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.

2. Powerplants and Pumping Plants. 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 powerplants and pumping plants and additions, modifications, or rehabilitations to existing powerplant and pumping plants. The size and complexity of the structure should govern the amount and detail of the design data required. Where both pumping and generating functions are to be provided in the same plant, furnish design data for both.

For existing non- Reclamation powerplants and pumping plants (i.e., Bureau of Indian Affairs), single-line diagrams and switching diagrams which include equipment ratings will be necessary for a proper evaluation of existing equipment within the scope of any proposed changes.

A. **General Map Showing:**

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

(2) The structure site.

(3) Existing towns, highways, roads, railroads, public utilities, transmission lines, substations, stream-gauging stations, townships, range, and section line.

(4) Locations of construction access road and permanent roads; and sites for required construction facilities.

(5) Sources of natural construction materials and disposal areas for waste material, including the extent of mitigation required.

(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; areas of cultural sensitivity; and areas of archeological, historical, and mining or paleontological interest.

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

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

(2) Availability of housing and 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; telephone and electric power for construction and for operation and maintenance.

(4) Climatic conditions that will affect design or construction 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; relative humidity including any variations due to monsoon seasons. (Extensive tabulations are not necessary.)

(5) Air pollution sources.

(6) 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.** A topographic map covering an area sufficient to include all practical arrangements of the structure including intake, tailrace, penstocks and discharge lines, switchyard or substation, service area, and visitor facilities. Show all manmade features in the included area on the map. A scale of 1 inch equals 50 feet with a 2-foot contour interval is suitable in most cases. For long discharge lines or penstocks, strip topography at a scale of 1 inch equals 400 feet and a 2-foot contour interval may be used. The scale contour interval and detail should be based on the conditions and need at each particular site. Photographs of the sites are desirable, in color if available with proposed structures marked in ink.

E. **Foundation Data.** The amount and detail of foundation data required for a feasibility design will vary greatly because of the wide range of size and complexity encountered in powerplants and pumping plants. The guiding criteria should be to provide sufficient data to allow the designer to determine the type of foundation required for the structure and to identify major foundation problems. Adequate foundation data may be obtained for small structures from an inspection of surface conditions and one or two exploratory holes or test pits to determine type of overburden and foundation conditions some distance below the base of the structure. These data, and any other data in the following paragraph that are relevant, along with a brief description of geologic conditions of the site, can be included in the design data.

For larger and more complex structures, a more comprehensive geologic program will be required, including a geologic report. For structures of this magnitude, a field conference should be held, including an inspection of the site to determine

the geologic investigations program. In developing the geologic program and in preparing the geologic report, the following should be considered:

(1) A resume of regional geology.

(2) A description and interpretation of site geology including physical quality, excavation characteristics and geologic structure of the foundation strata, ground water and seismic conditions, existing and potential slide areas, and engineering geologic interpretations as appropriate.

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

(4) 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.

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

(a) A classification, in accordance with the Unified Classification System, of the soil in each major stratum.

(b) A description of the undisturbed state of the soil in each major stratum.

(c) A delineation of the lateral extent and thickness of critical, competent, poor, or potentially unstable strata in foundations and excavation slopes, especially those to be permanently exposed.

(d) An estimate or a determination by limited tests of the significant engineering properties of the strata, such as excavation characteristics, density, permeability, shear strength, and consolidation or expansive characteristics; and the effect of structure load, changes in moisture, and fluctuations of permanent rise of ground water on these properties.

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

(7) A determination of natural ground water conditions at the site.

(8) Bedrock. Note geologic sections and soil profiles in (5) above.

(a) A description of the contour of bedrock surface, thickness of weathered, altered, or otherwise softened zones, and other structural weaknesses and discontinuities.

(b) A delineation of structurally weak, pervious, and potentially unstable zones and strata of soft rock and/or soil in foundation or excavation slopes, especially those to be permanently exposed.

(c) A determination by limited tests of the significant engineering properties of the bedrock such as density, excavation characteristics, absorption, permeability, shear strength, and strain characteristics; and the effect of structure load, changes in moisture, and fluctuations or permanent rise of ground water on these properties.

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

F. **Construction Materials 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) Annual periodic fluctuations of reservoir levels shown by tables or charts summarizing reservoir operation studies for normal and critical periods. Extent of anticipated wave action, including discussion of wave fetch.

Anticipated occurrence and amounts of silt, sediments, ice (thickness) and drift (trash), and possible effect on reservoir outlets to powerplants or inlets to pumping plants.

(2) Where unwatering of a plant site adjacent to a stream or lake is required, give maximum water levels expected during the construction period and the possibility of controlling water levels by operation of upstream or downstream facilities.

(3) Powerplant tailwater curves.

(4) Source of pumping plant water supply other than reservoir: maximum operating, and minimum operating water surface elevations; flood flows; average flow; and anticipated occurrence and amounts of sediments and ice (thickness). Recommend minimum trashrack or gate deck elevation.

(5) Analysis of water for chemical and physical characteristics and biological quality.

H. **Operating Data – Powerplants:**

(1) Static head and head duration and flow duration curves to be developed (maximum, minimum, weighted average, and rated). (For determination of rated head see chapter 1.3B of Design Standards No. 6, Turbines and Pumps.)

(2) Proposed initial and ultimate capacity.

(3) Characteristics of power load including: load-duration curve, load factors, typical daily load curves, summaries of power production studies, and power market demands.

(4) Destination, proposed voltage, and number of outgoing transmission circuits. Name of agency or utility with whom interface will be made.

Requirements for minimum and maximum system impedance, and any operating limitations to be imposed by agency or utility supplying power.

(5) Nature of operations, i.e., whether base load, peaking or seasonal, attended, semiautomatic, fully automatic or supervisory controlled; other facilities to be controlled from this plant and, if supervisory controlled; location of master station.

(6) Available source and the kilovolt capacity of standby station-service power.

I. **Operating Data - Pumping Plants:**

(1) Types and quantities of trash anticipated at the plant intake.

(2) Water use (municipal and industrial [M&I], irrigation) and distribution requirements: necessity for treating water and recommended method; consumption quantities by months; initial and ultimate capacities; capacity-duration curve.

(3) Profile, alignment, and outlet conditions and requirements for discharge lines.

(4) Location, capacity, hydraulic section, and water surface elevation of intake and discharge channels.

(5) Location and direction of existing or proposed incoming power lines terminating at plant site.

(6) Source and voltage of pumping power. Name of agency or utility supplying power, limitations on starting voltage dips and, number of starts, power factor limitations, and distance to source. Requirements for minimum and maximum system impedance, and any operating limitations to be imposed by agency or utility supplying power.

(7) Nature of operations, i.e., whether attended, semiautomatic, fully automatic, or supervisory controlled. If supervisory controlled, give location of master station.

(8) Recommended pump sizes and numbers.

(9) Requirements for measurement of plant discharge.

(10) Number of operators and support personnel.

(11) Requirement for year-round operation.

J. **Miscellaneous Data:**

(1) Recommendation as to inclusion of a major or minor machine shop or service area in the plant.

(2) Recommendations on whether plant should be indoor or outdoor structure.

(3) Requirements for public safety and visitor facilities.

(4) Future plans for power or pumping expansion.

(5) Water temperature including seasonal variations.

K. **Environmental Considerations.** Design data should include, as a minimum, the environmental commitments listed in the National Environmental Policy Act (NEPA) compliance document that would affect dam 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) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the plant.

(2) 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.

(3) Recommendations or commitments to maintain a specific hydrologic flow level to support biological or recreational resources.

(4) Background on the need for fish facilities such as screens, fishways, and barriers. Requirements for enhancement and/or protection and preservation of fish. Include recommendations of State fish authorities and Fish and Wildlife Service.

(5) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(6) Amount of power required for operation of pumping plants.

(7) Erosion and sediment control.

(8) The need for blending structures with the surroundings, including placing transmission circuits under ground.

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

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

(11) Anticipated public use around the structure.

(12) Location of closest residences (other than that of the operator) that might be affected by the noise of plant operation.

(13) Potential Indian trust assets.

(14) Potential environmental justice issues.

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

L. **Powerplant Uprating.** Design data should include, as a minimum, a description of the hydrologic and hydraulic conditions and anticipated increase in power capacity and/or energy. The data should also include recommendations regarding the expected means (machine addition or machine rebuilding) of achieving the uprate. The following items should be considered in preparing data:

(1) Need or replacement of any existing major power equipment due to age or deterioration.

(2) Changes in operation of the plant, such as from base load to peaking load operation, changes in upstream or downstream storage, and changes in irrigation demands.

(3) Environmental and recreational impacts resulting from changes in water release through the plant. Identify proposed mitigation measures if appropriate.

(4) Need or desirability to replace an existing rotating exciter with a static exciter.

(5) Recommendation as to replacing an existing voltage regulator with a static type.

(6) Identify and describe any changes required to bring the plant or equipment into compliance with electrical, safety, or fire codes.

(7) Identify any equipment that is being replaced and having any historical value.

M. **Mechanical Systems and Equipment:**

(1) Heating, ventilating, and air-conditioning system requirements. Preference for evaporative cooling or refrigeration cooling for the main plant/building area. Preference for electric or gas heat utilizing propane/natural gas.

(2) Is natural gas available at the site?

(3) Noise restrictions at the site.

(4) Requirements for emergency engine generator set for the plant/building. Systems to be connected to the standby emergency engine generator set.

(5) Anticipated engine generator usage for sizing the fuel storage tank.

(6) Preferred fuel (diesel/propane/natural gas) for the engine generator set.

(7) Required water quality analysis to determine the materials of construction for the plant piping systems. Types of materials of construction for existing piping systems conveying water. Have there been any corrosion problems with existing systems?

(8) Types of water supplies available at the site for plant/building fire suppression and other water usage requirements.

(9) Preferences concerning the method of joining the piping components for the various plant/building auxiliary mechanical systems. Are victaulic type grooved coupling connections acceptable?

(10) Types of hazardous materials on the existing piping systems (i.e., lead based paint, asbestos).

N. **Site Security.** 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.

3. Visitors Centers. 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 visitors centers and additions, modifications, or rehabilitations to existing visitors centers. The size and complexity of the structure should govern the amount and detail of the design data required.

A. **Design Narrative:**

(1) Discuss the determination of the need for public visitation.

(a) Uniqueness or informational/educational aspects of the project which would merit public visitation.

(b) Description of desired facilities that are not currently available in the area.

(2) Visitation projections.

(a) Accessibility to the site via regional transportation agencies and routes and the proximity of the site to urban areas.

(b) Visitor load projections.

(c) Type and proximity of other recreation destinations in the region.

(d) Anticipated parking needs (types of vehicles and numbers of each)

B. **General Purpose and Functional Requirements of the Visitor Facilities:**

(1) General outline of interpretive plan.

(2) General space requirements for storage, curatorial, staff, public, and interpretive exhibit areas.

(3) Parking facilities.

(4) Periods of operation (daily and weekly) and anticipated staffing needs.

(5) Public needs (restrooms during non-operational hours, regional information, food services, gift shops, and educational facilities).

(6) Discuss the impact public visitation may have on the project including overlooks, tour routes, etc.

(7) Discuss utilities including: water availability for domestic and fire protection, wastewater, air-conditioning, and security requirements.

(8) Any special environmental control needs such as special heating, ventilating, and air-conditioning requirements for artifact preservation.

(9) Special accessibility needs or programs such as trails for the blind.

C. **General Map Showing:**

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

(2) The structure site.

(3) Existing towns, highways, roads, railroads, public utilities, townships, range, and section line.

(4) Locations of construction access road and permanent roads; and sites for required construction facilities.

(5) Sources of natural construction materials and disposal areas for waste material, including the extent of mitigation required.

(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; areas of cultural sensitivity; and areas of archeological, historical, and mining or paleontological interest.

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

(1) The capabilities and constraints imposed by local shipping, transportation facilities, adjacent land uses, and easements.

(2) Availability of housing and other facilities in nearest and need for permanent housing for operating personnel.

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

(4) Climatic conditions that will affect design or construction 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.)

E. **Survey Control.** Field surveys should be done to obtain horizontal and vertical control in areas where relief is extreme and/or where a high level of accuracy is

required for layout studies. Use of any existing coordinate system or vertical control system is acceptable, but tying to the State plane coordinate system is recommended.

F. **Topographic Map.** A topographic map covering an area sufficient to include all practical arrangements and features of the visitor facilities and site access roads. Show all manmade features in the included area on the map. A scale of 1 inch equals 50 feet with a 2-foot contour interval is suitable for most structures. The scale of the contour interval and detail should be based on the conditions and need at each particular site. Photographs of the sites are desirable, in color, if available, with proposed structures marked in ink. Aerial photographs of the site covering the same area described above should also be provided.

G. **Foundation Data.** The amount and detail of foundation data required for a feasibility design will vary greatly because of the wide range of size and complexity encountered in visitors centers. The guiding criteria should be to provide sufficient data to allow the designer to determine the type of foundation required for the structure and to identify major foundation problems. Adequate foundation data may be obtained for small structures from an inspection of surface conditions and one or two exploratory holes or test pits to determine type of overburden and foundation conditions some distance below the base of the structure. These data, and any other data in the following paragraph that are relevant, along with a brief description of geologic conditions of the site, can be included in the design data.

For larger and more complex structures, a more comprehensive geologic program will be required, including a geologic report. For structures of this magnitude, a field conference should be held, including an inspection of the site to determine the geologic investigations program. In developing the geologic program and in preparing the geologic report, the following should be considered:

(1) A resume of regional geology.

(2) A description and interpretation of site geology including physical quality, excavation characteristics and geologic structure of the foundation strata, ground water and seismic conditions, existing and potential slide areas, and engineering geologic interpretations as appropriate.

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

(4) 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.

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

(a) A classification, in accordance with the Unified Classification System, of the soil in each major stratum.

(b) A description of the undisturbed state of the soil in each major stratum.

(c) A delineation of the lateral extent and thickness of critical, competent, poor, or potentially unstable strata in foundations and excavation slopes, especially those to be permanently exposed.

(d) An estimate or a determination by limited tests of the significant engineering properties of the strata, such as excavation characteristics, density, permeability, shear strength, and consolidation or expansive characteristics; and the effect of structure load, changes in moisture, and fluctuations of permanent rise of ground water on these properties.

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

(7) A determination of natural ground water conditions at the site.

(8) Bedrock. Note geologic sections and soil profiles in (5) above.

(a) A description of the contour of bedrock surface, thickness of weathered, altered, or otherwise softened zones, and other structural weaknesses and discontinuities.

(b) A delineation of structurally weak, pervious, and potentially unstable zones and strata of soft rock and/or soil in foundation or excavation slopes, especially those to be permanently exposed.

(c) A determination by limited tests of the significant engineering properties of the bedrock such as density, excavation characteristics, absorption, permeability, shear strength, and strain characteristics; and the effect of structure load, changes in moisture, and fluctuations or permanent rise of ground water on these properties.

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

H. **Construction Materials 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) A list and description of any preferred building materials and their availability.

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

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

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

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

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

(1) Cultural (archeological, historical, and paleontological) resources of influence within the project area.

(2) The need for blending the structure with surroundings.

(3) Landscaping and other special environmental requirements and commitments.

(4) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(5) Impact of increased pedestrian and auto traffic on existing road and commercial facilities.

(6) Amount of power required for operation of the visitors center.

(7) Erosion and sediment control.

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

(9) Review of designs by other agencies.

(10) Anticipated public use around the structure.

(11) Location of closest residences that might be affected by increases in noise, lighting, and other visual impacts.

(12) Potential Indian trust assets.

(13) Potential environmental justice issues.

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

J. **Site Security.** 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.

4. Tunnels. 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. Obtaining reliable data to support feasibility cost estimates for tunnels is both difficult and costly. The critical item in the design data is geologic information. This aspect should receive maximum attention during the data-gathering phase of the study.

A. **General Map.** The General Map should cover the project area and the area immediately surrounding the project within approximately 2 or 3 miles. The scale of the General Map should be adequate to clearly show listed details. A scale of approximately 1 to 3 miles per inch is commonly used. The following data are shown on a General Map for feasibility and specifications level design data collection:

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

(2) A legend of symbols used for existing and constructed facilities.

(3) North arrow.

(4) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project. The locations of these features should bear the parenthetical reference to the agency or entity which owns or operates the property; for example, the Bureau of Reclamation (Reclamation):

(a) Name of agency responsible for maintaining and/or managing the affected land.

(b) Recreation areas; fish and wildlife areas; building areas; highways, railroads, and shipping points; housing; areas of cultural sensitivity; areas of archeological, historical, and mining or paleontological interest; and bridges with special loads or size limitations.

(c) Existing towns, residences, private property, roads, transmission lines, substations, stream-gauging stations.

(d) Areas of environmental concern.

(e) Public utilities such as electric power and telephone lines, pipelines, etc.

(f) County, range, township, and section lines.

(g) Land use restrictions such as easements and rights-of-way.

(5) Rights-of-way:

(a) Show rights-of-way required or available for facility/structure sites, construction access, and staging areas.

(b) Land ownership boundaries and legal jurisdictions. Indicate ownership by agency acronym or private land with "private."

(6) The proposed structures and features:

(a) Location of features to be constructed or modified.

(b) Locations of potential construction and permanent access roads, sites for contractor's staging areas and construction facilities, and sites for temporary water treatment facilities.

(c) Locations of borrow areas for natural construction materials, locations of commercial quarries, and disposal areas for waste excavation.

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

(e) Sources of water for construction.

B. **Location Map.** Location maps are commonly used as a condensed method of showing location and alignment of the features and associated structures. The location map may be combined with the general map, site plan, or plan and profile drawings for small areas. A scale of 1 inch = 1,000 feet to 1 inch = 2,000 feet is commonly used for location maps. The location map should show:

(1) **General:**

(a) North arrow.

