Reclamation Manual
Design Data Collection Guidelines
Chapter 7 – Generic Sections

This chapter presents an alternative method for preparing a design data request. In this chapter, the design data collection guidelines are organized by comprehensive presentation of several items (general description, general map, etc.) which are common to many features, rather than by feature (dam, powerplant, etc.). This method may help in preparing the design data collection request when multiple features are involved in the project. The "generic" sections cover design data requirements common to all Reclamation projects. To complete a design data package, the "generic" sections must be used along with design data collection requirements specific to each feature (dams, powerplants, pumping plants, etc.)

The Introduction (chapter 1) for these design data collection guidelines contains additional information on preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal.

The size and complexity of the structure should govern the amount and detail of the design data required. A significant amount of design data prepared for previous studies may be available and should be used for the design. A feasibility report requires sufficient information to determine, with reasonable assurance, that the project will be successful and able to fulfill the repayment contract. For feasibility designs, funding for design data collection is often limited; the critical design data items should be determined and receive maximum attention.

Specification design requires, as a minimum, the same type of basic data as feasibility design. The data are brought up to date and will be addressed in more detail or more extensively.

Communication between designers and project personnel is essential to produce adequate design data. The Project Team and the Design Team will review the data used for authorization and the changes that have occurred since that time, the feature site selected, and the choice of structure type. They will then recommend a design data collection program to the design office and an estimated schedule.

The project team and design team should review these guidelines to determine and assemble the final data request for a specific project. The following is a list of possible "generic" data sections required for specifications design of the Bureau of Reclamation (Reclamation) facilities.

1. Project Overview
2. General Map(s)
3. General Description of Local Conditions
4. Surveying
5. Topographic Maps
6. Photographs

7. Drawings
    - Location maps
    - Plan and profile drawings
    - Site plans
8. Existing Facilities
9. Corrosion Survey
10. Construction Materials
11. Electrical Data
12. Cost Data for Field Cost Estimate
13. Environmental Data
14. Site Security and Public and Worker Safety
15. Mechanical and Hydraulic Equipment
16. Right-of-Way and Easements
17. Hydrology and River Morphology Data
18. Construction Considerations
19. Operating and Maintenance Data

1. Project Overview

A. For feasibility and specifications designs, provide a general description of the project and goals. The narrative should include the following:

(1) Project location.

(2) Project water source(s).

(3) Project goals such as water supply for municipal or irrigation demand, power production, rehabilitation of existing facilities, and improvement or expansion of existing facilities.

(4) Project schedule.

(5) Main features of project such as dams, pumping plants, fish facilities, canals, pipelines, and bridges.

(6) Design flows, reservoir capacity, water surface elevations, power production, and water storage requirements.

(7) Environmental considerations and anticipated environmental effects of the project.

(8) Functional, environmental, and aesthetical relationship between the proposed facilities and other similar facilities in the area.

B. Provide copies of previous studies that have been prepared by Reclamation or by others.

C. Provide a copy of any county or city development Master Plan, if available, along with any codes and regulation for development of land.

D. Provide copies of relevant correspondence to and from stakeholders such as Federal, State, or local agencies or private entities. Input from these stakeholders may have an impact in the design reviews or permitting process. Provide name of contact person, address, telephone number, Web site address, and email address for potential direct contact by the design team.

2. 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:

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

B. A legend of symbols used for existing and constructed facilities.

C. North arrow.

D. 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):

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

(2) 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.

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

(4) Areas of environmental concern.

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

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

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

E. Rights-of-way:

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

(2) Land ownership boundaries and legal jurisdictions. Indicate ownership by agency acronym or private land with “private.”

F. The proposed structures and features:

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

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

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

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

(5) Sources of water for construction.

(6) Recreational facilities:

(a) Any other recreation areas in the general vicinity and facilities available there.

(7) Wetlands:

(a) Reference sites (an existing wetlands site which is being used as a design basis for the proposed wetlands site) if used.

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

A. 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.

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

C. Permits or permit requirements and any past permit violations or exceedences.

D. Name and description of similar construction in the area or region.

E. 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.

F. 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).

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

G. 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. For concrete storage dams, daily readings of maximum, minimum, and mean temperatures of air and river water. Until a weather station is established, temperatures should be obtained whenever possible. Date, time of day, and corresponding air and water temperatures should be recorded.

H. Local frost depths.

I. Ground water presence and depths.

J. Vegetation to be cleared or preserved including kinds, sizes, and density of growth.

K. Road detour requirements.

L. Bridges and roads.

(1) 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) For bridges crossing rivers or streams, describe waterway condition that may affect design, construction, and O&M procedures.

(c) Detour requirements and how construction may be staged.

4. Surveying

A. **General.** Surveys are used to gather data critical (particularly for feasibility and specifications design levels) to the design and evaluation of the project and to create drawings and maps. Surveys provide data regarding existing features (topography, drainage, etc.), existing structures, utilities, and ties to the desired coordinate system. The design and project teams should determine data required to be shown on the maps and drawings. If existing maps are used, they should be reviewed for adequacy and accuracy.

Surveying is most often not required for an appraisal design. Existing survey information and data are typically used.

Surveys may be required for feasibility designs when:

(1) Existing drawings are required to be updated with additional data.

(2) Existing maps/drawings are unavailable or unsuitable:

(a) Existing maps (surveyed drawings or U.S. Geological Survey (USGS) topographic maps) do not adequately show existing features (i.e., fences, ditches, utilities, right-of-way, etc.). USGS maps may have up to +/- 40 feet vertical inaccuracies.

(b) Existing drawings do not adequately show topography; for example, relief is extreme and/or a high level of accuracy is required for design studies but is not available on existing maps.

(c) Existing maps/drawings do not show entire area required for design.

(3) A tie to an existing coordinate system is required. Selection of the preferred and appropriate coordinate system should be coordinated between the design team and client office. (See "Survey Control" section.)

Site specific surveys are normally required for specifications designs since they require, for both design and construction, a high level of detail and accuracy.

B. **Acquisition of Survey Data.** Surveys may be performed by either ground forces or by aerial photogrammety or a combination of both. Aerial surveys are more common when surveys of large areas are required.

Electronic files developed by surveying should be submitted to the design office in the format used by the design office for Computer Aided Drafting (CAD) drawings.

C. **Survey Control.** 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 or national plane 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.

D. **Content.** The surveys should cover an area sufficient to show all the possible arrangements of proposed structures and features, as well as existing structures and features which may affect the project (see Section 2, "General Maps(s)," Section 5, "Topographic Maps," and Section 7, "Drawings" (location map, plan and profile drawings, and site plan)). Surveys should show content according to Reclamation drafting standards and should include the following data:

(1) **Existing Facilities:**

(a) Existing manmade site features such as roads, parking turnarounds, buildings, structures, power lines, buried tanks, campgrounds, leach fields, picnic areas, and marinas.

(b) Constructed surface drainage features such as drainage from the approach roadways, streams, and ravines, along with any existing bridges or culverts (include invert elevations) in close proximity.

(c) Naturally formed site features such as springs, marsh areas, overflow channels, channel changes, edge of water, high water marks, types of vegetative cover, large boulders, exposed bedrock, etc.

(d) Surface and underwater topography (bathymetric chart) (see Section 5, "Topographic maps").

(e) Water surface elevations on date of survey.

(f) Existing right-of-way and fencing. Give dimensions and bearings of the property lines and a dimensional tie to a known section corner.

(g) Township lines, range lines, and section lines.

(h) Alignment of all transmission lines and utilities within the area.

(2) **Proposed Features/Facilities:**

(a) Locations and ties to proposed facilities:

- Ties and stations for proposed facilities such as buildings, structures, power lines, 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.

(b) Proposed right-of-way acquisitions and fencing.

(c) Geologic exploration holes, test pits, trenches, etc.

(d) For power and pumping plants and water delivery facilities such as canals and pipelines, show:

- Hydraulic grade line in the source canal, reservoir, or pipeline. Also show data such as capacities, grades, etc.

- Proposed centerline location and stationing.

(e) For distribution systems, show ownerships, gross acreage, and irrigable acreage for each property; proposed delivery location and type; and delivery water surface elevation. The acreage information, delivery type, and delivery water surface elevation may be omitted from the maps if the information is submitted separately in tabular form.

