

- 4. Tunnels.** The Introduction (Chapter 1) for these design data collection guidelines contains additional information concerning: preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal.
- 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 Map (may be combined with General Map). Location maps are commonly used as a condensed method of showing location and alignment of the features and associated structures. The location map may be combined with the general map, site plan, or plan and profile drawings for small areas. A scale of 1 inch = 1,000 feet to 1 inch = 2,000 feet is commonly used for location maps. The location map should show:

- (1) **General:**
 - (a) North arrow.
 - (b) Proposed alignment, major structures, and delivery locations by symbols. Station and appropriate ties to section lines, section corners, existing buildings, pipelines, roads, railroads, etc.
 - (c) Topography and ownership information should be shown.
 - (d) Towns, roads, railroads, streams, existing pipelines, canals, reservoirs, etc.
 - (e) Transportation facilities and other cultural features.
 - (f) Location of borrow areas, riprap sources, sources of special pipe embedment material, if required
 - (g) Disposal areas for wasting excess excavation.

- (h) For distribution systems, show ownership, turnout locations, and irrigable areas served.
- (i) Sources of power for construction and operation and maintenance.
- (j) Existing or potential areas or features having a bearing on the design, construction, or operation and maintenance such as: recreation areas, fish and wildlife areas, railroads, housing, and areas of archeological, historical, and mining and paleontological interest.
- (k) Where the scale does not permit proper detail of a congested area, a blowup at a larger scale may be included elsewhere on the drawing and referenced to its proper location.
- (l) Where density of the structures or other features is such that individual stationing and naming is impractical, the information should be shown in tabular form and station marks shown on the alignment.
- (m) Linear feature (tunnel), together with structures, adits, and stations. Structures and delivery locations are normally shown by symbol.
- (n) Legend of symbols for existing and proposed facilities
- (o) Right-of-way and land ownership 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. Surface Data:

- (1) **Survey Control.** Permanent horizontal and vertical survey control should be established at the earliest possible time. All line surveys should be tied to the state plane coordinate system at each portal, and at points of intersection where changes in the bearing of the tunnel centerline occur. Grid to ground correction factors including altitude and coordinate system correction should be furnished.
- (2) **Topographic Map.** A topographic map showing alignment of the tunnel and location of all possible arrangements of structures including inlet or intake, control or access shafts, air vents, adits, and outlet portal; normally this should be on a scale of 1 inch equals 400 feet (a scale of 1 inch equals 200 feet is preferable for short tunnels) and a contour interval of 5 feet. If

a topographic map is unavailable, strip topography may be furnished. Topographic maps of portal sites should be on a scale of 1 inch equals 50 feet and a contour interval of 2 feet and should have contours high enough to include top of portal cut slopes. For flat or gently sloping topography, contour intervals as small as 1 foot may be desirable. Show the coordinate system and existing land survey monuments and special control points established for the topographic survey. Show all manmade features in the included area.

- (3) **Aerial Photographs.** Aerial photographs (size 8 by 10 inches, color if feasible) of the portals or other major structure sites. The purpose of the aerial views is to permit early preparation of an artist's rendition of the feature and to permit a study of the environmental impact of the structure. Later such renditions or drawings may be used for inclusion in specifications or for other purposes.

These photographs should be taken from locations that would best show the proposed structure and from a vertical angle of approximately 20E to 30E above the horizontal. Where possible, indicate known tie points to the topographic maps, tunnel portal site, and tunnel alignment. These photographs should be taken between 11 a.m. and 2 p.m., so as not to show the principal area of the proposed structure in shadow. Submit the negatives or color slides.

Each Region is urged to provide these photographs for shaft sites or auxiliary structures whenever it is considered that artist's conceptions would be beneficial to the project and the designs would be influenced by the physical characteristics of the area.

- (4) **Photographs.** Color photographs of all existing facilities or structures in the vicinity of the proposed tunnel and closeup views of any features which may affect designs. Black and white photographs are acceptable for structures to be removed or demolished. Color or black and white photographs along tunnel alignment with structure locations and tunnel alignment marked in ink.

E. Tunnel Alignment and Geologic Data.

- (1) **General Engineering Requirements.** The location of tunnel portals, tunnel alignment and scope of the geological investigation, including number and location of drill holes, should be established by the originating office personnel with assistance from the region and TSC representatives. It is recommended that a field conference be held, including an inspection of the site. This conference should result in the selection of probable tunnel portals, tunnel alignment, and 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 rock formations, probability of encountering large water flows or dangerous gas, and the time and funds available for the study and will make maximum use of existing data. The U.S. National Committee on Tunneling and Technology (USNCTT) recommendation that the total length of boreholes equal 1.5 times the tunnel length may be used as a guide. The complexity of the site will be considered in determining the detail of the investigation. Location of portals will depend on required elevations, the most economical alignment, rock conditions, local topography, drainage, ease of access, and available staging area.