(b) Proposed alignment, major structures, and delivery locations by symbols. Station and appropriate ties to section lines, section corners, existing buildings, pipelines, roads, railroads, etc.

(c) Topography and ownership information should be shown.

(d) Towns, roads, railroads, streams, existing pipelines, canals, reservoirs, etc.

(e) Transportation facilities and other cultural features.

(f) Location of borrow areas, riprap sources, sources of special pipe embedment material, if required

(g) Disposal areas for wasting excess excavation.

(h) Sources of power for construction and operation and maintenance.

(i) Existing or potential areas or features having a bearing on the design, construction, or operation and maintenance such as: recreation areas, fish and wildlife areas, railroads, housing, and areas of archeological, historical, and mining and paleontological interest.

(j) Where the scale does not permit proper detail of a congested area, a blowup at a larger scale may be included elsewhere on the drawing and referenced to its proper location. Where density of the structures or other features is such that individual stationing and naming is impractical, the information should be shown in tabular form and station marks shown on the alignment.

(k) Linear feature (tunnel), together with structures, adits, and stations. Structures and delivery locations are normally shown by symbol.

(l) Legend of symbols for existing and proposed facilities

(m) Right-of-way and land ownership information

C. **General Description of Local Conditions.** The following data may be required for feasibility and specifications designs:

(1) Information relating to access for possible site visit by the design team, access for foundation exploration and construction, and access limitations due to environmental restrictions, etc.

(2) Access to the site for operation and maintenance (O&M) forces.

(3) Permits or permit requirements and any past permit violations or exceedences.

(4) Name and description of similar construction in the area or region.

(5) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; estimate of access road length and major structures required for new construction; and possible alternative means for delivering construction materials and equipment to the structure 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 (give location, power supplier, voltage, number of phases, and capacity of existing transmission lines; power rate schedules; probability of interruption of supply; and requirements for additional transmission line, if needed).

(a) Names, telephone numbers, email addresses, and Web sites of local utilities and contacts within those organizations.

(7) Climatic conditions that will affect design, construction, and O&M such as amount, rate, and distribution of rain, snow, and hail; ice conditions; heating and air-conditioning design temperatures; summer and winter temperatures with extremes; maximum wind velocities and their directions; probability of excessive dust or sand.

(8) Local frost depths.

(9) Ground water presence and depths.

(10) Vegetation to be cleared or preserved including kinds, sizes, and density of growth.

(11) Road detour requirements.

D. **Topographic Map.** The proposed alignment of the tunnel should be shown on a current USGS map (7½-minute quad sheets 1:24000 scale). Smaller scale topographic maps of the portals are useful if available. In the absence of portal topography, photographs of the portals will aid the designer in determining conditions and design problems.

E. **Geologic Data.** It is expected that one to five drill holes will be made during the feasibility study. Maximum effort should be directed toward obtaining geologic data along the tunnel alignment geology. This information will aid the designer and estimator in assessing problems such as competence of bedrock, method of construction, fault zones, water flows including hot water. It will also aid in selecting the appropriate tunnel shape and the need for or type of initial support and final lining. Drilling of portals will be included when major problems are anticipated. Maximum use should be made of existing data available from other Federal agencies, State and private sources, and educational institutions, as well as Reclamation data. The information will be put into a concise geologic report which will include a geologic section along the proposed tunnel route.

F. **Operating Data:**

(1) Reference any associated studies.

(2) Purpose - vehicular or water.

(3) Capacity of tunnel.

(4) Location, hydraulic section water surface of inlet and outlet channels.

(5) Flow controls required.

G. **Miscellaneous Data:**

(1) Location of disposal area for excavated material.

(2) Flood protection of tunnel portals.

(3) Information on the design and construction of nearby tunnels.

(4) Information on unusual waters being conveyed (i.e., acidic).

H. **Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect tunnel 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 tunnel.

(3) Recommendations for ensuring water quality standards are met including control of turbidity during construction.

(4) Need for fish barriers.

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

(6) Erosion and sediment control.

(7) The need for blending structures with the surroundings.

(8) Anticipated public use around the structure.

I. **Construction Considerations.** The following design data items should be considered for feasibility and specifications designs:

(1) Construction schedule:

(a) One contract or several contracts.

(b) Any construction timeframe restrictions

(c) Are designers required to provide a construction schedule and/or logic diagram?

(d) Recommended period for construction.

(e) Recommended period for completion of construction work and features of the work that should be completed early.

(f) Permissible times to make connections to existing facilities.

(g) Whether construction schedule will be adaptive, (e.g., provide a remedy, observe the effects, and then modify remedy as required).

(2) Allowable in-river materials (permanent and temporary).

(3) Construction constraints including allowable construction methods, traffic considerations, environmental restrictions, climatic restrictions, blasting limitations, etc.

(4) Filling and draining criteria for dam, ponds, and pipelines

(5) Unusual conditions for excavation or construction.

(6) Extent of construction surveying to be accomplished by Government surveyors.

(7) Water for construction purposes. For large rivers, this item may be unimportant. For small streams and offstream reservoirs, the item becomes critical. Determine if up to 2 cubic feet per second of diversion flow for construction purposes can be assured to the contractor. The Government should obtain the water rights required. If it is necessary to use ground water, obtain information on probable sources and yields. Furnish information on locations and yields of existing wells in the vicinity. Determine restrictions, if any, to use of ground water for this purpose. It may be necessary to obtain permits from State or other governing agencies. Retrieve water quality samples for testing and evaluation.

(a) Water treatment requirements for return flows

(8) Requirements for maintaining streamflow or diversions during construction and maximum length, time, and number of permitted interruptions.

(9) Required permits from government agencies and others.

(10) Requirements for meeting criteria for suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction.

(11) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(12) Requirements for temporary construction access roads, permanent access and service roads, and relocation of existing roads or railroads. Include any limiting requirements imposed by road owners for public access/haul roads.

(13) Comments on disposal of special excavation problem materials such as lignite.

(14) Give borrow area and temporary haul road restoration requirements such as stockpiling of topsoil, grading of the area, general cleanup, etc.

(15) Give consideration to using required excavated material in lieu of material from other borrow sources wherever possible.

J. **Cost Data for Field Cost Estimate.** The field cost estimate is an estimate of the capital costs of a feature or project from award to construction; non-contract costs are not included. Cost data developed in previous or other studies (either by Reclamation or others) should be included with the design data submittal. Include a description or outline of estimating methods and data used. The following design data for feasibility and specifications levels designs should be considered for submittal:

(1) **Procurement Strategy.** Will solicitation be advertised and awarded under other than full and open competition? This includes solicitations which will be set aside under socio-economic programs that may limit competition or allow award to other than the lowest bid or proposal.

(2) Estimate of cost of ROW for all features including reservoirs, dams, and appurtenant works. Include supporting data:

(3) Information on local labor supply and labor problems.

(4) Local freight or trucking rates.

(5) Housing accommodations.

(6) Interest rate for economic studies.

(7) Power rate in mills per kilowatt-hour, interest rate, and plant factor for economic tunnel, and pipeline sizing studies in cases where transported water is pumped.

(8) Estimated cost for construction items which cannot readily be determined in the design office and include the supporting data:

(a) Clearing reservoir area and for removing or replacing private improvements in the area.

(b) Earthwork (common and rock), excavation with freehaul distance. For canals, include compacting embankment, canal lining, and borrow (with free haul distance)

(c) Riprap, guardrail, culverts, row fencing, and gates.

(d) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment (i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction). Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing operations. If vegetation to be cleared is very sparse or can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other appropriate items of work.

(9) Where buildings are located within the area to be cleared by the prime contractor, and if disposal will be the contractor's responsibility, designate building groups by number and furnish detailed list of buildings for each group. Details should include general description, size, materials, and general condition. Drawings should be provided of these buildings, if available, that depict dimensions, construction materials, the structural system for the building, and major electrical and mechanical equipment. Determine if disposal will be the responsibility of the prime contractor. If not, submit dates when disposal will be completed by others.

(10) Information on important construction work that is in progress or planned in the vicinity and the presence of interested contractors or subcontractors in the area.

(11) If potential actions exceed anticipated funding, an assessment should be made as to whether the cost estimate will reflect incremental costs of these potential actions. Provide any known increment or arrangement of the incremental costs.

(12) Local and tribal taxes.

(13) Estimates of costs for relocating railroads, highways, roads, water systems, and other public utilities. Include supporting data.

(14) Method for projecting cost into the future if required.

(15) Cost of local materials (precast concrete, etc.).

K. **Site Security.** 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.

5. Canals. 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(s).** The General Map should cover the project area and the area immediately surrounding the project within approximately 2 or 3 miles. The scale of the General Map should be adequate to clearly show listed details. A scale of approximately 1 to 3 miles per inch is commonly used. The following data are shown on a General Map for feasibility and specifications level design data collection:

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

(2) A legend of symbols used for existing and constructed facilities.

(3) North arrow.

(4) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project. The locations of these features should bear the parenthetical reference to the agency or entity which owns or operates the property; for example, the Bureau of Reclamation (Reclamation):

(a) Name of agency responsible for maintaining and/or managing the affected land.

(b) Recreation areas; fish and wildlife areas; building areas; highways, railroads, and shipping points; housing; areas of cultural sensitivity; areas of archeological, historical, and mining or paleontological interest; and bridges with special loads or size limitations.

(c) Existing towns, residences, private property, roads, transmission lines, substations, stream-gauging stations.

(d) Areas of environmental concern.

(e) Public utilities such as electric power and telephone lines, pipelines, etc.

(f) County, range, township, and section lines.

(g) Land use restrictions such as easements and rights-of-way.

(5) Rights-of-way:

(a) Show rights-of-way required or available for facility/structure sites, construction access, and staging areas.

(b) Land ownership boundaries and legal jurisdictions. Indicate ownership by agency acronym or private land with "private."

(6) The proposed structures and features:

(a) Location of features to be constructed or modified.

(b) Locations of potential construction and permanent access roads, sites for contractor's staging areas and construction facilities, and sites for temporary water treatment facilities.

(c) Locations of borrow areas for natural construction materials, locations of commercial quarries, and disposal areas for waste excavation.

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

(e) Sources of water for construction.

B. **Location Maps.** Location maps are commonly used as a condensed method of showing location and alignment of the features and associated structures. The location map may be combined with the general map, site plan, or plan and profile drawings for small areas. A scale of 1 inch = 1,000 feet to 1 inch = 2,000 feet is commonly used for location maps. The location map should show:

(1) **General:**

(a) North arrow.

(b) Proposed alignment, major structures, and delivery locations by symbols. Station and appropriate ties to section lines, section corners, existing buildings, pipelines, roads, railroads, etc. These details are not required to be shown on the location map if they are shown on other drawings.

(c) Topography and ownership information should be shown.

(d) Towns, roads, railroads, streams, existing pipelines, canals, reservoirs, etc.

(e) Transportation facilities and other cultural features.

(f) Location of borrow areas, riprap sources, sources of special pipe embedment material, if required

(g) Disposal areas for wasting excess excavation.

(h) For distribution systems, show ownership, turnout locations, and irrigable areas served.

(i) Sources of power for construction and operation and maintenance.

(j) Existing or potential areas or features having a bearing on the design, construction, or operation and maintenance such as: recreation areas, fish and wildlife areas, railroads, housing, and areas of archeological, historical, and mining and paleontological interest.

(k) Where the scale does not permit proper detail of a congested area, a blowup at a larger scale may be included elsewhere on the drawing and referenced to its proper location. Where density of the structures or other features is such that individual stationing and naming is impractical, the information should be shown in tabular form and station marks shown on the alignment.

(l) Linear feature (canal, pipeline, wasteway, drains, etc.), together with structures and stations. Structures and delivery locations are normally shown by symbol.

(m) Legend of symbols for existing and proposed facilities.

(n) Right-of-way and land ownership information.

(2) **Distribution Systems.** Where the source of the water is a canal, reservoir, or pipeline with turnout or headworks located outside the distribution system area boundary, topographic maps of the same scale and contour interval provided for above should be submitted covering all the areas in which the connecting feeder main is to be located. The water surface elevation range in the source canal or reservoir or hydraulic grade line range in the source pipeline should be shown. Also, where appropriate, data such as capacities, grades, etc., should be shown.

C. **General Description of Local Conditions.** The following data may be required for feasibility and specifications designs:

(1) Information relating to access for possible site visit by the design team, access for foundation exploration and construction, and access limitations due to environmental restrictions, etc.

(2) Access to the site for operation and maintenance (O&M) forces.

(3) Permits or permit requirements and any past permit violations or exceedences.

(4) Name and description of similar construction in the area or region.

(5) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; estimate of access road length and major structures required for new construction; and possible alternative means for delivering construction materials and equipment to the structure 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 (give location, power supplier, voltage, number of phases, and capacity of existing transmission lines; power rate schedules; probability of interruption of supply; and requirements for additional transmission line, if needed).

(a) Names, telephone numbers, email addresses, and Web sites of local utilities and contacts within those organizations.

(7) Climatic conditions that will affect design, construction, and O&M such as amount, rate, and distribution of rain, snow, and hail; ice conditions; heating and air-conditioning design temperatures; summer and winter temperatures with extremes; maximum wind velocities and their directions; probability of excessive dust or sand.

(8) Local frost depths.

(9) Ground water presence and depths.

(10) Vegetation to be cleared or preserved including kinds, sizes, and density of growth.

(11) Road detour requirements.

D. **Survey Control.** Survey control is required for all surveys including surveys associated with photography. The survey can be tied to the township and range system or an existing coordinate system is acceptable but tying to the State plane coordinate system and a datum are recommended.

(1) Right-of-way surveys are required to locate Government owned and private property along the proposed alignment. This will also assist in coordinating and determining future land acquisition and proposed alignment.

(2) If designs are required to modify an existing system, conversion to the present datum and coordinate system should be made.

E. **Topographic Maps:**

(1) **General.** Topographic maps (commonly strip topography) will serve as the base on which the design and layout will be made. A scale of 1 inch equals 200 feet to 1 inch equals 400 feet with a contour interval of 2 feet is satisfactory for these maps; depending on the size of project and topography. The contour interval may be increased in hilly or mountainous terrain. If the project area is flat or small, a 1-foot contour interval may be required. The strip topography is often shown on the plan and profile drawing.

The map must cover the entire project area, including water source where it is outside the distribution service area. These maps will show:

(a) Existing significant features, natural and manmade.

(b) Ownerships, giving delivery water surface elevations and irrigable acres for each turnout location.

(c) Available survey information to include township and range lines, section lines, etc.

(d) Source of water (canal, reservoir, pipeline, wells, or combination of surface and ground water, etc.), giving operating water surface elevations or operating hydraulic gradients, rates of flow, flood data, etc., where appropriate.

(e) When preliminary studies have included a system layout, the layout should be submitted for consideration in feasibility designs as a part of these data.

(f) Cross drainage areas and potential scour depths.

F. **Plan and Profile Drawings.** Plan and profile drawings are normally requested for linear features such as roads, canals, and pipelines. Drawings are prepared so that both plan and profile are plotted on one sheet. Strip topography may be used for the plan view. The plan view may not be required if shown on other drawings. These drawings are normally prepared with a 1 inch = 10 feet vertical scale and the horizontal scales from 1 inch = 200 feet to 1 inch = 400 feet unless more or less detail is required. The scale should be adjusted, as required, if it is necessary to show details. Plan and profile drawings should show features such as:

(1) **General:**

(a) North arrow and land survey lines.

(b) Proposed centerline and stationing and curve data.

(c) Location of existing features such as highways, railroads, public utilities, major drainages, and any other features that will affect the location and cost of proposed project facilities.

(d) Ties and stationing for turnouts, sublaterals and deliveries, as well as road crossings, railroad crossings and utility crossings. Grid coordinates for major structures such as pumping plants, flow control stations, tanks, reservoirs, etc.

(e) Land control survey lines with ties to alignment where appropriate.

(f) Survey data to include stationing, ties to existing features, etc.

(g) Existing ground surface contours with date of surveys and mapping. Significant topographic features.

(h) Existing utility lines within the right-of-way and requirements for relocation.

(i) Location of any existing intersecting facilities, watercourses, or other physical features affecting the new line or riprap protection on steep slopes.

(j) Cross drainage and direction of flow. Location of riprap protection on steep slopes. For major cross drainages, include flow (cubic feet per second) and associated frequency (years)

(k) Low wire elevations and station of power lines (include voltage) where they cross the alignment.

(l) Buildings, fences, and other obstructions.

(m) Right-of-way.

(n) Feature alignment, curve data, and stationing.

(o) Pipe - Hydraulic properties by reaches of proposed features (including hydraulic gradeline, feature dimensions, and pressure class for pipe).

(p) Open channel - Hydraulic and section properties: bottom width, side slopes, water depth, hydraulic equation used, and associated coefficient are often shown in a table.

(q) Structures (including conduit size for siphons, turnouts, and culverts).

(r) Alignment of laterals, sublaterals, overflow wasteways, reservoirs, and access roads.

(s) Crossings: Individual drawings should be furnished that show the plan and the profile, drawn to appropriate scales, of the following types of crossings:

- Railroad crossings.
- Highway crossings which cannot be constructed by open-cut methods.
- River or canal crossings.

(t) Plan and profile drawings for any associated pipelines.

(u) Roads, borrow pits, and waste areas.

(v) Areas where special construction effort is required: low-density soils, high ground water table, bedrock, etc.

(w) Profile: The profile should show, as a minimum, bottom grade, original ground surface, water surface, and utilities and other subsurface features where they cross the alignment.

G. **Geologic Data**. Sufficient data on foundation conditions must be included to determine type of excavation materials that will be encountered. Logs of all auger holes and exploration pits will be included. Recommendations for lining, based on geologic conditions and the current Reclamation policy on lining of canals and laterals, and any other data will be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, erosive or dispersive soils, rock, and high water tables. Limited tests may be required to identify some of these problem soils. Sources and available quantities of construction materials should be identified.