(f) Drains:

- A rough depth-to-barrier map for areas where clays, shale, sandstone, or other low permeable materials occur at depths which will adversely affect drainage.

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

(g) Wetlands:

- A rough depth-to-barrier map for areas where clays, shale, sandstone, or other slowly permeable materials occur at depths which will adversely affect the wetland.

(h) Bridges:

- Provide a profile of the centerline of the river or stream bottom, where practical, for a minimum distance of 500 feet upstream and 500 feet downstream from the centerline of the proposed bridge structure. The profile should be plotted to a horizontal scale of 1 inch equals 50 feet and a vertical scale of 1 inch equals 10 feet.

- Provide at least four cross sections of the stream. Sections should be taken immediately upstream and downstream of the structure, and the other sections should be taken at each end of the stream profile. These cross sections should be typical of the stream. Indicate the elevations of low, present, and high water.

5. Topographic Maps

A. **General.** Topographic maps should cover an area that will accommodate all expected arrangements or alignments of facilities and rights-of-way (existing and proposed), existing facilities and areas which may affect design, cut and fill slopes, and areas concerning control and disposal of drainage at the site. In addition to the items listed under surveying, topographic maps should show the following:

(1) Underwater contours (bathymetric chart) for design of structures in and adjacent to a body of water such as dams, bridge piers and abutments; pumping plant intakes; powerplant tailrace areas; and river and outlet works features.

(a) Location of river thalweg.

(b) Channel modifications (existing and proposed).

(c) For bridges and other structures, topography should typically extend 100 feet upstream, 100 feet downstream, and 100 feet beyond the ends of the structure. However, the extent of topography will depend on the size and arrangement of all features and should be extensive enough to cover all alternative alignments being evaluated.

(2) Indicate general drainage of the vicinity.

(3) Critical spot elevations at edges and corners of existing structures, elevations along dropoffs, swales, and changes in topography.

B. **Horizontal Scale and Contour Interval.** The topographic data should allow the simple and direct creation of CAD model and drawing files with the horizontal scale and contour interval required for the designs. Tables 1 and 2 show horizontal scales and contour intervals that are commonly used by Reclamation for feasibility and specifications designs, respectively. Consideration should be given to acquiring the most stringent requirements at the feasibility stage in order to prevent duplicating the effort at specifications design.

Table 1. Specifications topography (horizontal scale and contour interval)

Item	Horizontal scale[1]	Contour interval (maximum)[1]
Large dams and large structures	1 inch = 100 feet	5 feet

Table 1. Specifications topography (horizontal scale and contour interval)

Item	Horizontal scale[1]	Contour interval (maximum)[1]
Moderate and small dams, tunnel portals, and structures (visitor centers, power and pumping plants, recreation facilities, general purpose buildings, switchyards, fish facilities, and major canal structures)	1 inch = 50 feet	2 feet
Large reservoirs	1 inch = 2,000 feet	10 feet
Small reservoirs	1 inch = 400 feet	5 feet
Small structures (small buildings and many pipeline and canal structures)	1 inch = 20 to 50 feet	2 feet
Tunnels[2,4]	1 inch = 400 feet for long tunnels 1 inch = 200 feet for short tunnels	5 feet
Drains	1 inch = 200 feet	2 feet
Canals[2,3,4,5]	1 inch = 200 feet (strip topography)	2 feet
Pipelines, pumping plant discharge lines[2,3,4]	1 inch = 100 to 400 feet (strip topography)	2 feet
Roads [2,4,5]	1 inch = 400 feet	2 feet
Bridges	1 inch= 20 feet	2 feet
Wetlands	1 inch = 50 feet	1 feet

[1] The scale, contour interval, and detail should be based on the conditions and needs at each particular site. Variations from scale or contour interval requirements in the table may be required (increases or decreases) to clearly show alignment, earthwork, delivery water surface elevations, and related details. The contour interval may be increased in steeper (hilly or mountainous) terrain. Smaller contour intervals may be more practical in flatter terrain. Also, if the project area is small or flat, a contour interval of 1 ft. may be desired. Where a 5-foot contour interval is not available it is suggested that topography be developed from aerial photography or some other method. Away from the structures, larger contour intervals may be acceptable.

[2] Topographic map or strip topography: Strip topography should consider width required for construction. Where strip topography is provided, separate topographic maps at structure sites may be required where large or complicated structures are planned, unusual conditions exist, or judgment dictates that more information will be required for review or design.

[3] Minimum strip width should be 200 feet for pipelines and canals.

[4] The scale of linear facilities, such as canals and pipelines, may be up to 1 inch equals 400 feet for large facilities or much smaller for small facilities.

[5] If necessary, topography for culverts under canals or other features can be augmented with sufficient data to show the requirements of allowable inlet pondage.

Table 2. Feasibility - topography (horizontal scale and contour interval)

Item	Horizontal scale[1]	Contour interval (maximum)[1]
Large dams and large structures	1 inch = 100 feet	5 feet
Moderate and small dams, tunnel portals, and structures (visitor centers, power and pumping plants, recreation facilities, general purpose buildings, switchyards, fish facilities, and major canal structures)	1 inch = 50 feet	2 feet
Large reservoirs	1 inch = 2,000 feet	10 feet
Small reservoirs	1 inch = 400 feet	5 feet
Tunnels[2,5]	USGS 7-1/2 minute quad sheets can be used	
Small structures (small buildings and many pipeline and canal structures)	1 inch = 20 to 50 feet	2 feet
Drains	USGS 7-1/2 minute quad sheet can be used	
Canals (strip topography)[3,4,5,6]	1 inch = 200 to 400 feet survey	2 feet
Pipelines and pumping plant discharge lines. Site topography or strip topography[3,5]	USGS 7-1/2 minute map or 1 inch = 100 to 400 feet survey	2 feet
Roads[3,5]	1 inch = 400 feet	2 feet
Bridges	1 inch = 20 to 50 feet for smaller areas	2 feet
Wetlands	1 inch = 50 feet	1 feet

[1] The scale, contour interval, and detail should be based on the conditions and need at each particular site. The contour interval may be increased in steeper (hilly or mountainous) terrain. Smaller contour intervals may be more practical in flatter terrain. Also, if the project area is small or flat, a contour interval of 1 ft. may be desired. Where a 5-foot contour interval is not available it is suggested that topography be developed from aerial photography or some other method. Away from the structures, larger contour intervals may be acceptable.

[2] Smaller scale maps of tunnel portal areas are useful if available. In the absence of portal area topography, photographs of the portal area will aid the designer in determining conditions and design problems.

[3] Use of site topography or strip topography - Strip topography should consider width required for construction. Where strip topography is provided, separate topographic maps at structure sites may be required where large or complicated structures are planned, unusual conditions exist or judgment dictates that more information will be required for review or design.

[4] Minimum strip width should be 200 feet for pipelines and canals.

[5] The scale of linear facilities such as canals and pipelines may be up to 1 in. equals 400 ft for large facilities or much smaller for small facilities.

[6] If necessary, topography for culverts under canals can be augmented with sufficient data to show the requirements of allowable inlet pondage

6. Photographs. Photographs are helpful and often necessary to determine suitable designs cost estimates, and monitoring for many types of facilities for both a feasibility design and a specifications design. Photographs should be submitted in the format agreed upon: prints, digital files, negatives, etc. If possible, prints should be 8 inches by 10 inches.

A. **Ground Level and/or Aerial Photographs:**

(1) **Feasibility and Specifications Design.** Ground level photographs are helpful for all facilities to be constructed. The photographs should show:

(a) Existing facilities or structures in the vicinity of the proposed facilities and closeup views of any features that may affect designs.

(b) Proposed structure/facility locations marked in ink.

(c) Areas that present any form of hazard or that may have restricted access before, during, or after construction.

(d) Location of possible access points to the site from existing routes.