- (2) **Geologic Data.** The following list of geologic design data provides general guidelines for the collection and reporting of geologic information for tunnels. The geologist should apply these guidelines with good judgment and sound reasoning, elaborating upon them as required by the particular geologic setting and engineering requirements. Because the collection of geologic data is a dynamic process and often continues into the preparation of final designs, all stages of the specification design geologic exploration program must be constantly coordinated with the designer through the appropriate geology office. The TSC geologic and geophysical staff will provide necessary assistance and guidance in the gathering of these design data.
- (a) Compilation, summary, and reporting of Reclamation and non-Reclamation geologic information on the area, with attention being paid to the sequence of explorations and historical geologic events.
 - (b) Surface geologic map showing location of explorations. Locations of all existing explorations should be indicated by coordinates or stationing of the permanent survey control system for the facility.
 - (c) Particular foundation exploration at portal locations, adit, shaft, or other structure sites. At portal sites attention must be paid to the geologic aspects of potential slope stability problems.
 - (d) Factual narrative description of surficial deposits, especially at portal sites and low cover reaches, with attention being paid to engineering geologic matters', such as swelling minerals, low-density materials, presence of gypsum and other sulfates, caliche, erodibility (see Earth Manual).
 - (e) Factual narrative description of bedrock with attention being paid to engineering matters such as swelling minerals, presence of gypsum and other sulfates; and depth, weathering, joints, faults, and other planes of weakness.

- (f) Selected samples for determination of engineering properties of surficial deposits and bedrock along tunnel grade, such as specific weight; absorption; solubility; compressive, tensile, and shear strength; permeability; modulus of deformation; expansion; uplift; and effects of air and water on engineering properties. The type and number of specimens required for these determinations should be coordinated with the TSC.
- (g) For a mechanically excavated tunnel, quartz content and cementation coefficient determined by petrographic analysis are appropriate data to be collected. Shore scleroscope and Schmidt hammer hardness tests are also useful.
- (h) For pressure tunnel design, measure the in situ state of stress of the rock. Discuss the creep of rock. Determine the permeability of the rock in place. Discuss the relationship of jointing to deformation modules.
- (i) Photographs, preferably in color, of representative or particular geologic conditions.
- (j) Summary and data of exploration geophysical surveys (seismic, resistivity, etc.), if performed.
- (k) Determine ground water conditions with attention being paid to water levels and their seasonal fluctuation, occurrence of unconfined and confined aquifers, water producing capabilities, water temperature, chemistry, and ground subsidence.
- (l) 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 may need to be augmented by appropriate borehole electric (geophysical) logs or optical borehole (borehole camera) image plots.
- (m) Evaluation of landslide, snowslide, and rock fall conditions, especially at portals.
- (n) Determine age of faulting in vicinity, especially if suspected to be late Pleistocene or Holocene.
- (o) Document past, present, and possible future petroleum, water, and mineral extraction operations in vicinity.
- (p) Determine geologic conditions which may affect construction methods such as boulders on ground surface, marshes, drilling conditions, and stability of grout or footing holes, ground

temperatures, gases. Any potential surface water runoff problems should be brought to the attention of a regional hydrologist.

F. Corrosion Survey.

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

G. Construction Materials Data including:

- (1) Location of and distance of suitable borrow areas for permeable and impermeable soil materials for fill or embankment; and for riprap for channel or slope protection. If quantities are limited, give approximate volumes available.
- (2) An earth materials report containing complete detailed information on those potential sources of soils and rocks that have been selected for final consideration. (See *Earth Manual*.)
- (3) Information on concrete aggregates. (See “Final Investigations” in Reclamation’s *Concrete Manual*.)
- (4) Data on commercial concrete and cement plants within practical hauling distance from the structure site.
- (5) Information on sources and character of acceptable road surfacing materials and railway bedding materials where these may be required. Consider excavated material as a possible source.
- (6) Results of sampling and analysis of materials, including previous tests.

- (7) Information including catalog of firms within practical hauling distance from the site manufacturing precast concrete products that may be interested in manufacture of precast concrete tunnel segment liners or structural shapes that could be utilized in associated features outside the tunnel.