H. **Operating Data:**

(1) Source of water.

(2) Water surface elevations and capacities at control points along canal at deliveries.

(3) Plan of operation for waterway including extent of automatic and/or supervisory control. If supervisory control, give location of master station. Will the operation be based on demand or supply control?

(4) A list of all structures showing stationing, type, size, and other control data as taken from preliminary design or later evaluations.

(5) Provisions for cross-drainage structures, wasteways, and spillways including estimated structure capacity.

(6) Measuring facilities required in canal and turnouts.

(7) Provisions required for sediment and ice control.

(8) Location of existing cross-drainage features.

(9) Canal lining proposed.

(10) Hydraulic data and basic criteria for sizing pipelines and laterals and deliveries will be developed in the originating Reclamation office.

These should be submitted to include:

(a) Seasonal requirement. This is usually stated in terms of acre-feet per productive acre per year.

(b) Monthly requirement. Expressed as a percentage of (a), above for each month of irrigation operation use.

(c) Peak requirement. This is the basic criteria for sizing laterals and is based on the maximum demand for a month or other time period. It should be stated as the number of productive acres to be served by a flow of 1 cfs or a flow rate of a specified number of gallons per minute required to irrigate 1 acre.

(d) Criteria for reducing irrigable acres to productive acres. This can be expressed as a percentage of the irrigable area.

(e) Basic criteria for sizing farm deliveries. This may be shown as a table of the maximum and minimum number of productive acres to be served by deliveries of 1, 2, 3, 4, etc., cubic feet per second capacity.

(f) Data covering any M&I (including fire) or domestic service to be included in the system, including capacity for future development. Include information on seasonal, monthly, and within monthly peaking requirements.

(g) Predicted conveyance efficiency along each canal reach.

(h) Regulating and storage reservoirs.

(i) Full demand or rotational (scheduled) irrigation.

I. **Hydrologic Data.** Flood flows, as required for cross drainage areas (whether crossed by culvert or siphon) and design flows for interceptor drains.

J. **Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect tunnel 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 canal.

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

(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 along the canal.

(8) The need for escape structures or crossings for human, deer, or other wildlife including the need for special fencing requirements.

(9) Any threatened and/or endangered critical habitat in or adjacent to the canal alignment.

(10) Existing or potential wetland areas

K. **Cost Data for Field Cost Estimate.** The field cost estimate is an estimate of the capital costs of a feature or project from award to construction; non-contract costs are not included. Cost data developed in previous or other studies (either by Reclamation or others) should be included with the design data submittal. Include a description or outline of estimating methods and data used. The following design data for feasibility and specifications levels designs should be considered for submittal:

(1) Procurement Strategy - Will solicitation be advertised and awarded under other than full and open competition? This includes solicitations which will be set aside under socio-economic programs that may limit competition or allow award to other than the lowest bid or proposal.

(2) Estimate of cost of ROW for all features including reservoirs, dams, and appurtenant works. Include supporting data:

(a) For reservoirs, include a curve showing estimated cost of ROW versus elevation of reservoir water surface from normal elevation to maximum estimated surcharge elevation or other physical or economic limit. Include supporting data.

(3) Information on local labor supply and labor problems.

(4) Local freight or trucking rates.

(5) Housing accommodations.

(6) Interest rate for economic studies.

(7) Power rate in mills per kilowatt-hour, interest rate, and plant factor for economic tunnel, and pipeline sizing studies in cases where transported water is pumped.

(8) Estimated cost for construction items which cannot readily be determined in the design office and include the supporting data:

(a) Clearing reservoir area and for removing or replacing private improvements in the area.

(b) Earthwork (common and rock), excavation with freehaul distance. For canals, include compacting embankment, canal lining, and borrow (with free haul distance)

(c) Riprap, guardrail, culverts, row fencing, and gates.

(d) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment (i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction). Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing operations. If vegetation to be cleared is very sparse or can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other appropriate items of work.

(9) Where buildings are located within the area to be cleared by the prime contractor, and if disposal will be the contractor's responsibility, designate building groups by number and furnish detailed list of buildings for each group. Details should include general description, size, materials, and general condition. Drawings should be provided of these buildings, if available, that depict dimensions, construction materials, the structural system for the building, and major electrical and mechanical equipment. Determine if disposal will be the responsibility of the prime contractor. If not, submit dates when disposal will be completed by others.

(10) Information on important construction work that is in progress or planned in the vicinity and the presence of interested contractors or subcontractors in the area.

(11) If potential actions exceed anticipated funding, an assessment should be made as to whether the cost estimate will reflect incremental costs of these potential actions. Provide any known increment or arrangement of the incremental costs.

(12) Local and tribal taxes.

(13) Estimates of costs for relocating railroads, highways, roads, water systems, and other public utilities. Include supporting data.

(14) Method for projecting cost into the future if required.

(15) Cost of local materials (precast concrete, etc.).

L. **Construction Considerations.** The following design data items should be considered for feasibility and specifications designs:

(1) Construction schedule:

(a) One contract or several contracts.

(b) Any construction timeframe restrictions

(c) Are designers required to provide a construction schedule and/or logic diagram?

(d) Recommended period for construction.

(e) Recommended period for completion of construction work and features of the work that should be completed early.

(f) Permissible times to make connections to existing facilities.

(g) Whether construction schedule will be adaptive, (e.g., provide a remedy, observe the effects, and then modify remedy as required).

(2) Allowable in-river materials (permanent and temporary).

(3) Construction constraints including allowable construction methods, traffic considerations, environmental restrictions, climatic restrictions, blasting limitations, etc.

(4) Filling and draining criteria for dam, ponds, and pipelines

(5) Unusual conditions for excavation or construction.

(6) Extent of construction surveying to be accomplished by Government surveyors.

(7) Water for construction purposes. For large rivers, this item may be unimportant. For small streams and offstream reservoirs, the item becomes critical. Determine if up to 2 cubic feet per second of diversion flow for construction purposes can be assured to the contractor. The Government should obtain the water rights required. If it is necessary to use ground water, obtain information on probable sources and yields. Furnish information on locations and yields of existing wells in the vicinity. Determine restrictions, if any, to use of ground water for this purpose. It may be necessary to obtain permits from State or other governing agencies. Retrieve water quality samples for testing and evaluation.

(a) Water treatment requirements for return flows

(8) Requirements for maintaining streamflow or diversions during construction and maximum length, time, and number of permitted interruptions.

(9) Required permits from government agencies and others.

(10) Requirements for meeting criteria for suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction.

(11) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(12) Requirements for temporary construction access roads, permanent access and service roads, and relocation of existing roads or railroads. Include any limiting requirements imposed by road owners for public access/haul roads.

(13) Comments on disposal of special excavation problem materials such as lignite.

(14) Give borrow area and temporary haul road restoration requirements such as stockpiling of topsoil, grading of the area, general cleanup, etc.

(15) Give consideration to using required excavated material in lieu of material from other borrow sources wherever possible.

M. **Miscellaneous Data.**

(1) Screening requirements at source of water (turnout, pumping plant, dam outlet, etc.).

(2) Location, reliability and data on source of existing electrical power.

(3) Criteria for road crossings, cross drainage (mostly for open lateral system), and other significant structures required in an open lateral system.

(4) Electrical Data:

(a) Names and telephone numbers of power suppliers and contacts within their organizations.

(b) Locations where connections to power supply will be made.

(c) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.

N. **Site Security.** 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.

6. Pipelines. 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 design data requirements included in this section cover pressure and gravity or open (low-pressure) pipeline systems.

A. **General Map(s).** The General Map should cover the project area and the area immediately surrounding the project within approximately 2 or 3 miles. The scale of the General Map should be adequate to clearly show listed details. A scale of approximately 1 to 3 miles per inch is commonly used. The following data are shown on a General Map for feasibility and specifications level design data collection:

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

(2) A legend of symbols used for existing and constructed facilities.

(3) North arrow.

(4) Existing or potential areas or features having a bearing on the design, construction, operation, or management of the project. The locations of these features should bear the parenthetical reference to the agency or entity which owns or operates the property; for example, the Bureau of Reclamation (Reclamation):

(a) Name of agency responsible for maintaining and/or managing the affected land.

(b) Recreation areas; fish and wildlife areas; building areas; highways, railroads, and shipping points; housing; areas of cultural sensitivity; areas of archeological, historical, and mining or paleontological interest; and bridges with special loads or size limitations.

(c) Existing towns, residences, private property, roads, transmission lines, substations, stream-gauging stations.

(d) Areas of environmental concern.

(e) Public utilities such as electric power and telephone lines, pipelines, etc.

(f) County, range, township, and section lines.

(g) Land use restrictions such as easements and rights-of-way.

(5) Rights-of-way:

(a) Show rights-of-way required or available for facility/structure sites, construction access, and staging areas.

(b) Land ownership boundaries and legal jurisdictions. Indicate ownership by agency acronym or private land with "private."

(6) The proposed structures and features:

(a) Location of features to be constructed or modified.

(b) Locations of potential construction and permanent access roads, sites for contractor's staging areas and construction facilities, and sites for temporary water treatment facilities.

(c) Locations of borrow areas for natural construction materials, locations of commercial quarries, and disposal areas for waste excavation.

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

(e) Sources of water for construction.

B. **Location Maps.** Location maps are commonly used as a condensed method of showing location and alignment of the features and associated structures. The location map may be combined with the general map, site plan, or plan and profile drawings for small areas. A scale of 1 inch = 1,000 feet to 1 inch = 2,000 feet is commonly used for location maps. The location map should show:

(1) **General:**

(a) North arrow.

(b) Proposed alignment, major structures, and delivery locations by symbols. Station and appropriate ties to section lines, section corners, existing buildings, pipelines, roads, railroads, etc.

(c) Topography and ownership information should be shown.

(d) Towns, roads, railroads, streams, existing pipelines, canals, reservoirs, etc.

(e) Transportation facilities and other cultural features.

(f) Location of borrow areas, riprap sources, sources of special pipe embedment material, if required

(g) Disposal areas for wasting excess excavation.

(h) For distribution systems, show ownership, turnout locations, and irrigable areas served.

(i) Sources of power for construction and operation and maintenance.

(j) Existing or potential areas or features having a bearing on the design, construction, or operation and maintenance such as: recreation areas, fish and wildlife areas, railroads, housing, and areas of archeological, historical, and mining and paleontological interest.

(k) Where the scale does not permit proper detail of a congested area, a blowup at a larger scale may be included elsewhere on the drawing and referenced to its proper location.

(l) Where density of the structures or other features is such that individual stationing and naming is impractical, the information should be shown in tabular form and station marks shown on the alignment.

(m) Linear feature (canal, pipeline, wasteway, drains, etc.), together with structures and stations. Structures and delivery locations are normally shown by symbol.

(n) Legend of symbols for existing and proposed facilities.

(o) Right-of-way and land ownership data.

(2) **Distribution Systems.** Where the source of the water is a canal, reservoir, or pipeline with turnout or headworks located outside the distribution system area boundary, topographic maps should be submitted covering all the areas in which the connecting feeder main is to be located. The water surface elevation range in the source canal or reservoir or hydraulic grade line range in the source pipeline should be shown. Also, where appropriate, data such as capacities, grades, etc., should be shown.

C. **General Description of Local Conditions.** The following data may be required for feasibility and specifications and designs:

(1) Information relating to access for possible site visit by the design team, access for foundation exploration and construction, and access limitations due to environmental restrictions, etc.

(2) Access to the site for operation and maintenance (O&M) forces.

(3) Permits or permit requirements and any past permit violations or exceedences.

(4) Name and description of similar construction in the area or region.

(5) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; estimate of access road length and major structures required for new construction; and possible alternative means for delivering construction materials and equipment to the structure 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 (give location, power supplier, voltage, number of phases, and capacity of existing transmission lines; power rate schedules; probability of interruption of supply; and requirements for additional transmission line, if needed).

(a) Names, telephone numbers, email addresses, and Web sites of local utilities and contacts within those organizations.

(7) Climatic conditions that will affect design, construction, and O&M such as amount, rate, and distribution of rain, snow, and hail; ice conditions; heating and air-conditioning design temperatures; summer and winter temperatures with extremes; maximum wind velocities and their directions; probability of excessive dust or sand.

(8) Local frost depths.

(9) Ground water presence and depths.

(10) Vegetation to be cleared or preserved including kinds, sizes, and density of growth.

(11) Road detour requirements.

(12) List similar construction in the area.

D. **Survey Control.** Survey control is required for all surveys including surveys associated with aerial photography. Use of an existing coordinate system or a system tied to the township and range system is acceptable but tying to the State plane coordinate system is recommended.

If designs are required to modify an existing system, verification of the original coordinate system and datum should be made.

E. **Topographic Maps:**

(1) **General.** Topographic maps will serve as the base on which the design and layout of the pipe system will be made. A survey with a scale of 1 inch equals 100 feet to 1 inch equals 400 feet and a 2-foot contour interval is satisfactory for these maps; depending on the size of project and topography. The contour interval may be increased in hilly or mountainous terrain. If the project area is flat or small, a 1-foot contour interval may be required.

The map must cover the entire project area, including water source where it is outside the distribution service area. These maps will show:

(a) Existing significant features, natural and manmade.

(b) Ownerships, giving delivery water surface elevations and irrigable acres for each turnout location.

(c) Available survey information to include township and range lines, section lines, etc.

(d) Source of water (canal, reservoir, pipeline, wells, or combination of surface and ground water, etc.), giving operating water surface elevations or operating hydraulic gradients, rates of flow, flood data, etc., where appropriate.

(e) When preliminary studies have included a system layout, the layout should be submitted for consideration in feasibility designs as a part of these data.

(f) Cross drainage areas and potential scour depths.

F. **Plan and Profile Drawings.** Plan and profile drawings are normally requested for linear features such as roads, canals, and pipelines. Drawings are prepared so that both plan and profile are plotted on one sheet. Strip topography may be used for the plan view. The plan view may not be required if shown on other drawings. These drawings are normally prepared with a 1 inch = 10 feet vertical scale and the horizontal scales from 1 inch = 100 feet to 1 inch = 400 feet unless more or less detail is required. The scale should be adjusted, as required, if it is necessary to show details. Plan and profile drawings should show features such as:

(1) **General:**

(a) For feasibility studies, strip topography should be provided.

(b) North arrow and land survey lines.

(c) Proposed centerline and stationing and curve data.

(d) Location of existing features such as highways, railroads, public utilities, major drainages, and any other features that will affect the location and cost of proposed project facilities.

(e) Ties and stationing for turnouts, sublaterals and deliveries, as well as road crossings, railroad crossings and utility crossings. Grid coordinates for major structures such as pumping plants, flow control stations, tanks, reservoirs, etc.

(f) Land control survey lines with ties to alignment where appropriate.

(g) Survey data to include stationing, ties to existing features, etc.

(h) Existing ground surface contours with date of surveys and mapping. Significant topographic features.

(i) Existing utility lines within the right-of-way and requirements for relocation.

(j) Location of any existing intersecting facilities, watercourses, or other physical features affecting the new line or riprap protection on steep slopes.

(k) Cross drainage and direction of flow. Location of riprap protection on steep slopes. For major cross drainages, include flow (ft^3/s) and associated frequency (years)

(l) Low wire elevations and station of power lines (include voltage) where they cross the alignment.

(m) Buildings, fences, and other obstructions.

(n) Right-of-way.

(o) Feature alignment, curve data, and stationing.

(p) Hydraulic properties by reaches of proposed features (including hydraulic gradeline, feature dimensions, and pressure class for pipelines).

(q) Structures (including conduit size for siphons, turnouts, and culverts).

(r) Alignment of laterals, sublaterals, overflow wasteways, reservoirs, and access roads.

(s) Crossings: Individual drawings should be furnished that show the plan and the profile, drawn to appropriate scales, of the following types of crossings:

- Railroad crossings.
- Highway crossings which cannot be constructed by open-cut methods.
- River or canal crossings.

(t) Roads, borrow pits, and waste areas.

(u) Anticipated right-of-way widths and minimum radius of curve that should be used to establish right-of-way (ROW) limits at points of intersection on pipeline centerline alignment. Where possible, curves having a minimum radius of 500 feet should be used at horizontal changes in the direction of the pipeline alignment. On large diameter pipelines, curve radii of 1,000 feet or more may be desirable to permit use of "pulled" joints in pipe or curves rather than concrete encasements.

(v) Areas where special construction effort is required, such as directional drilling, microtunneling, compacting pipe trench backfill up to the ground surface, excavating the pipe trench using shoring or a safety shield, limits of encasement under proposed drains or canals, etc.

(w) Profile: Existing ground surface, centerline elevations of pipelines, canals, hydraulic gradeline, utilities or other subsurface features where they cross the alignment.

G. **Geologic Data:**

(1) Surface geologic investigations sufficient to define:

(a) Approximate boundaries of major areas of soil and unconsolidated material and exposed bedrock outcrops, and estimated range and average depth of the soils strata overlying bedrock. Identify areas of common and rock excavation.

(b) Location and extent of areas of unusual conditions such as: existing or potential landslides, low-density or expanding clay soils, spoil banks, hazardous materials or corrosive soils.

(c) Estimated depth to ground water where shallow enough to be encountered in pipe trenches.

(d) Location and quantities of materials needed for construction.

H. **Operating Data:**

(1) Develop hydraulic data and basic criteria for sizing pipelines and deliveries. Operational data required depends on the pipeline ultimate use (irrigation or M&I).

