5. Canals. The Introduction (Chapter 1) for these design data collection guidelines contains additional information concerning: preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal.

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

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

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

(3) North arrow.

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

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

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

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

(d) Areas of environmental concern.

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

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

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

(5) Rights-of-way:

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

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

(6) The proposed structures and features:

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

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

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

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

(e) Sources of water for construction.

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

(1) **General:**

(a) North arrow.

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

(c) Topography and ownership information should be shown.

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

(e) Transportation facilities and other cultural features.

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

(g) Disposal areas for wasting excess excavation.

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

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

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

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

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

(m) Legend of symbols for existing and proposed facilities

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

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

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

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

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

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

(5) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; estimate of access road length and major structures required for new construction; and possible alternative means for delivering construction materials and equipment to the structure site.

(6) Availability or accessibility of public facilities or utilities such as water supply, sewage disposal, telephone utility, fire protection services, and electric power for construction (give location, power supplier, voltage, number of phases, and capacity of existing transmission lines; power rate schedules; probability of interruption of supply; and requirements for additional transmission line, if needed).

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

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

(8) Local frost depths.

(9) Ground water presence and depths.

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

(11) Road detour requirements.

D. Survey Control. Use of an existing coordinate system or tying to the township and range system is acceptable, but tying to the State or national system is recommended if practical. If existing facilities are affected or incorporated into the designs, the verification of the original coordinate systems and datum.

E. Topographic Maps.

(1) Strip Topography. Strip topography covering the proposed canal location should generally be provided. The desired scale is 1 inch equals 200 feet with a 2-foot contour interval and a minimum strip width of 200 feet. The strip topography should be provided on plan and profile drawings. If the project area is flat or small, a 1-foot contour interval may be required.

Aerial photographs or mosaics of the proposed canal alignment and of major structure sites should also be provided if available.

(2) Topographic maps at structure sites are required only where major or complicated structures are planned, unusual conditions exist, or judgment dictates that more information will be required for review or design. These site maps normally will be on a scale of 1 inch equals 20 feet to 50 feet and a contour interval of 1 foot (scale should be enlarged and/or contour interval decreased to 1 foot when necessary to clarify conditions

establishing alignment, earthwork, delivery water surface elevations, and related details). Exploration holes should be located on the maps.

(3) Topographic maps should be furnished covering all the project area showing ownerships, gross acreage, and irrigable acreage for each ownership, 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.

(4) 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 gradient range in the source pipeline should be shown. Also, where appropriate, data such as capacities, grades, etc., should be shown.

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

(1) **General:**

(a) North arrow and land survey lines.

(b) Proposed centerline and stationing and curve data.

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

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

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

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

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

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

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

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

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

(l) Buildings, fences, and other obstructions.

(m) Right-of-way.

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

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

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

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

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

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

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

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

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

(v) Profile: The profile should show, as a minimum, bottom grade, original ground surface, utilities and other subsurface features, and water surface.

(2) **Siphons, Road Crossings, and Associated 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 or other subsurface features where they cross the alignment. Hydraulic gradeline and pressure class for pipelines.

G. Canal Lining. Type of lining required: earth, concrete, or membrane.

H. Foundation Data.

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

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

office representatives. For major structures, it is recommended that a field conference be held, including an inspection of the site. This conference should result in a geologic investigations program outlining the need for and extent of surface and subsurface studies, and other requirements. The geologic investigations program must be based on site conditions, type of structure, and the time and funds available for the study and will make maximum use of existing data. The complexity of the site will determine the detail of the investigation.

Sufficient data on foundation conditions must be included to determine type of excavation materials that will be encountered and geotechnical analysis required. Drill holes shall be located at intervals of 2,500 ft. unless site conditions demand more frequent logs. Logs of all drill holes, auger holes, and exploration pits will be included. Recommendations for lining, based on foundation conditions, and any other data will be included. Major soil types should be identified, including such significant factors as expansive and low-density soils, rock, and high-water tables.

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

(a) Compilation, summary, and reporting of Bureau and non-Bureau geologic information on the area, with attention being paid to the sequence of explorations and historical geologic events.

