, etc.). The type and number of samples and tests required should be determined in cooperation with the TSC.
- (7) Photographs, preferably in color, of representative or particular geologic conditions.
- (8) Summary and data of exploration geophysical surveys (seismic, resistivity, etc.), if performed.

- (9) Determine ground water conditions with attention being paid to water levels and their seasonal fluctuation, occurrence of unconfined and confined aquifers, potential leakage, water-producing capabilities including permeability tests, chemistry, and land subsidence.
- (10) Logs of exploration. Logs of drill holes advanced by churn drilling, chop and wash, or other methods which result in less than adequate sample recovery should be augmented by borehole electric (geophysical) logs where appropriate.
- (11) Evaluation of landslide, snowslide, and rockfall conditions. If it is relevant, include a map of possible slide areas with as much detail as practicable.
- (12) If threat to life is significant, determine age of faulting in vicinity, especially if suspected to be late Pleistocene or Holocene.
- (13) Document past, present, and possible future petroleum, water, and mineral extraction operations in vicinity.
- (14) Determine geologic conditions which may affect construction methods such as, boulders on ground surface, marshes, cemented zones in surficial materials, etc. Any potential surface water runoff problems should be brought to the attention of a regional hydrologist.
- (15) Samples of foundation materials and ground water should be obtained and tested to determine any possible chemical reaction with the concrete or metalwork.

**H. Corrosion Survey:**

- (1) In situ electrical resistivity measurements of geologic materials in the area of construction. Additional measurements should be made in the areas where there is a pronounced change in type of geologic materials, drainage, and/or moisture conditions.
- (2) Performance history of materials of construction that have been used in the area.
- (3) List of structures in the vicinity of (within ¼ mile) the proposed structure and appurtenant features. Determine if buried structures in the vicinity have corrosion protection and, if so, the type of corrosion protection.
- (4) List location, output, and purpose of the direct-current sources in the earth situated within ¼ mile of the proposed structure and appurtenant features. If the purpose of the direct current is for cathodic protection, describe the structure protected and its location.

- (5) Chemistry of geologic materials, ground water, and/or product water.

**I. Construction Materials Data Including:**

- (1) An earth materials report containing complete detailed information on those potential sources of soils and rocks that have been selected for final consideration. (See *Earth Manual*.)
- (2) Information on concrete aggregates. (See “Final Investigations” in *Concrete Manual*.)
- (3) Information on sources and character of acceptable road surfacing materials, if required.
- (4) References to service history of materials if used previously and to results of sampling and analysis, including previous tests in the central Reclamation laboratories.
- (5) Environmental impacts associated with removing or obtaining construction material.
- (6) Dispersive soil analyses

**J. Biological Data:**

- (1) Fish species targeted.
- (2) Fish species swimming abilities.
- (3) Behavior.
- (4) Fish migration season.
- (5) Age of fish targeted.
- (6) Minimum and maximum size of the species.
- (7) Run size.
- (8) Biological requirements of the species (e.g., spawning, rearing or foraging habitats that require protection).

**K. Hydrological Data:**

- (1) Range of river flows.
- (2) Percent exceedance curves for flows.

- (3) River hydraulic data.
- (4) River rating curves over range of design flows.
- (5) River velocities.
- (6) Provide seasonal 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year river flow rates and water surfaces for evaluating construction related structures such as cofferdams and bypasses.

**L. Canal Hydraulic Data:**

- (1) Canal flow range and corresponding water surface elevations.
- (2) Maximum canal design flow.
- (3) Percent exceedance curves for flows.
- (4) Available head at point of diversion.
- (5) How diversions are made.
- (6) Dates of diversions.
- (7) Availability of bypass flow.
- (8) Type of tailwater control for fishscreen, if any.

**M. Agency Coordination:**

- (1) List of agencies to coordinate with.
- (2) Review of designs by other agencies, including the findings of the Fish and Wildlife Coordination Act Report (if available).
- (3) The need for a field conference to resolve critical environmental problems with participation of other agencies.
- (4) Agency criteria which is required to be complied with.

**N. Sedimentation Data:** Sedimentation studies, degradation, and aggradation studies should be included if appropriate. Sufficient data on the soil at the proposed structure site(s) must be included to perform these tests.

**O. Fish Screen Data:**

- (1) Type of screen required (e.g., flat plate, drum, etc.).
- (2) Maximum allowable approach velocity. Approach velocity measured perpendicular to the screen face.