(a) Irrigation system

- Note distribution of irrigable acres along the irrigation system.
- Seasonal requirement. This is usually stated in terms of acre-feet per productive acre per year for irrigation (application efficiency already considered).
- Monthly requirement. Expressed as a percentage of seasonal requirement for each month of operation. Irrigation flows will be distributed over the irrigation season and will vary based on crop requirements per month.
- Peak requirement. This is the basic criteria for sizing pipelines and can be based on the maximum demand for a month, peak day or other time period. The demand should be stated as the number of productive acres to be served by a flow of 1 ft^3/s or a flow rate of a specified number of gallons per minute required to irrigate 1 acre.
- Criteria for reducing irrigable acres to productive acres. This can be expressed as a percentage of the irrigable area.
- Basic criteria for sizing farm deliveries. This may be shown as a table showing the maximum and minimum number of productive acres to be served by deliveries of 1, 2, 3, 4, etc., ft^3/s.
- Type of farm distribution system, including pressure required at farm delivery for sprinkler or drip irrigation systems.
- Controls and equipment to be included in farm deliveries such as flow meters, control valves, open stands, and pressure-reducing valves.

(b) Municipal and industrial system

- Yearly requirement. This is usually stated in terms of acre-feet per year.
- Monthly requirement. Expressed as a percentage of the yearly

requirement for each month of operation. M&I systems may be spread out equally over the entire year when better data is not available.

- Peak requirement. This is the basic criteria for sizing pipelines and can be based on the maximum demand for a month, peak day or other time period. Delivery demands can be stated in acre-feet per month or ft^3/s and pressure requirements at the delivery points.
- Capacity for future development.
- Controls and equipment to be included in deliveries such as flow meters, control valves, altitude valves and pressure-reducing valves, etc.
- Chlorination requirements.
- Fire demand.
- Lifeline designation?

(2) Data on water source:

(a) Operating water surface elevations or hydraulic gradients.

(b) Data on turnout, dam outlet, pumping plant, etc., from which water will be delivered.

(c) Water quality information.

(3) Control Systems

Determine whether automatic and/or supervisory control is desired (including future provisions). If supervisory controlled, give location of master station.

(4) Filling and Draining Criteria

Data on allowable outage times based on operation and maintenance requirements.

(5) Storage Requirements:

(a) Fire code

(b) County or State regulations

I. **Miscellaneous Data:**

(1) Screening requirements at source of water (turnout, pumping plant, dam outlet, etc.).

(2) Location, reliability and data on source of existing electrical power.

(3) Criteria for road crossings (mostly for open lateral system) and other significant structures required.

(4) Minimum earth cover over the pipelines. This is usually set by the depth of frost penetration into the ground, water table location, depth of cultivation, potential scour at cross-drainage sites, traffic considerations, etc.

(5) Details of any existing utilities that may be in the area or cross the proposed alignment, such as gas pipelines, electrical powerlines, etc.

(6) Information about cathodic protection systems that may be employed in the project area.

(7) Information about Reclamation or private pipelines constructed in the project area including, corrosion protection, construction data and maintenance issues.

(8) Determine if there is a client preference for a type of pipe and what pipe types have been used in the project area previously.

(9) Soil resistivity surveys if metallic pipe or fittings are to be used as options.

(10) Compaction requirements for the pipe trench backfill where the alignment passes through existing farmers fields and underneath roads.

(11) Determination of the minimum ROW limits for construction and the permanent ROW limits required after completion should be obtained.

(12) The method for determining the ROW and how the ROW will be obtained should be described.

(13) Electrical Data:

(a) Names and telephone numbers of power suppliers and contacts within their organizations.

(b) Locations where connections to power supply will be made.

(c) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.

J. **Environmental Considerations.** Information should be included which will aid the designer in minimizing the environmental impacts due to construction of these systems. The following items should be considered in preparing design data:

(1) Photographs of the environmental setting.

(2) Cultural (historical, archeological, architectural, and paleontological) resources along any alignment or within the area of the distribution system.

(3) Wildlife or refuge areas.

(4) Existing or potential wetland areas.

(5) Any threatened and/or endangered critical habitat within or adjacent to the pipeline system.

(6) Areas of heavy public use should be clearly identified.

(7) The need for restoring borrow areas and reseeding spoil banks

(8) The water quality and location of return flows.

K. **Cost Data for Field Cost Estimate.** The field cost estimate is an estimate of the capital costs of a feature or project from award to construction; non-contract costs are not included. Cost data developed in previous or other studies (either by Reclamation or others) should be included with the design data submittal. Include a description or outline of estimating methods and data used. The following design data for feasibility and specifications levels designs should be considered for submittal:

(1) Procurement Strategy. Will solicitation be advertised and awarded under other than full and open competition? This includes solicitations which will be set aside under socio-economic programs that may limit competition or allow award to other than the lowest bid or proposal.

(2) Estimate of cost of ROW for all features including reservoirs, dams, and appurtenant works. Include supporting data:

(a) For reservoirs, include a curve showing estimated cost of ROW versus elevation of reservoir water surface from normal elevation to maximum estimated surcharge elevation or other physical or economic limit. Include supporting data.

(3) Information on local labor supply and labor problems.

(4) Local freight or trucking rates.

(5) Housing accommodations.

(6) Interest rate for economic studies.

(7) Power rate in mills per kilowatt-hour, interest rate, and plant factor for economic tunnel, and pipeline sizing studies in cases where transported water is pumped.

(8) Estimated cost for construction items which cannot readily be determined in the design office and include the supporting data:

(a) Clearing reservoir area and for removing or replacing private improvements in the area.

(b) Earthwork (common and rock), excavation with freehaul distance. For canals, include compacting embankment, canal lining, and borrow (with free haul distance)

(c) Riprap, guardrail, culverts, row fencing, and gates.

(d) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment (i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction). Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing operations. If vegetation to be cleared is very sparse or can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other appropriate items of work.

(9) Where buildings are located within the area to be cleared by the prime contractor, and if disposal will be the contractor's responsibility, designate building groups by number and furnish detailed list of buildings for each group. Details should include general description, size, materials, and general condition. Drawings should be provided of these buildings, if available, that depict dimensions, construction materials, the structural system for the building, and major electrical and mechanical equipment. Determine if disposal will be the responsibility of the prime contractor. If not, submit dates when disposal will be completed by others.

(10) Information on important construction work that is in progress or planned in the vicinity and the presence of interested contractors or subcontractors in the area.

(11) If potential actions exceed anticipated funding, an assessment should be made as to whether the cost estimate will reflect incremental costs of these

potential actions. Provide any known increment or arrangement of the incremental costs.

(12) Local and tribal taxes.

(13) Estimates of costs for relocating railroads, highways, roads, water systems, and other public utilities. Include supporting data.

(14) Method for projecting cost into the future if required.

(15) Cost of local materials (precast concrete, etc.).

L. **Construction Considerations.** The following design data items should be considered for feasibility and specifications designs:

(1) Construction schedule:

(a) One contract or several contracts.

(b) Any construction timeframe restrictions

(c) Are designers required to provide a construction schedule and/or logic diagram?

(d) Recommended period for construction.

(e) Recommended period for completion of construction work and features of the work that should be completed early.

(f) Permissible times to make connections to existing facilities.

(g) Whether construction schedule will be adaptive, (e.g., provide a remedy, observe the effects, and then modify remedy as required).

(2) Allowable in-river materials (permanent and temporary).

(3) Construction constraints including allowable construction methods, traffic considerations, environmental restrictions, climatic restrictions, blasting limitations, etc.

(4) Filling and draining criteria for dam, ponds, and pipelines

(5) Unusual conditions for excavation or construction.

(6) Extent of construction surveying to be accomplished by Government surveyors.

(7) Water for construction purposes. For large rivers, this item may be unimportant. For small streams and offstream reservoirs, the item becomes critical. Determine if up to 2 cubic feet per second of diversion flow for construction purposes can be assured to the contractor. The Government should obtain the water rights required. If it is necessary to use ground water, obtain information on probable sources and yields. Furnish information on locations and yields of existing wells in the vicinity. Determine restrictions, if any, to use of ground water for this purpose. It may be necessary to obtain permits from State or other governing agencies. Retrieve water quality samples for testing and evaluation.

(a) Water treatment requirements for return flows

(8) Requirements for maintaining streamflow or diversions during construction and maximum length, time, and number of permitted interruptions.

(9) Required permits from government agencies and others.

(10) Requirements for meeting criteria for suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction.

(11) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(12) Requirements for temporary construction access roads, permanent access and service roads, and relocation of existing roads or railroads. Include any limiting requirements imposed by road owners for public access/haul roads.

(13) Comments on disposal of special excavation problem materials such as lignite.

(14) Give borrow area and temporary haul road restoration requirements such as stockpiling of topsoil, grading of the area, general cleanup, etc.

(15) Give consideration to using required excavated material in lieu of material from other borrow sources wherever possible.

M. **Site Security.** 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.

7. Access Roads and Highway or Railroad Relocation. 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 data and information are required for feasibility design.

A. **General.** On some projects it is possible that the cost of relocating railroads and highways and constructing access roads will exceed the cost of the dam or other features; therefore, it is essential that the scope and cost of the relocation work be fully documented in the feasibility study. The future impact of recreation and environment should also be given due consideration.

B. **Design Standards:**

(1) **Relocated Roads and Highways.**

(a) Feasibility designs shall be based on construction to current local and/or county codes and standards where the traffic count and other considerations show justification.

(b) Replacement in kind shall be used where the existing roadway is equivalent to current local or county codes and standards or where there is no justification for upgrading to current standards.

(c) Standards higher than current local or county codes and standards shall be used only when the owner will pay the difference in costs due to the higher standards, or when due to recreation needs or special considerations, nonreimbursable funds are appropriated by Congress to cover the higher standards.

(2) **Access Roads.** Feasibility designs shall be based on the current local and/or county codes and design standards with modifications for unusual circumstances such as need for higher standards due to magnitude of the project, special haul problems, recreation needs or that the access will be used as a recreational facility, etc.

(3) **Recreation Roads.** Relocated roads, highways, or access roads intended for recreation purposes, or which will contribute to such purposes, may be constructed to higher standards with nonreimbursable recreation funds under project specific authorizing legislation or under the Federal Water Project Recreation Act of July 9, 1965, as amended by Title 28 of Public Law 102-575, but only after a non-Federal managing partner has agreed to cost share development and to operate and maintain the constructed facilities. In the absence of specific authorizing legislation, a non-Federal managing partner as stated above, or policy stating otherwise, Reclamation is limited to “minimum basic” facilities, as stipulated in Public Law 89-72. It is necessary that any roads intended for such use be

fully identified and described, including proposed standards, in the feasibility designs and in the feasibility report submitted to the Congress.

(4) **Railroads.** Feasibility designs shall be based on replacement in kind, with consideration given to higher standards only in the event of unavailability of certain materials, or at owner's expense.

C. **General Map Showing:**

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

(2) The proposed road or railroad alignment.

(3) Existing towns, highways, roads, railroads, public utilities, townships, range, and section line.

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

(5) 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; areas of cultural sensitivity; and areas of archeological, historical, and mining or paleontological interest.

D. **Topographic Map.** A topographic map or strip topography shall be provided showing alignment of facility and location of major structures. A scale of 1 inch equals 400 feet and a contour interval of not over 5 feet shall be used unless relief is such that a contour interval of less than 5 feet is necessary to adequately depict the topography.

E. **Foundation Data.** Sufficient data on foundation conditions must be included to determine the type of excavation that will be encountered and to delineate possible unstable areas. Logs of all auger holes, test pits, and results of materials testing that are applicable and available will be included.

F. **Construction Materials Data Including:**

(1) Source location and estimated available quantities of roadway and surfacing material, ballast, concrete aggregate, and any other construction materials required in large quantities, including the mitigation features required to restore borrow areas, etc.

(2) A description of above construction materials that generally defines their character and acceptance for the intended use.

(3) Information on firms within practical hauling distance from the site that provide a commercial source of construction materials. Include service history and photographs of these sources.

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

G. **Operating Data:**

(1) For railroad: Limiting grades and curvature, load limits, other operating limitations or requirements, and typical roadbed section, showing depth and type of ballast, weight of rail, size, spacing, and type of tie.

(2) For railroad: Information on operating facilities such as communication or signal lines.

(3) For highways: Design speed, limiting grades and curvature, load limits, and typical roadway section, showing width, thickness, and type of surfacing if other than those specified in local and/or county codes and standards.

H. **Miscellaneous Data:**

(1) Provide a description of bridges and other major structures with appropriate local and/or county codes and design standards.

(2) Provide a list of number, type, and size of required cross-drainage structures. For major structures include hydraulic requirements.

(3) List any public use areas along or adjacent to any potential alignments.

I. **Cost Data.** Any other pertinent cost estimates that have been prepared (either by Reclamation or the owner of the facility). Include a description or outline of estimating methods and data used.

J. **Environmental Considerations.** Highways and railroads should be located to minimize impacts to environmental resources. Design data should include a brief description of environmental resources that could be affected by the proposed location. Photographs, if available, are most helpful in describing the environmental setting. The following items should be considered in preparing the design data:

(1) Cultural (historical, archeological, architectural, and paleontological) resources along or adjacent to any potential alignment.

(2) The need for restoring borrow areas, and reseeding cuts and fills.

(3) The need for erosion and sediment control.

(4) Landscaping requirements.

(5) The need for game protection, including crossings, fencing, etc.

(6) Any threatened and/or endangered critical habitat in/or adjacent to potential alignments.

8. Drains. 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 design of open drains for the collection of surface and subsurface water requires data primarily on surface conditions, i.e., topography; flood runoff; soil erosion characteristics; outlet requirements for storm water and waste water from irrigation and laterals; and County, State, Federal, and private structure requirements. For subsurface drains to control ground water and salinity, the primary data required are on soils and substrata. Design of subsurface drains is based largely upon hydraulic conductivity of the various soil strata above the uppermost slowly permeable barrier in the soil profile, the position and thickness of these strata, land forms, surface infiltration rates, contemplated land use and irrigation practices, precipitation records, topography, and historic ground water conditions prior to irrigation.

Because a feasibility report requires only sufficient information to determine with reasonable assurance that the project will be successful and able to fulfill the repayment contract, the amount and coverage of the drainage investigations will depend on the knowledge, judgment, and experience of the drainage engineer. The reliability of the drainage requirements and cost estimate will depend on obtaining the right information to be used for additional extrapolation and interpretation in areas not covered in the investigations. Field investigations should be kept to a minimum.

A. **General Map**. A general map showing project area, nearby towns, roads, and railroads.

B. **Location Map.** A topographic map usually at a scale of 1 inch equals 2,000 feet showing approximate location of existing drains, roads, railroads, power lines, and gravel sources.

C. **General Description as It Affects Drainage Requirements and Covering:**

(1) Regional geology and geomorphology, topography, and climate.

(2) Texture, structure, hydraulic conductivity, infiltration, chemical characteristics, and stratification of soils, subsoils, and substrata.

(3) Chemical characteristics of ground water and irrigation water as they affect project productivity.

(4) Ground water conditions, including sources, position, any artesian pressures, and gradients.

(5) Predicted chemical characteristics of drainage water as it affects human health, and the environment.

(6) Location and class of jurisdictional wetlands.

(7) Contemplated land use, anticipated crops, and irrigation practices.

(8) Natural surface drainage, flood history, and channel locations and characteristics.

(9) General appraisal of subsurface drainability and requirements.

(10) Preliminary plan for surface and subsurface drain systems including types of drains to be provided, rough delineation of areas which may require special treatment, and any unusual excavation problems or working conditions.

(11) Suggested correlation and integration of project drain systems with farm drains, canals, laterals, flood control facilities, and nonproject protective works.

D. **Maps Showing the Following Drainage Data:**

(1) Topographic base maps showing existing drains, roads, improvements, canals, reservoirs, railroads, highways, etc. USGS quad sheets can be used.

(2) A rough depth-to-barrier map for areas where clays, shales, sandstone, or other slowly permeable materials occur at depths which will adversely affect drainage.

(3) A land classification map showing land classes by standard symbols and location of any special deep test holes.

E. **Profiles.** Appropriate multiple profiles across typical areas showing ground surface elevations, stratifications, permeabilities, and ground water levels.

F. **Hydrologic Data:**

(1) Precipitation and runoff records.

(2) Area-discharge curve of 5-, 10-, and 25-year storms for use in design of drains to remove surface water from irrigable lands.

(3) Economic capacity of cross channels based on consideration of probable frequency of flooding and the resultant damages to crops and project works.

(4) Water requirements, including canal and lateral losses, farm application, surface waste, and deep percolation losses.

(5) Hydrographs showing typical ground water fluctuations in selected observation wells.

(6) Stability of natural channels receiving drain flow.

(7) Expected water quality of drain flows

(8) Identify impoundments, streams, and/or wetlands likely to be affected by drain flows.

(9) State water quality criteria for water bodies receiving drain water. Identify probable range of concentrations for various constituents such as pesticides, selenium, etc.

G. **Gravel Sources.** Permeabilities and gradations of gravel sources.

H. **Other Requirements.** Structure requirements of other agencies, corporations, and individuals.

I. **Existing Systems.** Comparative Data from lands in the vicinity having similar soils and drainage conditions and already under irrigation:

(1) Map of the existing drainage system.

(2) General discussions of soil and substrata characteristics and the depths, capacities, and spacings of the drains.

(3) Detailed data on particular drains where the factors affecting drainage are similar to those in the project area. The data will cover type of drain, design, soil and substrata characteristics, ground water conditions, construction and maintenance problems, discharge, land use, irrigation practices, and area effectively drained for good crop production.

J. **Environmental Considerations.** During the investigation studies, the environmental impacts of the drainage system on other features, such as municipal, industrial, recreational, water quality, water quality standards, location of discharge and expected water quality of discharge, fish and wildlife, and aesthetic requirements should be considered. Close cooperation on environmental matters should be established and maintained between drainage personnel and personnel working in other technical disciplines. Liaison should also be established with regulatory agencies the environmental groups in the area.