H. Hydrologic Data:

- (1) Annual periodic fluctuations of reservoir levels shown by tables or charts summarizing reservoir operation studies for the critical period, where the tunnel has an inlet or outlet directly from or into the reservoir.
- (2) Anticipated occurrence and amounts of silt, ice (thickness), and drift (trash), and possible effect on tunnel intakes or tunnel flow.
- (3) Extent of anticipated wave action including discussion of wind fetch, where the tunnel has an inlet or outlet directly from or into the reservoir.
- (4) Reservoir storage allocations showing storage allocations with corresponding elevations.
- (5) Type and purpose of reservoir releases for the time of year to be made, include minimum releases for various seasons, where relevant.
- (6) Data for preparation of specifications hydrographs, including the location of gauging stations at or near the tunnel site and the dates for which hydrographs should be prepared. Copies of the daily discharge record should be supplied for stations with unpublished records.
- (7) Where unwatering or dewatering of a portal site adjacent to a stream or lake is required, give maximum water levels expected during the construction period and the possibility of controlling water levels by operation of upstream or downstream facilities. Provide recommendations on time of year when shoreline facilities should be constructed to take best advantage of low water levels.
- (8) Data on past degradation or aggradation of stream channel and possibility of future changes for direct connecting streams or cross drainage channels.
- (9) Source of water being transported other than reservoir: maximum operating, and minimum operating water surface elevations; floodflows; average flow; and anticipated occurrence and amounts of bed load and ice (thickness) in river, stream, or channel. Recommend minimum trashrack or gate deck elevation where applicable. Include data on possibility of flooding due to ice jams.

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

I. Operating Data:

- (1) Purpose – vehicular or water.
- (2) Capacity of tunnel, including largest future anticipated discharge requirements.
- (3) Location, hydraulic section, and hydraulic grade line at inlet and outlet channels, pipelines, or reservoirs.
- (4) Type of operation, continuous or cyclic (include possible periods of shutdown for maintenance), free flow, or pressure tunnel.
- (5) Flow controls and measurement required, including smallest and largest flows to be controlled and/or measured; degree of automation of controls (give estimated distance to point of central control).
- (6) Commitments for delivery of water or power.
- (7) Water use (M&I, irrigation) and distribution requirements: necessity for treating water and recommended method; consumption quantities by months, and locations; initial and ultimate capacities; capacity-duration curves; location of distribution and treating facilities; and special reliability requirements. Discuss minimum upstream head at which maximum capacity is required, minimum delivery capacity required for both maximum and minimum upstream heads and degree of control and accuracy of measurement required for these limiting conditions.
- (8) Details of upstream or downstream control sections, water measuring devices, gauging stations, or other operating works.

J. Miscellaneous Data:

- (1) Permits required for railway and/or road crossings including any local permits required, such as local Air Quality Permits.
- (2) Flood protection at tunnel portals.
- (3) Availability of gates and control equipment repair shops in vicinity; provisions for central shop.
- (5) Recommendations on whether gate hoist equipment, controls, and measuring devices should be indoor or outdoor types.

- (6) Housed and open O&M storage requirements at site; offsite storage to be provided; existing storage space and facilities.
- (7) Site Security.
 - (a) 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.
 - (b) Security requirements for protection of structures and equipment from vandalism or sabotage. Recommend specific measures to meet anticipated conditions such as 7-foot yard fence topped with barbed wire, special locks, special doors, heavy safety glass, security lighting, no windows, electronic surveillance equipment, etc.
 - (c) Description of existing fire protection plan which will be applied to the tunnel, together with any specific requirements for this tunnel.
- (8) Expected visitor load at site and special requirements for transport of Government personnel in and out of tunnel.
- (9) Requirements for public safety.
- (10) State potable water standards and water treatment requirements. These requirements should be cleared with water quality agencies in the State where tunnel is to be constructed.
- (11) State requirements for waste water treatment and disposal, and recommendations as to possible alternatives on prevention, control, and abatement of air and water pollution. List any restrictions imposed on construction activity by EPA waste water discharge permit.
- (12) Location of water treatment facilities.
- (13) Commitments for delivery of power or water.
- (14) Recommendations for special protection at portals from falling rocks or boulders.

- (15) Vegetation to be cleared (kinds, size, and density of growth) and clearing methods not permitted, e.g. burning or disposing on site.
- (16) State and local building codes when applicable.
- (17) Special exhaust, heating, ventilating, or air-conditioning requirements.
- (18) Right-of-Way. A marked print shall be submitted showing the following data:
 - (a) Proposed right-of-way boundaries for construction purposes, temporary and permanent.
 - (b) Proposed right-of-way boundaries for access purposes (if required).
 - (c) Designation of areas within right-of-way boundaries for the following special purposes:
 - Disposal of waste material
 - Contractor's plant, storage, and other incidental purposes
 - Government construction facilities (if applicable)
- (19) Disposition of existing facilities in the construction area such as pipelines, power and telephone lines, and fences.
- (20) Where a service area is specified furnish area requirements.
- (21) Requirements for installation of power, lighting or telemetering cables in tunnel.
- (22) Environmental Permit requirements (401, 404, Storm Water Runoff, etc.)
- (23) Requirements for providing permanent access to the tunnel or adit portal for operation and maintenance purposes.