(b) Surface geologic map of canal alignment showing location of explorations. Locations of all existing explorations should be indicated by coordinates or stationing of the permanent survey control system for the canal.

(c) Specific foundation exploration at bridges, inverted siphons, check structures, pumping plants, and other major structure sites; at deep cuts; and where required to explore particular geologic problems such as soft foundations or low-density material.

(d) Factual narrative description of surficial deposits with attention being paid to engineering geologic matters, such as swelling

minerals, low-density material, presence of gypsum and other sulfates, caliche, erodibility (see Earth Manual).

(e) Factual narrative description of bedrock with attention being paid to engineering geologic matters such as swelling minerals, presence of gypsum and other sulfates; and to depth, weathering, joints, faults, and other planes of weakness.

(f) Selected determination of engineering properties of surficial deposits and bedrock by laboratory or field tests (in-place density, penetration resistance, permeability, shear strength, gradation, and consolidation or expansion characteristics, etc.). The type and number of samples and tests required should be determined in cooperation with the TSC.

(g) Photographs, preferably in color, of representative or particular geologic conditions.

(h) Summary and data of exploration geophysical surveys (seismic, soil resistivity, etc.), if performed.

(i) Determine ground water conditions with attention being paid to water levels and their seasonal fluctuation, occurrence of unconfined and confined aquifers, potential leakage, water-producing capabilities including permeability tests, chemistry, and land subsidence.

(j) Logs of exploration. Logs of drill holes advanced by churn drilling, chop and wash, or other methods which result in less than adequate sample recovery should be augmented by borehole electric (geophysical) logs where appropriate. Log holes shall be spaced at 2500 ft.

(k) Evaluation of landslide, snowslide, and rockfall conditions. If it is relevant, include a map of possible slide areas with as much detail as practicable.

(l) If threat to life is significant, determine age of faulting in vicinity, especially if suspected to be late Pleistocene or Holocene.

(m) Document past, present, and possible future petroleum, water, and mineral extraction operations in vicinity.

(n) Determine geologic conditions which may affect construction methods such as, boulders on ground surface, marshes, cemented zones in surficial materials, etc. Any potential surface water runoff

problems should be brought to the attention of a regional hydrologist.

(o) Samples of foundation materials and ground water should be obtained and tested to determine any possible chemical reaction with the canal concrete or metalwork..

(p) Ensure that canal is not constructed on old spoil banks.

I. Corrosion Survey.

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

(2) Performance history of materials of construction that have been used in the area.

(3) List 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.

(4) 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.

(5) 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.

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

(7) Associated Pipe, Road Crossings, and Siphons: 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 determination shall be included:

(a) 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.

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

(c) 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:

- Distance from the pipeline to the nearest tower legs
- Horizontal distance between the ground below the nearest load carrying conductors and the nearest pipeline segment(s) roughly paralleling the conductors
- Distance of the conductors above ground.
- Obtain from the power company the geometric mean radius (GMR) of the shield wires and their lineal resistance (e.g., Ohms per kilometer).
- Obtain from the power company the maximum fault currents anticipated along the run of the pipeline for each circuit.
- Obtain from the power company the maximum anticipated current loading of each circuit.
- Obtain from the power company the horizontal and vertical separation distances between each of the phase conductors and shield wires.
- Obtain from the power company the order in which the phases are arranged on the tower.
- 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.
- Determine soil resistivity at pipe depth along the powerline route.

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

(e) Based on soil resistivity values, Technical Memorandum No. 8140-CC-2003-1, *Corrosion Considerations for Metallic Water Pipe* (posted on the Intranet) presents required external corrosion protection measures for pipelines.

J. Construction Materials Data including:

(1) Classification of all materials taken from test holes as soils, rock, etc., should be designed according to Unified Soils Classification System (see Earth Manual). Location and extent of rock, areas of high ground water (present and future), and other unusual conditions should be shown.

(2) Information on concrete aggregates. (See "Final Investigations" in Concrete Manual.)

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

(4) References to service history of materials if used previously and to results of sampling and analysis, including previous tests in the central Bureau laboratories.

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

(6) Dispersive soil analyses.

K. Hydrologic Data including:

(1) Design flood frequency to be used for design of cross drainage structures.