9. Wells. 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 design of wells for water supply, drainage, and other similar purposes requires extensive subsurface and other data. Because of the nature of the environment of ground water, maximum reliance for correct interpretation and use of the data must be based on the competence, experience, and judgment of the ground water engineer or geologist.

The following is a minimum checklist of data necessary for feasibility design and cost estimates for wells and well fields.

A. **Maps:**

(1) A general location map showing locations of the well site(s) and communities, transportation facilities, and other cultural features.

(2) A construction site map showing locations of the well(s), right-of-way, access roads, and sources of power and water for construction purposes.

(3) A geologic map showing surface geology, topography, subsurface data points such as existing wells, and other similar data.

B. **General Conditions:**

(1) Location of, ownership of, and accessibility to the site.

(2) Location and included area if a well field.

(3) Stratigraphic and structural conditions including general types and sequences of materials.

(4) Drilling conditions - ease of drilling, stability, etc.

(5) Standards, permitting requirements, etc.

(6) Other wells in the immediate area (oil, gas, etc.).

(7) Location and type of power sources, utility easements, buried cables, pipelines, etc.

C. **Aquifer Conditions:**

(1) Depth.

(2) Thickness.

(3) Type and stability of material.

(4) Size and range if material is granular.

(5) Transmissivity and storativity.

(6) Water budget.

(7) Aquifer storage capacity and amount of water storage.

(8) Depth and thickness of confining unit(s).

(9) Contour maps (bedrock surface, top of aquifer(s), etc.).

(10) Natural recharge and discharge locations and amounts.

(11) Sustained yield potential.

D. **Ground Water Conditions:**

(1) Static water level.

(2) Water level trends.

(3) Known locations and types of potential or existing pollution source(s) – either natural or anthropomorphic.

(4) Locations, amounts, and usage of existing and planned future withdrawals.

(5) Radius of influence and drawdown map.

(6) Quality of water to include the concentration of major ions and all parameters having primary and secondary maximum contaminant levels as defined by the Safe Drinking Water Act.

E. **Well Conditions:**

(1) Design yield. The foregoing factors must be considered in light of ground water reservoir conditions – areal distribution, recharge, yield, and pumping conditions, including pump costs, power availability and cost, etc.

F. **Environmental Considerations.** Impacts to environmental resources, especially the:

(1) Location, size and type of wetlands that could be influenced by the drawdown core or by discharge from the well.

(2) Impact of drilling and testing operations.

(3) State standards.

(4) Presence of completed facility.

(5) Permitting requirements.

G. **Safety Factors.** Material outlining safety factors, including presence of high subsurface pressures or toxic gasses.

H. **Report.** The foregoing data should be included in a report, together with a brief, descriptive summary of the geology of the area, existing ground water conditions, and ground water development to date.

I. **Electrical Data:**

(1) Location of point where connection to power supply will be made.

(2) Names, telephone numbers, Web sites, email addresses of electrical power suppliers, and contacts within those organizations.

(3) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.

10. Switchyards and Substations. 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) The proposed site or sites.

(3) Existing towns, highways, roads, railroads, power facilities, township, range, and section lines.

(4) The direction of proposed transmission lines or transformer circuits entering the yard.

Generally a map made from or prepared on a current USGS topographic map (7½-minute quad sheet) will be adequate.

B. **Aerial Photograph.** Aerial photographs of the proposed site area is desirable in color, if available.

C. **Foundation Data.** A brief description of foundation conditions, adequate to determine the type of excavation and allowable bearing capacities that will be encountered.

D. **Electrical Data.** For design of most substations, it will be sufficient to specify only supply and output voltage, number of connecting transmission line at each voltage, capacity of the facility in kilovoltamperes and type of operation (attended, unattended, or supervisory control). For more complex structures, the requesting office should consult with the designing office for specific details needed.

E. **Building Facilities.** State the need for service and maintenance buildings. State operating functions to be controlled from the building.

F. **Environmental Considerations.** Comment should be included on any ecological, aesthetic, or other environmental aspects peculiar to the location which would affect the layout and cost, including present and future use of adjoining lands.

G. **Site Security.** 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.

11. Transmission Lines. 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 within the State.

(2) The proposed route, including terminal and intermediate substation locations.

(3) The type of terrain, and natural or manmade features such as rivers, roads, highways, etc., which may have a significant effect on tower location, or may require long spans.

(4) Range, township, and section lines.

Generally, a map made from, or prepared on, current USGS topographic maps (15-minute quad sheets) will be adequate.

B. **Aerial Photographs.** Aerial photographs are desirable of major river and highway crossings, in color if available.

C. **Foundation Data.**

A general description of foundation conditions along the route adequate to determine the type and approximate number of auger, pad-stem, rock, or pile footings.

D. **Electrical Data:**

(1) Estimated average and peak loads.

(2) Operating voltage of the line.

(3) Value of energy for sizing purposes.

(4) A description of terminal and intermediate substations.

E. **Environmental Considerations.** Comments should be included on ecological, aesthetic, or other environmental aspects that affect the selection of the route. Emphasis should be on areas of raptor protection, threatened/endangered species habitat, high scenic or historical value, heavy public use, bird migration corridors, or fragile ecological areas.

F. **Site Security.** 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.

12. General Purpose Buildings, Office Buildings, and Operation and Maintenance Facilities (Use Specifications Design Data Collection Guidelines for Feasibility and Specifications.)

13. Recreational Facilities. 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. This section lists data required for design of recreation facilities. Small scale site development, such as a single campground loop, would need much of the data listed below but only for the area encompassing and immediately surrounding the project site.

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

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

(2) Restrictions to land uses, such as easements and rights-of-way.

(3) Land uses in general terms, with private land labeled "private" and public land labeled by governmental agency acronym.

(4) Locations for borrow areas, storage of construction materials, and sites for stockpiling of topsoil.

(5) Limits of construction or physical boundaries of the proposed site development.

B. **Topographic Map Showing:**

(1) Site topography covering an area large enough to include all potential site development. The extent of the topography should include the access road and the probable site entrance area. Contours at 2-foot intervals or 1-foot intervals if the site is very flat. If the project area is small, a contour interval of 1 may be needed. The data should be in the form of an electronic drawing file that can be used to create a base map. All points contained in the drawing file should have a z axis value which correspond to onsite elevation.

(2) Underwater contours with the elevation referenced to upland elevation, if needed for marina design.

(3) Surface drainage features such as streams and ravines and any existing bridges or culverts.

(4) Existing built site features, such as roads, parking, turnarounds, buildings, structures, power lines, buried utility lines and tanks, campgrounds, picnic areas, and marinas.

C. **Narrative and Photographic Description of Site Showing:**

(1) **Narrative Description of the Project Area.** This should be a brief description of the surrounding area, the nearest population center, its size, and the nature of the surrounding context. A description of existing recreation facilities, capacity, level and season of use, condition of structures and roads.

(2) **Color Photographs of the Site**. All photos should be keyed to the site map. Photos should show problem or hazardous areas, location of proposed facilities, location of possible access points to the site from existing routes, and close ups of existing features such as buildings or structures. These photos should also show favorable off-site views that should be preserved and considered when siting buildings. Photos should also be taken of unfavorable onsite features that should be screened from view or otherwise considered when siting facilities. Photos should show the condition of existing roads and buildings, if possible.

(3) **Aerial Photos**. 8- x 10-inch size, color if possible, at a scale which allows discerning the nature of the vegetation.

D. **Biological Data:**

(1) **Vegetation.** Narrative description of site vegetation, particularly density and distribution.

(2) **Wildlife.** List of threatened and endangered animals that have migration routes, critical habitat, or outstanding habitat in the immediate area. Map of any species' migration patterns, critical habitat, and outstanding habitat that occurs on or adjacent to the project site. List of species which may pose a danger to users or which may require special accommodations in site design, for example bears or moose.

(3) **Wetlands.** Map of wetlands outline showing seasonal fluctuation of the water level.

E. **Geologic and Soils Data:**

(1) Evidence of seasonal or occasional event of surface runoff beyond the banks of local streams, and a map showing where the water flows.

(2) Soil survey and map of soil texture for determining susceptibility of soils to erosion, and suitability of soils for building foundations, roads, trails, and leach fields.

(3) Areas of existing erosion or high soil moisture, which should be avoided.

(4) Seismic stability in areas prone to earthquakes.

(5) Evaluation of potential landslide, snowslide, and rock fall areas.

(6) Availability of potential fill materials on site and nearby, and a description of the type of materials.

F. **Weather Data.** Direction, intensity, seasonality, and daily fluctuations of wind. Probability of excessive blowing dust or sand.

G. **User Data:**

(1) Anticipated user activities and needs.

(2) Length of stay - a few hours, overnight, few days, etc.

(3) Destination or stop-over site.

(4) Seasons of use and differing uses by different users as the seasons change.

(5) Number of users expected at one time to use the site for an average weekend; for a holiday.

(6) Type of equipment the user is expected to bring along and the spatial/physical site requirements to accommodate that equipment.

(7) Utility requirements of the user (water, electricity, sewer).

H**. Utilities:**

(1) **Electricity:**

(a) Source of electricity: location of the point where the connection to power utility will be made, the capacity, and type-single phase/three-phase.

(b) Location of existing transformers.

(c) Route of proposed distribution lines and whether they are to be overhead or underground.

(d) Feasibility of applying solar collectors or adaptors to buildings.

(e) Feasibility and expense of generating power onsite with wind power.

(2) **Potable Water:**

(a) Source of existing potable and non-potable water.

(b) Route and sizes of existing pipes.

(c) Proposed distribution routes.

(d) Available pressure (pounds per square inch) and flow (gallons per minute).

(e) Location of potential or existing wells, treatment facilities, and holding tanks, if applicable.

(3) **Storm Water Runoff:**

(a) Conditions of the drainage plan, if applicable.

(4) **Sewage Disposal Systems:**

(a) **Pull-away systems:** spatial and access requirements of the pumping trucks which will service the vault toilet buildings and any retaining tanks. Includes turning radii and road gradient limitations.

(b) **Onsite disposal systems consisting of treating onsite (primary treatment plus a leach field):**

- Necessary slope, soil, and spatial quantity requirement.
- Spatial requirements for future expansion of the system.
- Spatial requirements for future expansion of the system.
- Spatial and access requirements of the vehicles or equipment which will be needed to service the treatment system.

I. **Roads Data:**

(1) **Existing Roads:**

(a) Location and vehicle capacity of existing access route to site.

(b) Road and shoulder widths, depths, and materials.

(c) Physical limitations to primary road.

(2) **Proposed Roads:**

(a) Turning radii required for roads and parking lots, based on vehicles which are anticipated to use the facility.

(b) Wheel loading of anticipated vehicles that will use the facility.

(c) Width, depth, length, and materials needed for new roads.

(d) Proximity of source of base course materials.

J. **Program Requirements.** As identified in the appropriate Resource Management Plan or other planning effort.

(1) Desired level of development, for example: urban, rural, semi-primitive.

(2) Numbers and locations of proposed facility elements, for example: numbers of pull-through sites with shade shelters; number of shade shelters and group use areas; number of sites with full utility hook-ups; number of day-use sites.

(3) Carrying capacities of the particular site, for example: proposed density of campsites or maximum number of boats in the marina and on the reservoir.

(4) Facilities that need to be replaced or upgraded to meet Reclamation and local codes and standards.

(5) Outlines of restricted use areas, such as non-motorized areas.

(6) Square footage of new building and size of its footprint. Number of parking spaces needed for building.

K. **Concessionaire's Requirements:**

(1) Type of equipment the user is expected to rent onsite from the concessionaire and the spatial/physical site requirements and location(s) to accommodate the storage and servicing of that equipment.

(2) Utility requirements of the concessionaire, e.g., gas and phone.

L. **Facility Operations and Maintenance Requirements:**

(1) Fee collection methods and location requirements for facility security. Include methods to achieve security.

(2) Requirements to close off one part of a facility from another.

(3) Requirements for vandal-proof materials and types of construction materials needed or preferred.

(4) Requirements for fire safety, such as the need for fire trucks and ambulances to traverse the site. The need for emergency vehicles to be able to reach facilities and acceptable limits of access.

(5) Roads and buildings needed for general maintenance of the area and their associated spatial and functional requirements.

M. **Revegetation and Landscaping Needs:**

(1) Availability of nursery plants and grass and forb seeds of appropriate species for revegetation.

(2) Availability of water to use for irrigation.

(3) Need to stabilize eroding streambanks or lake shores. This includes the treatment desired, whether it is hard surfacing or live material. Also includes a local source for riparian plant materials which can be used for cuttings, if known.

(4) Need for design of erosion control plan including silt fences, temporary seeding, erosion control blankets, etc., during construction to mitigate soil erosion and potential siltation of streams and water bodies.

N. **Dock and Marina Data:**

(1) Site topography covering an area large enough to include all potential marina development sites, with contours at 2-foot intervals or 1-foot intervals if the site is very flat.

(2) Underwater contours with the elevation referenced to upland elevation.

(3) Site exposure and prevailing winds.

(4) Location of vertical and horizontal obstructions in the proposed marina development area.

(5) Location, proximity, and size requirements of parking, including vehicles and vehicles with boat trailers.

(6) Condition of roads and their suitability for use by vehicles towing boat trailers.

O. **Miscellaneous Data:**

(2) Reservoir water surface levels – at season's highest, average summer pool, and at season's lowest.

(3) General condition of existing buildings, roads, recreation facilities, utility systems.

(4) Description and map of archeologically significant artifacts.

(5) Comments on any ecological, aesthetic, or other environmental aspects peculiar to this location which would affect layout or conceptual design.

(6) Unusual local pests that would influence type of construction materials.

14. Fishways. 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, canals, rivers, streams, and stream-gauging stations.

(5) Locations of 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.** Generally, both a map and an 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 structure. Elsewhere, larger contour intervals may be acceptable. Details to be shown are:

(1) Existing dam and appurtenant structures.

(2) Proposed fish ladder(s) location(s).

(3) Location of existing features such as highways, railroads, public and private utilities, canals, and any other features that may affect the location and cost of the fish ladder.

(4) Existing right-of-way. Proposed acquisition of additional right-of-way should be discussed.

(5) Below water contours should be included

C. **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) Climatic conditions of site (e.g., icing or freezing of river).

(6) Seismic conditions.

(7) River trash loading.

D. **Survey Control.** The survey can be tied to the township and range system or an existing coordinate system is acceptable but tying to the State plane coordinate system is recommended.

(1) Right-of-way surveys are required to locate government owned property at the structure site. This will assist in coordinating and determining future land acquisition.

E. **Foundation Data.** Sufficient data on rock and soil at the proposed structure site must be included to determine the type of materials that the foundation of the fish ladder will encounter. Logs of all drill holes, auger holes and exploration pits will be included. Generally, both a map and electronic file of the surface geology overlaying the topography should be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, erosive or dispersive soils, rock, and high water tables. Limited tests may be required to identify some of these problem soils.

F. **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).

(9) Source(s) of fish ladder water.

G. **Hydrological Data:**

(1) Range of river flows.

(2) Percent exceedence curves for flows.

(3) River water surfaces at dam tied to downstream gauge.

(4) Both tailwater and forebay rating curves over range of flows.

(5) River velocities.

(6) Diversion amounts and dates, if applicable.

(7) 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.

H. **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.

I. **Sedimentation Data**: Sufficient data on the soil at the proposed structure site(s) must be included to determine whether sedimentation will be a problem.

J. **Existing Structure Data**. As-built structural, mechanical and electrical drawings of the existing dam and appurtenant structures should be included.

K. **Fishways Data**:

(1) Type of fishways considered:

(a) Pool-type ladder.

- Vertical slot.
- Pool and weir ladder.
- Weir and orifice ladder .
- Full width stream weir.

(b) Baffled channel.

- Riprap channel with boulder weirs.

(c) Roughened chute ladder.

- Alaska Steeppass.
- Denil.
- Roughened stream channel.
- Pool-chute fish ladder.

(d) Low gradient channel.

(e) Vertical lift.

(2) Range of river flows to design for.

(3) Fishway design flow.

(4) Maximum and minimum head loss or drop through the slots, orifice, and weirs.

(5) Maximum and minimum fishway floor slope.

(6) Minimum water depth.

(7) Minimum clear opening between vertical trashrack bars.

(8) Minimum spacing of horizontal trashrack bars.

(9) Maximum velocity through trashrack.

(10) Minimum fishway pool volume.

(11) Energy Dissipation Factor (EDF).

(12) Capacity based on fish run size.

(13) Location of fishway exit from dam crest, spillways or any river outlet gates, etc.

(14) Requirement for stoplog slots or gates to be provided for dewatering the ladder.

(15) Requirement for entire fishway, including entrance and exit structures, to be covered with grating.

(16) Predation issues.

(17) Provision for future dam raise.

L. **Fish Entrance Areas (or Pools):**

(1) Field observations and sketches of flow patterns above and below the barrier should be made, especially at high flows.

(2) Observations of fish location and orientation when attempting to pass a barrier.

(3) Entrance flow.

(4) Type of fishway entrance (e.g., suppressed weir, contracted weir, vertical slot or orifice).

(5) Number and dimension(s) of entrance(s).

(6) Fishway entrance(s) location(s) and alignment(s).

(7) Minimum flow depth through gate.

(8) Minimum depth and radius of pool outside of entrance gate.

(9) Design head loss across entrance gate.

(10) Minimum velocity in the gate flow contraction.

(11) Requirement for instrumentation.

(12) Need for jet attraction pipes.

(13) Design flow of jet attraction pipe where applicable.

(14) Velocity of jet attraction pipes where applicable.

(15) Location of attraction pipe outlet and orientation to the river flow.

M. **Auxiliary Water Systems:**

(1) Flow required.

(2) Vertical or horizontal diffuser grating.

(3) Maximum clear opening between bars of diffuser grate.