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

- (1) **Procurement Strategy.** Will solicitation be advertised and awarded under other than full and open competition? This includes solicitations which will be set aside under socio-economic programs that may limit competition or allow award to other than the lowest bid or proposal.
- (2) Estimate of cost of ROW for all features including reservoirs, dams, and appurtenant works.
- (3) Information on local labor supply and labor problems.
- (4) Local freight or trucking rates.
- (5) Housing accommodations.
- (6) Interest rate for economic studies.
- (7) Power rate in mills per kilowatt-hour, interest rate, and plant factor for economic tunnel, and pipeline sizing studies in cases where transported water is pumped.
- (8) Estimated cost for construction items which cannot readily be determined in the design office and include the supporting data:
 - (a) Clearing reservoir area and for removing or replacing private improvements in the area.
 - (b) Earthwork (common and rock), excavation with freehaul distance. For canals, include compacting embankment, canal lining, and borrow (with free haul distance)
 - (c) Riprap, guardrail, culverts, row fencing, and gates.
 - (d) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment (i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction). Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing operations. If vegetation to be cleared is very sparse or can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other appropriate items of work.
- (9) Where buildings are located within the area to be cleared by the prime contractor, and if disposal will be the contractor's responsibility, designate building groups by number and furnish detailed list of buildings for each group. Details should include general description, size, materials, and

general condition. Drawings should be provided of these buildings, if available, that depict dimensions, construction materials, the structural system for the building, and major electrical and mechanical equipment. Determine if disposal will be the responsibility of the prime contractor. If not, submit dates when disposal will be completed by others.

- (10) Information on important construction work that is in progress or planned in the vicinity and the presence of interested contractors or subcontractors in the area.
- (11) If potential actions exceed anticipated funding, an assessment should be made as to whether the cost estimate will reflect incremental costs of these potential actions. Provide any known increment or arrangement of the incremental costs.
- (12) Local and tribal taxes.
- (13) Estimates of costs for relocating railroads, highways, roads, water systems, and other public utilities. Include supporting data.
- (14) Method for projecting cost into the future if required.
- (15) Cost of local materials (precast concrete, etc.).

L. Environmental Considerations. Design data should include, as a minimum, the environmental commitments listed in the NEPA compliance document that would affect the design and a brief description of the environmental and ecological values that could be affected by the proposed development. The emphasis should be on those areas in the range of alternatives open to the designers in developing a structural design. The following items should also be considered in preparing design data:

- (1) Cultural (archeological, historical, and paleontological) resources of influence within the project area.
- (2) The need for blending structures with the surroundings.
- (3) Comment on any ecological, aesthetic, or other environmental aspects including protection of wildlife which would affect layout or conceptual design.
- (4) Indicate the suitability and possibility of present or future use of land adjacent to Bureau facilities by the public for recreation, hobbies, sports, leisure, education, health, housing, etc. Provide data on zoning regulations and subdivision proposals.

- (5) Furnish data on allowable noise limits and blasting in the vicinity of the proposed facilities where fixed by law or local ordinance, or where otherwise considered necessary or advisable; measurements of existing daytime and nighttime ambient noise levels in the area; and distances to the nearest residential units.
- (6) Identify special environmental compliance requirements for ensuring water quality standards are met including 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.
- (7) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.
- (8) Background on the need for fish facilities such as screens, fishways, and barriers.
- (9) Recommendations or commitments to maintain specific flow requirements for biological and/or recreational resources.
- (10) Comment on disposal of special excavation problem materials such as lignite.
- (11) Specify seeding or replanting requirements for erosion control or aesthetics.
- (12) Furnish data on State or local restrictions on the use of soil herbicides, or local factors limiting their use.
- (13) Specify requirements for clearing and disposal of timber.

M. 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 tunnel. 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.

- (1) Names and telephone numbers of electrical power suppliers and contacts within their 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) Discuss requirements for an alternate power source. If an alternate 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 alternate source.
- (5) Requirements for remote monitoring of conditions at the facility. Discuss location of remote station, and items required to be monitored.
- (6) Requirements for supervisory control, including location of station from which supervisory control is exercised.
- (7) Requirements for voice and data communications between the supervisory master station and the remote facilities.

N. 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.
- (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 ft³/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) 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) Give borrow area and temporary haul road restoration requirements such as stockpiling of topsoil, grading of the area, general cleanup, etc.
- (14) Give consideration to using required excavated material in lieu of material from other borrow sources wherever possible.