(e) For buildings and other features where aesthetics are important:

- Favorable offsite views, which should be preserved and considered when locating and arranging buildings
- Unfavorable onsite features, which should be screened from view or otherwise considered when locating and arranging facilities

(f) Geology

- Representative or particular geologic conditions
- Photographs of sources for locally obtained construction materials

(g) Wetlands

- Historic photographs
- Existing wetlands within the general vicinity or reference wetlands

(h) Monitoring

- Photographs may be required for comparing how conditions change or do not change from the feasibility design (or earlier)

through post construction conditions for monitoring and evaluation programs.

B. **Aerial Photographs**

(1) **Feasibility Design.** Aerial photographs, if available, should be provided for design of large or special features.

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

(b) Transmission lines - Aerial photographs are desirable of major river and highway crossings.

(c) Recreational facilities - At a scale which allows discerning the nature of the vegetation.

(2) **Specifications Design.** Aerial photographs and orthophotos are normally required for the following features: large dams, significant bridge sites, powerplants and pumping plants, canals, pipelines, and roadway alignments. Oblique imagery as required for facilities requiring any type of architectural consideration or treatment (buildings, some dams, some bridges). The purpose of the oblique views is to permit early preparation of an artist's rendering and to permit a study of the aesthetical and environmental impact of the facilities. Later, such renderings or drawings may be included in specifications or for other purposes.

Where possible, indicate known tie points to the topographic maps.

These oblique imagery photographs should be taken from locations that would best show the proposed structure and from a vertical angle of approximately 20 to 30 degrees above the horizon. These photographs should be taken between 11 a.m. and 2 p.m., to avoid showing the principal area of the proposed structure in shadow.

In addition to items listed under feasibility design, aerial photographs should include:

(a) Mosaics of the proposed alignment of canals, pipelines and roads; and of major structure sites.

(b) Show river, highway, railroad and canal crossings.

(c) Unusual or problem topographic features.

C. **Satellite Photographs.** Commercially available material on the Internet and may be most useful for use on appraisal studies.

D. **Orthorectified Imagery.** Desired for contour overlay mapping, as it is distortion free.

7. Drawings. Drawings provided with the design data submittal should show both existing data and the proposed features and facilities. Section 4, "Surveying," and Section 5, "Topographic Maps" describe surveying requirements and existing and proposed features which should be shown on the drawings. The following drawings may be required: topographic maps, location maps, plan and profile drawings, and site plans. Topography and associated data may be shown on any of the drawings. Location maps normally show the layout of linear features (canals, pipelines, roads, etc.) at a scale of approximately 1 inch = 1,000 feet to 1 inch = 2,000 feet. Plan and profile drawings are also used to show linear features but show more detail at an enlarged scale (1 inch = 100 feet to 1 inch = 400 feet). Site plans show locations of specific structures at smaller scales of from 1 inch = 10 feet to 1 inch = 100 feet, depending on the size and type of feature. The scales may be adjusted to clearly show required data. The arrangement of all drawings should conform to requirements described in Reclamation Drafting Standards. The drawings should be prepared in digital electronic format suitable for feasibility or specifications use and with consideration for final CAD drawing production as required. The design team must determine drawing requirements based on the need to produce the design in the most effective and efficient method possible.

A. 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. 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 unless they are shown on other drawings.

(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 or density of the structures or other features is such that individual stationing and naming is impractical and/or a blowup at a larger scale may be included elsewhere on the drawing and referenced to its proper location, 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.

(3) **Wells:**

(a) Locations of the well site(s), transportation facilities, cultural facilities, and communities.

(4) **Transmission Lines:**

(a) Proposed alignments for any new transmission lines and alignments for existing transmission lines.

(b) Show terminal and intermediate substation locations.

(5) **Drains:**

(a) 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.

B. 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. 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.

(2) **Canals:**

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

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

(c) 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.

(3) **Pipelines:**

(a) 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.

(b) 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.

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

(4) **Drains:**

(a) The plan should depict location of drains, location and size of manholes, and drain stationing.

(b) Structures (including conduit size for siphons and culverts).

(c) Hydraulic properties (normally tabulated) by reaches of proposed section.

(d) Typical sections: Show proposed earthwork dimensions for open and closed drains. For concrete lined drains, detail views of the lining may be required for clarification.

(e) Areas where special construction effort is required.

(f) Profile: The profile should depict existing ground surface, bottom grade, water surface elevation, and section.

(5) **Transmission Lines:**

(a) Key map, and plan and profile sheets.

(b) Profile: The profile should show the existing ground surface.

(6) **Bridges:**

(a) Coordinate with the required cross section for roadways or railroads.

(b) Horizontal position of road centerline with complete curve information, right-of-way lines, existing road for 500 feet each way from points of intersection, and any survey ties.

(c) Location, type, and nominal dimensions of all required structures (bridges, culverts, etc.).

(d) Location of any existing intersecting facilities, watercourses, or other physical features affecting the new bridge.

(e) Location of protective ditches and dikes.

(f) Location of guardrails, guard posts, or delineators.

(g) For railroad bridges:

- Horizontal position of track centerline with complete curve and spiral information, right-of-way lines, existing track for 1,000 feet each way from points of connection, and any survey ties.
- Vertical position on track centerline of original ground line, new subgrade (with complete information on grades, elevations, and vertical curves), existing subgrade for 1,000 feet each way from points of connection, and any survey ties or datum equations.
- Location, type, and nominal dimensions of all required structures and operating facilities (bridges, culverts, ditches, passing tracks, sidings, motorcar setoffs, etc.).
- Location of protective ditches and dikes.
- Location and type of ROW fencing and gate.

(h) High water surface elevations

(i) Profile: Vertical position on road centerline of the original ground surface, new subgrade (with complete information on grades, elevations, and vertical curves), existing road surface for 500 feet each way from points of intersection, any datum equations, and utilities and other subsurface features where they cross the alignment.

C. Site Plans. The site plan normally shows all of the required design data discussed in Section 4, "Surveying" and Section 5, "Topographic Maps": the survey data, existing features, and proposed features.

8. Existing Facilities. When the project involves replacing an existing facility, incorporating an existing facility into the final project, modifying an existing facility, relying on an existing facility to facilitate construction or O&M, or working in the area of existing facilities, the design data collection should include pertinent information concerning the existing facilities. The data collection requirements are similar for both feasibility and specifications level designs.

A. List and describe existing facilities affected by the project or which will affect the project.

B. Latest drawings.

C. Location and condition of existing facilities.

D. Anticipated future use of existing facilities.

E. Structural capacity.

F. Flow capacity.

G. Power production or power usage.

H. O&M problems especially those that may affect the proposed facilities..

I. If existing facilities are to be removed, note how the existing facilities will be disposed of and environmental or other concerns with removing the facilities.

J. Hazardous materials that will require removal and disposal.

K. Operational data on upstream and downstream dams, diversions, pumping plants, and reservoirs. Discuss if dams appear to be hydraulically inadequate.

L. Existing or potential areas or features having a bearing on the design construction, operation, or management of the project feature such as:

(1) 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, National Park Service (NPS), or U.S. Fish and Wildlife Service (FWS).

(2) 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).

9. Corrosion Survey. Corrosion surveys are performed for the specifications design phase; however, they are not usually required for the feasibility design phase. Corrosion surveys are necessary to determine suitable material requirements and corrosion protection requirements.

A. In-situ electrical resistivity measurements of geologic materials in the area of construction. Additional measurements should be made in the areas where there is a pronounced change in type of geologic materials, drainage, and/or moisture conditions.

B. Performance history of construction materials that have been used in the area.

C. List of structures within ¼ mile of the vicinity of the proposed structure and appurtenant features. Determine if buried structures in the vicinity have cathodic protection and, if so, the type and location of the cathodic protection groundbed.

D. List location, output, and purpose of the direct-current sources in the earth situated within ¼ mile of the proposed structure and appurtenant features. If the purpose of the direct current is for cathodic protection, describe the structure protected and its location.

E. Information as to any unusual chemistry in the area from geologic materials, ground water, or manmade sources shall be gathered. In particular, analyze for pH, chlorides, and sulfates.