(4) Design flow per gross wetted area of diffuser grate.

(5) Maximum clear opening of vertical bars of intake trashrack.

N. **Other Features:**

(1) Equipment needed to determine fish movement by telemetry or other means where applicable.

(2) Need for trap and evaluation facility.

(3) Requirements for supplemental lighting.

(4) Location of access required by fishery interests.

O. **Construction Data:**

(1) Construction window to complete all work.

(2) Restrictions on in-water work.

P. **Operating and Maintenance Data:**

(1) Plan of operation for fish ladder facilities, dam and canal.

(2) Portion of year structures should be designed to operate.

(3) O&M access requirements.

Q. **Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect a fish ladder 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 ladder.

(3) Background on the need for fish ladder.

(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) Anticipated public use around the structure.

(7) Any threatened and/or endangered critical habitat in or adjacent to the fish ladder.

(8) Existing or potential wetland areas.

R. **Cost Data.** Cost data developed in planning and appraisal estimates should be included.

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:**

A key map locating the general map area within the State.

(1) Location of the structure site.

(2) County, township, range, and section lines.

(3) Existing towns, highways, roads, railroads, public and private utilities, transmission lines, substations, rivers, streams, and stream-gauging stations.

(4) Locations of sites for required construction facilities.

(5) Sources of natural construction materials, location of commercial quarries, 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: housing and building areas; and areas of paleontological, archeological, historical or mining interest.

(7) Sources of construction power and power for operation.

(8) Scale of the general map should be adequate to clearly show listed details.

(9) North arrow.

B. **Topographic Maps.** Generally, both a map and an 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. 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. **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) Climatic conditions of site (e.g.., icing or freezing of canal).

(6) Seismic conditions.

D. **Survey Control.** The survey can be tied to the township and range system or an existing coordinate system is acceptable but tying to the State plane coordinate system is recommended.

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

E. **Foundation Data.** Sufficient data on rock and soil at the proposed structure site(s) must be included to determine the type of materials that the foundations of the fish facility structures will encounter. Logs of all drill holes, auger holes and exploration pits will be included. Sufficient pumping tests should be preformed to evaluate dewatering costs during construction. Generally, both a map and electronic file of the surface geology overlaying the topography should be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, erosive or dispersive soils, rock, and high water tables. Limited tests may be required to identify some of these problem soils.

F. **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).

G. **Hydrological Data:**

(1) Range of river flows.

(2) Percent exceedence 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.

H. **Canal Hydraulic Data:**

(1) Canal flow range.

(2) Maximum canal design flow.

(3) Percent exceedence 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.

I. **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.

J. **Sedimentation Data:** Sufficient data on the soil at the proposed structure site(s) must be included to determine whether sedimentation will be a problem.

K. **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.

L. **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.

M. **Trashrack Data:**

(1) Amount and type of floating debris in canal and/or river.

(2) Minimum clear opening between trashrack bars.

(3) Cleaning system.

N. **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.

O. **Construction Data:**

(1) Construction window to complete all work.

(2) Restrictions on in-water work.

(3) Will bypass around canal construction site be required?

P. **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 water diversion.

(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?

Q. **Environmental Considerations.** Design data should include, as a minimum, the environmental issues and/or requirements that would affect a fish screen facilities design and construction 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) Minimum river flows.

(3) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the fish screen facilities.

(4) Background on the need for fish screen facilities.

(5) The need for blending structures with the surroundings, restoring borrow areas, and reseeding spoil banks.

(6) Anticipated public use around the structure.

(7) Any threatened and/or endangered critical species and habitat in or adjacent to the fish screen facilities or bypass.

(8) Cofferdam requirements, materials and allowable time period.

(9) Existing or potential wetland areas.

R. **Cost Data.** Cost data developed in planning and appraisal estimates should be included.

16. Wetlands. 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. This section lists data which may be required for feasibility design of wetlands projects. The project team and the design team should review these guidelines to determine and assemble the final data request for a specific project. Biological data other than that requested in this guideline may be required. All wetlands projects should involve appropriate specialists in biology, hydrology (surface and groundwater), landscape site planning, and/or water quality (chemical limnology) disciplines. Depending on the scope and complexity, wetlands project plans should be developed or reviewed by a certified Professional Wetlands Scientist (PWS) or at a minimum by a member of the Society of Wetlands Scientists (SWS).

According to the U.S. Environmental Protection Agency:

- **Wetlands –** "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

- **Coastal Wetlands –** "found along the Atlantic, Pacific, Alaskan, and Gulf coasts. They are closely linked to our nation's estuaries, where sea water mixes with fresh water to form an environment of varying salinities."

- **Inland Wetlands –** "most common on floodplains along rivers and streams (riparian wetlands), in isolated depressions surrounded by dry land (for example, playas, basins, and "potholes"), along the margins of lakes and ponds, and in other low-lying areas where the ground water intercepts the soil surface where precipitation sufficiently saturates the soil (vernal pools and bogs)."

The following is a list of possible data required for design of wetlands:

A. **General Description of Proposed Wetlands Project:**

(1) **General Map(s) Showing:**

(a) A key map locating the general map area.

(b) The construction site or sites.

(c) Reference sites (if used).

(d) Existing towns, residences, private property, highways, roads, bridges with special loads or size limitations, railroads and shipping points, public utilities such as electric power and telephone lines, pipelines, etc., and stream-gauging stations.

(e) Locations for potential construction and permanent access roads, sites for contractor's staging areas, and construction facilities.

(f) Locations of borrow areas for natural construction materials and disposal areas for waste excavation.

(g) 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, areas of cultural sensitivity; and areas of archeological, historical and mining or paleontological interest. The locations of these features should bear the parenthetical reference to the agency most concerned; for example, Reclamation.

(h) Rights-of-way for construction, access, and staging areas.

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

(j) Buried utilities, pipelines, tanks, or other structures within the proposed construction site.

(2) **General Purpose and Function (definitions are provided at the back of this section):**

(a) Discuss type of wetlands work:

(i) Establishment of new wetlands.

(ii) Restoration of previously existing wetlands.

(iii) Enhancement or enlargement of an existing wetland.

(iv) Replacement for abandoned or displaced wetlands.

(v) Protection and maintenance of existing wetlands.

(b) State overall approach to resolving problems:

(i) Watershed based.

(ii) Local area.

(iii) Both of the above.

(iv) Use natural approach or bioengineering approach or a combination or both.

(c) Describe, in detail, any specific functional requirements and goals for the wetland:

(i) Habitat restoration (restore habitat to a pre-existing condition) or creating a new wetlands:

- Restore native species.
- Create and sustain diverse habitats supporting diverse species.
- Protect or re-establish threatened or endangered species.
- Increase or improve wildlife habitat.
- Increase or improve plant habitat.
- Restore hydrologic and vegetative characteristics of altered meadows and riparian areas.
- Requirements for removal of non-native plant or animal species.

(ii) River or land restoration:

- Replace acres lost to manmade or naturally occurring activities or events.
- Provide bank or shoreline protection.
- Reduce loss of topsoil.
- Facilitate onsite sediment disposal.

(iii) Facilitate fish passage and habitat requirements (create, restore, enhance).

(iv) Recreation:

- Aesthetic needs or desires.
- Facilitate or improve sporting activities (e.g. hunting, boating, fishing, camping, and bird watching).

(v) Moderation of stream flows and flood protection:

- Reduce peak flows.
- Increase water retention.

- Increase base flow.

(vi) Water treatment for instream flows, wastewater, and overland flows:

- Reduce suspended sediment.
- Remove nutrients and/or pollutants.
- Prevent and correct pollution discharges.

(d) Describe conditions envisioned immediately after construction and long term.

(e) Type of wetlands (coastal, inland, bog, etc.)

(3) **Wetlands Project Requirements:**

(a) Describe the source(s) of water for the wetlands: river, reservoir, ground water, overland flow, or piped in.

(b) Describe any specific Federal or State Regulations.

(c) Provide desired review requirements of designs by other agencies including timeframe, period, or stage of design for the review and the level of the review.

(d) Input from advisory groups and technical teams assembled to facilitate or oversee work.

(e) Describe alternatives to be considered.

(f) Describe pre-established requirements or preferences:

(i) Potential location(s) of wetlands.

(ii) Area, shape, and depth requirements.

(iii) Importation of plants and/or animals.

(iv) Intentions to emulate conditions at an another existing site:

- Location of existing site.
- Description of desired conditions.

(g) Descriptions of existing or future conditions that will have an impact on design, arrangement, and/or location of wetlands such as:

(i) Commercial, industrial, residential, or agricultural development or operations in vicinity.

(ii) Current ground water conditions and potential future changes.

(iii) Potential changes in river channel conditions (e.g., flow, degradation, aggradation, bank erosion, etc.).

(iv) River control operations such as upstream dams and powerplants.

(h) Description of any known restrictions for construction, timing of construction, placement of facilities, water quality standards, duration of construction, preservation of existing vegetation and facilities, or construction access.

(i) Proposed project timeframe.

(j) Required provisions for public safety, accessibility, or visitor facilities.

(k) Proposed vegetation and planting requirements:

(i) Discuss the purpose(s) of the vegetation: habitat, water treatment, bank stability, re-establish original vegetation, feed for endangered species.

(ii) Specify seeding or planting requirements.

- Discuss how planting will be accomplished and whether planting can be accomplished by self-design (allowing volunteer wetland plants to be established without active planting efforts).

(iii) Furnish State or local restrictions concerning the use of soil herbicides, or local factors limiting their use.

(iv) Cost effectiveness of collecting vs. purchasing plant materials:

- Discuss the availability of riparian shrub species growing locally on public land that could be harvested for cuttings if needed.

- Practicality of collecting plants to be used in revegetation plan from: project site, other wetlands, other river sites.

(v) Revegetation limitations:

- Depth to ground water around shoreline. Discuss how wide the band of moist soils is, how steeply soil moisture drops off, and the seasonality of the water table.

- Ability of the soil immediately uphill of the shoreline to hold moisture, how fast draining the soil is based on texture or underlying geology.

(vi) Need for armoring the shoreline against wave action, particularly on a windy site or where there is a long fetch across a large water body. Is plant material desired or is a hard material desired, or a combination of the two?

(vii) Irrigation or water control needs, based on water regime requirements of the plants that will be used, and local growing conditions.

(viii) Upland vegetation requirements:

- The need for restoring and seeding cuts and fills and spoil banks.

- Source of water for irrigation, if required.

(ix) Water treatment wetlands:

- Desired goals for water treatment.

- Shoreline gradient required or desired, if any.

- Draw down requirements, seasonality and length of dry season.

- Shoreline and upland requirements for wildlife considerations.

- Suitable plants required and available for the wetlands.

- Water control requirements: depth, flow, time passing through wetland.
- Product water quality requirements (see "Water Quality" subsection and table 1 for water quality monitoring parameters).

(l) Special requirements for the water body:

(i) Water depth conditions. – Discuss the required water depth conditions and the ratios of those conditions, such as the amount of shallow benches in relation to deep water that is desired. Give amounts of each water depth desired, specifically shallow benches, intermediate benches, and deep water; and the depth of water in inches or feet required for each condition. Include a minimum required amount of water access for waterfowl, in linear feet.

(ii) Islands. – Discuss whether islands are desired and the purpose for them. Include the required shoreline configuration of the landform to support those uses, such as shallow benches, etc. Include the total acres desired to be designated to islands.

(m) Operating and maintenance data requirements:

(i) Anticipated adaptive management requirements if any.

(ii) Self sustainability requirements – Minimum or no maintenance requirements.

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

(iv) Standards by which to measure progress.

(v) Vehicle or boat access requirements for maintenance.

(vi) Need for installed maintenance and handling facilities.

(vii) Facilities required to facilitate monitoring.

(viii) Availability of or need for permanent buildings for operating personnel.

(4) **Post Construction Evaluation and Monitoring Requirements:**

(a) Baseline standards for evaluation.

(b) Organization responsible for follow-up action if required.

B. **Coordination Requirements:**

(1) Coordination/input requirements from other government and nongovernmental organizations and agencies. Identify agencies and organizations which will have input into the design, construction, and operation of the wetland. The roles and responsibilities of each party should be clearly defined.

(2) Identify any "land use agreements", or similar mechanisms which secure short- or long-term commitments by the parties to manage the site for a set of established objectives. This should include issues related to water rights/entitlements which are anticipated for the management and operation of the wetland system.

C. **Specific Wetlands Project Considerations and Parameters:**

(1) **Historic and Existing Site Conditions:**

(a) For projects where it is desired to simulate prior conditions, it is necessary to determine the historic time and conditions that are desired and feasible to simulate.

(b) Old maps.

(c) Interviews with residents.

(d) Old photographs of the wetlands area.

(e) Existing wetlands site and area vegetation:

(i) Narrative description of existing site vegetation.

(ii) Dominant plant associations (group of plants that are common and growing on the site).

(iii) Describe endangered plant species growing on the site including where they are located.

(iv) A brief listing of the area's native tree, shrub, forb (a flowering plant, with a non-woody stem, that is not grass), and grass species growing locally.

(v) Identify trees/vegetation which may or may not be removed.

(vi) Habitat survey:

- Community type.
- Surface cover.

(f) Wildlife uses of the site:

(i) Include the animals targeted for use and their specific needs and uses for the site, including feeding, cover, loafing, nesting, etc. Include the specific predator-prey relationships and how that influences design requirements such as the need for islands or specific landform types.

(ii) Is the site critical habitat for any endangered species? If so when and how do the endangered species use the site?

(g) Land use survey of upland areas, areas adjacent to the wetlands site, and the wetlands site.

(h) Soils:

(i) Provide published soil surveys by county, state, National Resources Conservation Service or others. Surveys may indicate soil types (sand, loam, clay, etc.), texture, and use (rangeland, agriculture, etc.).

(ii) Discuss the availability of topsoil either at the site or locally.

(iii) Discuss the moisture holding capacity, salinity, herbicides, plant disease organisms, or other problems with the soils.

(iv) If the wetland will be constructed from dry land, what is the availability of topsoil, either on site or locally? Typically the top six inches of soil over an area that will be cut or filled would be stripped, stockpiled, and spread back over new contours to create the final grade.

(v) Soil chemical properties related to plant growth for revegetation purposes:

- Results of a routine soil analysis performed by a professional soils testing laboratory, including recommendations for amending the soil for desired plant types to be grown. The analysis report giving values for soil texture, pH, soluble salts, organic matter, amount of available nutrients, lime. Nutrient levels reported in parts per million of the elemental

nutrient. Additional tests for gypsum and sodium adsorption ration may be run.

- Presence of soil contaminants that could be toxic in high enough concentration, such as petroleum products or herbicides. Levels of heavy metals on land that has been mined.

(vi) Presence of plant or animal disease organisms.

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

Design data should include, as a minimum, 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 design. The following items should also be included in the design data:

(a) Cultural (historical, archeological, architectural, and paleontological) resources in the area of the construction.

(b) The need for blending structures with the surroundings.

(c) Comments on ecological, aesthetic, or other environmental aspects peculiar to this location which would affect layout or conceptual design.

(d) Problems with existing bank erosion.

(e) Erosion and sediment control requirements.

(f) Environmental permit requirements (Clean Water Act).

(g) Special environmental requirements for transmission lines or underground transmission systems.

(h) Location, volume, and contamination levels or any solid waste or hazardous waste facilities within the construction area.

(i) Provide data on the method(s) of brush and tree disposal permitted by local and State pollution regulatory agencies.

(j) Biological information requirements:

(i) Disease vector control considerations. Diseases may be carried by several animals most commonly mosquitoes. Discuss which disease vectors may be present and potential control measures such as:

- Water management – prevention of stagnant water
- Excavation depths
- Use of insecticides
- Timing of construction
- Other control measures

(ii) Potential invasive species which may damage the wetlands and or adjacent areas.

(iii) State anticipated impacts to threatened and endangered species and mitigation measures which can be taken to avoid/and or minimize these impacts. Emphasis should be placed on gathering, or planning for the collection of any data which will later be required to support necessary permit applications (including Ecological Society of America (ESA) consultations and Clean Water Act (CWA) section 404 permits).

(3) **Water Supply and Water Quality Factors:**

(a) Source of water for wetlands:

(i) Describe the source of water (river, reservoir, and ground water).

(ii) Is the source of water continuous or intermittent?

(iii) Will rainfall, river flows, or reservoir adequately supply water or will supplemental water be required?

(b) Rivers/streams – hydrologic data:

(i) Design floods and flood hydrographs. Normally a probability curve of flood peak discharges up to 100-year recurrence period will be sufficient.

(ii) Flood hydrographs for frequencies of 2, 5, 10, and 25 years for use during construction.

(iii) Monthly hydrographs for past 10 to 100 years.

(iv) Historical monthly flow averages. Include periods of expected no-flow or aquifer size and recharge rate monthly averages.

(c) River morphology:

(i) Water surface elevation curves, sedimentation studies, degradation and aggradation studies should be included. Water surface elevations should be determined for floods of 100-, 50-, 10-, 5-, and 2-year frequencies.

(ii) Potential impacts of the project that require design considerations, e.g., increased channel scour, and downstream channel protection, etc.

(iii) Anticipated future river channel improvement or other construction (upstream and downstream in the river) which might change regimen.

(iv) Data on upstream and downstream dams, diversions, pumping plants and reservoirs.

(d) Reservoirs:

(i) Maximum and minimum operating water surfaces.

(ii) Operating procedures.

(e) Anticipated occurrences and amounts of silt, sediments, biomass, ice (thickness) and drift (trash).

(f) Ground water:

(i) Describe and provide background data on ground water elevations over time period, including seasonal and over a long period of time.

(ii) Chemical composition (See table 1 for water quality monitoring parameters).

(iii) Recharge and percolation rates.

(g) Water quality:

(i) Existing water quality (see table 1 for water quality monitoring parameters).