(2) Peak design flow discharges for minor drainage areas, except where temporary ponding time uphill of the canal is a design consideration, then hydrographs of the design storms should be submitted, and topography should extend uphill of the canal a sufficient distance to cover the temporarily inundated area.

(3) Hydrographs of design floods for major cross-drainage areas if the canal section extends across the natural channel or broad, poorly defined drainage.

(4) The expected volume of sediment taken into the canal and/or accumulated uphill of a canal drain inlet used for major cross-drainage areas for large capacity canals.

(5) Peak discharge or hydrograph, as appropriate, for flood frequency greater than design frequency.

(6) Tailwater curves, sedimentation studies, degradation, and aggradation studies should be included if they are critical.

L. Operating Data including:

(1) Source of water.

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

(3) Plan of operation for waterway including extent of automatic and/or supervisory control. If supervisory control, give location of master station. Demand or supply control system.

(5) A list of all structures showing stationing, type, size, and other control data.

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

(7) Measuring facilities required in canal and turnouts.

(8) Percent of design capacity that the canal is expected to carry each month, and probable dates that it may be taken out of service for maintenance each year.

(9) For canals operated in subfreezing weather: minimum temperatures, lengths of time freezing may occur, average and maximum ice depths, conditions to be anticipated as to alternate freezing and thawing, and probability of canal drifting full of snow.

(10) Explain any proposed rotational, scheduled irrigation, or full demand plan and alternative types of systems considered.

(11) 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.

(12) Type of maintenance machinery contemplated.

(13) Type of communications system contemplated.

(14) Type of water service for land (include planning report if available):

(a) Furrow irrigation.

(b) Pumped system (Reclamation or farmer).

(c) Design efficiency.

(d) Filling and draining criteria.

M. Structure Data including:

(1) **General.** Unless shown elsewhere, the information should be submitted on tabulations for similar structures, data sheets, or special sketches. Do not duplicate.

(2) **Cross Drainage:**

(a) Design capacity, frequency of design storm, and map of contributory drainage area.

(b) Strip topography of canal - Augmented, if necessary, by sufficient data to show the requirements of outlet control and allowable inlet pondage.

- The information should be shown in tabular form and station marks shown on the alignment.
- Maximum, normal, and minimum flows in live stream, if existing, possibility of scour.

(3) **Road, Highway, and Railroad Crossings (siphons, bridges, and culvert):**

(a) Point of contact for each crossing.

(b) Type of structure and possible alternatives.

(c) Base of rail elevation for railroad, and crown elevation and width of surfacing for road. Minimum clearance between top of culvert or siphon and base of rail or crown of road.

(d) Railroad or highway right-of-way limits. Number and location of future tracks and sidings; or limits of highway widening. Location of shoofly or detour if required during construction.

(e) For smaller culverts and siphons, possibility of jacking pipe through roadbed, and if feasible, agency's approval of this type of construction.

(f) Maximum encroachment limits on highway or railroad right-of-way during construction and for completed structure, including canal banks.

(g) Location, bottom grade, dimensions, and capacity of any existing drainage ditches.

(h) Highway or railroad loadings.

(i) Method of maintaining traffic during construction.

(j) Liability obligations to be assumed by Government construction contractor and types of indemnity bonds or liability insurance (with maximum limits) to be furnished by contractor, as set forth in crossing agreement with railroad company or highway department.

(4) **Wasteways and Spillways:**

(a) Type of control (slide gate, radial gate, side overflow, siphonic overflow) and capacity. Weather warning plan is required.

(b) Range of control of water surface if wasteway is to be automatic.

(5) **Checks:**

(a) Type of control, stoplog, slide gate, or radial gate. Capacity of overflow weir, if desired. Type of operation (i.e., manual, automatic, and/or remotely monitored and controlled). Requirements for backup power.

(b) Details of combination requirements, if to be combined with other structures.

(6) **Turnouts:**

(a) Capacity, minimum operating water surface in canal, and maximum water surface immediately below turnout.

(b) Type of measuring device and whether data are telemetered.

(c) Operation and maintenance road elevations and clearances.

(d) Requirement for screens if turnout is to be connected with a pipe distribution system or sprinkler irrigation system.