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

G. Pipelines: In order to determine corrosion mitigation measures for external surfaces, corrosivity surveys shall be performed on all projects where buried pipe options with ferrous materials are considered. This survey shall include information relating to the native corrosivity of the surroundings and to interfering direct current (DC) and alternating current (AC). The following determinations shall be included:

(1) In-situ electrical resistivity measurements in accordance with the 10-percent Soil Resistivity Method (see Technical Memorandum No. MERL-05-19) shall be made. Resistivity data are to be processed through an inversion program such as Resix-Plus (Interpex, Ltd.) or equivalent. The controlling 10-percent soil resistivity shall be determined following computer processing of the data.

(2) Road salt use is aggressive and shall be noted.

(3) Identify the location of any nearby high-voltage AC (HVAC) transmission lines running parallel or nearly parallel to the pipeline in question. If not

parallel, provide approximate angle of real or projected intersection between the pipeline and such electrical transmission lines. Determine:

(a) Distance from the pipeline to the nearest tower legs.

(b) Horizontal distance between the ground below the nearest load carrying conductors and the nearest pipeline segment(s) roughly paralleling the conductors.

(c) Distance of the conductors above ground.

(d) Obtain from the power company the geometric mean radius (GMR) of the shield wires and their lineal resistance (e.g., Ohms per kilometer).

(e) Obtain from the power company the maximum fault currents anticipated along the run of the pipeline for each circuit.

(f) Obtain from the power company the maximum anticipated current loading of each circuit.

(g) Obtain from the power company the horizontal and vertical separation distances between each of the phase conductors and shield wires.

(h) Obtain from the power company the order in which the phases are arranged on the tower.

(i) Measure the longitudinal electric field strength for AC lines using the horizontal wire method and obtain from the power company the percent of line load at the time of the measurement.

(j) Determine soil resistivity at pipe depth along the powerline route.

(4) Identify the location of any high-voltage DC (HVDC) grounding electrode beds within 50 miles of the pipeline.

(5) Based on soil resistivity values, Technical Memorandum No. 8140-CC-2004-1, *Corrosion Considerations for Metallic Water Pipe* (posted on the Intranet) presents required external corrosion protection measures for pipelines.

H. **Pipelines.** Determine the corrosivity of fluids carried by the pipeline or in which the pipeline is immersed. Corrosion mitigation measures shall meet or exceed service life requirements. The following determinations shall be included:

(1) Determine the pH, chloride, and sulfate content of the fluid.

(2) Determine the corrosion rate of the pipeline in the carried fluid, at temperature, by subjecting the pipe metal in question to standard corrosion tests such as ASTM G4, ASTM G31, ASTM G102, or similar.

(3) If the external surfaces of a pipeline are immersed but not buried, then the external corrosion rate of the pipeline in that fluid, at temperature, shall be determined by subjecting the metal in question to standard corrosion tests such as American Society for Testing and Materials (ASTM) G4, ASTM G31, ASTM G102, or similar.

I. Identify the location of any high voltage DC (HVDC) grounding electrode beds within 50 miles of the pipeline.

10. Construction Materials. Data collection for feasibility and specifications level designs is similar.

A. Borrow Materials. Consider required excavation material as a possible source.

(1) An earth materials report/inventory containing complete detailed information on those potential sources of available materials. Classification of all materials taken from test holes as soils, rock, etc., should be designed according to Unified Soils Classification System (see the *Earth Manual*). Location and extent of rock, areas of high ground water, and other unusual conditions should be shown.

(2) Reference to service history of any material considered suitable for use on the project if specific material application and performance records are available. This should also include results of sample analysis and tests including previous tests and photographs of sources.

(3) Location of and distance to borrow areas or commercial sources and approximate quantities available:

(a) Impervious and pervious embankment materials.

(b) Rockfill.

(c) Rock for riprap.

(d) Pipe embedment.

(e) Information on concrete aggregates. (See the *Concrete Manual*.)

(f) Information on sources and character of acceptable road surfacing materials.

(4) Environmental impacts associated with removing or obtaining construction materials.

I. Requirements concerning permanent stockpiles and suggested permanent stockpile locations.

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

K. Information including catalogues on firms that are within practical hauling distance from the site and that manufacture precast concrete products and brick or other masonry units.

L. Data on commercial concrete plants within practical hauling distances from the structure site.

M. Statement of availability of timber for structural work and other purposes.

N. Pipelines:

(1) Embedment requirements for pipe (native soil, select material, gravel, CLSM (controlled low strength material)).

(2) Desirability of including CLSM as an allowable pipe embedment option.

(3) Types of pipe commonly used on the project or in the project area, including types of pipe which are not acceptable for use on the project.

11. Electrical Data. This section presents design data collection guidelines for feasibility and specifications designs.

A. **Feasibility Designs.** The following is a list of design data required for feasibility designs:

(1) Availability of electric power for construction and for O&M.

(2) For existing non-Reclamation powerplants and pumping plants, single-line diagrams and switching diagrams that include equipment ratings will be necessary for a proper evaluation of existing equipment within the scope of any proposed feasibility or specifications design.

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

(4) Location of existing transformers.

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

(6) Plant uprating (powerplant): 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:

(a) Need for replacement of any existing major power equipment due to age or deterioration (generator winding and core, power transformers, power circuit breakers, switchgear, station service equipment, etc.).

(b) 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.

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

(d) Recommendation/need or to replace existing rotating exciter/voltage regulator with static excitation system.

(e) Recommendation/need to replace existing mechanical governor with a digital system.

(f) Recommendation/need to replace existing protection system with modern digital system.

(g) Recommendation/need to replace existing control systems.

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

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

(7) Switchyards and substations:

(a) For design of most substations, it will be sufficient to specify only supply and output voltage, number of connecting transmission lines at each voltage, capacity of the facility in kilovolt amperes, 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.

(8) Transmission lines:

(a) Estimated average and peak loads.

(b) Operating voltage of the line.

(c) Value of energy for sizing purposes.

(d) A description of terminal and intermediate substations.

B. Specifications Designs. The following is a list of data requirements for specifications designs, in addition to data requested for feasibility designs.

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

(2) Source and voltage of incoming power including construction power.

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

(4) Estimated electrical peak load.

(5) State and local code requirements.

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

(8) Dates when power will be available.

(9) Electrical system reliability criteria.

(10) Discuss requirements for an alternative power source. If an alternative supply is required, indicate:

(a) If required by a State or local authority.

(b) If source should be an engine-generator.

(c) If a threat to life or property will result if normal power supply is lost.

(d) Loads requiring service from alternative source.

(11) Feasibility and expense of generating power onsite with wind power, solar collectors, or adaptors.

(12) O&M considerations.

(a) Requirements for remote monitoring of conditions at the facility, including fire protection or security systems. Discuss location of remote station and items required to be monitored.

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

(c) Include location of station from which supervisory control is exercised.

(d) Requirements for voice and data communications between the supervisory master station and the remote facility.

(e) Requirements for lighting for night operation or security.

(13) Powerplants and pumping plants:

(a) The data furnished should be sufficient to permit designers to complete the basic design (single-line diagram) for the facility. After designs have progressed enough to develop details of electrical system needs, designers will prepare a list of additional data required to complete final design of electrical installation.

(b) Proposed initial and ultimate power generation capacity.

(c) Need for bypass of water during generator shutdown or load rejection.

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

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

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

(g) 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.

(h) Existence of transmission lines of other agencies and utility companies operating in the area that might influence connection of power units; furnish voltage, capacity, type of construction, and distance of these lines from powerplant or pumping plant.

(i) Local load requirements and availability and capacity of reliable outside sources for alternative supply of station-service power.

(j) Recommended number of pumps and pump sizes.

(k) Requirements for measurement of plant discharge.

(l) Plant uprating:

- For design data, see items listed under subsection A., "Feasibility Designs." For specifications designs, target date(s) for completing the uprate work and the outage periods when the unit(s) may be removed from service should also be provided. In addition, the designers should be asked for a specific list of design data required.

(14) Switchyards and substations.

(a) Single-line diagram of foreign primary systems which will connect to the Reclamation station. This information is required for relay studies and should include the following:

- Location of primary system circuit breakers and relays as contemplated for initial operation. Future changes should be indicated where possible.

- Type of primary system relays (distance, overcurrent, etc.) and the relay operating characteristics. The actual relay settings will be required to make coordinating settings of Reclamation relays, but these data need not be provided initially if it will delay receipt of other information. Relay coordination problems, such as slow relaying on primary system, should be presented.