(ii) Results of water quality studies carried out at or near the site.

(iii) Potential changes to land use which may affect water quality: industrial, residential, logging, mining, and agricultural.

(iv) Product water quality requirements (water treatment wetlands):

- Water quality requirements or standards which have to be met.
- Desired salinity of product water and limits on specific ion levels, if applicable.
- Consider potential impacts to the wetlands site, which may occur from surface water runoff originating form off-site sources, containing salts, fertilizers, oils, or any other non-point source of pollution.
- Screening requirements for potential contaminants which may impact the ability of the project to meet design and operating criteria, or pose potential hazards to wildlife or human health and safety.

(4) **Climate:**

(a) Climatic conditions that will affect construction and operation and maintenance procedures such as: amount, rate, and distribution of rain and/or snow; ice conditions; summer and winter temperatures, with extremes; and probability of excessive dust or sand.

(b) Number of days of frost in the area of the project site.

(c) Evaporation - Annual net evaporation rates and monthly distribution. Include average monthly wind velocities, extreme wind velocities and prevailing directions.

D. **Site Design and Construction Data:**

(1) **Surface Data Including Historic Conditions:**

(a) **Surveying:**

(i) **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.

(ii) Survey data should show existing facilities:

- Existing manmade site features such as roads, parking turnarounds, buildings, structures, power lines, buried tanks, campgrounds; leach fields, picnic areas, and marinas.
- Surface drainage features such as drainage from the approach roadways, streams, and ravines plus any existing bridges or culverts (include invert elevations) in close proximity.
- Site features which would be important design information such as, springs, marsh areas, overflow channels, channel changes, edge of water, high water marks, types of vegetative cover, large boulders, exposed bedrock, etc.
- Surface and underwater topography (bathymetric chart) (see subsection for “Topography”).
- Existing right-of way, easement and fencing. Give dimensions and bearings of the property lines and a dimensional tie to a known section corner as required.
- Township lines, range lines, and section lines.
- Show the direction of all transmission lines within the area.
- Indicate general drainage of the area.

(iii) Survey data should show the proposed features/facilities:

- Show locations and ties to all proposed facilities such as buildings, structures, powerlines, buried utility lines and tanks, picnic areas, marinas, sublaterals and deliveries, road crossings, railroad crossings and utility crossings.
- Grid coordinates for major structures such as pumping plants, flow control stations, tanks, reservoirs, etc.
- Proposed right-of-way and easement acquisitions and fencing.
- Geologic exploration holes.
- Location of river thalweg.
- Channel modifications.

(b) **Topographic Map.** A topographic map covering an area sufficient to accommodate all possible arrangements of structures and features; normally this should be on a scale of 1 inch equals 50 feet with a contour interval of 1 foot (wetlands are normally flat areas which require a small contour interval for design and construction). Show the coordinate system and existing land survey corner monuments or special control points established for the topographic survey. Show all manmade features in the included area.

Show underwater contours (bathymetric chart). Bythymetric survey should extend a minimum100 feet upstream, 100 feet downstream, and 100 feet beyond the ends of the wetlands. The area covered by the Bythymetric survey should be large enough to cover all alternative sites and site arrangements being evaluated.

(c) **Photographs -** Photographs of the sites are desirable, in color if available with proposed structures marked in ink.

(2) **Foundation Data**. Sufficient data on foundation conditions must be included to determine type of excavation materials that will be encountered. Logs of all auger holes and exploration pits will be included.

(a) Determine ground water conditions with attention being paid to water levels, occurrence of unconfined and confined aquifers, water-producing capabilities, and chemistry.

(b) Determine depth to impermeable layer.

(c) Determine soil percolation rates (exfiltration and infiltration).

(d) Provide logs of explorations.

(3) **Construction Materials Data:**

(a) Location of and distance to suitable borrow areas for permeable and impermeable soil materials for fill or embankment; topsoil; and for riprap for channel or slope protection.

(b) Information on concrete aggregates.

(c) Data on commercial concrete plants within practical hauling distance from the structure site.

(5) **Electrical Data:**

(a) Names, telephone numbers, email addresses and web sites of electrical power suppliers and contacts within those organizations.

(b) Location of point where connection to power supply will be made.

(c) System voltage at which power will be supplied, number of phases, and whether service will be overhead or underground.

(6) **Construction Considerations:**

(a) Allowable construction methods.

(b) Requirements for maintaining stream flow or diversions during construction and maximum length, time, and number of permitted interruptions.

(c) Comments on disposal of special excavation problem materials such as lignite.

(d) Measures which need to be taken prior to construction.

(e) Disposal areas for excess excavated materials.

(7) **Cost Data:**

(a) If potential actions exceed anticipated funding, should the cost estimate reflect incremental costs of potential actions? Provide any known increment or arrangement of the incremental costs.

(8) **Right-of-Way:**

(a) Proposed right-of-way boundaries for construction and access purposes (if required).

(b) Existing private or public easements and right-of-way across or adjacent to the construction area.

(9) **Miscellaneous Data:**

(a) Availability or accessibility of public facilities or utilities such as: water supply, sewage disposal, telephone utility, and fire protection services. Names telephone numbers, email addresses and web sites of local utilities and contacts within those organizations.

Table 1 – Water quality monitoring parameters

Water Quality Monitoring – Selected parameter groups			Technical Service Center, 86-68520 January 10, 2007	
Series		Symbol	Parameter	Description
A.	1. 2. 3. 4. 5.	Flow Rate (Q) Water Depth Air Temperature Atmos. Pressure Weather	stream gauge, weir, or flume field record or staff gauge field measurement field barometer reading filed note observations	Site flow and weather measurements
B.	1. 2. 3. 4.	Water Temp. DO pH EC	field measurement field Dissolved Oxygen field / lab pH meter units field / lab Specific Conductivity	Basic field or continuous monitoring methods
C.	1. 2. 3. 4. 5. 6. 7.	NO_3 + NO_2 as N NH_3 as N TKN as N SRP-PO_4 TDP TP Chlorophyll a	dissolved nitrate+nitrite (as N) total Ammonia (as N) total Kjeldahl Nitrogen soluble ortho-Phosphate total dissolved Phosphorus total (unfiltered), Phosphorus total - phytoplankton filter	Nutrients and algae growth indicators
D.	1. 2. 3. 4. 5. 6. 7.	Turbidity TSS VSS BOD_5 COD TOC DOC	Standard turbidity units Total Suspended Solids Volatile Solids, TSS Biochemical Oxygen Demand Chemical Oxidation Demand Total Organic Carbon Dissolved Organic Carbon	Organics and particulate matter indicators
E.	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13.	Alkalinity Carbonate Bicarbonate TDS Na K Ca Mg SO_4 Cl SiO_2 F B	meq CO_3+HCO_3 total CO_3 titration total HCO_3 titration total dissolved solids dissolved Sodium dissolved Potassium dissolved Calcium dissolved Magnesium dissolved Sulfate dissolved Chloride dissolved Silica dissolved Fluoride dissolved Boron	Major ions and inorganic chemistry parameters
F.	1. 2. 3.	Fecal Coliform Enterococci E. Coli	unfiltered, std. micro. test unfiltered, std. micro. test unfiltered, std. micro. test	Enteric bacteria indicators
G.	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.	Fe Mn Cu Ni Zn Cr Cd Pb Hg As Se	total Iron total Manganese total Copper total Nickel total Zinc total Chromium total Cadmium total Lead total Mercury total Arsenic total Selenium	Metals and trace elements
Notes: The parameters represent common water quality indicators. Actual monitoring should be adjusted to study objectives. Other methods may apply to specific site conditions or topics of interest. Refer to applicable sampling, preservation, analytical standard methods, and quality control procedures.				

DEFINITIONS

Basin – A drainage basin is a region of land where water from rain or snowmelt drains downhill into a body of water, such as a river, lake, dam, estuary, wetland, sea or ocean. The drainage basin includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels. The drainage basin acts like a funnel - collecting all the water within the area covered by the basin and channeling it into a waterway. Each drainage basin is separated topographically from adjacent basins by a ridge, hill or mountain, which is known as a water divide or a watershed.

Bog – A bog is a wetland type that accumulates acidic peat, a deposit of dead plant material.

Creation – Construction of a wetland in an area that was not a wetland in the recent past (within the last 100-200 years) and that is isolated from existing wetlands (i.e. not directly adjacent).

Enhancement – The modification of specific structural features of an existing wetland to increase one or more functions based on management objectives typically done by modifying site elevations or the portion of open water. Although this term implies gain or improvement, a positive change in one wetland function may negatively affect other wasteland functions.

Mitigation – Refers to the restoration, creation, or enhancement of wetlands to compensate for permitted wetland losses.

Establishment – The manipulation of the physical chemical or biological characteristics present to develop a wetland that did not previously exist.

Marsh – A marsh is a type of wetland, featuring grasses, rushes, reeds, typhas, sedges, cat tails, and other herbaceous plants (possibly with low-growing woody plants) in a context of shallow water. A marsh is different from a swamp, which is dominated by trees rather than grasses and low herbs. The water of a marsh can be fresh, brackish or saline.

Playas – Playa lakes are round hollows in the ground in the Southern High Plains of the United States. They are ephemeral, meaning that they are only present at certain times of the year.

Prairie potholes – Prairie potholes are depressional wetlands (primarily freshwater marshes) found most often in the Upper Midwest, especially North Dakota, South Dakota, Wisconsin, and Minnesota. This formerly glaciated landscape is pockmarked with an immense number of potholes, which fill with snowmelt and rain in the spring. Some prairie pothole marshes are temporary, while others may be essentially permanent. Here a pattern of rough concentric circles develops. Submerged and floating aquatic plants take over the deeper water in the middle of the pothole while bulrushes and cattails grow closer to shore. Wet, sedgy marshes lie next to the upland.

Protection/Maintenance – The removal of a threat to, or preventing decline of wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term preservation. Protection/Maintenance does not result in a gain of wetland acres or function.

Swamps – A wetland that features permanent inundation of large areas of land by shallow bodies of water, generally with a substantial number of hummocks, or dry-land protrusions. Swamps are usually regarded as including a large amount of woody vegetation. When a wetland area does not include such vegetation, it is usually termed a marsh.

Reallocation or replacement – Applies when most or all of a wetland is converted to a different type of wetland.

Restoration – The term indicates that degraded and destroyed natural wetland systems will be reestablished to sites where they once existed. But, what wetland ecosystems are we talking about? How far back in time should we go to find target ecosystems? Is establishing any type of wetland enough to be called "restoration"?

- **Re-establishment** – Restoration should reestablish insofar as possible the ecological integrity of degraded aquatic ecosystems

- **Rehabilitation** –The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function, but does not result in a gain in wetland acres.

- Guiding principles

    - Preserve and protect aquatic resources.

    - Restore ecological integrity – Restoration strives for the greatest progress toward ecological integrity achievable within the current limits of the water shed by using designs that favor the natural processes and communities that have sustained native ecosystems through time.

    - Restore natural structure – Restoring the original site morphology and other; physical attributes is essential to the success of other aspects of the project, such as improving water quality and binging back native biota.

    - Restore natural function – It is essential to identify what functions should be present and make missing or impaired functions priorities in the restoration. Verifying whether desired functions have been reestablished can be a good way to determine whether the restoration project has succeeded.

    - Broader context – Requires a design based on the entire watershed.

- Natural potential of the watershed – requires knowledge of historical range of conditions that existed on the site prior to degradation and what future conditions might be.
- Ongoing causes of degradation – identify the causes of degradation and eliminate or remediate ongoing stresses wherever possible. It is important to look at upstream and up-slope activities.
- Develop clear and achievable measurable goals.
- Anticipate future changes.
- Design for self-sustainability.
- Use passive restoration when appropriate – i.e., simply reducing or eliminating the sources of degradation and allowing recovery time. Restoring the hydrologic regime may be enough to let time reestablish the native plant community, with its associated habitat value. Relies on natural processes. Over time.
- Restore native species and avoid non-native species.
- Use natural fixes and bioengineering techniques, where possible – create wetlands to treat storm water, to restore vegetation on river banks, to enhance natural decontamination of runoff.
- Monitor and adapt -

Vernal pools – A vernal pool is usually a shallow, natural depression in level ground, with no permanent above-ground outlet, that holds water seasonally. They could colloquially be referred to as temporary wetlands. In the northeast United States (Maine, Massachusetts, and perhaps others) vernal pools fill with the rising water table or with the melt water and rain of spring. Many vernal pools in the northeast are covered with ice in the winter.

17. Bridges. 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 data and information are required for feasibility design of vehicular bridges. This document can be used to request design data for railroad and pedestrian bridges along with buried box, round, or arch culverts to be constructed under roadways. These buried structures qualify as bridges under the American Association of State Highway and Transportation Officials (AASHTO).

AASHTO's definition of a bridge is as follows: "a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening."

A. **General Map Showing:**

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

(2) A legend of symbols used for existing and constructed facilities.

(3) The location of the structure site, alignment of the roadway, highway, access road or railway.

(4) Existing towns, highways, roads, railroads, public utilities, transmission lines, substations, canals, dams, rivers and streams, stream-gauging stations, county, township, range, and section lines.

(5) Locations of potential construction and permanent access roads, detour routes and major crossings.

(6) Locations of borrow areas for natural construction materials, location of commercial quarries, and disposal areas for waste excavation.

(7) Existing or potential areas or features having a bearing on the design, construction, possible use and future maintenance of the proposed bridge such as: recreation areas, fish and wildlife areas, building areas, and areas of archeological, historical and mining or paleontological interest.

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

(1) **General Engineering Requirements.** There should be a narrative of the project area, which includes a brief description of the surrounding area,

the size of the nearest population centers, the condition of bridges and other structures and roads. This description shall include the following (if available):

(a) Location (structure name, structure number, state, county or route number, distance to nearest city or town, etc).

(b) Project description (new structure, replacement, or modification required due to necessary improvements, etc.).

(c) Site description (information relating to access for possible site visit by the design team, access for foundation exploration, and construction, and access limitations due to environmental restrictions, etc.).

(d) Weather and climate conditions that may affect design or construction (temperature extremes, local building code requirements for wind velocities, snow and ice loading, etc.).

(e) Utilities such as powerlines, waterlines, or telephone lines that require installation on the bridge superstructure or are in the vicinity and may be impacted by the project. Include names, telephone numbers, and internet and email addresses of the local utilities and names of contacts within their organization.

(f) Provide copies of relevant correspondence to and from stakeholders such as Federal, State or local agencies or private entities. These stakeholders input may have an impact in the design reviews or permitting process. Provide name of contact person, address, telephone number, internet and email address for potential direct contact by the design team.

(g) Provide copies of previous reports or studies that have been prepared by Reclamation or by others.

(h) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; and possible alternative means for delivering construction materials and equipment at the structure site.

(i) Local freight or trucking rates.

C. **Surface Data:**

(1) **Survey Control.** Survey control is required for all surveys including surveys associated with aerial topography. Show coordinate system and existing land survey monuments and special control points established for the survey. All preceding survey work and all subsequent survey work, including topography and location, and ground surface elevations of subsurface exploration, should be revised to conform with the permanent control system.

All points contained in the electronic files should have coordinates for northing and easting and values which correspond to the ground level elevations. Specify the vertical datum, such as National Geodetic Vertical Datum (NGVD), and the horizontal datum, such as the State Plane Coordinates (NAD83) along with epoch date.

Legends should show grid factors and reduction to sea level factor, or a combination of the two.

Feasibility phase: Tying to the State plane coordinate system or national coordinate system is recommended.

Specifications phase: Permanent horizontal and vertical survey control should be established at the earliest possible time. The coordinate system should be related to a State or national coordinate system.

(2) **Topographic Map.** When the horizontal alignment of the proposed bridge is known, the topographic map should embrace a minimum area of 100 feet upstream and 100 feet downstream and 100 feet beyond the ends of the structure. This area may have to be enlarged to cover any alternate alignments being evaluated or specific construction items such as cut and fill limits and channel modifications. Generally, both a map and an electronic file, in AutoCAD or compatible format, of the topography covering the structure site should be provided. The topographic map should be plotted to a scale of 1 inch equals 10 feet to 1 inch equals 20 feet with a maximum contour interval of 2-feet. Elsewhere, larger contour intervals may be acceptable. Details to be included are:

(a) Proposed bridge location.

(b) Locate and identify existing site features which would be important design information such as roads, parking, turnarounds, buildings, structures, power lines, buried utility lines, campgrounds, picnic areas, springs, marsh areas, overflow channels, channel changes, edge of water, high water marks, types of vegetative cover, large boulders, exposed rock, etc.

(c) Existing right-of-way and proposed acquisition of additional right-of-way should be discussed.

(d) Provide a profile along the existing or proposed road centerline extending at least 500 feet beyond the ends of the bridge. The profile should be plotted to a horizontal scale of 1 inch equals 20 feet. Indicate recommended grade; elevations of extreme low, present and extreme high water; elevations of the stream bottom in the vicinity of the proposed piers or abutments; and type of foundation material underlying the substructure locations.

(3) **Photographs.** Digital color photographs of all existing facilities or structures in the vicinity of the proposed bridge site with close-up views of any features which may affect designs. These photographs should be taken to best show the proposed structure and, if possible, indicate known tie points to the topographic maps.

D. **Foundation Investigation Data:**

(1) **General Engineering Requirements.** The need for foundation data should be established by originating office personnel with assistance from the region and TSC representatives. For major bridge structures and unusual or difficult road alignments, it is recommended that an onsite inspection and a field conference be held.

(2) **Geologic Data.** The amount and detail of foundation data required for a feasibility design will vary greatly because of the wide range of size and complexity encountered in bridge design. The guiding criteria should be to provide sufficient data to allow the designer to determine the type of foundation required for the structure and to identify major foundation problems. Adequate foundation data may be obtained for small structures from an inspection of surface conditions and one or two exploratory holes or test pits to determine type of overburden and foundation conditions some distance below the base of the structure. These data, and any other data in the following paragraph that are relevant, along with a brief description of geologic conditions of the site, can be included in the design data.