- (3) Minimum allowable sweeping velocity. Sweeping velocity measured parallel to the screen face.
- (4) Maximum allowable time of travel for fish moving along the screen face before entering a bypass.
- (5) Maximum clear opening of the screen mesh.
- (6) Maximum and minimum drum screen submergence, if applicable.
- (7) If applicable, are drum screens to operate at optimum submergence for all flows?
- (8) Maximum and minimum design flows through screens.
- (9) Should screen structure be expandable if canal flow is increased in future.
- (10) Predation issues.

**P. Fish Bypass Data:**

- (1) Entrance requirements (e.g., flow control weir, etc.).
- (2) Maximum and minimum entrance velocities.
- (3) Maximum and minimum conveyance velocities.
- (4) Is there a requirement for pumpback system with secondary screens.
- (5) If on a river, trashrack bar spacing.

**Q. Trashrack Data:**

- (1) Amount and type of floating debris in canal and/or river.
- (2) Minimum clear opening between trashrack bars.
- (3) Cleaning system.

**R. Other Features:**

- (1) Criteria for fish viewer where applicable.
- (2) Criteria for adult trapping facility where applicable.
- (3) Equipment needed to determine fish movement by telemetry or other means where applicable.
- (4) Requirements for supplemental lighting.
- (5) Location of access required by fishery interests.

**S. Construction Data:**

- (1) Construction window to complete all work.
- (2) Restrictions on in-water work.
- (3) Will bypass around canal construction site be required?

**T. Operating and Maintenance Data:**

- (1) Plan of operation for fish screen facilities.
- (2) Portion of year structures should be designed to operate.
- (3) Dates of irrigation season.
- (4) O & M access requirements.
- (5) Method for cleaning rotating drums.
- (6) Responsibility for maintaining screens.
- (7) Type of equipment to remove screens for service (e.g., gantry, jib crane, mobile truck).
- (8) Frequency of O&M.
- (9) Ability and experience of O&M personnel to maintain proposed screens.
- (10) Will cleaning of screens be problematic source(s) of fish screen facilities water.
- (11) Percent of design capacity that the fish screen facilities is expected to carry each month, and probable dates that it may be taken out of service for maintenance each year.
- (12) For fish screen facilities operated in subfreezing weather: minimum temperatures, lengths of time freezing may occur, average and maximum ice depths, conditions to be anticipated as to alternate freezing and thawing, and probability of fish screens drifting full of snow.
- (13) Character of water to be conveyed with respect to probable sediment deposition.
- (14) Type of maintenance machinery contemplated.
- (15) Type of communications system contemplated.

**U. Miscellaneous Information:**

- (1) Prevalence of any unusual local pest action such as termites, dry rot, and marine borers; local practices for combating same.
- (2) Special requirements and locations of safety devices such as guardrailing, security lighting and fences in populated areas.

**V. Environmental Considerations.** Implementation of design features should be consistent with the environmental commitments as described in the NEPA compliance document. Implementation of design features should be consistent with agreements reached between Interior bureaus, Federal agencies, and other governmental agencies.

Design data should include, as a minimum, the environmental issues and/or requirements that would affect a fish screen facilities design and a brief description of the environmental resources that could be affected by 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 helpful.
- (2) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the fish screen facilities.
- (3) Background on the need for fish facilities.
- (4) The need for blending structures with the surroundings, restoring borrow areas, and reseeding spoil banks.
- (5) The need for a field conference to resolve critical environmental problems with participation of other agencies.
- (6) Review of designs by other agencies, including the findings of the Fish and Wildlife Coordination Act Report (if available).
- (7) Anticipated public use around the structure.
- (8) Any threatened and/or endangered critical habitat in or adjacent to the fish screen facilities.
- (9) Existing or potential wetland areas

**W. Electrical Data.** Data listed below will be required to initiate design. After designs of the facility have progressed enough to develop details of electrical

system needs, designers will prepare a list of additional data required to complete final design of electrical installation.

- (1) Name and telephone numbers of electrical power suppliers and contacts within those organizations.
- (2) Location of point where connection to power supply will be made.
- (3) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.
- (4) Electrical system reliability criteria.
- (5) Discuss requirements for an alternate power source. If an alternate supply is required, indicate:
  - (a) If required by State or local authority.
  - (b) If source should be an engine-generator.
  - (c) If a threat to life or property will result if normal power supply is lost.
  - (d) Loads requiring service from alternate source.
- (6) Requirements for remote monitoring of conditions at the facility. Discuss location of remote station, and items required to be monitored.
- (7) Requirements for supervisory control, including location of station from which supervisory control is exercised.
- (8) Requirements for voice and data communications between the supervisory master station and the remote facilities.