- Primary system operating conditions which may affect Reclamation relaying or control.

- Reclosing time if automatic reclosing breakers will be used on the primary systems.

- Length and characteristics of primary lines and whether they are three-wire or four-wire circuits.

- Location, connections, and rating of transformers and synchronous machines which connect to the primary systems. The locations and type of neutral grounding should be included.

(b) Heights and locations of existing buildings, transmission lines, and other obstructions which are not associated with the station but are in or near the station site and will present clearance problems.

(c) Capacity charge, energy charge, interest rate, and plant factor to be used in evaluating transformer losses.

(d) Refer to the specific requirements of the "Environmental Criteria for Electric Transmission Systems" by the Departments of the Interior and Agriculture.

(15) Tunnels:

(a) Requirements for installation of power, lighting or telemetering cables in tunnel.

(16) General purpose buildings:

(a) Number of buildings to be served, segregating residences and other types, with anticipated load and recommended supply voltage for each type.

(b) Use of electric ranges, electric water heaters, and/or electric heating in residences.

(c) Desire for a series-type street lighting system.

(d) Other requirements for power, such as water pumps, warehouse cranes, machine shops, etc.

(e) Fire protection plan for the community, including information on available fire protection services.

(17) Rehabilitation of existing electrical power equipment/systems which may require replacement/modifications.

(a) Detailed list of structures and equipment being modified or replaced with list of electrical equipment servicing this equipment or structure (i.e., at sewage lift station XX existing pumps and electrical controls boards CBA, CCA and distribution panels DBA, and DBB to be removed and replaced with new equipment).

(b) Latest as-built drawings for existing power equipment, controls, protection, and indication/annunciation circuitry.

(c) Latest as-built drawings for existing equipment layout, conduits, cables and conductors, and grounding systems.

(d) Operational description of existing control systems and list of features that are still required in rehabilitated or modified installation and required new features.

(e) Description of downtime/outage period allowed when removing or modifying existing equipment or systems. List of critical equipment which downtime must be kept to a bare minimum (i.e., Critical control and protection circuitry that must be powered up continuously during renovation of a DC control board).

(f) List of known hazardous materials (lead paint, asbestos, etc.) which will be encountered or handled by the Contractor during rehabilitation work. If unknown, then provide a testing program to test suspected equipment or materials.

12. 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:

A. **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.

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

(1) 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.

C. Information on local labor supply and labor problems.

D. Local freight or trucking rates.

E. Housing accommodations.

F. Interest rate for economic studies.

G. 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.

H. Estimated cost for construction items which cannot readily be determined in the design office and include the supporting data:

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

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

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

(4) 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.

I. 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.

J. 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.

K. 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.

L. Local and tribal taxes.

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

N. Method for projecting cost into the future if required.

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

13. Environmental Data. Implementation of design features should be consistent with environmental commitments listed in the National Environmental Policy Act (NEPA) compliance document and with agreements reached between the U.S. Department of the 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. Design teams should review the design data items to determine which ones should be included in their projects. Design data items which are not applicable to the project should be omitted. Design data items which would have a minor effect on a feasibility design or cost should be omitted. The following items should also be considered in preparing the design data request:

A. **General:**

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

(2) Review of designs by other agencies, including stage of design and level of review, and the findings of the Fish and Wildlife Coordination Act Report. The Fish and Wildlife Coordination Act requires that fish and wildlife resources receive equal consideration to other project features. Federal agencies that construct water resource development projects are required to first consult with the U.S. Fish and Wildlife Service and, in some cases, the National Marine Fisheries Service, and State fish and wildlife agencies regarding impacts on fish and wildlife resources and measures to mitigate these impacts.

(3) Comments on ecological, aesthetic, or other environmental aspects that are peculiar to the location and would affect layout or design.

(4) Published guidelines and regulations concerning air and water quality standards.

(5) The environmental setting.

(6) Environmental permit requirements (401, 404, Storm Water Runoff, etc.).

(7) Environmental monitoring requirements.

(8) List of endangered species.

(9) Potential Indian Trust assets.

(10) Potential environmental justice issues.

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

(12) Existing or potential wetlands and wildlife refuge areas should be identified.

(13) Identify cultural (historical, archeological, architectural, and paleontological) resources in the area of the facilities.

(14) Photographs of the environmental setting.

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

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

(17) Unusual local pest (termites, borers, etc.) action and recommended preventive measures (including local practices for combating them).

(18) For water intakes, debris type and loading anticipated.

(19) Character of water to be conveyed with respect to probable sediment deposition and anticipated growth of algae in the channel and of other water-loving plants or weeds along banks.

(20) If domestic flow is provided, State health department requirements for water-supply systems.

(21) Water pollution control standards for design and construction.

(22) Impact of water quality on the proposed area of water or the mixing with natural waters. For dam outlet works, include water temperature requirements.

(23) Indicate the suitability and possibility of developing Government land adjacent to our facilities for use by the public for recreation, hobbies, sports, leisure, education, health, etc.

(24) Problems with bank erosion.

(25) Erosion and sediment control requirements.

(26) Special environmental requirements for transmission lines (above ground and underground).

(27) Potential invasive species which may damage project area.

(28) Any required mitigation measures

B. **Noise and Light Control Requirements:**

(1) Furnish data on allowable noise limits in the vicinity of the facility where fixed by law or local ordinance, or where otherwise considered necessary or advisable; measurements of existing daytime or nighttime ambient noise levels in the area; and distances to the nearest residential units.

(a) Noise and dust abatement requirements.

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

C. **Need for Blending Structures, Roadways, etc., with Surroundings.** Include reasoning:

(1) Aesthetic requirements should be considered in the benefit-cost studies and design of the facilities and related power lines.

(2) Comments on any ecological, aesthetic, or other environmental aspects that are peculiar to this location and would affect layout or conceptual design.

(3) Special considerations to provide structures that are compatible with surroundings.

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

D. **Fish and Wildlife Considerations:**

(1) List of threatened, endangered, or otherwise protected 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. Discuss any known mitigation requirements.

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

(4) The need for game/livestock protection, including crossings, fencing, etc.

(5) Requirements and background, if any, for the need for fish facilities such as fishways and barriers**.**

(6) Background on the need for fish protection and passage during construction at stream crossings.

E. **Construction (see also Section 18, "Construction Considerations"):**

(1) 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; preservation of existing growth adjacent to construction; obliteration of temporary roads and restoration to original appearance; dust abatement; etc. Give recommendations on steps to be taken to meet these requirements.

(2) Limitations that may affect in-stream construction, foundation investigation work. Restrictions for encroaching onto the waterway for placing falsework, cofferdams, sheet piles, etc.

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

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

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

(6) Construction window, traffic restrictions, and detour requirements.

(7) Water for construction purposes.

F. **Removal and Disposal of Materials:**

(1) Comments on disposal of special excavation problem or hazardous materials such as lignite.

(2) Vegetation to be cleared, including kind, size, and density of growth.

(3) Comment on disposal of material from clearing operations. Consider State and local burning regulations, burying or chipping of materials, and maximum utilization of merchantable timber.

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

(5) Specify requirements for clearing and disposal of timber.

(6) Comment on disposal of debris from O&M operations:

(a) Debris, biomass, aquatic weeds, sediment, and sludge.

(7) For water treatment plants:

(a) Suggested disposal sites should be able to meet requirements of either State or the U.S. Environmental Protection Agency (EPA) for discharge of pollutants.

(b) Plant reject flow.

(c) Spent chemicals from pretreatment and desalting, cleaning, and storage solutions.

(8) Disposition of existing facilities such as pipelines, power and telephone lines, and fences.

G. **Landscaping, Seeding, and Erosion Control:**

(1) Areas that will require landscaping, replacement of topsoil, seeding.

(2) Landscaping and other special environmental requirements.

(3) Recommendations for landscaping and source of irrigation water.

(4) Note bank erosion and sediment control concerns:

(a) Specify seeding requirements, replanting requirements, or other requirements for erosion control or aesthetics in riverbanks, borrow areas, spoil banks, and excavated slopes.

(5) A brief listing of the area's native and/or commonly used plant materials.