For larger and more complex structures, a more comprehensive geologic program will be required, including a geologic report. For structures of this magnitude, a field conference should be held, including an inspection of the site to determine the geologic investigations program. In developing the geologic program and in preparing the geologic report, the following should be considered.

(a) A resume of the regional geology.

(b) 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.

(c) A surface geologic map of the bridge site, plotted on the topographic map of the bridge site, showing surface geology and the location of geologic sections, soil profiles, and of all subsurface explorations, including coordinates or stationing.

(d) A description and interpretation of site geology including physical quality and geologic structure of the foundation strata, seasonal ground water, ground subsidence, existing and potential landslide, snowslide and rock fall areas, surface water runoff; and engineering geologic interpretations as appropriate.

(e) Geologic logs of all subsurface exploration.

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

- A classification, in accordance with the Unified Soil Classification System, of the soil in each major stratum.
- A description of the undisturbed state of the soil in each major stratum.
- A delineation of the lateral extent and thickness of critical, competent, poor, or potentially unstable strata, in foundations and excavation slopes, especially those to be permanently exposed.
- An estimate or a determination by tests of the significant engineering properties of the strata, such as density, permeability, shear strength, 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

(g) Digital color photographs of pertinent geologic and topographic features of the terrain.

(h) Samples of foundation strata as needed for visual examination or laboratory testing. Test pits and results of material testing should be included.

(i) A determination of natural ground water conditions at the site.

E. **Hydrologic Data (Required for bridges crossing rivers and streams):**

(1) Annual periodic fluctuations of stream or river water levels.

(2) Drainage area located upstream of the bridge site.

(3) Anticipated occurrence and amounts of sediment, ice (thickness), and drift (trash).

(4) Erosion protection requirements and calculated scour depths, which will be used for support structure foundation design.

F. **Design Standards:** For vehicular bridges, the design code is the American Association of State Highways and Transportation Officials (AASHTO) Load and Resistance Factor Design Specifications published by AASHTO.

G. **User and Operating Data:**

(1) For road and highways:

(a) Number of traffic lanes, including shoulders.

(b) Pedestrian sidewalk requirements.

(c) Typical roadway cross section.

(d) Deck protection or rehabilitation.

(e) Existing cross drainage structures located within the proposed construction site, including hydraulic requirements.

(2) For railroad bridges:

(a) Track classification, type of service, design load limits, typical roadbed section.

H. **Construction Materials Data Including:**

(1) Inventory of available borrow areas for permeable and impermeable soil materials required for fill or embankment; distance to quarry or stockpile for riprap required for channel or slope protection.

(2) Information on concrete aggregates. (See “Final Investigations” in the *Concrete Manual*.)

(3) Data on commercial concrete and precast concrete plants within practical hauling distance from the bridge site.

(4) Results of sampling and analysis of materials, including previous tests conducted at the Technical Service Center (TSC).

(5) Information, including catalogues, on firms within practical hauling distance from the bridge site which manufacture precast concrete products such as beams and piles.

I. **Cost Data:**

(1) Estimate of cost of right-of-way or easements. Include supporting data.

(2) Estimates of cost for relocating public utilities within the construction area.

(3) Estimates of cost for removal of buildings and other structures within the construction area.

(4) Provide any pertinent cost estimates or information that has been prepared or obtained by Reclamation or the owner.

J. **Environmental Considerations.** Implementation of design features should be consistent with the environmental commitments listed in the project's 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, 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 railroad or highway relocation, an access road alignment, or a bridge structural design. The following items should also be considered in preparing design data:

(1) Cultural (historical, archeological, architectural, and paleontological) resources along or adjacent to any potential alignment.

(2) The need for blending the bridge structure with the surroundings and the need for restoring and for reseeding cuts and fills.

(3) Comment on any ecological, aesthetic, or other environmental aspects peculiar to this location which would affect the bridge layout or roadway approaches.

(4) Furnish data on allowable noise limits in the vicinity of the proposed bridge where fixed by law or local ordinance, or where otherwise considered necessary or advisable; measurements of existing daytime and nighttime ambient noise levels in the area; and distances to the nearest residential units.

(5) Identify special environmental compliance requirements including water quality standards such as suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction.

(6) Background on the need for fish protection and passage during construction at stream crossings.

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

(8) Any threatened and/or endangered critical habitat in/or adjacent to the potential alignments.

(9) Wildlife, wetlands, required environmental permits, construction window, traffic restrictions, and detour requirements.

(10) Erosion and sediment control.

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

(12) Review of designs by other agencies.

(13) Railroad, highway, or access road clearing plan to consider fish and wildlife requirements.

(14) Anticipated public use of Reclamation access roads.

(15) Applicable permits and monitoring requirements.

K. **Site Security.** 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.

18. Removal of Dams and Hydroelectric Facilities. 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 design data collection section has not been prepared for these features. Until a section is prepared, the following reference should be used, *Guidelines for Retirement of Dams and Hydroelectric Facilities*, Task Committee on Guidelines for Retirement of Dams and Hydroelectric Facilities, American Society of Civil Engineers (1997)).

19. Water Treatment Plants. 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 feasibility design of water treatment facilities. The size and complexity of the process system and structures should govern the amount and detail of the design data required.

A. **General Map Showing:**

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

(2) The plant site and other applicable construction areas.

(3) Existing towns, highways, roads, railroads, public utilities, streams, stream-gauging station, canals, drainage channels, townships, range, and section lines.

(4) Locations of construction access roads, permanent roads, and sites for required construction facilities.

(5) Sources of natural construction materials and disposal areas for waste material, including the extent of mitigation required.

(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) Water sources to be treated such as surface water or underground water.

(8) Brine disposal ponds

(a) Location of potential sites for brine disposal ponds.

(b) Location of channels and storage sites for brines, sludge, and chemicals.

(c) Disposal areas for pond residue waste material.

(9) Scale of the general map should be adequate to clearly show listed details.

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

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

(2) Availability of housing and 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, telephone, and electric power for construction.

(4) Climatic conditions that will affect operation and maintenance and construction procedures such as: amount, rate, and distribution of rain and/or snow; ice conditions; frost depth; monthly maximum and minimum (or at least summer and winter) temperatures, and relative humidity; and extreme wind velocities and prevailing directions. (Extensive tabulations are not necessary.)

(5) Copies of existing planning or assessment reports.

(6) Permits or permit requirements and any past permit violations or exceedences.

C. **Surface Data:**

(1) **Survey Control**. Permanent horizontal and vertical survey control should be established at the earliest possible time. A coordinate system on a true north-south grid should be established with the origin located so that all of the features (including borrow areas) at a major structure will be in one quadrant, and so that the values of the coordinates for any major structure are widely separated numerically. The coordinate system should be related to a State or national coordinate system, if available. All preceding survey work, including topography and location and ground surface elevation of subsurface exploration, should be corrected to agree with the permanent control system; and all subsequent survey work, including location and ground surface elevation of subsurface exploration, should be based on the permanent control.

All line surveys should be tied to the established coordinate system at each plant site.

(2) **Topographic Map.** A topographic map covering an area sufficient to include all practical arrangements of the facilities including intake, product and reject lines, brine ponds, switchyard or substation, service area, sludge disposal area, trash disposal area, and visitor facilities. Show all manmade features in the included area on the map. A scale of 1 inch equals 50 feet with a 2-foot contour interval is suitable for most structures. The scale, contour interval, and detail should be based on the conditions and need at each particular site.

(3) **Photographs**. Photographs of the sites are desirable, with proposed structures marked in ink.

D. **Foundation Data**.

The amount and detail of foundation data required for a feasibility design will vary. The guiding criteria should be to provide sufficient data to allow the designer to determine the type of foundation required for the structures and to identify major foundation problems. Adequate foundation data may be obtained for small structures from an inspection of surface conditions and one or two exploratory holes to determine type of overburden and foundation conditions some distance below the base of the structure. These data, and any other data in the following paragraph that are relevant, along with a brief description of geologic conditions of the site, can be included in the design data.

A geologic report shall be prepared and a field conference should be held, including an inspection of the site to determine the geologic investigations program. In developing the geologic program and in preparing the geologic report, the following should be considered:

(1) A description of regional geology.

(2) A description and interpretation of site geology "including physical quality and geologic structure of the foundation strata, ground water and seismic conditions, existing and potential slide areas, and engineering geologic interpretations as appropriate."

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

(4) 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.

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

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

(7) A determination of natural ground water conditions at the site.

(8) Overburden soils (see *Earth Manual*). Note geologic sections and soil profiles in (5) above.

(a) A classification, in accordance with the Unified Classification System of the soil in each major stratum.

(b) A description of the undisturbed state of the soil in each major stratum.

(c) A delineation of the lateral extent and thickness of critical, competent, poor, or potentially unstable strata in foundations and excavation slopes, especially those to be permanently exposed.

(d) An estimate or a determination by limited test of the significant engineering properties of the strata, such as density, permeability, shear strength, and consolidation or expansive characteristics, and the effect of structure load, changes in moisture, and fluctuations of permanent rise of ground water on these properties.

(9) **Bedrock.** Note geologic sections and soil profiles in (5) above.

(a) A description of the contour of bedrock surface; thickness of weathered, altered, or otherwise softened zones; and other structural weaknesses and discontinuities.

(b) A delineation of structurally weak, pervious, and potentially unstable zones and strata of soft rock and/or soil in foundation or excavation slopes, especially those to be permanently exposed.

(c) A determination by limited tests of the significant engineering properties of the bedrock such as density, absorption, permeability, shear strength, and strain characteristics; and the effect of structure load, changes in moisture, and fluctuations or permanent rise of ground water on these properties.

(10) Brine disposal ponds

(a) Excavation, fill and slope lines for ponds

(b) Special problems such as possible ground water contamination and regulations governing seepage losses should be addressed.

(c) Major soil types should be identified including significant factors such as expansive and low-density soils, dispersive soils, and rock. Material tests should be performed as required to identify problem soils.

(d) Water table elevation

(e) Lining recommendations. See *Brine Disposal Pond Manual*.

E. **Construction Materials Including:**

(1) Location and distance to suitable borrow material for pervious and impervious backfill and embankments and riprap material.

(2) Sources of concrete aggregate.

(3) Data on commercial concrete plants in the area.

F. **Hydrologic Data:**

(1) Description of feed water source (surface water, ground water, drains, wells, wastewater, partially treated wastewater, etc.).

(2) Monthly periodic fluctuations of feed water flows shown by tables or charts summarizing operation studies for normal and minimum and maximum periods. Include periods of expected no-flow or aquifer size and recharge rate monthly averages.

(3) Maximum, maximum and minimum operating water surface elevations; flood flows; average flow. For under ground sources, include expected drawdown during pumping as a function of pumping rate.

(4) Recommend minimum trashrack or gate deck elevation.

(5) Anticipated occurrence and amounts of silt, sediments, biomass, ice (thickness) and drift (trash), and possible effect on feedwater source outlets to pretreatment plants or inlets to desalting plants.

(6) Potential location for and volume of reservoir's) suitable for leveling of daily or annual fluctuation in flow or salinity of water source.

(7) Where unwatering of a plant site adjacent to a stream or lake is required, give maximum water levels expected during the construction period and the possibility of controlling water levels by operation of upstream or downstream facilities.

(8) Determine composition of feed water; see table 1 at the end of this section.

(9) For brine disposal ponds obtain flood frequency flows for major surface channels.

G. **Operating and Maintenance Data**.

(1) Product water data to include the following:

(a) Desired salinity and pH of product water and limits on specific ion levels, if applicable.

(b) Desired percent of water recovery.

(c) Proposed initial and ultimate plant capacity.

(d) Desired use and projected quantity of product water delivery on demand basis or minimum delivery required over useful plant life.

(e) Maximum acceptable cost of product water, dollars per thousand gallons.

(2) Current estimated dollar value of:

(a) Product water.

(b) Salt removed.

(c) Water to replace reject.

(3) The availability and cost of possible energy sources:

(a) Electrical.

- Location and direction of existing or proposed incoming powerlines terminating at site.
- Source and voltage of incoming power. Name of agency or utility supplying power, limitation on motor starting voltage drops and number of starts, power factor limitation, and distance to source.
- If a switchyard is required, refer to Section 10, "Switchyards and Substations."

(b) Fossil fuel.

(c) Solar, geothermal, wind, other.

(4) Disposal sites for:

(a) Plant reject flow.

(b) Debris, biomass, sediment, and sludge.

(c) Spent chemicals from pretreatment and desalting cleaning and storage solutions.

(d) The suggested disposal sites should be able to meet requirements of either State or the U.S. Environmental Protection Agency for discharge of pollutants.

(5) Nature of operation, i.e., whether attended, semiautomatic, fully automatic, or supervisory controlled. If supervisory controlled, give location of master station.

(6) Flow, pressure, or other parameters and measurement accuracy requirements.

(7) Availability, cost, and method of shipment of treatment chemicals, such as:

(a) Lime, CaO, and $Ca(OH)_2$.

(b) Soda ash, Na_2CO_3.

(c) Ferric sulfate.

(d) Chlorine.

(e) Carbon dioxide.

(f) Sulfuric acid, H_2SO_4.

(g) Sodium hexametaphosphate.

(h) Others.

(8) For brine disposal ponds:

(a) Source and quantity of water.

(b) Water surface elevations and capacity at the inlet control.

(c) Annual net evaporation rates and monthly distribution.

(d) Average monthly wind velocities and prevailing direction.

(e) Plan of operation for disposal pond controls including extent of supervisory control.

(f) Provisions for surface drainage in the area of disposal ponds.

(g) Provisions for cleaning ponds and delineation of disposal areas for residue from ponds.

(h) Possible utilization of residue from ponds such as reclaiming chemicals, etc.

(i) Evaporation enhancement programs to be considered such as spray or dyes.

(9) Location of nearest railroad spur.

(10) If recalcination is to be considered provide information for determining the feasibility of recalcination, such as environmental factors and market potential for excess lime.

(11) Market potential for treatment by products such as sludge or brine.

(12) Regional comprehensive operating scheme, including possible integration with any existing scheme.

(13) Recommendation for a major or minor machine shop or service area in the plant.

(14) Recommendation for maintenance facilities in the plant.

(15) Recommendations concerning whether the plant should be indoors or outdoors.

H. **Environmental Considerations**. Design data should include, as a minimum, a brief description of the environment that could be affected by the proposed development. The emphasis should be on those areas in the range of alternatives open to the designers in developing a process and plant design. The following items should also be considered in preparing design data:

(1) Historical and archeological values.

(2) Recommendations for maintenance of water quality standards including:

(a) Suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction; also requirements for multilevel intakes.

(b) Post treatment requirements for pH and limitations on chemical constituents for the desalting plant product water and brine reject.

(c) Published guidelines and regulations for air and water quality standards.

(3) Background on the need for fish facilities, fishways, and barriers.

(4) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.

(5) Erosion and sediment control.

(6) The need for blending structures with the surroundings, including placing transmission circuits underground.

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

(8) Anticipated public use around the structure.

(9) Recommendations for landscaping and source of irrigation water.

(10) Brine disposal ponds.

(a) The environmental setting.

(b) Photographs.

(c) The need for escape structures and/or protective fences for human beings, deer, or other wildlife.

(d) Any laws or regulations that pertain to seepage of ground water or disposal of residue from ponds.

(e) Local effects of increased humidity due to evaporation.

I. Site Security:

(1) Security requirements for protection of plant and equipment from vandalism or sabotage.

(2) 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.

J. Coordination with Other Agencies:

(1) List of agencies and organizations outside of Reclamation which will have design and construction requirements inputs. Also, give names of contact persons, mailing addresses, telephone numbers, email addresses, and web sites.

(2) Design requirements.

(3) Review requirements.

K. Miscellaneous Data:

(1) Recommendations for visitor facilities.

Table 2 – Feedwater quality data requirements

Parameter	Units
Total Hardness as $CaCO_3$	mg/L
Calcium (Ca^{+2})	mg/L
Magnesium (Mg^{+2})	mg/L
Sodium (Na^{+})	mg/L
Potassium (k^{+})	mg/L
Total Cations	meq/L
Total Alkalinity as $CaCO_3$	mg/L
Carbonate (CO_3^{-2})	mg/L
Bicarbonate (HCO_3^{-})	mg/L
Sulfate (SO_4^{-2})	mg/L
Fluoride (F^{-})	mg/L
Chloride (Cl^{-})	mg/L
Nitrate (NO^{-3})	mg/L
Phosphate (PO_4^{-3})	mg/L
Total Anions	meq/L
Aluminum (Al^{+3})	mg/L
Barium (Ba^{+2})	mg/L
Copper (Cu^{+2})	mg/L
Iron (Total)	mg/L
Iron (Dissolved-Fe^{+2})	mg/L
Manganese (Total)	mg/L
Manganese (Dissolved-Mn^{+2})	mg/L
Arsenic (As^{+3})	µg/L
Selenium (Total)	mg/L
Selenium (Dissolved-Se^{-2})	µg/L
Strontium (Sr^{+2})	mg/L
Dissolved Oxygen (O_2)	mg/L
Hydrogen Sulfide/Sulfide	mg/L
Total Suspended Solids	mg/L
Silica (SiO_2)	mg/L
Specific Conductivity	µohm/cm
Total Dissolved Solids (TDS, Evap @ 180 ^{o}C)	mg/L
Total Organic Carbon	mg/L
Temperature	^{o}C
Turbidity	NTU
pH	Unitless

Notes: Monthly minimums, maximums and average concentrations of the above parameters for 12 consecutive months is ideal. May need bacteriological (cryptosporidium, giardia, e-coli) data. May need PAH's, HAA's, or TTHM data.