(7) **Chutes and Drops:**

(a) Range in capacities, water surface, and bottom grade elevations, both upstream and downstream.

(b) Combinations with other structures such as checks, siphons, operating or highway bridges, or turnouts.

(c) Range in capacities if the chute or drop is to be used as a measuring device; and reason for measurement.

(8) **Measuring Devices:**

(a) Type of structure and accuracy required.

(b) Bottom grade and maximum and minimum operating water surfaces both upstream and downstream.

(c) Maximum and minimum capacity to be measured.

(d) Whether a continuous record of discharge is required and whether remotely monitored. Telemetering requirements.

(9) **Miscellaneous Information:**

(a) Months of the year in which flow of irrigation ditches or drains to be crossed can be suspended.

(b) Prevalence of any unusual local pest action such as termites, dry rot, and marine borers; local practices for combating same.

(c) Hold water during winter for livestock.

(d) Need for operating roads on or along canal banks.

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

(f) Number, width, and loading requirements for farm bridges.

(g) Special requirements and locations of safety devices such as guardrailing, security lighting, fences in populated areas, nets, and racks; game crossing requirements, fencing, and escapes.

(h) Type, location, owner, and requirements of irrigation and utility crossings.

N. Environmental Considerations. Implementation of design features should be consistent with the environmental commitments as described in the NEPA compliance document (include document) that would affect the design and a brief description of the setting and the resources that would be affected by the proposed canal. Implementation of design features should be consistent with agreements reached (include agreements) between Interior Bureaus, Federal agencies, and other Governmental agencies.

Design data should include, as a minimum, a brief description of the environmental resources that could be affected by the proposed development. The emphasis should be focused on those areas within the range of alternatives open to the designers in developing a structural design. The following items should also be considered in preparing design data:

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

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

(3) Wildlife or refuge areas and wetlands.

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

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

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

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

(8) Anticipated public use around the structure.

(9) The need for escape structures or crossings for human, deer, or other wildlife including special fencing needs.

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

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

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

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

(14) Environmental considerations such as water pollution control standards, noise and dust abatement requirements, areas that will require landscaping, replacement of topsoil, seeding, architectural treatment for structures, tree lists, endangered species, and mitigation requirements, etc.

O. Electrical Data. Data listed below will be required to initiate design. The data furnished should be sufficient to permit designers to complete the basic design (single-line diagram) for the canal, wasteway, spillway, check, turnout, chute, drop, or other structure. After designs of the facility have progressed enough to develop details of electrical system needs, designers will prepare a list of additional data required to complete final design of electrical installation.

(1) Name and telephone numbers of electrical power suppliers and contacts within those organizations.

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

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

(4) Electrical system reliability criteria.

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

(a) If required by State or local authority.

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

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

(d) Loads requiring service from alternate source.

(6) Requirements for remote monitoring of conditions at the facility. Discuss location of remote station, and items required to be monitored.

(7) Requirements for supervisory control, including location of station from which supervisory control is exercised.

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

P. Cost Data for Field Cost Estimate. The field cost estimate is an estimate of the capital costs of a feature or project from award to construction; non-contract costs are not included. Cost data developed in previous or other studies (either by Reclamation or others) should be included with the design data submittal. Include

a description or outline of estimating methods and data used. The following design data for feasibility and specifications levels designs should be considered for submittal:

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

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

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

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

(4) Local freight or trucking rates.

(5) Housing accommodations.

(6) Interest rate for economic studies.

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

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

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

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

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

  (d) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment (i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction). Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing

operations. If vegetation to be cleared is very sparse or can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other appropriate items of work.

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

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

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

(12) Local and tribal taxes.

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

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

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

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

(1) Construction schedule:

(a) One contract or several contracts.

(b) Any construction timeframe restrictions

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

(d) Recommended period for construction.

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

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

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

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

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

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

(5) Unusual conditions for excavation or construction.

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

(7) Water for construction purposes. For large rivers, this item may be unimportant. For small streams and offstream reservoirs, the item becomes critical. Determine if up to 2 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.

(a) Water treatment requirements for return flows

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

(9) Required permits from government agencies and others.

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

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

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

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

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

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

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