(6) Furnish data on State or local restrictions on the use of soil herbicides or local factors limiting their use.

(7) Revegetation and landscaping needs (see Reclamation's current *Recreation Facility Design Guidelines,* September 2002).

H. **Anticipated Public Use Around the Facilities:**

(1) Indicate the suitability and possibility of present and future use of land adjacent to Reclamation facilities by the public for recreation, hobbies, sports, leisure, education, health, housing, etc. Provide data on zoning regulations and subdivision proposals.

(2) Anticipated public use of Reclamation access roads.

(3) Provide data on zoning regulations and subdivision proposals.

I. **Dams and Reservoirs:**

(1) Requirements for multilevel intakes to protect the fisheries.

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

(3) Location, volume, and contamination levels or any solid waste or hazardous waste facilities within the reservoir basin.

(4) Location of any underground storage tanks within the reservoir basin.

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

J. **Transmission Lines, Switchyards, and Substations:**

(1) Refer to the specific requirements of the *Environmental Criteria for Electric Transmission Systems* by the U.S. Departments of the Interior and Agriculture.

(2) 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.

K. **Wetlands:**

(1) Biological information requirements:

(a) Disease vector control considerations. Diseases may be carried by several animals, most commonly mosquitoes.

(b) Discuss which disease vectors may be present and potential control measures such as:

- Habitat control – prevention of stagnant water.
- Use of insecticides.
- Other control measures.

14. Site Security and Public and Worker Safety. Many Reclamation projects may require a security risk assessment. The need for a site-specific security risk assessment should be considered for every specifications level design. Specific issues to consider are listed below. Feasibility level designs may also consider the following security issues, particularly where they may impact the field cost estimates. If assistance is required to determine specific design data needs, contact the Office of Security, Safety and Law Enforcement. The following design data for feasibility and specifications levels designs should be considered for submittal:

A. **Site Security:**

(1) Consider potential for vandalism, theft, and terrorism.

(2) Consider the potential for loss of facilities and loss of life at the facilities and property if the facilities are subjected to a terrorist attack.

(3) Consider the potential loss of offsite life and property if the facilities are subjected to a terrorist attack.

(4) Consider availability of local law enforcement forces, fire protection forces, and medical facilities.

(5) Consider access by nearby roads and trails and access by boats and required restrictions to this access.

(6) Consider specific measures to meet anticipated security conditions and requirements such as limiting access, metal detectors, motion detectors, guards, identification requirements, protective barriers, 7-foot yard fence topped with barbed wire, special locks, special doors, heavy safety glass, security lighting, exclusion of windows, electronic surveillance equipment, etc.

(7) Consider requirements for notifying police and other public safety agencies in the event of an attack.

(8) Consider compliance requirements in regard to Reclamation Manual, DM Part 444 – Physical Protection and Facility Security, Chapters 1 and 2.

(9) Description of existing project fire protection plans that will be applied to the facility design, together with any specific requirements for this facility. Consider need and any limitations of access for emergency vehicles.

(10) Number of employees at the facility and how many hours per day the plant is staffed.

(11) Need for attended operation of the facility during and following a nuclear attack.

(12) Legal or practical requirements for fencing; recommended type of fencing, if required.

(13) Wells: Material outlining safety factors, including presence of high subsurface pressures or toxic gases.

B. **Public and Worker Safety:**

(1) Anticipate public visitation and use around facility.

(2) Consider fencing, lighting, handrail, and related requirements.

(a) Legal or practical requirements for fencing.

(b) Recommended type of fencing, if required.

(c) Special requirements and locations of safety devices such as guardrail; security lighting; fences in populated areas, nets, and racks.

(d) Special safety requirements such as fall protection in certain areas (roofs, steep inclines, and other safety confined space access at Reclamation facilities).

(3) Consider access limitations.

(4) Recommendations for special protection of tunnel portals, roofs, or yards from falling rock.

15. Mechanical and Hydraulic Equipment. The following design data items may be required for feasibility and specifications levels designs:

A. **General:**

(1) Purpose of equipment.

(2) Hydraulic design criteria:

(a) Range of upstream and downstream water surface elevations anticipated over the life of the project.

(b) Velocity criteria (maximum and minimum requirements).

(c) Any anticipated or potential changes in flow rates over the life of the project.

(3) Access available or desired for removal and installation of equipment, along with anticipated size and weight of equipment and proposed or desired methods of handling.

(4) Recommendations on whether gate hoist equipment, controls, and measuring devices should be indoor or outdoor types.

(5) Operating period (all year, irrigation season, extreme events, or emergencies).

(6) Corrosion potential of material in contact with equipment, such as water, air, and soil.

(7) Material requirements (steel, stainless steel, plastic (type), special material).

(8) Debris type and loading anticipated.

(9) Climatic conditions.

(a) Type of ice loading, if any, anticipated.

(10) Are facilities manned or unmanned?

(11) Is mechanical equipment locally operated, automatically controlled, supervisory controlled?

(12) Is electric power readily available? Will equipment be hand operated or power operated?

(13) If power operated, state preference for electric operators or hydraulic operators.

(14) Plant factor and power and interest rates for economic sizing of pumps, turbines, and intake and discharge lines.

B. **Mechanical Equipment:**

(1) Trashracks and debris screens:

(a) Bar spacing.

(b) Angle of trashracks with vertical.

(c) Type of deck and deck size anticipated.

(d) Type and loading of debris.

(e) Desired method of cleaning: manual, automated trashrake, etc.

(f) Method of debris removal (manual, conveyor belt).

(2) Fish screens:

(a) Location.

(b) Fishery agency requirements (criteria): type of opening, required percent opening, maximum opening requirements, approach velocity, sweeping velocity, etc.

(c) Desired type of screen:

- Flat plate, drum, traveling

(d) Type and loading of debris.

(e) Method of debris removal and type of cleaning equipment anticipated

(f) Fish bypass requirements.

(g) Will sediment deposits at the screens be a potential O&M problem?

(3) Hoists:

(a) Location.

(b) Type.

(c) Pickup and dropoff points.

(d) Size and weight of components or equipment to be handled.

(4) Heating, ventilating, and air conditioning:

(a) Type of building.

(b) Size of building.

(c) Range of outdoor temperatures.

(d) Special exhaust, heating, ventilating, or air-conditioning requirements including artifact storage and preservation, and laboratory ventilation and exhaust.

(e) 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.

(f) Is natural gas available at the site?

(g) Noise restrictions at the site.

(5) Flow and water level measurement:

(a) Location.

(b) Type of flow measurement structure or device (ramp flume, constant head orifice, Parshall flume, venture meter, ultrasonic, etc.).

(c) Units of measurement and totalizing requirements.

(d) Accuracy requirements.

(e) Read locally or send data to remote location, or both.

(6) Bulkheads and stoplogs:

(a) Location.

(b) Provide expected upstream and downstream water surface levels over the life of the project.

(c) Type of guides.

(d) Anticipated lifting equipment.

(7) Miscellaneous metal designed to control or guide flow.

(8) Engine-generator sets:

(a) Location, enclosure requirements, and any special O&M needs or aesthetic requirements.

(b) Voltage and phase required.

(c) Equipment to be operated by engine-generator set.

(d) Standby (backup) or main power source.

(e) Fuel preference (diesel, propane, natural gas, etc.).

(f) Automatic or manual transfer.

(g) Ambient temperature range.

(h) Altitude.

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

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

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

C. **Hydraulic Equipment:**

(1) Pumps:

(a) Range of flows and heads anticipated over life of project.

(b) Initial and ultimate design flows.

(c) Number of pumps and type of pumps to be considered.

(d) Flow for each pump or range of flow for each pump.

(e) Special fishery or other environmental requirements

(2) Hydraulic power turbines:

(a) Flow range and operating heads.

(b) Number and type of turbines and flow range for each turbine.

(c) Special fishery or other environmental considerations.

(3) Piping for water, air, etc.:

(a) Range of flow rates.

(b) Type of fluid to be carried.

(c) Restrictions or special provisions for location of piping.

(d) Cleaning and draining requirements.

(e) 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?

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

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

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

(4) Gates and valves:

(a) Location (pipe, canal, general buildings, powerplants, and pumping plants).

(b) Purpose of gate or valve:

- Flow control
- Energy dissipation
- Segmentation
- Isolation for maintenance
- Release of flow during an extreme event such as a spillway gate

(c) Type of gate (slide, radial, overtopping, other).

(d) Type of valve (butterfly, gate, other).

(e) Type of operator.

16. Right-of-Way and Easements. For feasibility and specifications designs submit the following data:

A. Existing ROW and easements (right to use land for a special purpose).

B. Proposed ROW and easements.

(1) ROW and easement requirements for installation.

(2) Proposed easement requirements for construction purposes including construction access (temporary and permanent).

C. Existing private or public easements and ROW across or adjacent to alignment.

D. Designation of areas within ROW boundaries for the following special purposes:

(1) Disposal of waste material.

(2) Contractor's plant, storage, and other incidental purposes.

(a) Borrow sources.

(b) Government's construction facilities (if applicable).

17. Hydrologic and River Morphology Data. For feasibility and specifications designs, hydrologic, sediment transport, geomorphic, and water quality data may be acquired for the project. Hydrologic data may include precipitation rates and basin areas, flow gauge records, staff gauge records, ground water well data, Federal Emergency Management Agency flood reports, studies on probable maximum flow, and freezeup, breakup and ice thickness records. Sediment transport data may include suspended or total load measurements, bed material sampling, cross section data, LiDAR or ortho-photography surface mapping, and field observations of aggradation, incision, bank erosion and existing revetment treatments. In addition to the data listed above, morphologic data could include historic or current aerial photography, river profile surveys, vegetation data, debris history, and icing and freezeup data. Water quality data could include temperature, suspended sediment and testing for metal and chemical compositions.

This information is acquired for analysis, design and successful operation and maintenance of diverse projects with elements including reservoir filling and draining studies, spillway capacities, reservoir capacities, channel conveyance systems, culvert and bridge passage requirements, water quality construction concerns, pumping plant intake systems, effects of a powerplant tailrace, water surface and floodway studies, dam safety, structure erosion maintenance, minimalization of aggradation/degradation impacts, bank stabilization, river morphology and channel change, habitat protection, reservoir sedimentation maintenance, stable channel design, dam removals, and river restoration work. The data required will be specific to the project needs. For feasibility studies, the critical design data items should be identified and receive maximum attention.

The design data and design criteria for a structure or facility should be documented in a report. For specifications designs, the data will be updated based on any additional information developed since the feasibility designs. The specifications design data submittal shall reference the feasibility data document and, thus, eliminate the need to repeat the information enumerated below. If, for any reason, the information enumerated below is not contained in the report prepared for the feasibility design, this information should be provided for the specifications design. Examples of hydrologic design criteria include design flows and recurrence intervals for specific features, maximum changes in water surface and probable maximum flood (pmf). Information to be included in the feasibility or specifications data report or memorandum, if pertinent to the project, are listed below.

A. **General:**

(1) The operational impacts of the project that require alternative designs (e.g., outlet works and downstream river temperature, spillways and gas supersaturation, increased channel scour, and downstream channel protection, etc.).

(2) Flood protection requirements.

(3) Operational data on upstream and downstream dams, diversions, pumping plants, and reservoirs. Discuss if dams appear to be hydraulically inadequate.

B. **Hydrology:**

(1) Source of water being transported.

(2) Data used/required to estimate flows and hydrographs:

(a) Precipitation and runoff records.

(b) Location of gauging station at or near the site, gauge number if it is a USGS gauge, and the dates for which hydrographs should be prepared. Copies of the daily discharge record should be supplied for stations with unpublished records.

(c) Drainage area located upstream from the site. Shape, size, slope, and character of each catchment area, probable rainfall intensity as required, and method used for the flow computation.

(d) Discuss if upstream dams appear to be structurally or hydraulically inadequate.

(3) Flows and recurrence intervals required to be estimated including normal flows, floodflows, peak flows, and minimum flows. The flow estimate requirements will depend on the type of facility being constructed and the required frequency of the design storm.

(4) Peak design flow discharges for minor drainage areas. Assess ponding upstream or up-gradient of the feature and if temporary ponding in these areas is possible then hydrographs of the design storms should be submitted, and topography should extend upstream and above the feature a sufficient distance to cover the temporarily inundated area.

(5) Surface drainage facilities:

(a) Location of any existing intersecting facilities, watercourses, or other physical features affecting the proposed facility.

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

(c) Location and description of protective dikes and ditches.

(d) Preliminary plan for surface and subsurface drain systems, including types of drains to be provided.

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

(f) Permissible additional capacity of natural channels which will convey drain water and stability, including an assessment of future conditions of sediment transport, of natural channels receiving drain flows.

C. **Reservoir Hydrology:**

(1) Inflow design flood and possible preceding and recurring flood hydrographs with recommended routing criteria. For a diversion dam involving little or no storage, normally a probability curve of flood peak discharges up to the 100-year point 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) Area capacity curves and/or tables to at least the dam crest elevation.

(3) For features such as water treatment plants, potential location for and volume of reservoir(s) suitable for leveling of daily or annual fluctuation in flow or salinity of water source.

(4) Annual periodic fluctuations of reservoir levels shown by tables or charts, summarizing reservoir operation studies:

(a) With the expected initial reservoir level for flood routing studies.

(b) For the critical and normal climatic periods. Include any annual reservoir drawdowns for operation and maintenance purposes.

(5) Storage allocations and corresponding elevations.

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

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

(8) Extent of anticipated wave action, including a discussion of wind fetch.

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

(10) Required outlet and sluiceway capacities for respective reservoir water surfaces, and sill elevations. Give type and purpose of reservoir releases

and the time of year to be made. Include the minimum release during winter and other seasons. If temperature or water quality control of releases is anticipated, the degree and purpose of the control should be included.

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

(12) Annual net evaporation and distribution.

D. **Sediment Transport and River Morphology:**

(1) Data collection for assessing the morphology of the river and sediment transport concerns, such as occurrences of degradation or aggradation, bank erosion, changes in the river alignment or condition of the stream channel, and general channel stability can include:

(a) Repeated surveys of river cross sections at established locations.

(b) Surveyed longitudinal profile of the river.

(c) Information on existing natural or constructed, vertical or horizontal controls, especially those affecting tailwater. Include location, distance, physical dimensions, and characteristics of the controls.

(d) Bathymetry surveys of the submerged channel bed, pond, or reservoir.

(e) Bed and bank samples providing gradations of the channel materials, or pebble counts for larger bed materials.

(f) Records of bank stratigraphy and height at cut banks.

(g) Suspended sediment measurements or grab samples in conjunction with a discharge measurement or gage reading.

(h) Turbidity measurements in conjunction with discharge.

(i) Bedload measurements using samplers or traps in conjunction with discharge.

(j) Surveys or bank pins for measuring rate of bank retreat.

(k) Photos at established locations to note changes in deposition, bar features, and bank erosion.

(l) Mounted video recorders for capturing time lapse photography of bed, bank, and bar changes during high flow events or other increments

(2) To help assess the ongoing river processes and potential for future changes, research historical records on the river including:

(a) Hydrologic data for geomorphic concerns including maximum, mean, minimum, and 1.5-year flows in natural streams, and recorded flood stage elevations at major drainage and river crossings (bridges, pipelines, etc.).

(b) Aerial photographs of the river, often available back to the 1930s

(c) Mapping by Land Office in the 1800s or from the USGS sometimes available back to the late 1800s

(d) Historical surveys by the USGS, U.S. Army Corps of Engineers (Reports to the War Office), road departments, railroads, water delivery districts, and other entities.

(e) Historical sediment samples and longitudinal profiles.

(f) The degree of exposure of bridge abutment and footing foundations and foundations of other structures, along with the age of the bridge and maintenance record, can provide telling data on both scour and river degradation.

(g) Ice potential and effect on channel including the possible flooding from jams, channel avulsions, or the scour of vegetation in channels.

(h) Previous reports on geomorphic and sediment transport conditions or professional journal articles.

(i) Construction and maintenance records from government groups and private entities including records of structural failures and recurring maintenance actions, tailwater curves, and USGS repeat surveys for adjustments to gage station rating curves.

(j) Narrative descriptions of the river including journals or compilations from early explorers, travelers, scientific expeditions and settlers, and accounts from newspapers.

(3) Concerns and issues for specific types of structures could include:

(a) Identifying downstream of structures the height and location of any stream headcuts or kickpoints and their approximate rate of upstream migration.

(b) Measurements of local scour and constriction scour data on bridge foundations and other structures in the stream.

(c) Estimate the incision and channel change downstream of a reservoir or large pond, estimate the aggradation in the reservoir, and the aggradation and change in alignment upstream of the reservoir or pond inlet for sediment transport studies.

(d) Identify deposition potential and potential for channel migration at intake structures.

(e) Consider the anticipated occurrence and amounts of sediment, ice (thickness) and flooding from ice jams, and drift (trash), and possible effect on facilities such as reservoir outlets, water intakes, spillways, fish screens, etc.

(f) Channel and bank protection requirements and allowable materials and potential alternative solutions that allow for natural channel processes.

(g) Describe imposed conditions resulting from project construction that contribute to river instability and address concerns (e.g., increased channel bed or bank erosion, downstream channel protection; removing natural vertical control, replacing with constructed control; etc.).

(h) The expected volume of sediment which would be taken into the canal or other features and/or accumulated upstream of a facility, and plans for addressing concern.

E. **Water Quality:**

(1) Published guidelines and regulations for water quality standards.

(2) Recommendations for maintenance of water quality standards such as suppression of nitrogen, adequate oxygen levels, and temperature control and control for turbidity during construction.

(3) Water temperature, including seasonal variations.

(4) Analysis of water for intakes or other purposes as required for chemical and physical characteristics and biological quality.

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

A. Construction schedule:

(1) One contract or several contracts.

(2) Any construction timeframe restrictions

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

(4) Recommended period for construction.

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

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

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

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

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

D. Filling and draining criteria for dam, ponds, and pipelines

E. Unusual conditions for excavation or construction.

F. Extent of construction surveying to be accomplished by Government surveyors.

G. 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 ft^3/s 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.

(1) Water treatment requirements for return flows

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

I. Required permits from government agencies and others.

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

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

L. 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.

M. Comments on disposal of special excavation problem materials such as lignite.

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

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

19. Operating and Maintenance Data. Operation and maintenance items include: conditions that may cause operation and maintenance problems, facility requirements for operation and maintenance personnel, periods when the facilities will be operated, monitoring and control requirements, communications requirements, requirements for preparation of Designers' Operating Criteria and availability of operation and maintenance personnel and equipment. Operation and maintenance data does not include data required for design of the facilities such as: flows, water surface elevations, electrical data, public facilities, fire protection and fencing, etc. The following design data items may be required for either feasibility (if data would materially affect cost or design) or specifications level designs:

A. **Operation Considerations:**

(1) Plan of operation for facilities (canals, pipelines, powerplants, and pumping plants, etc.).

(2) Comprehensive Regional operating scheme, including integration with any such scheme.

(3) Responsible organization(s) for operating and maintaining facilities.

(4) Description of initial operation and maintenance requirements and possible future operation and maintenance requirements for project facilities.

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

(a) Periods of shutdown (such as seasonal). Give conditions during shutdown, such as: unattended, winter maintenance, and needs for station power.

(b) Dates of irrigation season or when demand needs to be met.

(6) Data on allowable outage times based on operation and maintenance requirements.

(7) Filling and draining criteria (reservoirs, pipelines, canals) for operation and maintenance.

(8) Special reliability requirements.

(9) Self sustainability requirements – minimum or no maintenance requirements.

(10) Personnel availability:

(a) Will facilities be operated by a part time or full-time resident caretaker?

(b) Capabilities of existing O&M workforce.

(c) Intervals when operation and maintenance forces are expected to be on site (e.g., hours per day for plant staffing: 24 hours a day, 8 hours a day, once a day, once a week).

(d) Number of operations and support personnel which are anticipated to be available at the facilities.

(11) Requirements for lighting for night operation or security purposes including requirements for temporary or permanent facilities (e.g. areas where visual monitoring may be required for water surface levels, leakage, or proper position or operation of equipment.).

(12) Recommendations on whether gate hoist equipment, controls, and measuring devices should be indoor or outdoor types.

B. **Access for Maintenance:**

(1) Requirements for providing permanent access to the facilities for operation and maintenance. Include any limiting requirements imposed on private roads for public access/haul roads.

(a) Need for O&M roads on or along canal banks.

(b) Vehicle or boat access requirements for maintenance.

(2) Requirements for providing permanent access to a tunnel or adit portal for operation and maintenance purposes and special requirements for transport of Government personnel in and out of tunnel.

C. **Monitoring and Control Requirements:**

(1) Requirements for flow controls, flow measurement, water level measurement, and pressure measurement instrumentation. Include smallest and largest flows and pressures to be controlled and/or measured; degree of automation of controls.

(2) Requirements for voice and data communications between the supervisory master station and the remote facilities.

(3) For facilities located on open reservoirs and open channels (canals and rivers). Details of required downstream control sections, water measuring devices, gauging stations, or other operating equipment.

(4) Use of automatic controls such as automatic pump restart after power failure; installation of alarms, warning devices, etc.

D. **Trash, Sediment, and Ice Considerations:**

(1) Types and quantities of trash (including terrestrial and aquatic weeds, algae, etc.) anticipated at the plant intake;

(2) Locations of trash-disposal areas. The suggested disposal sites should be able to meet requirements of either State or EPA for discharge of pollutants. Include items such as:

(a) Debris, biomass, aquatic weeds, sediment, and sludge.

(b) Spent chemicals from pretreatment and desalting cleaning and storage solutions.

(3) Anticipated growth of algae in the channel and of other water-loving plants or weeds along banks.

(4) Recommend methods of cleaning, trash handling and disposal and anticipated problems and delineation of disposal areas.

(5) Potential for sediment deposition and disruption of operations. Discuss potential methods for sediment removal.

(6) For facilities such as fish ladders and canals which are operated in subfreezing weather; minimum temperatures, lengths of time freezing may occur, average and maximum ice depths, conditions to be anticipated as to alternative freezing and thawing, and probability of facility drifting full of snow

(7) Recommended or preferred provisions for sediment and ice control.

(8) Possible utilization of residue such as reclaiming chemicals, etc.

E. **Type of Maintenance Equipment and Machinery Contemplated Including:**

(1) Screens which are required to prevent disruption of operations by debris.

(2) Equipment which is required to remove and dispose of debris.

(3) Requirements for permanent equipment handling capabilities (e.g. overhead cranes, gantry cranes, monorail hoists, jib cranes, etc.) or use of a mobile truck for equipment handling.

F. **Operation and Maintenance Requirements for Space and Buildings; Include Size and Location Requirements:**

(1) Recommendation on whether plant should be indoor or outdoor structure.

(2) Availability of or need for permanent buildings for operating and maintenance personnel and functions (such as a remote control station) to be controlled from the buildings. Include locations of buildings.

(3) Availability of repair shops (plant equipment, gate and control equipment) in vicinity

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

(5) Where a service area or machine shop is specified in a plant, furnish floor area requirements, and the name and size of machine tools, benches required, and need for welding booths.

(6) Housed and open O&M storage requirements at the site; offsite storage provided; existing storage space and facilities.

(7) Office and file space requirements

G. **Post Construction Monitoring and Evaluation Requirements (Often Required for Fishery and Wetlands Type Facilities):**

(1) Facilities required for evaluation and monitoring.

(2) Base line standards for evaluation and standards by which to measure progress.

(3) Anticipated adaptive management requirements if any (e.g., for habitat areas if initial plantings or environment are inadequate and require follow-up remedial work).

(4) Self sustainability requirements – minimum or no maintenance requirements.

H. **Powerplants:**

(1) Nature of operations, i.e., whether baseload, peaking or seasonal.

(2) Need for operation when isolated from power system, and including need for black-start (ability to start a unit without system power capability), particularly for small hydroplants.

I. **Tunnels:**

(1) Recommended or preferred personnel or equipment access requirements including locations.

(2) Special exhaust, heating, ventilating, or air-conditioning requirements.